

2017 GUIDE FOR WEED, DISEASE, and INSECT MANAGEMENT IN NEBRASKA



The 2017 Guide

This Guide offers valuable information on pest management for major crops, pasture, range, turf, and aquatic environments in Nebraska. It's written by UNL Extension specialists who encourage the use of Integrated Pest Management (IPM) strategies based on chemical, cultural, mechanical, and biological methods of pest control. We believe that the proper use of IPM can increase the profitability and sustainability of farm operations. Therefore, our goal was to provide a comprehensive publication that will enable users to make sound pest control decisions based on unbiased, research-based information, and to carry out pest control activities in a safe and responsible manner.

Information in the 2017 Guide is organized into broad topical categories, highlighted in the Table of Contents on page 1. The Index, beginning on page 2, will help you quickly locate the information you need. Modes of action are provided for fungicides, herbicides, and insecticides to facilitate their rotation in order to minimize chance for pest resistance.

Reference to commercial products, or trade names, is made with the understanding that no discrimination is intended and no endorsement by the University of Nebraska–Lincoln is implied. Always consult product labels for specific use recommendations and requirements.

We appreciate your feedback and encourage you to contact the section authors listed on the divider pages if you have any comments or suggestions. Comments can be also emailed directly to Stevan Knezevic, at sknezevic2@unl.edu, or mail to:

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To Order

To order additional copies of the UNL Extension *2017 Guide for Weed Management in Nebraska with Insecticide and Fungicide Information* (EC130) go to MarketPlace.unl.edu. Cost is \$15 per copy. A downloadable version is also available.

Dee Foote, project assistant and head wrangler.

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One of the major efforts of the University of Nebraska–Lincoln weed science faculty is the extensive weed management section of the *Guide for Weed Management in Nebraska with Insecticide and Fungicide Information*. The Guide is designed to be a comprehensive, information-packed resource for farmers, pesticide applicators, and agribusiness professionals in Nebraska. Each year the authors meet to review content suggestions from industry representatives and discuss feedback from readers on how the *Guide* is used. They add only new herbicides that are tested in UNL trials and update weed

response tables and weed management strategies based on UNL research results.

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Herbicide Modes of Action (effect on plant growth)

This chart groups herbicides by their modes of action to assist you in selecting herbicides 1) to maintain greater diversity in herbicide use and 2) to rotate among herbicides with different sites of action to delay the development of herbicide resistance.

	Site of Action Group*	Site of Action	No. of Resistant Weed Species in U.S.	Chemical Family	Active Ingredient		Site of Action Group*	Site of Action	No. of Resistant Weed Species in U.S.	Chemical Family	Active Ingredient
Lipid Synthesis Inhibitors	1	ACCase Inhibitors (acetyl CoA carboxylase)	15	Aryloxyphenoxy propionate	fenoxaprop flazifop quizalofop	Nitrogen Metabolism	10	Glutamine Synthesis Inhibitor	0	None accepted	glufosinate
				Cyclohexanedione	clethodim sethoxydim						
Amino Acid Synthesis Inhibitors	2	ALS Inhibitors (acetolactate synthase)	38	Sulfonylurea	chlorimuron foramsulfuron halosulfuron iodosulfuron nicosulfuron primisulfuron prosulfuron rimsulfuron thifensulfuron tribenuron	Pigment Inhibitors	13	Diterpene Synthesis Inhibitor	0	Isoxazolidinone	clomazone
							27	HPPD Inhibitors	0	Isoxazole Triketone	isoxaflutole mesotrione tembotrione tropamezone
				Imidazolione	imazamox imazaquin imazethapyr	Cell Membrane Disrupters	14	PPO Inhibitors	2	Diphenylether N-phenylphthalimide Aryl triazinone Trifluoromethyl uracils	acifluorfen, fomesafen lactofen flumiclorac flumioxazin sulfentrazone carfentrazone saflufenacil
Growth Regulators (Synthetic auxins)	4	Specific site unknown	7	Phenoxy	2,4-D		22	Photosystem I Electron Diverter	4	Bipyridilium	paraquat
				Benzoic acid	dicamba						
				Carboxylic acid	clopyralid fluroxypyr						
Photosynthesis Inhibitors	5	Photosystem II Inhibitors (different binding than 5 & 7)	22	Triazine	atrazine simazine metribuzin	Seedling Root Growth Inhibitors	3	Microtubule Inhibitors	6	Dinitroaniline	ethalfluralin pendimethalin trifluralin
				Triazinone							
				Nitrile	bromoxynil						
Photosynthesis Inhibitors	6	Photosystem II Inhibitors (different binding than 5 & 7)	1	Benzothiadiazole	bentazon	Seedling Shoot Growth Inhibitors	8	Lipid Synthesis Inhibitors (not ACCase)	5	Thiocarbamate	butalate EPTC
				Ureas	linuron						
Photosynthesis Inhibitors	7	Photosystem II Inhibitors (different binding than 5 & 6)	7			Seedling Shoot Growth Inhibitors	15	Long-chain Fatty Acid Inhibitor	1	Chloroacetamide	acetochlor alachlor metolachlor dimethenamid pyroxasulfone
										Oxazolinone	
										Oxyacetamide	flufenacet

*Site of Action Group is a classification system developed by the Weed Science Society of America.

This table is excerpted with permission from the Corn and Soybean Herbicide Chart (GWC-3), part of the Glyphosate, Weeds, and Crop Series published by Purdue University through a cooperative effort of weed scientists in the 16-state USDA North Central Region.

Classification of Herbicides by Mode and Site of Action and Chemical Family

Herbicides may be classified into families based on how they kill plants (mode of action and site of action) or by chemical similarity. An example of a common commercial herbicide containing the active ingredient is also listed. Please refer to the *Herbicide Dictionary* to identify other commercial herbicides that contain the same active ingredient. In some cases, herbicides from different chemical families have a similar site of action. A knowledge of herbicide families and herbicide mode and site of action will reduce the risk of choosing herbicides that will lead to the development

of herbicide-resistant weeds or problems with chemical carryover.

Repeated use of a herbicide or herbicides with the same site of action may lead to selection of herbicide-resistant weeds, or a shift in the weed species present in the field to weeds tolerant to a particular herbicide or herbicide family. For example, repeated use of ALS inhibitors can result in the selection for ALS-resistant weeds. Using both sulfonylurea and imidazolinone herbicides (Classic, Pursuit, etc.) in the same growing season can result in increased carryover problems or possible crop injury.

These problems can be lessened by rotating or combining herbicides with different action sites. In the table the site of herbicide uptake is indicated by: R = root uptake; S = shoot uptake; and F = foliage uptake. Letter sequence indicates the primary order of herbicide uptake. Repeated use of herbicides with a common mode and site of action pose the highest risk of an additive effect which can lead to resistant weed development, additional carryover, or more crop injury. Refer to the journal, *Weed Technology*, 11: 384-393 (1997) for additional information on herbicide classification.

Common Name — Trade Name — Site of Uptake

Lipid Synthesis Inhibition

Group 1. ACCase inhibition

1. Aryloxyphenoxypropionates (FOPs)
clodinafop propargyl — Discovery — F
diclofop — Hoelon — F
fenoxaprop — Acclaim Extra — F
fluzafop-P — Fusilade DX — F
pinoxaden — Axial — F
quizalofop-P — Assure II — F
2. Cyclohexanediones (DIMs)
clethodim — Select Max — F
sethoxydim — Poast — F
tralkoxydim — Achieve — F

Amino Acid Synthesis Inhibition

Group 2. ALS-AHAS inhibition

1. Imidazolinones
imazamethabenz — Assert — R/F
imazamox — Raptor — F/R
imazapic — Plateau — R/F
imazapyr — Arsenal — R/F
imazaquin — Scepter — R/F
imazethapyr — Pursuit — R/F
2. Sulfonylureas
bensulfuron — Londax — F/R
chlorimuron — Classic — F/R
chlorsulfuron — Glean/Telar — F/R
ethametsulfuron — Muster — F
foramsulfuron — Option — F
halosulfuron — Permit — F/R
iodosulfuron — Autumn — F
metsulfuron — Ally/Escort — F/R
nicosulfuron — Accent — F
primisulfuron — Beacon — F/R
prosulfuron — Peak — F/R
rimsulfuron — Matrix — F/R
sulfometuron — Oust — F/R
sulfosulfuron — Maverick
thifensulfuron — Harmony — F/R
triasulfuron — Amber — F/R
tribenuron — Express — F/R
triflurosulfuron — Upbeet — F

3. Triazolopyrimidine

chloransulam methyl — FirstRate — F/R
florasulam — R/F
flumetsulam — Python — R/F
pyroxsulam — PowerFlex — F/R

4. Pyrimidinylbenzoic acid

bispyribac-sodium — Velocity — F

5. Triazolones

flucarbazone — Everest — F/R
propoxycarbazone-sodium — Olympus — F/R
thiencarbazone-methyl — Corvus — F/R

Group 9. EPSP synthetase inhibition

glyphosate — Roundup/Touchdown — F

Seedling Growth Inhibition

Group 3. Microtubule assembly inhibition

1. Dinitroanilines

benfluralin — Balan — S/R
ethalfluralin — Curbit/Sonalan — S
oryzalin — Surflan — S
pendimethalin — Prowl — S
proflumizone — Barricade — S
trifluralin — Treflan — S

2. Pyridines

dithiopyr — Dimension — R/F

3. Benzamides

pronamide — Kerb — S/R

4. Benzoic acids

DCPA — Dacthal — R

Group 15. Long-chain fatty acid inhibitor

1. Chloroacetamides

acetochlor — Harness/Surpass NXT — S/R
alachlor — Intrro — S/R
dimethenamid — Outlook — S/R
metolachlor — Dual — S/R
propachlor — Ramrod — S/R

2. Oxyacetamides

flufenacet — Define — S/R

3. Acetamides

napropamide — Devrinol — R/S

4. Oxazoles

pyroxa-sulfone — Zidua — S/R

Seedling Growth Inhibition (*continued*)

- Group 16. Lipid synthesis inhibition (not ACCase)
1. Benzofuranes
ethofumesate — Nortron SC — S/R
- Group 8. 1. Phosphorodithionates
bensulide — Betasan — R
2. Thiocarbamates
butylate — Sutan + — S/R
cycloate — Ro-Neet — S/R
EPTC — Eradicane — S/R
triallate — Far-Go — S/R
- Group 19. Auxin transport inhibition
1. Phthalamates
naptalam — Alanap — R/F
 2. Semicarbazone
diflufenzopyr — Distinct — F

Cell Wall Synthesis Inhibition

- Group 21. Benzamides
isoxaben — Gallery — R/S
- Group 20. Nitriles
dichlobenil — Casoron — R/F

Growth Regulators

- Group 4. Synthetic auxins
1. Phenoxyacetic acids
2,4-D — many — F/R
2,4-DB — Butyrac — F
dichlorprop — many — F
MCPA — many — F/R
mecoprop — many — F
 2. Benzoic acids
dicamba — Banvel/Clarity — F/R/S
 3. Pyridine carboxylic acids
aminopyralid — Milestone — F/R
clopyralid — Stinger — F/R
fluroxypyr — Starane — F
picloram — Tordon — F/R
triclopyr — Garlon — F/R
 4. Quinoline carboxylic acids
quinclorac — Paramount — F/S
 5. Pyrimidine carboxylic acids
aminocyclopyrachlor — Imprelis — F/R

Photosynthesis Inhibition (Photosystem II) — Classes differ in binding behavior

- Group 5. C₁ class
1. Triazines
ametryn — Evik — R/F
atrazine — AAtrex — R/F
prometon — Pramitol — R/F
simazine — Princep — R
 2. Triazinones
hexazinone — Velpar — R/F
metribuzin — Sencor — R/F
 3. Phenylcarbamates
desmedipham — Betanex — F
phenmedipham — Spin-Aid — F
 4. Uracils
bromacil — Hyvar — R
terbacil — Sinbar — R
 5. Pyridazinones
pyrazon — Pyramin — R/F
- Group 7. C₂ class
1. Phenylureas
diuron — Karmex — R
linuron — Lorox — R/F
siduron — Tupersan — R
tebuthiuron — Spike — R

- Group 6. C₃ class
1. Benzothiadiazinones
bentazon — Basagran — F
 2. Nitriles
bromoxynil — Buctril — F
 3. Phenylpyridazine
pyridate — Tough — F

Cell Membrane Disruption

- Group 14. PPO inhibition
1. Diphenylethers
acifluorfen — Blazer — F
fomesafen — Reflex/Flexstar — R/F
lactofen — Phoenix/Cobra — F
oxyfluorfen — Goal — R/S
 2. N-phenylphthalimides
flumiclorac — Resource — F
flumioxazin — Valor — S/F
 3. Triazinones
sulfentrazone — Authority/Spartan — R
carfentrazone ethyl — Aim — F
 4. Thiadiazoles
fluthiacet methyl — Cadet — F
 5. Phenylpyrazoles
pyraflufen-ethyl — Vida — F
 6. Trifluoromethyl uracils
saflufenacil — Kixor — R/F/S
- Group 22. Photosystem I electron diversion
1. Bipyridyliums
diquat — Reward — F
paraquat — Gramoxone — F
- Unclassified Cellular pH alteration
1. Fatty acids
pelargonic acid — Scythe — F

Carotenoid Biosynthesis Inhibition (Pigment Inhibitors)

- Group 12. Phytolene desaturase inhibition
1. none accepted
fluridone — Avast — S/R
 2. pyridazinone
norflurazon — Zorial — S
- Group 27. 4-HPPD inhibition
1. Callistemones
mesotrione — Callisto — F/R
tembotrione — Laudis — F/R
 2. Isoxazoles
isoxaflutole — Balance Flexx — R/F
 3. Pyrazolones
pyrasulfotole — Huskie — F/R
topramezone — Armezon/Impact — F/R
- Group 13. Diterpene synthesis inhibitor
1. Isoxazolidinone
clomazone — Command — R/S
- Unknown site of action
1. Triazole
amitrole — Amitrole — F

Nitrogen Metabolism Inhibition

- Group 10. Glutamine synthetase inhibition
1. glufosinate — Liberty — F

Unclassified or Unknown

1. Organoarsenical
DSMA — many — F
MSMA — many — F
2. Other
endothall — Aquathol — R/F
difenzoquat — Avenge — F
fosamine — Krenite — F

Competitive Index and Competitive Load

Weeds compete with crops for water, mineral nutrients, sunlight, and infrequently for carbon dioxide and oxygen. Weed species differ in competitiveness based largely on their growth rate, size, canopy shape, and emergence date. Competitive index (CI) is a term used to describe the relative competitiveness of weed species and is expressed as a range of 1-10. A plant with a CI of 1.0 is 1/10 as competitive as a plant with a CI of 10.0. **The CI of common weeds is listed in parentheses “()” in the weed response tables in this publication.**

Competitive load is a term used to describe the total competitive effect of a weed population (community) and is a summation of the number of individual weeds multiplied by the CI of each. If there are five individuals of pigweed (CI 2.5) and two individuals of shattercane (CI 3.5) per 100 sq ft, the competitive load is 5 (pigweed) X 2.5 (CI of pigweed) + 2 (shattercane) X 3.5 (CI of shattercane) = 19.5.

Competitive Load Required for a 5% Yield Reduction for Weeds Normally Found With Crop

Crop	Competitive Load per 100 sq ft	Relative Competitiveness*
Corn	39	10.0
Soybean	10	2.5
Sorghum	10	2.5
Sugarbeet	10	2.5
Wheat, winter	50	—

$$CL = (CI_1 \times Sp_1) + (CI_2 \times Sp_2) + (CI_3 \times Sp_3) + \text{etc.}$$

Where CL = Competitive load

CI = Competitive index for that species

Sp = Number of plants of that species

*Relative competitiveness of the crop in competition with the weeds common to that crop, assuming that the weeds emerge with the crop.

This equation plus the table can be used to estimate yield loss. Crop yield reductions due to weed competition are directly related to the competitive load. Crops vary in their

competitiveness with weeds based on their growth characteristics. Therefore, a specific competitive load may cause a larger yield reduction in one crop than another.

Integrated Weed Management (IWM)

Integrated weed management (IWM) has been defined in many ways. Some describe it as a combination of mutually supportive technologies to control weeds, while others call it a multidisciplinary approach to weed control utilizing the application of numerous alternative control measures. In practical terms, it means developing a weed management program using a combination of preventive, cultural, mechanical, and chemical practices. It does not mean abandoning chemical weed control, but relying on it less.

IWM advocates the use of all available weed control options such as: plant breeding, fertilization, crop rotation, tillage practices, planting pattern, cover crops, and mechanical, biological, and chemical control. A single weed control measure is not feasible due to the number of weed species and their highly variable life cycles and survival strategies. In addition, if only one or two control methods are used, weeds can adapt to those practices. Applying the principles of IWM can help minimize the overall economic impact of weeds, reduce herbicide use, and provide optimum economic returns to the producers.

In essence, the development of an integrated weed management program is based on a few general rules that can be used at any farm:

- Use agronomic practices that limit the introduction and spread of weeds, preventing weed problems before they start,
- Help the crop compete with weeds,
- Use practices that keep weeds off balance and do not allow weeds to adapt.

Combining agronomic practices based on these rules will allow you to design an IWM program for your farm. Remember, there isn't a single recipe for all conditions and years. Your plan will need to be changed and adjusted to a particular farming operation and season. The goal is to manage, not eradicate, weeds.

Prevent Weed Problems Before They Start

The best method of weed control is to keep the weeds out of the field. **Field sanitation** involves practices that prevent weeds from entering or spreading across your field. Planting weed-free crop seed is a good starting point to reduce weed infestations. Planting weed-free, **certified seeds** will produce vigorous seedlings and good crop emergence and establishment, which are important for weed competition and yields. **Control of volunteer weeds** along field edges, fence lines, and

ditches is useful in preventing the spread of weeds. **Cleaning equipment**, especially combines, before moving from field to field will further reduce the spread of weeds. **Tarping grain trucks** prevents introduction of weeds on roadsides, which in turn can invade neighboring fields. **Manure** can be a problem by increasing weed numbers and introducing new weed species to a field, especially if the animals or livestock feed were imported from a different region. Aging or composting manure for at least a year before spreading on the field will reduce weed seed viability. Control patches of **new invading weeds or herbicide-resistant weeds** before they spread. In general, preventive weed control techniques are usually the least expensive, but routinely, the most overlooked.

Help the Crop Compete Against Weeds

Several things can be done to give the crop an advantage over weeds. For example, **fertilizer placement** affects the crop's ability to compete with weeds. Placing the fertilizer where the crop, but not the weeds, has access allows the crop to be more competitive with weeds. Studies indicate that banding nitrogen fertilizer reduces competitiveness and population

density of many weed species. **Adjusting row spacing** also will allow the crop to be more competitive. Indications are that soybean planted at 7 inches or 15 inches is more competitive against weeds than soybean planted at 30 inches or 38 inches. Certain **crop varieties** can be more competitive than others. For example, taller wheat and soybean varieties close their canopy more completely than shorter types, which helps shade out weeds. Taller varieties may still need to be sprayed, but weed control will be better due to added crop competition.

Keep Weeds Off Balance — Avoid Giving Them a Chance to Adapt

Crop rotation is the first step to keeping weeds off balance. Diversified crop rotation will allow weeds to be managed in different ways and at different times over the growing season. For example, using forage crops (perennial or annual) allows weeds to be cut before they set seeds, which is an important form of weed removal. Crops also differ in their **competitive ability**. For example, winter cereals are generally better competitors against summer annual weeds than spring cereals. **Rotating crops with different life cycles** will help prevent weeds from adapting. Annual weeds are more common in annual crops while biannual and perennial weeds are mostly found in perennial crops. For example, winter annual weeds adapt well in the fields of winter annual crops (e.g., downy brome in winter wheat), and perennial weeds are more common in perennial crops (e.g., dandelion in alfalfa). Rotating crops with different life cycles will prevent weeds with specific life cycles from adapting and establishing.

Rotating crops also will allow for **rotating herbicide practices**. Rotating herbicides with different modes of action and application times will help delay weed adaptation and reduce the chance of resistance development. Selecting herbicides for a particular application window (e.g., preplant incorporated, preemergence, postemergence) will help keep weeds off balance, too. For example, widespread use of postemergence herbicides may shift weed populations toward late emerging weeds (e.g., fall panicum, crabgrass, and morning glory). **Rotating herbicide-tolerant crops** also will be beneficial. Herbicide-tolerant crops are not “silver bullets” and should be viewed as just another tool for weed control.

Crops also can be selected to vary the **planting date**, which can be used to help

manage a particular weed species. Planting early may give a crop a better chance against late emerging weeds such as waterhemp, morning glory, and fall panicum. Planting late may allow the use of a burn-down herbicide or a tillage operation to control early-emerging weeds such as winter annuals (field pennycress, shepherds purse, mustards, and henbit), velvetleaf, lambsquarters, and green foxtail. Changing the planting date from year to year will not allow a specific weed to adapt.

Using cover crops and their residues also can keep weeds off balance. They help manage weeds through competition, physical suppression, and allelopathic effects. Biological control of weeds also has the potential for weed management through the use of grazing animals and natural enemies (insects, pathogens). It is a more suitable method of weed control in perennial crops (e.g., pastures) than in annual crops. Annual crops require more rapid weed control and the site disturbance often prevents long-term establishment of a biocontrol agent. In general, keeping weeds off balance and not allowing them to adapt to your cropping practices will allow you to maintain and use a variety of tools for weed control.

Making a Spray Decision

One of the most common questions that farmers ask about herbicide use is when to spray. Before deciding whether to spray, consider the following general guidelines:

Scouting. Assessing the type and number of weeds will help you determine if a spray operation is necessary. The entire field should be walked in an inverted “W” pattern and weed density assessed (see *Field Scouting*). Some weeds are not distributed uniformly, and can be found in patches or in low spots of the field. These areas should be sprayed separately, as fieldwide spraying may not be required. Mapping weed patches also will help assess the effectiveness of the control program over time.

Timing of weed emergence relative to the crop growth stage. Studies of crop-weed competition show that yield loss is very sensitive to small differences in the period between crop and weed emergence. Use the concepts of critical period of weed control and economic thresholds.

Critical period of weed control (CPWC) is a period in the crop growth cycle when weeds must be controlled to prevent yield losses. Weeds that emerge before or after this period may not represent a threat to crop yields. This information is essential in determining the need

for and timing of weed control and in achieving efficient herbicide use.

UNL research has shown that each crop has a critical period of weed control, the length of which is influenced by cropping practices (e.g., nitrogen level in corn and row spacing in soybean). Reducing the N-fertilizer level in corn resulted in a longer critical period of weed control, thus making corn a less competitive crop. The critical period of weed control ranged from the 1st-10th, 3rd-9th, 4th-9th, and 6th-9th leaf stages of corn for N-levels of 0, 55, 110, and 210 lb/A, respectively. Reducing the row spacing in soybean delayed the timing of weed control, thus increasing the crop tolerance to weed presence early in the season. In wide-row (30-inch) soybean the beginning of the critical period of weed control was at the first trifoliate stage, suggesting that in wide-row soybean control measures should start early in the season (at the first trifoliate stage). With 15-inch rows, the beginning of the critical period of weed control was delayed and corresponded approximately to the second trifoliate stage. With 7.5-inch row soybean, the control period was at the third trifoliate stage.

Cost of delaying weed control.

Delaying weed removal beyond the start of the identified period for weed control will cost a producer an average of 2 percent in yield loss per every leaf stage of delay in both corn and soybean. From a practical standpoint, an arbitrary level of, for example, 2 percent, 5 percent, or 10 percent yield loss can be used to signify the beginning of the critical period (time of weed removal). This range will allow a producer to make adjustments depending on the level of risk he or she is willing to take. To illustrate the point, an arbitrary level of 5 percent yield loss was used to determine the beginning of the critical period of weed control for corn and soybeans (see *Figures 1 and 2*).

To determine the cost of delaying weed control, use the curve above the arbitrarily selected point (the beginning of the critical period of weed control). For example, if an arbitrarily selected point is 5 percent, the 5 percent yield loss will occur if the weeds are removed at the second leaf stage in 0-N level (*Figure 1*). Delaying weed control to the third leaf stage will cause about 7 percent yield loss, in essence costing the producer a 2 percent yield loss. A similar trend is observed for the later leaf stages at each of the four curves (*Figure 1*).

Delaying weed control in soybean re-

sulted in similar yield losses as in corn and was significantly influenced by crop row spacing. For example, 5 percent yield loss in drilled soybeans (7.5-inch rows) occurred at the third trifoliolate stage compared to a 7 percent yield loss at the fourth trifoliolate. This indicates a 2 percent yield loss. Similar costs in delaying weed control in soybean were observed for the later leaf stages at each of the three curves (Figure 2).

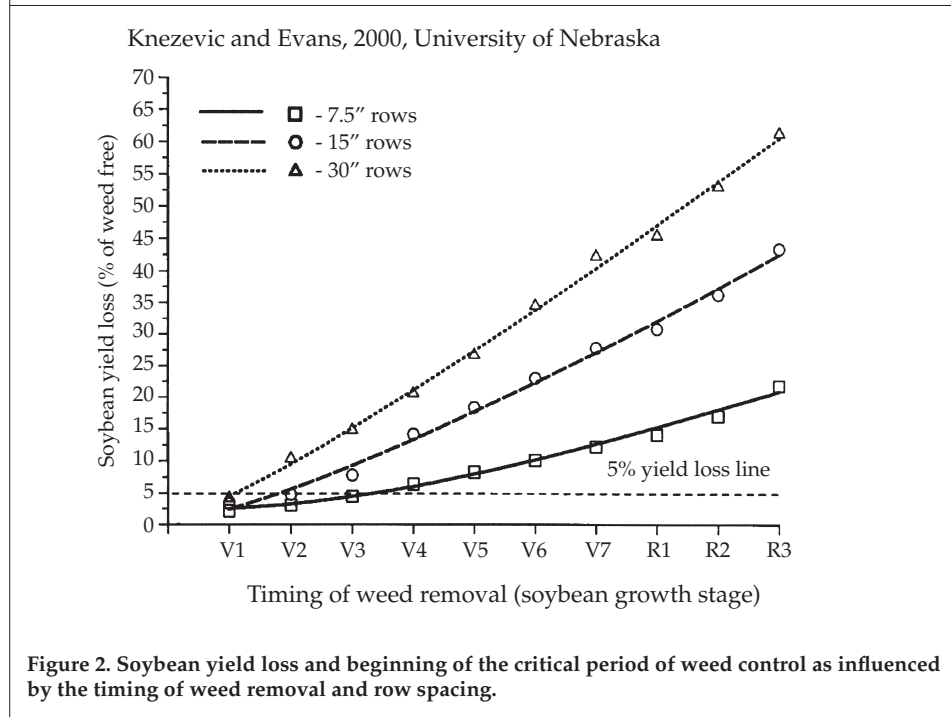
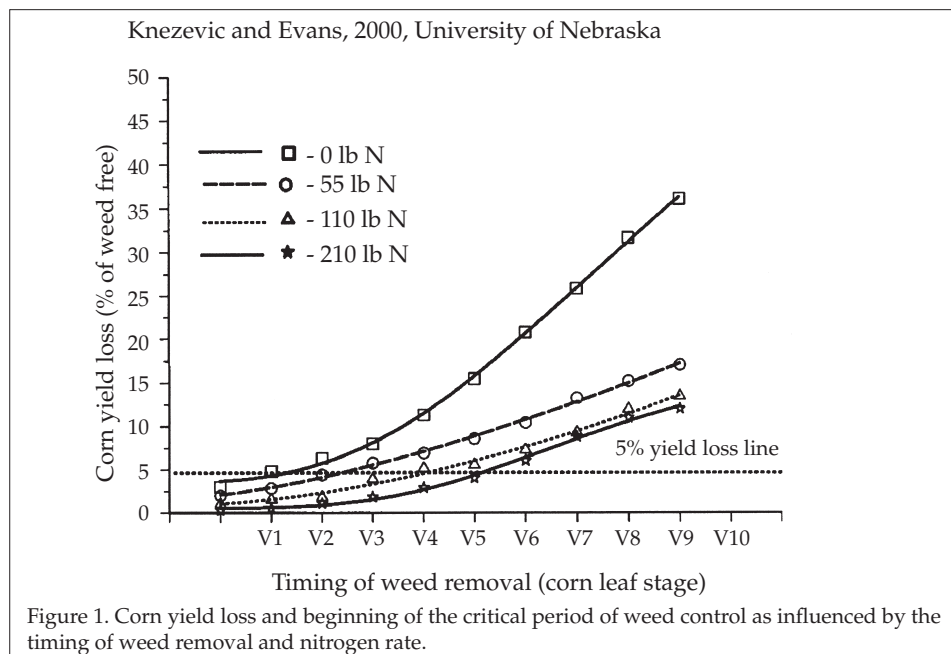
To determine the actual economics of delaying control, the producer can convert the percentage yield loss of the actual target yield on the farm. For example, if a target yield for corn is 100 bushels per acre, delaying weed control for every leaf stage of crop will cost producers about 2 bu/A of yield (thus 2 percent of 100 bushels per acre). In terms of actual economic loss, it will be about \$6 per acre for every crop leaf stage of delay, assuming a price of \$3 per bushel for corn. The loss in soybean will be about one bushel (2 percent of a 40 bu/A target yield). Considering current prices of soybean (about \$9 per bushel), the economic loss will be about \$9 per acre for every leaf stage of delay.

Economic threshold is the level of weed infestation at which the cost of weed control equals the increased return on crop yield in the current year. The threshold values will vary with time of weed emergence, weed species competitiveness, and commodity prices. A list of competitive indices for major weeds is on page 11. The bottom line is: Spray only when it pays. Spraying for annual weeds that are below threshold level is not necessary from both biological and economical perspectives.

Computer models also have been developed to aid with spray decisions. University of Nebraska–Lincoln weed scientists developed the decision support software, WeedSOFT. This software can help you select the most economical herbicide based on the various weed species present, their densities, and the soil type in your field.

Field scouting to determine weed density. Crop producers are well aware of the effect of high weed densities on crop yields; however, it is at low weed densities that they must make weed management decisions, comparing the economic benefits of controlling weeds with the costs. Field scouting is an important part of deciding whether to spray. Accurately determining the types of weeds, their density and relative times of emergence in the field will help determine if a spray operation is necessary.

One of the major constraints to using

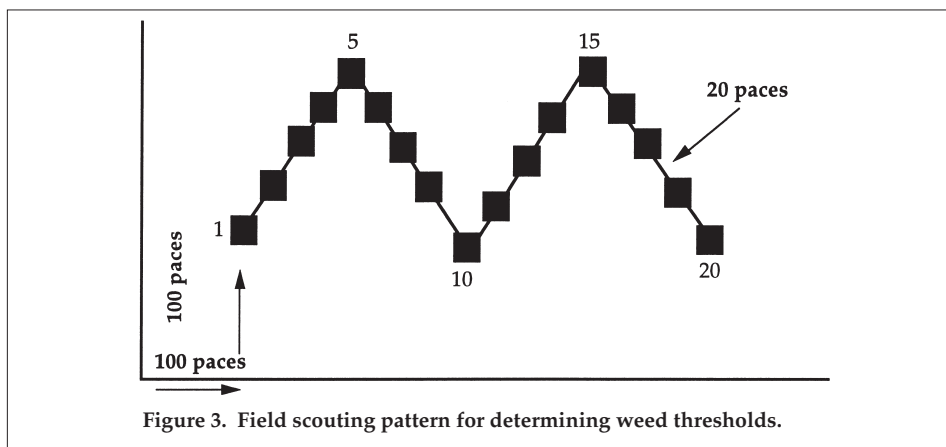


weed thresholds at the farm level is a lack of practical sampling methods for estimating weed density over larger field scale. We suggest that the entire field should first be walked to get a feel for the "weed pressure" and then sampled. While several sampling methods are available, we recommend using an inverted "W" pattern as illustrated in Figure 3.

The scout should walk for about 100 paces along the edge of the field and then turn at a right angle and walk 100 paces into the field. The sampling begins at this point. A wooden or wire "quadrant"

enclosing a 2- by 2-foot area can be used to determine weed density at every sampling spot along the inverted "W" pattern. At each sampling spot the quadrant should be placed to the ground and the number of weeds present in the quadrant counted and recorded. A minimum of 20 sampling units, each at least 20 paces apart, should be taken across the field and an average weed density calculated. The average weed density can be used to estimate yield loss using WeedSOFT or some other yield loss estimator.

Many times weeds are not uniformly



distributed and may be more heavily concentrated in patches, low spots, and along field edges. These areas should be considered separately from the rest of the field.

Documentation and Record Keeping

Documentation and record keeping are essential to an IWM program. Field histories and information on cropping practices will help you evaluate your weed control

program over time. Information can be recorded on paper or in computerized forms, which can be developed as a database application. Data forms should have basic information such as: site description, field monitoring and evaluation, records of herbicide applications, and other methods of weed control. Generally, knowing the weeds on your farm, taking notes, and watching for possible shifts in weed species may prevent costly surprises.

Integrated Weed

Management — Making It Work

Since there are many kinds of weeds with very different life cycles, no single IWM program is best under all circumstances. Obviously you cannot use all of the described techniques at once; however, if new methods are implemented in a systematic manner, significant advances in weed control can be achieved. Use the best combination of techniques for your needs.

There are many ways to start developing an integrated weed management program. The easiest way is to try one or two techniques, adding more each year. After a few years, you will have developed an integrated weed management program that works well for your operation. Using a variety of weed control tools reduces the reliance on any tool, which means that those tools will still be effective in the years to come. Using various methods keeps weeds off balance and prevents them from adapting to your management strategy. And remember, there is no such a thing as a “silver bullet” when it comes to weed control.

Nonchemical Weed Control

Nonchemical weed control can be used exclusively or integrated with chemical control. In either case, nonchemical methods can play a major role in weed management. The major nonchemical weed control techniques include: biological, cultural, and mechanical approaches. Successful nonchemical control is best achieved through an integrated approach based on the biology of the weeds and the crop. The following discussion highlights some of the major elements of nonchemical weed control.

Weed Seed Banks

Seed banks are reservoirs of weed seeds that may, under favorable conditions, germinate and emerge to compete with crops. Most agricultural soils contain large reservoirs of weed seeds, with up to 12,500 seeds/ft². The number and composition of weed seeds in soils vary greatly but are closely associated with climatic factors, soil characteristics, cropping, cultivation, and weed management practices. Seed banks have a number of similarities. Generally, they consist of numerous species, although several species may comprise 70-90

percent of the total seed bank. This large set may be followed by a second smaller subset of species that may comprise 10-20 percent of the seed reserve. A final group, accounting for only a small percentage of the total seed reserve, consists of species that are remnants of past crops.

The depth of seed burial and the amount and intensity of soil cultivation are important in seed longevity. In general, weed seed longevity will be less in cultivated soils than in noncultivated soils. Only a portion of the weed seed in the seed bank emerges each year and many annual weeds have well-defined periods of emergence. For example, common lambsquarters and redroot pigweed have major peaks of emergence from mid-spring until early summer, whereas downy brome emergence peaks from late summer through fall.

In cultivated soils, most seeds are found in the upper 6 inches, although they may be found as deep as the soil is cultivated. As the intensity of tillage declines, the seed bank moves closer to the soil surface. Seeds are then in a better position to germinate and interfere with crop production;

conversely, under good weed management, the seed bank could be more easily reduced. Design of planting and weed control systems in crops that capitalize on the shallow seed bank can improve the effectiveness of the cropping system. It is important to design weed management programs that limit the renewal of seed banks. Programs incorporating the most suitable crop rotations, herbicides, and cultivation practices play an important role in limiting the number and diversity of seeds in the seed bank.

Weed species that infest cropped fields vary greatly in their potential seed production capacity. Some examples of the potential seed production capacity per plant for several annual weeds are 250 for wild oat, 7,160 for barnyardgrass, 72,450 for common lambsquarters, and 117,400 for redroot pigweed. The actual production per plant varies greatly from year to year and depends upon factors such as plant competition, climatic conditions, soil fertility, the suppressive effect of weed control techniques, and time of emergence.

The longevity of the seed bank depends, in part, on the percentage of seeds that

germinate, the number of weeds that produce seeds, and the species present. Clearly, increasing the rate of germination, coupled with prevention of seed production, can shorten the time needed to reduce weed populations to noncompeting levels.

Biological Weed Control

Biological weed control is the control of weeds by parasites, predators, or pathogens. Biological control reduces weed density but does not eliminate the target weed, as the biocontrol agent often requires the weed as a host or food source. In some instances biological control can be permanent as the biocontrol agent may be self-perpetuating and not require additional management. The target organism may then be controlled indefinitely without further human effort, a particular advantage in certain geographically or environmentally limiting settings. Biocontrol agents are rigorously evaluated prior to approval and release to avoid deleterious effects. The effect of biocontrol agents is limited to the target weed and perhaps a few of its close relatives. The economics of successful biocontrol can be favorable since following release the organism may perpetuate itself indefinitely and often disperses on its own.

The response to a biocontrol program is often slow because the population of the organism must increase from the level of the initial release. As a result, most biocontrol agents are best suited to a stable long-term environment, i.e., grazing land or natural areas rather than an annual cropping system. Most biocontrol agents, by virtue of their specificity, control only a single species and are not well suited to address the complex of weeds normally found in cropland. Since most biocontrol agents by themselves do not reduce weed populations to an acceptable level, they must be used in conjunction with other approaches in an integrated weed management (IWM) program.

An often cited example of biological control success is the use of the imported cactus moth and several secondary insects to control prickly pear in Australia. A large scale biocontrol program in the United States used the Klamath beetle and other species to control the Klamath weed in Oregon. Varying degrees of success have been realized in Nebraska with biocontrol efforts targeting Canada thistle, diffuse knapweed, leafy spurge, musk thistle, and purple loosestrife. Research continues at the national and state levels to develop biocontrol agents.

Cultural Weed Control

A variety of cultural practices can be used to improve crop competitiveness. Crop rotation and crop selection are two of the easiest and most effective practices. Crop rotation permits diversified management, which allows less opportunity for an individual weed to become dominant. For example, the use of forage crops (perennial or annual) provides an opportunity to cut weeds before they set seeds, which is an important form of weed removal.

Crops differ in their competitive ability. For example, winter cereals are generally better competitors than spring cereals against summer annual weeds. Rotating crops with different life cycles will help to prevent a single weed, or small group of weeds, from dominating and having an economic impact on crop production. Annual weeds are more common in annual crops; biennial and perennial weeds are more common in perennial crops; and winter annual weeds are most problematic in winter annual crops (e.g., downy brome in winter wheat).

Crop and cultivar selection provide a variety of planting date options to aid in the management of a particular weed species. Changing the planting date from year to year can reduce the buildup of specific weeds. Planting early will give the crop an edge against late emerging weeds such as waterhemp, morningglories, and fall panicum. Planting late may allow the use of a preplant tillage operation to control early emerging weeds such as winter annuals (field pennycress, shepherdspurge, mustards, henbit), velvetleaf, lambsquarters, and green foxtail.

Adjusting crop population density and row spacing influences plant competition for water and nutrients, canopy closure, and crop shading effects on weeds. To a point, higher crop population densities generally are more competitive with weeds than lower population densities. The time to canopy closure can be altered by changing row spacing. Generally, narrow row spacings result in earlier canopy closure than wider row spacings. Canopy shading is a major means by which crop plants suppress weeds, but the crop must develop rapidly to stay ahead of the weeds. Nebraska's research showed that soybean is more competitive when planted in narrow rows than in wide rows. Crop selection, population density, and row spacing should be considered in any cropping system. These cultural practices are especially important for crops with shorter stature.

Cover crops and their residues also may provide a means to keep weeds in check. Cover crops are generally planted in closely spaced rows to provide good ground cover. They help manage weeds through competition, physical suppression, and allelopathic effects.

Mechanical Weed Control

Mechanical weed control is one of the most commonly used nonchemical methods of weed control. Tillage, mowing, cutting, and for small areas, hoeing, hand removal, and physical barriers are common mechanical weed control techniques. A variety of implements can be used, depending on the crop and the system. Tillage destroys emerged weeds but also plants seeds that are on the soil surface. Depending on the depth of weed seed burial, tillage often tends to encourage large-seeded broadleaf weeds and discourage small-seeded broadleaf weeds and grasses.

Primary tillage includes moldboard plowing, chiseling, heavy disking, rototilling, and similar operations. Tillage will destroy annual and biennial weeds, and disrupt the root systems and other vegetative reproductive structures of perennials. Primary tillage also buries crop residue, leaving the soil subject to erosion.

Secondary tillage is performed after primary tillage and is intended to prepare a weed-free seedbed for crop planting. Commonly used implements are disks, field cultivators, and harrows. Tertiary tillage is performed after crop planting and is intended to keep weeds from becoming established in the growing crop. Commonly used implements include harrows, rotary hoes, and various row cultivators. Many specialized implements have been designed for mechanical in-crop weed control.

Ridge planting is a system that incorporates mechanical weed control in that the crop is planted on an existing ridge where a sweep on the planter removes any growing weeds from the row area ahead of the planter unit and also moves weed seeds to the row middles. Subsequent cultivation and ridging controls weeds between the rows and buries small weeds growing in the crop row.

Successful weed control with secondary and tertiary tillage is highly dependent on timing, the weather, and soil moisture before and after the operation. Soil moisture must permit tillage while the weeds are in the small, vulnerable stage and drying conditions must exist for several hours after the operation to desiccate the

small weeds. Delaying planting provides the opportunity to kill one or two "crops" of weeds prior to planting and allows the soil to warm up, resulting in rapid crop growth. Rapid crop growth is important in reaching a size differential between a larger crop plant and the weed. This size differential is required for success with many harrow, rotary hoe, and cultivation operations.

Properly timed mowing or cutting will suppress weeds but with few exceptions will not kill them. Cutting cedar trees (or other plants without basal buds) below the lowest branch will kill them. Mowing tends to be more effective on broadleaf weeds than grasses since most grasses rapidly regrow from the crown. Mowing must be carefully timed to maximize damage to the weed and minimize damage to the crop.

Physical barriers include placing black plastic sheeting (mulch) either on the soil surface or beneath a surface covering of gravel or stone. The crop or plant to be grown is planted through a hole cut in the plastic. Black plastic is important because it excludes sunlight from reaching weed seeds or small plants. Plastic mulch is most common with high value horticultural crops.

Propane-Fueled Flame Weeding

Flame weeding is an acceptable weed control option in organic production and has received renewed interest for conventional cropping systems. It can be used as part of an integrated pest management program not only for weeds but also for insect control in agronomic crops. Flame weeding controls weeds by heating plant tissue rather than burning it. Propane burners can generate combustion temperatures of up to 2000°F, which rapidly raises the temperature of the exposed plant tissues. The resulting thermal shock to the plant tissue boils water molecules inside the cells and breaks up proteins, especially in the cell wall. The expanding water generates a pressure that ultimately ruptures the cell wall, dehydrating the plant through cell leakage. Eventually plants die or their competitive ability is drastically reduced.

Pros and Cons of Flame Weeding

Flaming provides multiple advantages, such as:

- No chemical residue is left in plants, soil, air, or water.

- No drift hazard or herbicide carry-over to the next season.
- Herbicide-tolerant or -resistant weeds are controlled.
- Reduced cost compared to hand weeding.
- Reduced need for repeated cultivation and the risk of new weed flushes or increased soil erosion.
- Reduced need for hand weeding in organic systems.

The disadvantages of flame weeding when compared to conventional herbicides include:

- Higher equipment cost than with traditional herbicide applicators.
- Precise timing of flaming operation is required for crop safety.
- Low application speed due to smaller coverage. (Most flamers treat four to eight rows, unless custom built for 16 or more rows.)
- Lack of residual weed control.

A flame weeder may have almost the same weed control capacity as a mechanical cultivator, but it is usually slower than those used for chemical weed control.

From a resource and environment point of view, the high energy requirement and the release of carbon emissions could be seen as a disadvantage; however, propane combustion is relatively clean compared to other fossil fuels, such as diesel.

Weed Response to Flame Weeding

Based on our recent research to determine how various weed species respond to broadcast flaming, propane doses of 10 to 12 gallons per acre were highly effective in controlling many broadleaf weeds at early growth stages (up to 10 inches tall), providing over 90% control of velvetleaf, ivyleaf morningglory, redroot pigweed, common waterhemp, lambsquarters, field bindweed, kochia, and Venice mallow. The same dose of propane also provided 80% control of several grass species, including barnyardgrass, green foxtail, and yellow foxtail. The weeds listed can be controlled prior to crop planting, as well as before and after crop emergence.

Control of perennials with flame weeding can be challenging as the flame's heat can't penetrate deep into the soil to destroy root structures. To provide control of perennial weeds, flaming will need to be repeated several times throughout the season.

Crop Tolerance to Flaming

We have determined the tolerance level of major crops to propane flaming. Depending on the tolerable crop injury level, a propane dose could be selected to either control the weed, or reduce its competitive ability against the crop. Crop susceptibility to propane flaming varies with species and growth stages.

Grass crops such as field corn, popcorn, sweet corn, and sorghum are most tolerant and can be safely flamed from their VE (emergence) to V10 (10-leaf) growth stages, with a maximum of two postemergence flaming operations per season.

Soybean is tolerant to flaming only at the VE–VC stages (emergence to unfolded cotyledon) and after the V4 (4 trifoliate leaves) growth stages. Sunflower is tolerant to flaming only at the VE–VC stage (emergence to cotyledon) and after the V8 (8-leaf) growth stage. Flaming in wheat is recommended only before crop emergence.

Cost of Flame Weeding

Cost of a single flaming operation broadcast below crop canopy could be \$10–\$124 per acre, excluding equipment and labor costs. (This estimate is based on a propane cost of \$1/gallon applied at a rate of 10–12 gallons per acre.) A banded flaming application (over the crop row) can cost \$5–\$8 per acre due to lower propane use rates (4–6 gallons per acre).

Resources

For more information on flame weeding:

- Visit <http://propanecouncil.org> and search for the publication, *Propane-Fueled Flame Weeding in Corn, Soybean and Sunflower*, by Stevan Knezevic et al. The 30-page manual is free.
- Contact Extension Weeds Specialist Steven Knezevic at 402-584-3808 or sknezevic2@unl.edu.

Summary

Few nonchemical methods of weed control are so effective that any one can stand alone in providing acceptable weed control. An integrated weed management (IWM) program (see previous section) incorporating multiple approaches is important for success with nonchemical weed control.

Weed Management in Conservation Tillage Systems

No-till

Converting from an annual tillage to a strict no-tillage system usually results in a shift to greater winter annual weed pressure in corn and soybean cropping systems. In Nebraska, henbit, pennycress, tansymustard, shepherdspurse, downy brome, and foxtail barley are some of the more common species. In an annual tillage system, winter annual weeds are controlled by fall and/or spring tillage. In a no-till system, growers typically rely on burndown herbicide applications to control these weeds.

An effective weed management program will eliminate competition from weeds at planting time and when the crop is small to maximize crop yield. Competition from weeds will deplete soil moisture and nitrogen. The effect of uncontrolled winter annual weeds is especially evident in dry springs as the crop may emerge later or its growth rate may be slower. When weeds emerge prior to or with the crop, they often will shade and slow early season crop growth, reducing yield potential.

No-till systems can provide some benefits for weed control. Because the seeds are not worked into the soil by tillage, more are exposed to predation by insects, rodents, and birds. Also, residues remaining after a corn or wheat crop can act as a mulch to reduce weed emergence.

The most consistent herbicide-based weed management programs include a preplant or preemergence application, followed by a timely postemergence application (when weeds are 2-4 inches in height). In fields where winter annual or early spring weeds emerge before planting, an early preplant application with a burndown herbicide and a soil residual herbicide should provide a weed-free seedbed at planting. After planting, soil disturbance by the planter may allow weed growth in the row. In fields with heavy weed pressure or where irrigation to activate the residual herbicide is unavailable, it may be advantageous to split the soil residual application between a preplant application and a preemergence application.

The burndown herbicide should be applied before winter annual weeds enter the reproductive growth phase in order to maximize weed control. This is typically 10-30 days before planting. In situations where effective residual herbicides are available, fall burndown applications may

be applied prior to the soil freezing. Where effective residual herbicides are unavailable, the fall burndown application may result in increased pressure from early spring weeds, and require a second burndown application prior to planting.

Tables in the corn, soybean, and sorghum sections of this Guide provide ratings for herbicide efficacy on different weed species, and specific recommendations on effective treatments. Some of the residual herbicides that may be used preplant also have foliar activity (Valor, Authority, Sharpen, Callisto, Atrazine, Balance, Pursuit, FirstRate, Python, and Reflex). The burndown activity of these herbicides may be enhanced by using a crop oil concentrate or methylated seed oil and a liquid nitrogen fertilizer. Consult the label for specific adjuvant recommendations. Some combinations of residual herbicides, coupled with appropriate adjuvants, will provide satisfactory burndown control. With others, adding 2,4-D, glyphosate, Gramoxone, or similar foliar herbicides may still be necessary.

Ridge-till

During planting, the ridge clearing device (sweeps or disks) moves soil containing most weed seed, corn kernels and ears, and sorghum seed from the ridge into the inter-row furrow. This reduces the potential number of seeds that can compete in the crop row, and moves much of the weed pressure to the furrow.

As with no-till, an effective weed management program for ridge-till will eliminate competition from weeds at planting time and when the crop is small. Emerged weeds may interfere with planting if they are too large to uproot and smother with the ridge-clearing device. Where there is heavy weed pressure, a burndown herbicide application may be warranted prior to planting. Weeds that emerge after planting can be removed by interrow cultivation, a postemergence herbicide application, or a combination of herbicides and cultivation.

If crops are planted before weeds become large, effective weed control can be achieved with the ridge-clearing device followed by a banded herbicide over the crop row. If timely cultivation is not possible, weed density is heavy, or the field contains hard to control weeds like velvetleaf, a broadcast preemergence herbicide treatment at planting may be necessary.

Weeds will grow vigorously before planting in crops planted in mid-May or later. Two approaches can be used to control these weeds:

The first would be to select an early preplant treatment and apply it by mid to late April. Since the planting operation will destroy this herbicide barrier, a second herbicide application over the row is required at planting. A split application of two-thirds rate applied preplant and one-third rate banded over the row at planting should be effective.

The second would be to apply a postemergence burndown herbicide such as Roundup or Gramoxone in late April or early May before weeds are more than 3 to 4 inches tall. This should be followed with a preemergence herbicide at planting. In most cases the time interval between the burndown and preemergence applications should not exceed three to four weeks.

Tables in the corn, sorghum, and soybean sections of this publication provide control ratings for the more common weeds for burndown, preplant, and preemergence ("soil-applied") herbicide treatments. There are also specific recommendations on how to use these herbicides. Please refer to the "No-till" section above for additional discussion on burndown herbicide applications.

When herbicide use is not desired, the furrows can be preplant cultivated, leaving ridge top weed removal to the planter ridge-clearing device. This works extremely well on fields where corn was ensiled. Preplant cultivation also allows for rebuilding ridges, which may be desirable if they have been damaged by harvest equipment or livestock trampling. However, preplant cultivation and ridge building mixes weed seeds into the ridge that may complicate postemergence weed control.

Ecofarming

Ecofarming is a system that controls weeds after wheat harvest and throughout the fallow period by using herbicides and/or tillage with minimum disturbance of crop residues and soils. For a more detailed discussion, see pages 92-99.

Herbicide-Resistant Weeds in Nebraska

Not all weeds in a field (or state) have the same genetic makeup. This genetic variability allows a weed species to survive diverse environmental and management conditions because at least some individuals live to reproduce each year. The degree of genetic variability is not consistent among weed species. For instance, all the individuals in one species in a field may be clones of each other (like yellow nutsedge which propagates vegetatively), or there may be a high level of diversity (like common waterhemp, which is cross-pollinated). Genetic diversity results from different “alleles” — different versions of a given gene. For example, in humans, there are at least two alleles for eye color — blue and brown. In weeds, different alleles for a gene may result in differences in leaf shape, flower color, or susceptibility to a herbicide application.

A population of weeds with a unique feature that allows it to survive a given selection pressure is called a “biotype.” A biotype may be likened to a crop variety. One variety (biotype) of soybean may be resistant to white mold, where a second variety (biotype) is susceptible to the disease. Our management strategies may favor the survival of one species over another, or within a species, one biotype over another. For example, repeatedly applying 2,4-D to a field will eventually eliminate broadleaf weeds, but will favor the survival of grass weeds. Or applying Balance herbicide at the same time every year in the same field may result in a shift in kochia emergence from a biotype that emerges early (April) to one that emerges late (June) after the herbicide is no longer active. Selection pressure that affects which species or biotypes survive can result from management practices (crop rotation, herbicides used, tillage) and from environmental conditions (moisture level, disease pressure, soil fertility).

How Resistance Evolve

We select for herbicide-resistant weeds by applying the same herbicide or same herbicide mode of action repeatedly in a given field. Individual plants with an allele that makes them resistant to a herbicide can survive the herbicide application and produce seed. Over time, most individual plants susceptible to the herbicide will be eliminated and a “resistant population”

will develop. It is likely that in every weed species there are individual plants that have a gene or genes that will allow them to survive a particular herbicide application. Fortunately, those individuals are not in every field.

The speed at which we select for herbicide resistance is a function of the selection pressure and the frequency of the resistant allele. If the resistant allele is present in 1 in 1,000 individuals, we will select for resistant biotypes more quickly than if it is only present in 1 in 1,000,000. Selection pressure is also a function of herbicide rate and herbicide persistence. The effect of herbicide rate is a complex issue, and depends on the level of resistance in the weed. A herbicide can “persist” either through repeated applications of the same herbicide (e.g., two applications of glyphosate to a field each year) or by the herbicide lasting a long time in the soil, like atrazine and imazethapyr (Pursuit). When a herbicide is “persistent,” it increases the number of individual plants exposed to the herbicide and the probability that only resistant individuals will survive to reproduce.

Sometimes a weed will be resistant to a herbicide that has never been applied to a field. We call this “cross-resistance.” This occurs because many herbicides share the same mode of action (way the plant is killed) and site action (location where the herbicide acts to kill the plant). Often shattercane populations that are resistant to Accent also are resistant to Beacon. Both herbicides inhibit the ALS enzyme, and bind to the enzyme at about same location. In the resistant shattercane population, the allele for the ALS enzyme is changed in a way that prevents both herbicides from binding.

Resistance Levels

The level of resistance (amount of herbicide required to kill a weed) can be classified as “high” or “low.” A weed with a high level of resistance is not controlled when 10 times the label rate of herbicide is applied. Some resistant weeds (like ALS-resistant waterhemp) are not even controlled with 50 or 100 times the labeled rate. A weed with a low level of resistance is not controlled by the labeled rate, but may be controlled by applying three to four times the label rate. Glyphosate-resistant marestail behaves this way; however, because the

amount of a herbicide that may be applied in a given year is restricted, glyphosate by itself is no longer adequate for controlling marestail.

Altering the herbicide rate will have little effect on the selection of “high level” resistance because these weeds have a single gene that controls resistance, and the level of resistance is much higher than the rate of herbicide we can apply. Applying reduced rates of a herbicide may favor the selection of low-level resistance because resistance may be controlled by several genes (see *Research Findings on Glyphosate-Resistant Cropping Systems*).

It is possible for low levels of resistance to increase over time. Scientists in Australia were able to dramatically increase the level of glyphosate-resistance in rigid ryegrass in three generations. In the first year, they applied a very low rate of glyphosate. A few individuals survived; they crossed those individuals and obtained seed. The next year they applied a higher rate of glyphosate to the progeny of the crosses, and crossed the survivors again. By the third generation, they had many individuals that survived a full rate of glyphosate.

Herbicide-Resistant Biotypes in Nebraska

There are at least 21 herbicide-resistant biotypes in Nebraska (see *Table*). Some of these biotypes have existed for many years. Resistant weeds can be managed, but it often results in greater expense for the farmer.

Over the past 16 years, corn and soybean farmers have become increasingly reliant on glyphosate for weed control. Repeated application of glyphosate places selection pressure on the weeds in the field and will lead to weed shifts. In states where continuous soybean or continuous corn are common and farmers have relied solely on glyphosate for weed control, they have selected for weed biotypes resistant to glyphosate.

Resistant Species in Other States

Some of the weeds that are resistant to glyphosate in other states are of economic importance in Nebraska (see *Table*). We

Herbicide-Resistant Weed Biotypes in Nebraska

Weed Species	Type of Resistance	Example Herbicides (Site of Action)	Distribution in Nebraska
Common ragweed	glycine	glyphosate (9)	Isolated field in east
Giant ragweed	glycine	glyphosate (9)	Isolated fields in east
Johnsongrass	ALS	Accent/Zest, Pursuit	Isolated fields in southern
Kochia	ALS	Glean (2)	West
	glycine	glyphosate (9)	West
	growth regulator	2,4-D, dicamba (4)	Isolated populations in west
	triazine	atrazine (5)	West
Marestail (horseweed)	ALS	FirstRate	Isolated fields in southeast
	glycine	glyphosate (9)	Southeast and south central
Palmer amaranth	ALS	Pursuit, Classic (2)	Throughout southeast, south central, and west central
	glycine	glyphosate (9)	Isolated fields in southwest and south central
	HPPD	Callisto, Laudis,	A corn seed production field in south central
	Photo-system II	Buctril Impact/Armezon (27)	Isolated fields in south central
	triazine	atrazine (6)	Isolated fields in south central
Redroot pigweed	triazine	atrazine (5)	Isolated fields in northeast
Shattercane	ALS	Accent (5), Beacon (2)	Southeast and south central
Waterhemp	ALS	Pursuit, Classic (2)	Throughout the state
	glycine	glyphosate (9)	Throughout the northeast, southeast, and south central Nebraska
	growth regulator	2,4-D	A native-grass seed production field in southeast Nebraska
	HPPD	Callisto (4), Laudis, Impact/Armezon (27)	Isolated fields in northeast
	triazine	atrazine (5)	Isolated fields in southeast

Herbicide-Resistant Weed Biotypes in Other States Common in Nebraska

Species with resistance to glyphosate	States where glyphosate-resistant populations have been confirmed	Resistance to modes of action other than glyphosate (not necessarily in the same population)
Common ragweed	MO, KS, AR, OH	ALS inhibitors, PPO inhibitors, PSII inhibitors (triazines)
Common waterhemp	MO, KS, IL, MN, IA, MS, TX, TN, OK, SD, ND, IN, OH	ALS inhibitors, glyphosate, PPO inhibitors, PSII inhibitors (triazines), HPPD inhibitors
Giant ragweed	OH, IN, KS, AR, MN, TN, IA, MO, IL, MS, WI	ALS inhibitors, glyphosate
Johnsongrass	AR	ACCase inhibitors, Dinitroanilines
Kochia	KS, MT, CO, SD, OK, WY	ALS inhibitors, glyphosate, PSII inhibitors (triazines), growth regulators
Marestail	DE, KY, TN, IN, MD, MO, NJ, OH, AR, MS, NC, OH, PA, CA, IL, KS, MI, NE, IA	ALS inhibitors, glyphosate, PSII inhibitors, Bipyrilidiums
Palmer amaranth	GA, MS, TN, AR, NC, AL, MO, NM	ALS inhibitors, Dinitroanilines, glyphosate, PSII inhibitors (triazines)

should be attentive in managing these weeds to avoid selecting resistant populations. Weeds that are resistant to other herbicides and which may become resistant to glyphosate are particularly difficult to manage. When a weed has resistance to multiple herbicides (glyphosate + ALS + triazine), it may be likened to gene stacking of herbicide resistance in corn (Round-up Ready + Liberty Link).

Practices to Minimize the Development of Herbicide Resistance

The following strategies will reduce the risk of selecting for herbicide-resistant weeds:

1. Rotate crops to keep any one weed species from dominating. Rotations that include row crops, small grains, and perennial forages are most effective.
2. Include tillage as a weed management tool.
3. Use cultural practices that increase the crop's ability to compete against weeds. These practices include planting crops in narrow rows to increase shading of weeds, fertilizing adequately to enhance vigorous crop growth, and controlling weeds while they are small.
4. Do not use the same herbicide every year.
5. Use herbicides with different sites of action in successive years, and where possible, within a year. This approach will reduce the selection pressure and slow the development of resistance to a given site of action. See *Classification of Herbicides*, pages 9-10, for more information on herbicide site of action.
6. Use several herbicides with different modes of action within a given year. This can be done effectively by including a preemergence herbicide as part of your weed management strategy, or by tank-mixing two or more herbicides for postemergence applications.
7. Use short residual rather than long-residual (persistent) herbicides.

Weed Management in Herbicide-Resistant Crops

Herbicide-resistant crops have become popular during the last 20 years. As with most things in life, there are pros and cons to using herbicide-resistant crops.

The pros include weed management that usually will be improved because herbicide rates and timings are not dictated by crop tolerance. Another pro is that the total cost of weed management is lower, even when the increased seed cost is included.

Crops that are less competitive with weeds (for example, soybean is less competitive than corn) and cropping systems that reduce crop competition (for example, skip-row corn or low population rainfed corn) benefit the most from herbicide-resistant crops.

The cons are the increased cost of seed for most varieties and hybrids and that the producer must buy new seed each year

due to plant variety protection restrictions. Also, genetically modified crops may have a limited market and can contaminate adjoining crops. Another con is that repeated use of the same herbicide-resistant trait increases the potential for weeds to evolve resistance to that herbicide.

The first case of glyphosate resistance in a weed occurred where soybeans were planted continuously with no-till and only glyphosate was used before and after planting. (If your goal is to develop resistance in a weed rather than control it, this is probably the method to use.)

Total postemergence (POST) weed management programs have become popular with herbicide-resistant crops. Let's compare the advantages and disadvantages of the four primary weed control strategies.

The lowest risk of developing herbicide resistance occurs when both a PRE and a POST herbicide are used in the same year. The next lowest risk occurs in the POST tank-mix strategy, where two unique herbicides are applied at the same time. The risk of herbicide resistance is only reduced in PRE + POST and POST tank-mix strategies if two or more of the herbicides have activity on each of the weeds in the field. For example, a tank-mix of glyphosate + Select will reduce the risk of green foxtail developing resistance to glyphosate, but will not reduce the risk of common waterhemp developing resistance.

Using only one herbicide mode of action (glyphosate, glufosinate, or any other), either once or twice a year, for several consecutive years, is a high-risk scenario for developing herbicide-resistant populations.

Weed Management Strategies

<i>Weed Control</i>	<i>Advantages</i>	<i>Disadvantages</i>	<i>Risk of Herbicide-Resistant Weeds</i>
PRE + POST Burndown (Preplant)	•Excellent weed control •POST timing less critical •Tolerant/resistant weeds checked	•Two operations •Higher costs	Low
POST 1X	•Single operation •Low cost	•Narrow application window •Early and late competition •Incomplete control •Select tolerant/resistant weeds	High
POST Two Pass	•Excellent weed control	•Two operations •Two post treatments (wind) •Select tolerant/resistant weeds	High
POST TANK-MIX	•Single operation •Excellent weed control •Both herbicides must have activity on high-risk weed •Multiple modes of action	•Narrow application window •Early competition •Potential higher cost	Low-Moderate

Research Findings on Glyphosate-Resistant Cropping Systems

Over the last several years glyphosate has been applied to over 90 percent of the soybean, 80 percent of the corn, and recently up to 98 percent of the sugarbeet acreage in Nebraska. Applying glyphosate alone on millions of acres of farmland has led to natural selection for weeds resistant to or with enhanced tolerance to glyphosate.

In general the first sign of weed tolerance is the appearance of healthy weeds in fields recently treated with glyphosate. In some cases the weeds may have avoided treatment because of shading or environmental conditions that reduced plant uptake of glyphosate. Another option is that the weeds may be developing

resistance to glyphosate. Whatever the situation, the appearance of weed escapes should raise a red flag for the grower to immediately address the problem.

Several long-term studies are being conducted by University of Nebraska–Lincoln researchers to address this problem. Findings from these studies suggest the best management approach is to change the weed control program to not rely totally on glyphosate. Other suggestions for achieving successful weed control in glyphosate-resistant crops while helping slow the development of glyphosate-resistant weeds:

- Use a full rate of a residual herbicide or tank-mix herbicides at planting.

This will introduce different herbicide modes of action into the cropping system.

- Be prepared to change the preemergence herbicide program to a different herbicide if the PRE treatment fails to control the troublesome weed.
- Add another herbicide to glyphosate to broaden the weed spectrum and add a different mode of action to counter weed shifts and herbicide-tolerant weeds.
- Use a herbicide at planting followed by a postemergence herbicide after crop emergence to help improve the sustainability of glyphosate-based weed control in a glyphosate-resistant cropping system.

Volunteer Herbicide-Resistant Crop Control

The widespread adoption of herbicide-resistant crop (HRC) technology has given rise to a new weed problem — volunteer herbicide-resistant crops. An HRC is created by inserting a gene that makes the crop plant resistant to an herbicide. The gene conferring herbicide resistance is passed on to succeeding generations along with all the other genes in the plant. As a result, the volunteer plants developing the year after the HRC was grown are also herbicide resistant. The grower is then confronted with controlling the volunteer HRC the next year. The current list of HRCs includes Roundup Ready (RR) corn, Roundup Ready soybean, Roundup Ready alfalfa, Roundup Ready (RR) sugarbeet, Liberty Link (LL) corn, Clearfield (CF) corn, Clearfield sunflower, Clearfield wheat, Enlist corn and SU sunflower.

Controlling these volunteer HRCs with herbicides involves selecting an effective herbicide with a site of action different

than the resistant target site in the HRC. Refer to the Herbicide Classification section of this publication for herbicide site of action information. The herbicide selected also must be registered for the crop or site in question. Sometimes it is difficult to meet all these requirements. A problem arises when the most effective herbicide for the conventional version of the crop is the herbicide to which the volunteer crop is resistant. A common situation is controlling volunteer RR corn in RR soybean. This can be handled by using Assure II, Fusion, Poast Plus or Select Max in the soybean.

A more difficult problem is control of a poor stand of RR corn prior to replanting corn. Glyphosate is ineffective on volunteer RR corn. Assure II, Fusion, or Poast Plus would be a good choice if the replant crop is soybean but not corn because the residual activity of those herbicides would damage the corn.

Many crops do not routinely volunteer as a weed; however, corn, wheat, sunflower, and alfalfa may present a problem in the following crop. Expect a problem with volunteer HRC when high harvesting losses leave grain in the field. This should be considered in selecting the next crop. Once the next crop has been planted, many control options are no longer available.

The following table lists treatments useful in controlling common HRC plants. Some treatments provide suppression rather than a high degree of control. Control of the volunteer HRC would be required where an established crop is not present to compete with the volunteer crop, such as in fallow or where the next crop has not yet been planted. Suppression of the volunteer HRC may be adequate where the object is to eliminate competition from the volunteer HRC plants in a growing competitive crop as is the case with volunteer corn control in corn.

Herbicides for Control of Volunteer Herbicide-Resistant Crops

Volunteer HRC to be Controlled	Treated Crop or Situation						
	Corn	Soybean	Sorghum	Wheat	Fallow	Sugarbeet	Dry Bean
RR Corn	Liberty ^a (in LL corn) Lightning (in CF ^b corn)	Assure/Targa Fusilade DX Liberty (in LL soybean) Poast Select Max		Beyond in CF wheat	Fusilade DX Gramoxone ^a Liberty ^a	Assure/Targa Poast Select Max	Assure/Targa Poast Select Max
LL Corn	Glyphosate (in RR corn) Lightning (in CF ^b corn)	Assure/Targa Fusilade DX Poast Select Max		Beyond in CF wheat	Fusilade DX Glyphosate ^a Gramoxone ^a	Assure/Targa Poast Select Max	Assure/Targa Poast Select Max
Enlist Corn		Select Max		Beyond in CF wheat		Select Max	Select Max
CF ^b Corn	Glyphosate (in RR corn) Liberty ^a (in LL corn)	Assure/Targa Fusilade DX Poast Select Max		Beyond in CF wheat	Fusilade DX Glyphosate Gramoxone ^a Liberty ^a	Assure/Targa Poast Select Max	Assure/Targa Poast Select Max
RR Soybean	Dicamba		Dicamba	Dicamba	Dicamba	Stinger	
CF ^b Wheat	Glyphosate (in RR corn) Liberty ^a (in LL corn)	Glyphosate (in RR bean) Assure/Targa Fusilade DX Select Max Poast			Glyphosate	Assure/Targa Poast Select Max	Assure Select Max
SU Sunflower	Many other than ALS ^c	Many other than ALS ^c	Many other than ALS ^c	Dicamba 2,4-D	Dicamba 2,4-D Glyphosate	Stinger	Other than ALS ^c

^aSuppression, plants are usually not killed.

^bClearfield corn and wheat are resistant to some ALS-inhibiting herbicides. See *Classification of Herbicides*, pages 9-10.

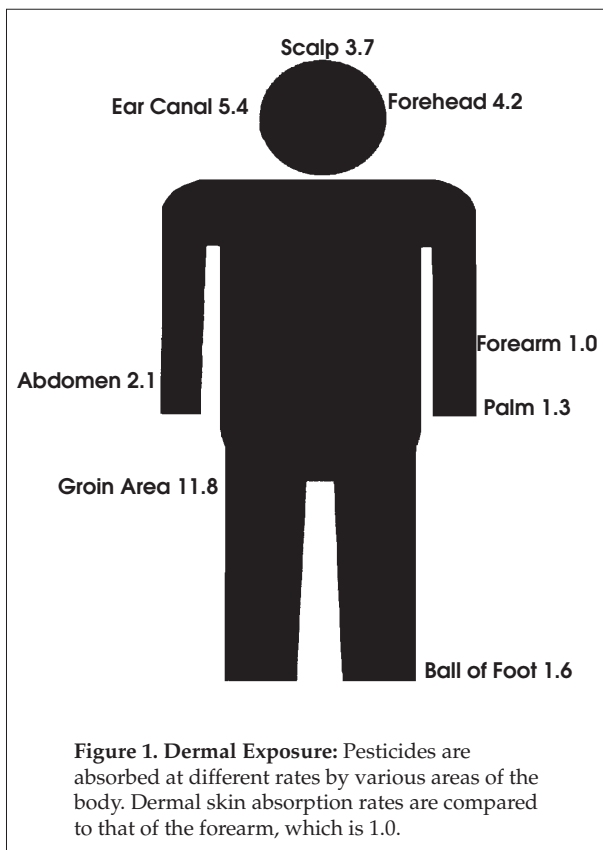
^cFor a list of ALS-inhibiting herbicides, see *Classification of Herbicides*, pages 9-10.

Human Hazards When Applying Pesticides

The signal words CAUTION (slightly toxic), WARNING (moderately toxic), and DANGER (highly toxic) indicate the relative toxicity of a herbicide or other pesticide active ingredient to humans. Signal words indicate the level of risk associated with acute oral, dermal, inhalation, or eye exposure. Signal words should be used as a guide for precautionary measures during handling, mixing, or application of pesticides. (Information on the toxicity of common pesticides is available on pages 25-28.) Signal words appear on the front of product labels, often with other Precautionary Statements. The word "Poison" and the skull and crossbones symbol are associated with the DANGER signal word on certain labels if the product may cause acute oral, dermal, and/or inhalation toxicity.

Always consult the pesticide label for the requirements for personal protective equipment (PPE). In some cases, personal protective equipment for the same product will differ between the mixer/loader operator and the applicator.

Dermal exposure (skin contamination) is the most common method of exposure and a potentially dangerous hazard for users of herbicides and other pesticides. It can occur any time a pesticide is handled, mixed, or applied and may go undetected initially. The potential danger from dermal exposure depends on the toxicity of the material, location of the exposure on the human body, the rate of absorption through the skin, the amount of skin exposed, and the amount of time the material is in contact with the skin. Rates of absorption through the skin differ depending on the part of the body that is exposed. Figure 1 shows the rate of absorption for different parts of the body in relation to that of the forearm (1x). Absorption may be 11.8 times (11.8x) faster in the lower groin area than on the forearm. At this rate, absorption of a pesticide through the skin into the bloodstream may be more dangerous than swallowing it. Absorption continues as long as the material remains in contact with the skin. Danger from exposure is increased if the contaminated area is large or if the material is left on the skin for a prolonged period. Contact with the eyes is also a concern. Use protective eyewear as required by the pesticide label, at the very least.



Other components of a formulated pesticide product also can be hazardous. Many pesticides are carried in an oil base, which may be toxic if it gets into the bloodstream. Oil penetrates the skin as rapidly as some pesticides in highly sensitive areas of the body. Nitrile or neoprene aprons should be worn to protect the lower parts of the body. Absorption continues as long as the material is left on the skin.

Agricultural pesticide handlers are permitted to wear separate glove liners

Relative oral toxicities of several common household materials, along with corresponding signal words (as found on the pesticide label) for four pesticides

Material	Oral LD ₅₀ in mg/kg	Pesticide Signal Word
Sugar	29,700	
Grain alcohol (Ethanol)	9,000	
Glyphosate — herbicide	5,600	Caution
Table salt	3,000	
Malathion — insecticide	1,375	Caution
Aspirin	1,000	
Metalaxyl — fungicide	633	Warning
Ammonia	350	
Caffeine	192	
Nicotine	1	
Aldicarb — insecticide	0.93	Danger — Poison
Botulinum toxin	0.00001	

beneath chemical-resistant gloves. The liners may not be longer than the chemical-resistant glove, and they may not extend outside the glove. The liners must be disposed of after 10 hours of use or whenever the liners become contaminated. Lined or flocked gloves, where the lining is attached to the inside of the chemical-resistant outer glove, remain unacceptable.

See *Safe Transport, Storage, and Disposal of Pesticides* (EC2507) for information on proper procedures for storage and handling of pesticides. For additional information, see *Protective Clothing and Equipment for Pesticide Applicators* (NebGuide G758), *Pesticide Safety: Choosing the Right Gloves* (G1961), *Maintaining and Fit Testing Cartridge Respirators for Pesticide Applications* (NebGuide G2083), and *Managing Pesticide Poisoning Risk and Understanding the Signs and Symptoms* (EC2505). Several Internet sites are excellent resources:

UNL Pesticide Safety Education Program Web site (with links to social media) <http://pested.unl.edu>

UNL pesticide-related Extension publications <http://extensionpubs.unl.edu>

Pesticide Information Profiles on individual active ingredients <http://extoxnet.orst.edu/pips/ghindex.html>

Recognition and Management of Pesticide Poisonings <http://www.epa.gov/pesticide-worker-safety/recognition-and-management-pesticide-poisonings>

National Pesticide Information Center <http://npic.orst.edu/>

Environmental Considerations When Applying Pesticides

Maximizing pesticide effectiveness in a way that is safe for users and environmentally responsible requires awareness of possible exposure hazards and the relative potential for leaching and runoff.

Pesticide leaching through soil can contaminate groundwater, while pesticide loss in runoff can contaminate surface water. The potential for pesticide movement through runoff or leaching varies with pesticide and soil properties, as well as climatic variables and management practices. Whether pesticide residues become contaminants of groundwater or surface water depends to a large extent on their retention by soil, solubility in water, and persistence. The amount of chemical applied, as well as the timing and amount of rainfall or irrigation, are important. The effects of these variables may also be influenced by management practices. Depth to groundwater and distance to surface waters can determine the extent of contamination when pesticide transport occurs.

Pesticide Properties

Pesticides differ in *water solubility* and *sorption (retention)* in soil, which has a major influence on their availability for plant uptake, degradation, and movement

with water. Water solubility is often given in *parts per million* (ppm). The *Koc (organic carbon partition coefficient)* indicates relative pesticide retention in soil. The figures that follow show comparative water solubility, soil retention, and persistence of herbicides used in Nebraska. Herbicide products with mixtures of active ingredients that differ significantly in chemical properties are not included.

The relative persistence of pesticides in soil is based on rates of degradation and may be evaluated by comparing their *half-lives*. A half-life is the time required to decrease the amount of pesticide present by one-half. The actual half-life of a pesticide in the field varies among soils and with environmental conditions. More information on pesticides is available in the *Pesticide Handbook of the Weed Science Society of America, Tenth Edition — 2014*.

Relative Risk of Ground and Surface Water Contamination

The relative potential for pesticides to leach through soil and contaminate groundwater can be determined from their soil retention (Koc values), water solubility, and persistence. The relative potential for pesticides to move off a field with runoff and

potentially contaminate surface waters can be estimated from their Koc values. These properties were used to classify the mobility — the relative potential for groundwater contamination from leaching and relative runoff potential — of the pesticides listed in the table that follows. Classifications assume the pesticide is applied to or reaches the soil surface during application.

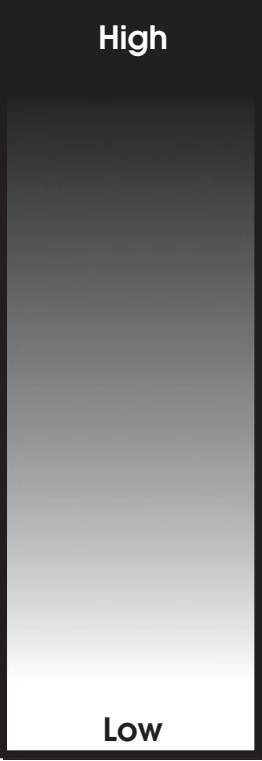
Soil and Application Factors Influencing Pesticide Movement

Coarse-textured (sandy), porous soils tend to be highly permeable and may promote pesticide leaching, while runoff may be greater in fine-textured (high clay), less permeable soils. When the water table is shallow, the potential for groundwater contamination may be high for many pesticides. The potential for contamination through runoff is high when pesticides are applied on steeply sloped land in close proximity to surface water. Excessive irrigation can promote pesticide loss through leaching and/or runoff. The total amount of pesticide available for leaching and runoff is usually less for postemergence applications compared to preemergence and other direct soil applications.

Water Solubility of Some Herbicides

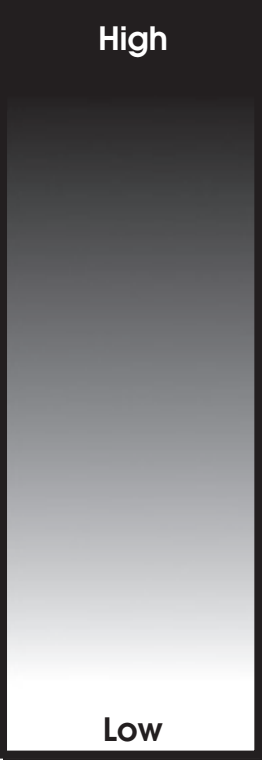
High Low	greater than 3000 ppm	Accent, Acquire, Arsenal, Banvel, Basis, Callisto, Clarity, Cyclone, Distinct, Glean, glyphosate, Gramoxone SL, Hoelon, Impact, Laudis, Liberty, Matrix, Option, Peak, Plateau, Poast, Poast Plus, Python, Raptor, Resolve, Rodeo, Roundup, Touchdown, Starane, Ultima 160, Velpar
	300 to 3000 ppm	Ally, Amber, Authority/Spartan, Basagran, Buctril, Cadet, Cimarron, Classic, Command, Connect, Dual, Dual II Magnum, Eradicane, Harmony GT, Hyvar, Maverick, MCPA, Outlook, Permit, Pursuit, Reward, Select, Sencor, Stinger, 2,4-D amine, 2,4-D ester, Tordon
	30 to 300 ppm	Aatrex, Atrazine, Beacon, Blazer, Buctril, Connect, Evik, FirstRate, Flexstar, Harness, Huskie, Intrro, Karmex, Linex, Nortron, Nortron SC, Paramount, Partner, Reflex, Ro-Neet, Scepter, Surpass, Topnotch, Upbeet
	3 to 30 ppm	Affinity, Achieve, Aim, Anthem/Pyroxasulfone, Balance FLEXX, Betamix, Casoran, Far-Go, Kerb, Princep, Tupersan
	less than 3	Acclaim Extra, Assure II, Balan, Cobra, Curbit, Dimension, Fusilade DX, Gallery, Goal, Pendimax, Phoenix, Prowl, Resource, Sonalan, Surflan, Targa, Treflan

Relative Soil Persistence of Some Herbicides (half-life in days)

	greater than 100 days	Cyclone*, Gramoxone SL, Paramount, Plateau, Sinbar, Spartan
	31 to 100 days	Aatrex, Acquire*, Amber, Anthem/Pyroxasulfone, Arsenal, Assure II, Atrazine, Balan, Casoran, Classic, Curbit, Define, Devinol, Dual, Dual II, Dual II Magnum, Evik, Far-Go, Flexstar, Gallery, Glean, glyphosate*, Goal, Hyvar, Karmex, Kerb, Linex, Maverick, Peak, Pendimax, Princep, Prowl, Pursuit, Python, Reflex, Rodeo*, Roundup*, Scepter, Sonalan, Starane, Targa, Tordon, Touchdown*, Treflan, Tupersan, Velpar, Zorial
	16 to 30 days	Accent, Achieve, Ally, Assert, Avenge, Balance, Basagran, Beacon, Betamix, Cimarron, Command, Dimension, FirstRate, Hoelon, Huskie, Intro, Nortron, Nortron SC, Outlook, Partner, Permit, Raptor, Ro-Neet, Sencor, Stinger, Surflan
	5 to 15 days	Acclaim Extra, Action, Aim, Alanap, Banvel, Blazer, Buctril, Callisto, Clarity, Connect, Eradicane, Express, Fusilade DX, Harmony GT, Harness, Impact, Laudis, Liberty, Matrix, MCPA, Option, Poast, Poast Plus, Resolve, Resource, Reward, Spartan, Surpass, 2,4-D amine, 2,4-D ester, Topnotch, Ultima, Upbeet
	less than 5 days	Basis, Cadet, Cobra, Distinct, Phoenix, Select

*These compounds are tightly bound to the soil and are biologically inactive soon after application; therefore, rotation restrictions should not be a major concern.

Relative Soil Retention (Koc) of Some Herbicides

	greater than 2000	Acclaim Extra, Acquire, Avenge, Balan, Betamix, Cobra, Curbit, Cyclone, Dacthal, Far-Go, Fusilade DX, glyphosate, Goal, Gramoxone SL, Hoelon, Pendimax, Phoenix, Prowl, Resource, Rodeo, Roundup, Sonalan, Touchdown, Treflan
	500 to 2000	Assure II, Axiom, Buctril, Connect, Dimension, Kerb, Devinol, Ro-Neet, Surflan, Targa, Zorial
	150 to 500	Cadet, Casoran, Command, Dual, Dual II, Dual II Magnum, Eradicane, Evik, Gallery, Harness, Intro, Karmex, Nortron, Nortron SC, Partner, Plateau, Starane, Surpass, Topnotch, Tupersan
	50 to 150	Aatrex, Amber, Anthem/Pyroxasulfone, Arsenal, Assert, Atrazine, Balance FLEXX, Beacon, Blazer, Callisto, Classic, Distinct, FirstRate, Flexstar, Frontier, Laudis, Liberty, MCPA, Outlook, Permit, Poast, Poast Plus, Princep, Reflex, Reward, Sencor, Sinbar, Ultima 160, Upbeet, Velpar
	less than 50	Accent, Achieve, Affinity, Aim, Alanap, Ally, Banvel, Basagran, Basis, Cimarron, Clarity, Express, Glean, Harmony GT, Huskie, Hyvar, Impact, Matrix, Maverick, Option, Paramount, Peak, Pursuit, Python, Raptor, Resolve, Scepter, Select, Spartan, Stinger, 2,4-D amine, 2,4-D ester, Tordon

Potential Human Exposure Hazard and Environmental Risks of Herbicides

This table does not include all products and/or active ingredients. Examples are for comparison of human health hazards, use rates, and potential for leaching and runoff.

Product Name	Common Name of Active Ingredient	Potential Human Exposure Hazard		Relative Use Rate ³	Relative Leaching Potential ⁴	Relative Runoff Potential ⁵
		Signal Word ¹	Toxicity Class ²			
2,4-D amine, 2,4-D ester	2,4-D	D, C	I, III	M-H	M*	Mw
AAAtrex	atrazine	C	III	H	M*	H
Accent Q	nicosulfuron	C	III	L	M*	Mw
Acclaim Extra	fenoxaprop-P-ethyl	C	III	L	L	Ms
Affinity, Broadspec	thifensulfuron-methyl (25%) tribenuron-methyl (25%)	C	III	L	H	Mw
Aim	carfentrazone-ethyl	C	III	L	H*	Lw
Alanap	naptalam	W	II	H	H*	Mw
Ally	metsulfuron-methyl	C	III	L	H*	Mw
Ally Extra	thifensulfuron-methyl (37.5%) tribenuron-methyl (18.75%) metsulfuron-methyl (15%)	C	III	L	H*	Mw
		C	III	L	H*	Mw
		C	III	L	H*	Mw
Amber	triasulfuron	C	III	L	H*	H
Arsenal	imazapyr	C	III	M-H	H*	H
Assure II/Targa	quizalofop-P-ethyl	D (eye)	I	L-M	M*	H
Balan DF	benefin	C	III	H	L	Ms
Balance Flexx	isoxaflutole	C	III	L	M	H
Banvel, Clarity	dicamba	W, C	II, III	M	H	Lw
Basagran, Basagran T/O, Broadloom	bentazon	C	III	M	M	Mw
Basis Blend	rimsulfuron (20%) thifensulfuron-methyl (10%)	C	III	L	M	Mw
Beacon	primisulfuron-methyl	C	III	L	H*	Mw
Betamix	phenmedipham (8%) desmedipham (8%)	W	II	M	L	H
Breakfree ATZ, Breakfree ATZ Lite	acetochlor atrazine	C	III	H	M*	H
Breakfree, Degree, Harness, Surpass, Topnotch	acetochlor	C	III	H	M	H
Buctril, Volley	bromoxynil	W	II	M	L	H
Cadet	fluthiacet-methyl	W	III	L	M	M
Callisto	mesotrione	C	III	L	L	L
Canopy	metribuzin (64.3%) chlorimuron-ethyl (10.7%)	C	III	L	H*	H
Casoron	dichlobenil	C	III	H	M	H
Cimarron Plus, Cimarron Xtra	metsulfuron-methyl (30%) chlorsulfuron (37.5%)	C	III	L	H*	Mw
Cinch ATZ, Cinch ATZ LITE	atrazine S-metolachlor	C	III	H	M*	H
Classic	chlorimuron-ethyl	C	III	L	H*	H
Cobra, Phoenix	lactofen	C	III	L	VL	Ms

¹Signal Words: C = Caution, W = Warning, D = Danger. Classification may vary with formulation. V = varies by product.

²EPA Toxicity Class: I = most toxic; IV = least toxic.

³L = Low (less than 0.25 lb ai/A); M = Medium (0.25-0.99 lb ai/A); H = High (greater than 0.99 lb ai/A).

⁴VL = Very Low; L = Low; M = Medium; H = High. Asterisk (*) indicates the potential for contamination from leaching increases with increasing soil pH. Salt and acid formulations generally are highly leachable. Ester formulations are less leachable, but are often rapidly hydrolyzed to corresponding acid forms that may be highly leachable.

⁵Loss with runoff when leaching also occurs: Lw = Low, primarily lost with runoff water; Ls = low, primarily lost with sediment/soil in runoff; Mw = medium, primarily lost with runoff water; Ms = medium, can be lost with displaced sediment/soil in addition to runoff water; H = high, lost in both runoff water and with displaced sediment/soil. When no leaching occurs, herbicides with Koc values less than 5000 have a high potential to be lost with runoff water. The table for insecticides has an Hs for an insecticide lost mainly through displaced sediment/soil but not in runoff water. Please see that table.

Potential Human Exposure Hazard and Environmental Risks of Herbicides (continued)

Product Name	Common Name of Active Ingredient	Potential Human Exposure Hazard		Relative Use Rate ³	Relative Leaching Potential ⁴	Relative Runoff Potential ⁵
		Signal Word ¹	Toxicity Class ²			
Command 3 ME	clomazone	C, W	III, II	M	M	H
Devrinol	napropamide	D, C	I, III	H	M	H
Dimension	dithiopyr	C	III	L-H	L	H
Distinct	diflufenzopyr	C	III	L	M	H
DSMA Plus	DSMA	C	III	H	L	Ms
Dual, Dual II, Dual II Magnum SL, Cinch	S-metolachlor	C	III	H	M	H
Enlite	chlorimuron-ethyl (2.9%) flumioxazin (36.2%) thifensulfuron-methyl (8.8%)	C	III	L	H*	H
Eptam, Imperium	EPTC	W	II	H	L	H
Evik	ametryn	C	III	M-H	M	H
Express	tribenuron	C	III	L	H*	Mw
Far-Go	triallate	C	III	H	L	H
Fierce	flumioxazin (33.5%) pyroxasufone (42.5%)	C	III	L	L	L
Finesse	chlorsulfuron (62.5%) metsulfuron-methyl (12.5%)	C	III	L	H*	Mw
FirstRate	cloransulam-methyl	C	III	L	H*	H
Fusilade DX	fluazifop-P-butyl	C	III	L	L	Ms
Gallery	isoxaben	C	III	M	M	H
Glean	chlorsulfuron	C	III	L	H*	Mw
Goal	oxyfluorfen	W	II	L-H	VL	L
Gramoxone SL	paraquat	D	I	M	VL	Ls
Harmony	thifensulfuron-methyl	C	III	L	H*	Mw
Harrow	rimsulfuron (20%) thifensulfuron-methyl (10%)	C	III	L	M	Mw
Huskie	pyrasulfotole (3.3%) + bromoxynil (26.3%)	W	II	L	H	H
Hyvar X-L, X	bromacil	W, C	II, III	M-H	M	Mw
Impact	topramezone	C	III	L	H	H
Instigate	rimsulfuron (4.2%) mesotrione (41.7%)	C	III	L	M*	Mw
Karmex	diuron	C	III	H	M	H
Intrro	alachlor	D, W	I, II	H	M	H
Kerb	pronamide	C	III	M-H	M	H
Laudis	tembotrione	C	III	L	H	H
Liberty	glufosinate-ammonium	W	II	H	M	H
Linex	linuron	C	III	H	M	H
Matrix, Resolve	rimsulfuron	C	III	L	M*	Mw
Maverick	sulfosulfuron	C	III	L	H*	Mw
MCPA	MCPA	D (acid, salt), C (ester)	I, III	M-H	M*	H
Nortron SC	ethofumesate	C	III	M	M	H
Outlook	dimethenamid	W	II	M-H	H	H

See footnote on page 25.

Potential Human Exposure Hazard and Environmental Risks of Herbicides (continued)

Product Name	Common Name of Active Ingredient	Potential Human Exposure Hazard		Relative Use Rate ³	Relative Leaching Potential ⁴	Relative Runoff Potential ⁵
		Signal Word ¹	Toxicity Class ²			
Paramount	quinclorac	C	III	M	H*	Mw
Peak	prosulfuron	C	III	L	M*	Mw
Permit, Sandea, Sedgehammer	halosulfuron-methyl	C	III	L	M*	H
Plateau	imazapic	C	III	L	H*	H
Poast	sethoxydim	C	III	M	L*	H
Prequel	rimsulfuron (15%) isoxaflutole (30%)	C	III	L	M*	H
Princep	simazine	C	III	H	M	H
Prowl H ₂ O, Pendulum	pendimethalin	C	III	H	L	Ms
Pursuit	imazethapyr	C, W	III, II	L	H*	Mw
Python WDG	flumetsulam	C	III	L	M*	Mw
Raptor	imazamox	C	III	L	H*	Mw
Realm Q	rimsulfuron (7.5%) mesotrione (31.3%)	C	III	L	M*	Mw
Reflex, Flexstar	fomesafen	D, W	I, II	M	H	H
Require Q	rimsulfuron (6.3%) sodium salt of dicamba (52.9%)	W	II	L	H*	Mw
Resolve Q	rimsulfuron (18.4%) thifensulfuron-methyl (4.0%)	C	III	L	M*	Mw
Resource	flumiclorac-pentyl	W	II	L	L	Ms
Ro-Neet	cycloate	C	III	H	L	H
Roundup, Rodeo, Touchdown, Glyfos	glyphosate	V	V	M-H	VL	Ms
Scepter	imazaquin	C	III	L	H*	Mw
Select Max	clethodim	W	II	L	M	Mw
Sinbar	terbacil	C	III	M-H	H	H
Sonalan HFP or 10G	ethalfuralin	D	I	M-H	L	H
Spartan 4F	sulfentrazone	C	III	L-M	H*	H
Starane	fluroxypyr	W	II	M	M*	H
Steadfast, Steadfast Q	nicosulfuron (50%, 25.2%) rimsulfuron (25%, 12.5%)	C	III	M*	M*	Mw
Stinger	clopyralid	C	III	L	H*	H
Stout	nicosulfuron (67.5%) thifensulfuron-methyl (5%)	C	III	L	M*	Mw
Surflan A.S.	oryzalin	C	III	H	L	H
Synchrony XP	chlorimuron (21.5%) thifensulfuron-methyl (6.9%)	C	III	L	H*	H
Tordon, 22K or K	picloram	D, C	I, III	M-H	H*	Mw
Treflan	trifluralin	C	III	H	L	Ms
TriCor	metribuzin	C	III	M	M*	H
Tupersan	siduron	C	III	H	M	H
Ultra Blazer	acifluorfen	D	I	M	M	H
UpBeet	triflusulfuron-methyl	C	III	L	M*	H
Valor	flumioxazin	C	III	L	L	Ms
Velpar	hexazinone	D (eye)	I	L-H	H	H

See footnote on page 25.

Potential Human Exposure Hazard and Environmental Risks of Herbicides

This table does not include all products and/or active ingredient. Examples are for comparison of human health hazards, use rates, and potential for leaching and runoff.

Product Name	Common Name of Active Ingredient	Potential Human Exposure Hazard		Relative Use Rate ³	Relative Leaching Potential ⁴	Relative Runoff Potential ⁵
		Signal Word ¹	Toxicity Class ²			
<i>Justice</i> ^{6,*}	acetamiprid + bifenthrin	W	II	L	H	Hw
<i>Neemix 4.5</i>	azadirachtin	C	III	L	L	L
<i>Baythroid XL</i>	beta-cyfluthrin	W	II	L	VL*	Ls
<i>Bifenture LFC, Brigade 2EC, Capture LFR, Dicipline 2EC, Fanfare 2EC, Sniper, Tundra EC</i>	bifenthrin	V	III, II	L	VL	Ls
<i>Carbaryl, Sevin Brand XLR Plus</i>	carbaryl	C	III	H	L	Mw
<i>Fortress 2.5G</i>	chlorethoxyfos	W	II	L	VL	Lw, Ms
<i>Govern 4E; Hatchet; Lorsban 4E, 15G, Advanced; NUFOS 4e; Vulcan; Warhawk; Yuma 4E</i>	chlorpyrifos	W	II	M to H	L	Ls
<i>Coragen, Prevathon</i>	chlorantraniliprole	None	IIII	L	M	Mw, Ms
<i>Belay, Poncho 600</i>	clothianidin	C	III	L	M	Mw
<i>Renounce 20WP, Tombstone Helios</i>	cyfluthrin	V	III, I	L	VL	Ms
<i>Delta Gold 1.5EC</i>	deltamethrin	D	I	L	VL	Hs
<i>Dimilin 25W, 2L</i>	diflubenzuron	C	III	L	VL	Ls
<i>Cygon, Dimate 4E, Dimethoate 4E</i>	dimethoate	W	II	M	L	Lw
<i>Asana XL, Adjour</i>	esfenvalerate	W	II	L	VL	Ls
<i>Zeal</i>	etoxazole	C	III	L	VL	Ls
<i>Belt SC</i>	flubendiamide	C	III	L	M	M
<i>Sivanto 200 SL</i>	flupyradifurone	C	III	L	H	Mw
<i>Declare, Proaxis</i>	gamma-cyhalothrin	C	III	L	VL	Ls
<i>Onager</i>	hexythiazox	C	III	L	VL	Ls
<i>Alias 2F, 4F; Gaucho 600F; Prey 1.6</i>	imidacloprid	C	III	L	M	Mw
<i>Steward EC</i>	indoxacarb	C	III	L	VL	Ls
<i>Lambda-cy EC, Paradigm, Silencer, Taiga Z, Warrior II with Zeon Technology</i>	lambda-cyhalothrin	V	II, III	L	VL	Ls
<i>Fyfanon ULV AG; Malathion 8F, 57EC</i>	malathion	V	III, II	M to H	VL	M
<i>Lannate LV, SP</i>	methomyl	D	I	M	H	Mw
<i>Intrepid 2F</i>	methoxyfenozide	C	III	L	M	Mw
<i>Ambush 2EC, Arctic 3.2EC, Permethrin, Pounce 1.5G</i>	permethrin	V	II, III	L	VL	Ms
<i>Thimet 20G</i>	phorate	D	I	H	L	M
<i>Comite II</i>	propargite	D	I	H	M	Ms
<i>Radiant SC</i>	spinetoram	C	III	L	L	Ls
<i>Entrust, Seduce Insect Bait, Success, Tracer</i>	spinosad	C	III	L	L	Ls
<i>Oberon 4SC</i>	spiromesifin	C	III	L	L	Ls
	tebupirimfos				M	Ms
<i>Aztec 2.1G⁶, 4.67G; Defcon 2.1G⁶</i>	tebupirimfos + cyfluthrin*	W	II	L	M	Ms
<i>Force 3G, CS</i>	tefluthrin	V	II, III	L	VL	Ms, Lw
<i>Counter 15G Lock 'n Load, Smartbox 20G</i>	terbufos	D	I	H	VL	L
<i>Cruiser 5FS</i>	thiamethoxam	C	III	L	H	Mw
<i>Mustang Maxx, Max EC; Respect</i>	zeta-cypermethrin	V	II, III	L	VL	Ls

*When a product has more than one active ingredient, risk rating is based on the highest risk level for any component.

¹Signal Words: C = Caution, W = Warning, D = Danger. Classification may vary with formulation. V = varies by product.

²EPA Toxicity Class: I = Most toxic; IV = Least toxic.

³L = Low (less than 0.25 lb ai/A); M = Medium (0.25-0.99 lb ai/A); H = High (greater than 0.99 lb ai/A).

⁴VL = Very Low; L = Low, M = Medium; H = High. Asterisk (*) indicates the potential for contamination from leaching increases with increasing soil pH. Salt and acid formulations generally are highly leachable. Ester formulations are less leachable, but are often rapidly hydrolyzed to corresponding acid forms that may be highly leachable.

⁵Potential for loss with runoff (assumes some leaching may also be occurring): Lw = Low, primarily lost with runoff water; Ls = low, primarily lost with sediment/soil in runoff; Mw = Medium, primarily lost with runoff water; Ms = Medium, can be lost with displaced sediment/soil in addition to runoff water; H = High, lost in both runoff water and with displaced sediment/soil. Hs = High potential for runoff with sediment/soil; little potential for leaching. When leaching is minimal, herbicides with Koc values less than 5,000 have a high potential to be lost with runoff water.

⁶For products containing two or more active ingredients, classifications are based on the component representing the highest risk.

Minimizing Water Contamination

Pesticide contamination of groundwater and surface water is a public concern. Contamination results from two types of sources — point and nonpoint.

Point Source Contamination

Point source contamination results from localized spills or accidents, i.e., the contamination can be traced back to an identifiable area. Point source contamination accounts for large doses being introduced into groundwater and poses a high risk of rendering the water unfit for drinking.

Spills and other mishaps during the handling and mixing of pesticides are a major contributing factor. Several steps can be taken to minimize contamination.

Wells are a direct conduit to the groundwater and extra care should be taken at these sites when handling pesticides. In addition, many wells are not adequately sealed, which increases the risk of contamination in the event of a spill. To help avoid contaminating wells:

- Mix pesticides at least 200 feet from wells.
- Use a nurse-tank as a water source.
- Avoid back-siphoning by using anti-backflow devices or keeping the end of the filler hose above the water level in the spray tank.
- Clean up all spills immediately, especially those near wells and other water supplies.

Because of the risk of a major mishap and groundwater contamination from chemigation, we do not suggest applying herbicides through an irrigation system. If you need information, contact the specific chemical company or a local Natural Resources District office.

Additional practices which help prevent point source contamination include triple-rinsing and the proper disposal of

pesticide containers and excess pesticides. Refer to the pesticide label for instructions on how to properly dispose of pesticides and pesticide containers.

Emergency Situations

If necessary, in an emergency involving spills, leaks, or fires, call 911 and then work with the proper authorities to clean up the spill and contaminated soil. The 911 office will contact the appropriate authority: county sheriff, roads department or State Patrol. The contacted authority will notify the Nebraska Department of Environmental Quality and a spill response team. Smaller spills may not need to be reported if they are in a confined area and are manageable by you. For assistance with human pesticide exposures, call the Poison Center at 800-222-1222.

Nonpoint Source Contamination

Contamination that occurs from nonpoint sources cannot be traced back to a specific location or event. Examples of nonpoint source contamination include the leaching of pesticides through the normal course of pesticide use, or pesticides carried into streams by surface runoff. The extent of nonpoint source contamination depends on the pesticide, soil, geology, topography, management practices, and weather.

There are several practices that minimize nonpoint source contamination:

- Read the pesticide label to determine the correct rate.

- Calibrate sprayers properly to ensure uniform applications and more effective control.
- Apply the proper amount of pesticide for the crop, weed, and site.
- Reduce rates by banding or using combination products. This also will reduce the loading potential of any one product.

Remember that less mobile, short residual products are less likely to leach to the water table. Using different pesticides each year also reduces risk.

The greatest risk for groundwater contamination exists where the water table is close to the soil surface. Pesticides are

more likely to contaminate groundwater when applications are made to coarse-textured soils low in organic matter. High pH soils also present concerns because some pesticides leach more readily under these conditions. Extra care should be taken when any of these situations exist.

The greatest risk for surface water contamination is on steeply sloping land that drains directly into a stream or lake. Management practices such as terracing and conservation tillage can reduce water runoff. Use untreated buffer zones next to streams or lakes and grass waterways to encourage water infiltration.

Herbicide Carryover and Residue Analysis

Certain herbicides can persist in the soil to the extent that subsequent crops in the rotation may be injured. The potential for herbicide carryover increases from eastern to western Nebraska. Low rainfall and low soil organic matter increases carryover potential. Herbicide carryover potential is greater on eroded soils and may be influenced by pH. Carryover is also a function of application accuracy. Carryover will be more apparent in headlands and other areas where sprayer overlap is common. Herbicide applications made later in the

growing season have greater carryover potential compared to earlier applications.

Carryover can restrict crop rotation options as well as limit replant options if a crop is lost due to hail or other disasters. Care should be taken when choosing herbicides to fit your rotation sequence. Consult the weed response charts for carryover restrictions and consult herbicide labels for rotation intervals (*Replant Option Tables*, pages 172-185) and carryover restrictions. Conducting a plant bioassay can be helpful

in determining whether carryover will be a problem in your fields.

Herbicide injury sometimes occurs because of spray drift or tank contamination, and plant tissue tests are requested. Unless the problem is detected very shortly after the misapplication, it is generally difficult to determine much from a tissue test. This is because plants are often able to break down or metabolize the herbicide. If several days have elapsed, and the herbicide is one that may be detected on

the soil, it may be better to evaluate a soil sample instead of a plant tissue sample.

Testing for Herbicide Residues

The following laboratories provide herbicide residue analyses of soils. Commercial labs also may offer testing services for some pesticide compounds. For information about their services, visit their Web sites or contact them by phone.

Agricultural Experiment Station (AES) Analytical Laboratory
Montana State University
McCall Hall, Room 10, Bozeman, MT 59717
Phone: (406) 994-3383
Fax: (406) 994-4494
Email: hthickes@mt.gov
Website: <http://ag.montana.edu/analyticallab/>

Midwest Laboratories
13611 B St.
Omaha, NE 68144
Phone: (402) 334-7770
Fax: (402) 334-9121
Email: getinfo@midwestlabs.com
Website: www.midwestlabs.com

SGS North America
241 34th Ave.
Brookings, SD 57006
Phone: (877) 692-7611
Fax: (605) 692-5908
Email: analytical.brookings@sgs.com
Website: www.sgs.com/en/Agriculture-Food

South Dakota Agricultural Laboratories
1006 32nd Ave. STE 105
Brookings, SD 57006
Phone: (605) 692-7325
Fax: (605) 692-7326
Email: regina.wixon@sdaglabs.com
Website: sdaglabs.com

State Hygienic Laboratory at the University of Iowa
2490 Crosspark Road
Coralville, IA 52241
Phone: (319) 335-4500 or (800) 421-4692
Fax: (319) 335-4555
Email: ask-shl@uiowa.edu
Website: www.shl.uiowa.edu

What does a herbicide residue level of 0.3 ppm (parts per million) in the soil mean? Herbicide concentrations may be more easily visualized as lb/A rather than ppm. The tilled layer (6-7 inches deep) of an acre of loam soil weighs approximately two million pounds. Two pounds of herbicide per acre mixed in the tilled layer of soil would result in a concentration of 1 ppm (two parts herbicide per two million parts soil); 1 ppm = 1,000 ppb (parts per billion) which is more commonly used.

What herbicide residue levels are safe to sensitive crops? This varies with the herbicide, the environment, and the soil properties. The table below is provided as a guide. Consult the herbicide manufacturer for more specific information. Check compliance with herbicide label and follow all label guidelines.

Crop Tolerance to Herbicide Residue in the Soil (Injury Threshold Guidelines)

Herbicide concentrations equal to or greater than those listed may cause crop injury.

Herbicide	Crop	Soil	
		Silt Loam 2-3% OM pH less than 7.0	Sandy Loam 1-2% OM pH greater than 7.0
		Concentration (ppb)*	
Atrazine	Alfalfa	100	40
	Oat	150	60
	Soybean	250	100
	Sugarbeet	5	< 5
	Wheat	180	75
Classic	Corn	3	1
	Wheat	5	2
Command	Corn	150	75
	Wheat	75	15
Prowl H ₂ O	Corn	250	150
	Sugarbeet	70	70
	Wheat	300	200
Pursuit	Corn	25	10
	Sorghum	10	4
	Sugarbeet	< 1	< 1
Scepter	Corn	10	5
	Wheat	30	10
Treflan	Corn	150	100
	Sugarbeet	70	70
	Wheat	200	150

*ppb = parts per billion of active ingredient

Reducing Drift

It is estimated that two-thirds of pesticide drift problems involve mistakes which could have been avoided. Drift is of concern because it takes the pesticide from the intended target, making it less effective, and deposits it where it is neither needed nor wanted. The pesticide then becomes an environmental pollutant in the off-target areas where it can injure susceptible vegetation, contaminate water, or damage wildlife. Drift cannot be eliminated but the use of proper equipment and application procedures will maintain the drift deposits within acceptable limits.

There are two kinds of drift:

Particle drift is off-target movement of the spray particles.

Vapor drift is the volatilization of the pesticide molecules and their movement off target.

A Mississippi State University study analyzed data from more than 100 studies involving drift from ground sprayers.

Of the 16 variables considered, three were most important.

1. Wind speed. When the wind speed was doubled, there was almost a 700 percent increase in drift when the readings were taken 90 feet downwind from the sprayer. Hence the recommendation of spraying in 10 mph winds or less.

2. Boom height. When the boom height was increased from 18 to 36 inches, the amount of drift increased 350 percent at 90 feet downwind.

3. Distance downwind. If the distance downwind is doubled, the amount of drift decreases five-fold. Therefore, if the distance downwind goes from 100 to 200 feet, you have only 20 percent as much drift at 200 feet as at 100 feet and if the distance goes to 400 feet, you only have 4 percent of the drift you had at 100 feet. Check wind direction and speed when starting to spray a field. You may want to start spraying one side of the field when the wind is lower. Also, it may be necessary to only spray

part of a field because of wind speed, wind direction, and distance to susceptible vegetation. The rest of the field can be sprayed when conditions change.

Pesticide drift also can be reduced by using one of the new types of tips and by adjusting spray pressure. Higher spray pressures produce smaller droplets which are more susceptible to drift. If using a rate controller, be careful of increased speed. Since most rate controllers increase the pressure to maintain the same gpa when the speed increases, try to maintain the speed within +10 percent. For example, if you're applying 20 gpa at 8 mph at 40 psi and you increase the speed to 11 mph, the pressure will now be 75.5 psi which will produce a lot of small particles prone to drift. Also, this pressure will be above the operating range of most tips. Drift reduction agents may be helpful.

New spraying technology such as the "blended pulse" can decrease the risk of drift by allowing flow rate to be controlled independently of spray pressure.

Herbicide Application Terms

Soil-Applied

Early preplant (EPP) treatments are made 10-45 days before planting. **Preplant surface-applied (PPSA)** treatments are made 0-10 days before planting. Soil disturbance by some planters may allow weed growth in rows where herbicides are applied EPP or PPSA. **Preplant incorporated (PPI)** treatments are made before planting the crop. The herbicide is then thoroughly incorporated with rototiller or two angled passes of a tandem disk, field cultivator, or similar equipment.

Preemergence (PRE) treatments are applied from planting time to just before crop emergence or weed seed germination. **Surface mix (SM)** is the shallow mixing of a PRE herbicide into the top 1 to 2 inches of soil using a rototiller, mulch treader, field cultivator, or similar implement.

Weed control with PRE treatments may be poor if there is no rain to move the herbicide into the top inch of soil. Rainfall required for activation is generally 1/4 to 1/2 inch on coarse-textured soils and 1/2 to 1 inch on fine-textured soils.

To overcome dependence on rainfall and to increase dependability, some PRE herbicides may be incorporated into the surface soil with a rotary hoe. Excessive rainfall may leach some of the more soluble herbicides into the subsoil, especially on sandy soils. Weed control with preplant herbicides is more satisfactory on surface-planted crops. Some weed species are resistant to particular herbicides. Herbicides and crops should be rotated to control a wider spectrum of weeds and to reduce the risk of herbicide carryover.

Postemergence

Early postemergence (EPOST) refers to herbicide applications made soon after the crop has emerged; control of late emerging weeds may be reduced. **Postemergence (POST)** treatments are applied after emergence of weeds or crop. **Directed POST** treatments are made to the lower portion of the crop plant.

Layby treatments are applied at last cultivation to provide an extended period of weed control.

Harvest aid treatments are applied late in the growing season to reduce weed seed production and make harvest easier.

Desiccants are applied after crop maturity to hasten drying and permit earlier harvest.

Excellent growing conditions make weeds more susceptible to POST herbicides. Likewise, crops may be more subject to herbicide damage when growing rapidly. **Adjust herbicide and additive dosages downward** when excellent conditions for growth are present the week before application and **upward** when ideal growth is limited by one or more factors. Rate of carrier should be in accordance with label recommendations.

Mid postemergence (MPOST) refers to herbicide applications typically made approximately four weeks after the crop has emerged. Weeds may be 3-5 inches tall.

Late postemergence (LPOST) refers to herbicide applications typically made approximately six or more weeks after crop emergence. It may be combined with EPOST to provide longer weed control. If it's the only treatment, weeds are usually over 6 inches tall and control may be reduced.

Nozzle Selection

For maximum effectiveness of pesticides, they must be applied uniformly and at the correct rate. Six factors can affect application efficiency and success:

1. Sprayer design
2. Nozzle type
3. Boom height
4. Boom pressure
5. Agitation
6. Ground speed

Pesticides applied uniformly at the proper rate will give maximum benefit while those applied incorrectly can result in wasted chemical, marginal weed, insect or disease control, excessive carryover, groundwater contamination, pesticide residues in plants and/or crop damage. New developments in application technology can help assure the proper application of pesticides. Along with these new developments, there has been a trend toward decreasing spray volumes. This is because some herbicides perform better with reduced spray volumes (especially with low in quality water). Many new row crop sprayers have limited tank capacity, and water is expensive to haul. In many areas of the state it may be a great distance from the water source to the field and filling the sprayer takes time. Decreased spray volumes also may allow the use of less expensive, smaller sprayers. Larger sprayers increase soil compaction, especially if the soil is wet. More additives such as non-ionic surfactant and water conditioners may be needed with more carrier volume.

The nozzle is a major factor determining the amount of spray applied to an area, the uniformity of application, the coverage obtained on the target surface, and the potential amount of drift. Nozzles break the spray mix into droplets, form the spray pattern, and propel the droplets in the proper direction. Nozzles determine the amount of spray volume delivered at a given operating pressure, travel speed, and spacing. Drift can be minimized by selecting nozzles that produce the largest droplet size while providing adequate coverage at the intended application rate and pressure. Do not mix nozzles of different materials, types, spray angles, or spray volumes on the same spray boom. A mixture of nozzles produces uneven spray distribution.

Nozzle Types

Nozzle types commonly used in low-pressure agricultural sprayers include:

flat-fan, flood, raindrop, hollow-cone, full-cone, and others. Special features or subtypes such as extended range, low pressure, drift guard, and turbos are available for some nozzle types.

Flat-Fan

Flat-fan nozzles are widely used for broadcast spraying of herbicides and produce a tapered-edge spray pattern. These nozzles have several subtypes such as standard flat-fan, even flat-fan, extended range flat-fan, drift guards, Turbo TeeJet venturi type, and some special types such as off-center flat-fans and twin-orifice flat-fan.

The **standard** flat-fan normally is operated between 30 and 60 psi, with an ideal range between 30 and 40 psi. The even (E) flat-fan nozzles (nozzle number ends with E) apply uniform coverage across the entire width of the spray pattern. They are used for banding pesticide over the row and should not be used for broadcast applications. The band width can be controlled with the nozzle height, spray angle, and the orientation of the nozzles.

The **extended range** (XR or LFR) flat-fan provides excellent drift control when operated between 15 and 25 psi. This nozzle is ideal for an applicator who likes the uniform distribution of a flat-fan nozzle and desires lower operating pressure for drift control. Since extended range nozzles have an excellent spray distribution over a wide range of pressures (15-60 psi), they are ideal for sprayers equipped with flow controllers.

The **Turbo TeeJet** has the widest pressure range of the flat-fan nozzles — 15 to 90 psi. It produces larger droplets for less drift and is available only in 110°.

The **drift guard** flat-fan has a pre-orifice which controls the flow. The spray tip is approximately one nozzle size larger. It produces larger droplets, reducing the number of small drift-prone droplets.

The **venturi-type** nozzle produces large air-filled drops through the use of a venturi air aspirator for reducing drift.

Flat-fan nozzles also include the **off-center** (LX) flat-fan which is used for boom end nozzles and produces a wide swath projection and the **twin-orifice** (TJ) flat-fan which produces two spray patterns — one angled 30° forward and the other directed 30° backward. The TJ droplets are small due to the atomizing by two smaller orifices. The two spray directions and smaller droplets improve coverage and penetration, a plus when applying postemergence contact herbicides. To produce fine droplets, the twin-orifice usually operates between 30 and 60 psi.

Flat-fan nozzles are available in several spray angles, the most common of which are 80° and 110°. The table below provides the recommended nozzle heights for flat-fan nozzles during broadcast application.

Nozzle height is the distance from the nozzle to the target, which may be the top of the ground, growing canopy or stubble. Use 110° nozzles when boom heights are less than 30 inches and 80° nozzles when the booms are higher.

Although wide-angle nozzles produce smaller droplets which may be more prone to drift, the reduction of boom height reduces the drift potential more than reducing droplet size. The nozzle spacing and orientation should provide for 100 percent overlap at the target height. Nozzles should not be oriented more than 30° from vertical.

Most nozzle manufacturers identify their flat-fan nozzles with a four- or five-digit number. The first numbers are the spray angle and the other numbers signify the discharge rate at rated pressure. For example, an 8005 has an 80° spray angle and will discharge 0.5 gallons per minute (GPM) at the rated pressure of 40 psi. An 11002 nozzle has a 110° spray angle

Suggested Minimum Spray Heights

Spray Angle Degrees	Spray Height (in)			
	20-inch Spacing With Overlap of		30-inch Spacing With Overlap of	
	30%	100%	30%	100%
80	17	26	26	38
110	10	15	14	25

Nozzle Types And Discharge Rates At Rated Pressure

Nozzle Type	Discharge (gpm)	Rated Pressure (psi)	Operating Range	
			Min (psi)	Max (psi)
Regular flat-fan 8006	0.6	40	30	60
Regular flat-fan 11008	0.8	40	30	60
Extended range flat-fan 8006XR	0.6	40	15	60
Turbo TeeJet TT11005VP	0.5	40	15	90
Drift Guard DG8002VS	0.2	40	40	60
AI TeeJet AI11005-VS	0.5	40	30	100
Flood TKSS 6	0.6	10	10	40
AIXR11005VP	0.5	40	15	90
Turbo FloodJet TF-VS2	0.2	10	10	40

and will discharge 0.2 GPM at the rated pressure of 40 psi. Nozzle material also may be designated: “BR” — brass material; “SS” — stainless steel; “VH” — hardened stainless steel; “VS” — stainless steel, and “VK” — ceramic. See the table above for nozzle types and discharge rates.

Flood

Flood nozzles are popular for applying suspension fertilizers where clogging is a potential problem. These nozzles produce large droplets at pressures of 10 to 25 psi. The nozzles should be spaced less than 60 inches apart. The nozzle height and orientation should be set for 100 percent overlap.

Nozzle spacing between 30 and 40 inches produces the best spray patterns. Pressure influences spray patterns of flood nozzles more than flat-fan nozzles; however, the spray pattern is not as uniform as with the flat-fan nozzles, and special attention to nozzle orientation and correct overlap is critical. These nozzles are best used only for fertilizer suspensions.

A new flood nozzle is the Turbo FloodJet. It incorporates a pre-orifice which controls the flow and has a turbulence chamber. The tip design more closely resembles a flat fan nozzle, resulting in a much improved pattern with tapered edges. Use this turbo flood nozzle with its improved pattern when incorporating herbicides. Because of its large droplet size, do not use the turbo flood nozzle where good coverage is needed.

Cone

Hollow-cone nozzles generally are used to apply insecticides or fungicides to field crops when foliage penetration and complete coverage of the leaf surface

is required. These nozzles operate in a pressure range from 40 to 100 psi. Spray drift potential is higher from hollow-cone nozzles than from other nozzles due to the small droplets produced.

Full-cone wide-angle nozzles are a good choice if drift is a concern because they produce larger droplets than flood nozzles. Full-cone nozzles usually are recommended over flood nozzles for soil-incorporated herbicides. Full-cone nozzles operate at a pressure range of 15 to 40 psi. Optimum uniformity is achieved by angling the nozzles 30° and overlapping the spray coverage by 100 percent.

Fine hollow-cone. The ConeJet (Spray Systems) offers wide-angle (80° to 120°), hollow-cone nozzles. These are used for postemergence contact herbicides where a finely atomized spray is used for complete coverage of plants or weeds under a hood for band spraying. Drift potential is great for these nozzles.

Nozzle Material

Nozzles can be made from several materials. The most common are brass, nylon, stainless steel, and hardened stainless steel, and ceramic. Stainless steel nozzles last longer than brass or nylon and generally produce a more uniform pattern over an extended time. Nylon nozzles with stainless steel or hardened stainless steel inserts offer an alternative to solid stainless steel nozzles and are less expensive. Thermoplastic nozzles have good abrasion resistance but swelling can occur with some chemicals, and they are easily damaged when cleaned. Ceramic has superior wear life and is highly resistant to abrasive and erosive chemicals. Life of ceramics is 5-16.7 times that of stainless steel and ceramics are usually the best buy.

Nozzle Replacement

Replace nozzles when:

- spray pattern is distorted;
- nozzles show irregular wear; and
- nozzle flow rate is 10 percent greater than with new nozzles of the same type.

Note: Each nozzle's flow rate on the spray boom needs to be within five percent of the average flow rate of nozzles.

Nozzle Selection and Considerations

It is important to select a nozzle that develops the desired spray pattern. The specific use of a nozzle, such as for broadcast application of herbicides or insecticide application on row crops, determines the type of nozzle needed. Examine current and future application requirements and be prepared to have several sets of nozzles for a variety of application needs. In general, do not select a nozzle with an orifice so small that it requires a nozzle screen finer than 50 mesh. Nozzles requiring 80- and 100-mesh screens plug too easily.

The standard nozzle spacing on broadcast sprayers has been 20 inches. If you're considering a narrower or wider spacing to improve pesticide application, first consider these factors: coverage needed, spray deposition, effect on drift, row crop spacing, desired spray coverage, nozzle cost, boom height, and overlap.

Postemergence nontranslocated herbicides require adequate and uniform coverage. Preplant incorporated herbicides require the least coverage, therefore large spray droplets could be used. Nozzles which produce large spray droplets, such as Spraying Systems turbo floods, could be used effectively for preplant soil-incorporated herbicides and also would reduce drift.

Spray Deposition

Research by the University of Nebraska–Lincoln has demonstrated that spray pattern uniformity from 110° nozzles on 30-inch spacing was equivalent to 80° nozzles on 20-inch spacing. The 110° nozzles on 20-inch spacing did not have an advantage over 30-inch spacing if the carrier volume remained constant, for example 20 gpa for both nozzles.

Row Spacing

The most popular row spacing is 30 inches, which easily allows for the use of drop nozzles, if needed. Some pesticides should not be sprayed directly in the whorl of the plant. With 20-inch spacing it is impossible to keep from spraying directly over some of the plants. With 30-inch spacings, nozzles can always be between the rows or, if needed, they can be moved directly over the rows for band spraying.

Self-Cleaning Line Strainer

A self-cleaning line strainer mounted on the discharge side of the pump minimizes nozzle clogging. This strainer uses the excess flow to bypass potential clogging particles back to the spray tank. To use the self-cleaning strainer the sprayer must have excess pump capacity. The amount of excess pump capacity depends on the size of the strainer. Minimum flow rate is 6 gpm extra for the 0.75-inch and 1.00-inch self-cleaning line strainers and 8 gpm for the 1.25-inch and 1.50-inch sizes.

Fresh Water Tanks

It is very common now on most sprayers to see a fresh water tank for wash-up and infield clean-up. These range from smaller, 5- to 10-gallon tanks on farm-type

Application Tips

- To reduce tip plugging, avoid using any tip that requires a screen smaller than 50 mesh.
- Buy quality tips. Stainless steel, stainless steel inserts in nylon tips, polyacetal, and ceramic tips are the most economical in the long run.
- Use a special tip-cleaning brush. Keep pocket knives, paper clips, and wire away from the tips as they will distort the pattern and change the flow rate. Also, before adding any herbicide, check the sprayer with water to make sure that the tips are not plugged and fittings and hoses do not leak.
- Use strainers before the pump and before the flow control system. Use tip screens at the nozzle tips.
- Use a diaphragm check valve or similar item to give instant-on and instant-off control to eliminate drip and delay when the boom is turned on and off.
- For new sprayers, flush the entire system with water before installing screens and tips.

sprayers to tanks that hold 100 gallons or more on the larger floaters. In the event of a spill, clean water from these tanks is the first step in self-decontamination.

Induction Tanks (Cones)

Induction tanks for adding chemical to the spray mix have been available for several years and are a great safety device.

They are usually mounted at a more convenient height for adding chemicals than when you have to climb up to the main tank. Also, some carry fresh water and use that for rinsing out the sprayer after completing the job.

Nozzle Selection for Droplet Size

Many pesticide labels now list recommended or required spray droplet size (or sizes) for application. Following the label guides can increase pesticide efficacy and help manage spray drift. The droplet size classes are based on BCPC specifications and in accordance with ASABE standard S572.1. .

Category	Symbol	Color Code
Extremely Fine	XF	Purple
Very Fine	VF	Red
Fine	F	Orange
Medium	M	Yellow
Coarse	C	Blue
Very Coarse	VC	Green
Extremely Coarse	XC	White
Ultra Coarse	UC	Black

Pesticides listing the recommended or required spray droplet size and carrier rate on the label. Always check label before applying.

Herbicides

<i>Herbicides</i>	<i>Drop Size Classification</i>	<i>Ground Application GPA</i>	<i>Herbicides</i>	<i>Drop Size Classification</i>	<i>Ground Application GPA</i>
2,4-D amine	C	8 to 20+	Breakfree NXT	Large Droplet, Not Fine**	Minimum 10
2,4-D ester #4	C	10+	Breakfree NXT ATZ	Large Droplet, Not Fine	Minimum 10
2,4-D ester #6	C	10+	Broadaxe SE	Minimal Amts of Fine Spray	Minimum 10
AAtrex 4L	C	Minimum 10	Butyrac 200	C-but nozzle types that will provide adequate coverage	Minimum 10
AAtrex Nine-O	C	Minimum 10	Cadet	M - C	Min 15; up to 40 for dense canopy or weeds
Accent Q	M - C	Minimum 15	Callisto 4SC	M to C	PRE:10 to 60 & POST: 10 to 30
Acuron	M to C	Pre-Emergence 10 - 80 & Post-Emergence 10 - 30	Callisto XTRA	M to C	10 to 30
Acuron Flexi	M to UC	Minimum 10	Canopy DF	C to VC	Minimum 10
Affinity BroadSpec	Largest Droplet Size*	Minimum 5 to 20	Canopy EX	M, C	Minimum 20
Agility SG	Largest Droplet Size*	Minimum 5 to 20	Capreno	M to C	Minimum 10
Aim EC	Min Amt of Fine Spray Droplets	Minimum 10	Chapparral	C	Minimum 10
Ally Extra SGW / TOTSOL	Largest Droplet Size*	Minimum 5 to 20	Chateau SW	No Mention	PRE: 10-30; Burndown: 15-60; & POST: Min 15 (20 if dense vegetation)
Ally 60XP	Largest Droplet Size	Minimum 3 to 20	Cimarron Plus	C to VC	Minimum 10
Alluvex	M (C if spray vol is increased)	Min 15; Min 5 to 10 w / Glyphosate	Cimarron XTRA	C to VC	Minimum 10 to 30
Amber Custom Pak	M - C	Minimum 3 - 20	Cinch	No Mention	Minimum 5
Anthem	M to VC	Min 5 to 10; up to 40 if crop or weeds are dense	Cinch ATZ	No Mention	Minimum 5
Anthem ATZ	M	Min 10; up to 40 if crop or weeds are dense	Cinch ATZ Lite	No Mention	Minimum 5
Anthem Maxx	medium	Minimum 5 POST Minimum 10; For dense weed crop up to 40	Clarity	C	Minimum 20
Aquathol K	No mention	No Mention	Classic	M to C to VC	Minimum 10 to 20
Armezon	Larger droplets	Minimum 10	Cobra	No Mention	Minimum 10
Armezon Pro	C to VC	Minimum 10	Command 3ME	C or Greater	Minimum 10
Arrow (clethodim)	Large droplets	Minimum 5 - 10	Corvus	C	Minimum 10
Arsenal Powerline	C or Coarser	Minimum 5	Crossbow	C or Coarser	Minimum 20
Assure II	NOT Coarse	Minimum 10 to 15	Curbit EC	No Mention	Minimum 20
Atrazine 4L	No mention	Minimum 10	Curtail	C or Coarser	Minimum 10
Atrazine 90 DF	M or Coarser	Minimum 10	Curtail M	M or Coarser	Minimum 10
Authority Assist	Largest Droplet Size*	10 to 40	Degree XTRA	Large Droplet, Not Fine	Minimum 10
Authority Elite	Largest Droplet Size*	Minimum 10	Dicamba	C	Minimum 20
Authority First DF	Largest Droplet Size*	10 to 40	Diflexx	Coarse (VMD 400 Micron +)	20
Authority Maxx	Minimize risk of fine droplets	10 to 40 GPA	Diflexx DUO	M to C	10 to 20**
Authority MTZ DF	Largest Droplet Size*	Minimum 10	Dimension 2EW	No Mention	No Mention
Authority XL	Largest Droplet Size*	10 to 40	Diquat 2 L	Largest Droplet Size*	Minimum 15 to 20
Autumn Super 51 WDG	C	Minimum 10	Distinct	C	More than 3
Axial XL	No Mention for Ground Application	5 to 10	Diuron 80DF	Largest Droplet Size*	Minimum 25
Balance Flex	C	Minimum 10	Dual II Magnum	No Mention for Ground Application	Min 10; min 5 for low carrier
Banvel	C	3 to 50	Dual Magnum	No Mention for Ground Application	Min 10; min 5 for low carrier
Basagran 5L	No Mention for Ground Application	10 to 20	Durango DMA	Avoid Fine Mist	3 to 40
Basis Blend	M to C	Minimum 10 to 15	Enlist Duo	See Nozzles Listed in Label	10 - 15
Beacon	M to C	Minimum 10	Enlite	C to VC	Minimum 10
Beyond	No mention	Min 10; Min 20 for No-Till	Envive	C to VC	Minimum 10
Bicep II Lite Magnum	No Mention for Ground Application	Min 10; Min 5 for low carrier	Eptam 7E	No Mention	Minimum 10
Bicep II Magnum	No Mention for Ground Application	Min 10; Min 5 for low carrier	Escort XP	Largest Droplets that are consistent w/pest control objectives	10 to 50??
Boundary 6.5 EC	No mention	Minimum 10	Evik DF	M or Coarser	Minimum 20
			Expert	M to C	Minimum 10

Pesticides listing the recommended or required spray droplet size and carrier rate on the label. Always check label before applying.

Herbicides (continued)

<i>Herbicides</i>	<i>Drop Size Classification</i>	<i>Ground Application GPA</i>	<i>Herbicides</i>	<i>Drop Size Classification</i>	<i>Ground Application GPA</i>
Express SG TotalSol	M	Minimum 5 to 20	Lumax EZ	M to C	Pre: 10 to 80 & Post: 10 to 30
Extreme	No Mention for Ground Application	Min 10; Min 20 for No-Till	Marvel	M	Min 10; Min 20 if dense weeds or canopy
Facet L	Larger Spray Droplets	5 to 40	Matrix SG	Largest Droplet Size*	Minimum 10
Fallow Star	Avoid Fine Droplets or Mist	3 to 10	MCPA Amine 4 lb	M to C	5 to 15
Fierce	M	Pre: 10 to 30 & Burn-down: 15 to 60	MCPA Ester 4 lb	M or Coarser	5 to 15
Fierce XLT	Medium or Coarser	16 to 60, 10 to 30	Metribuzin 75 DF	Largest Droplet Size*	Minimum 10 to 40
Finesse	Largest Droplet Size*	Minimum 3 to 20	Milestone	C	Minimum 10
FirstRate	Not Fine (large)	Minimum 10	North Star	M to C	Minimum 10
Flexstar GT 3.5	M	15 to 20	Nortron SC	M: Coarse May Be Used If GPA Is Increased to Maintain Coverage of Weeds	10 to 60, 10 to 40, 5 to 10
ForeFront HL	C or Coarser	Greater than 10			
Fultime NXT	No Mention	Minimum 10			
Fusilade DX	NOT COARSE	5 - 40	Olympus 70 DG	C	5 or More
Fusion	No Mention	Minimum 5 - 40	Opensight	C	Minimum 10
Garlon 3 A	Not Fine	Minimum 20	Optill WG	M to C	5 or More
Garlon 4 Ultra	Not Fine	20 or More	Oust 75XP	Largest Droplet Size*	???
Glean XP	Largest Droplet Size*	Minimum 3 to 20	Outflank	No Mention	Pre: 10 to 30 & Burndown 15 to 60
Glory	No Mention	Minimum 10 to 40	Outlook	Largest Droplet Size*	5 or More
Glyphosate (generic) w surfactant 5#	Avoid Fine Particles	3 to 40	Overdrive	Largest Droplet Size*	Minimum 3
Goal 2XL	C	20 or More	Panoflex w/ TotalSOL	M to C	5 to 20
Gramoxone SL 2.0	No Mention for Ground Application	Minimum 5 - 50, varies by crop	Parallel	No Mention	Minimum 10
Grazon P&D	C or Coarser	10 to 40	Parallel Plus	No Mention	Minimum 5
Habitat	C or Coarser	Low Vol; 5 - 20	Parazone 3SL	No Mention for Ground Application	Min 10; Min 20 - 25
Halex GT	M to C	10 - 30	Pasturegard HL	C or Larger	Minimum 5
Harmony Extra and Extra SG with Totsol	Larger Droplet Size*	Minimum 5 to 20	Pathfinder II	Larger, Not Fine	??
Harness	Large, Not fine	Minimum 10	Peak	M	Minimum 5
Harness 5.6L XTRA	Large, Not fine	Minimum 10	Permit	No Mention for Ground Application	Minimum 15
Hi-Dep	C	1 to 10	Perspective	C or greater	Minimum 10 (Turf)
Hornet WDG	Large, Not fine	10 to 60	Phoenix	Need Small Enough Droplets for Adequate Weed Coverage	15 to 20; Low Vol: Min 10
Huskie	M	10 or More			
Hyvar XL	Largest Droplet Size*	???	Plateau	Largest Droplet Size*	Minimum 5
Impact	Larger Droplets Less Like to Drift	10 or More	Poast	M or C	5 to 20
Instigate	M to C	10 - 80	PowerFlex HL	Large, Not fine	Minimum 10
Journey	Larger Droplet Size*	5 or more to reduce drift, otherwise 2 or more	Pramitol 25E	No Mention	50 - 100
Karmex DF	No Mention	Sufficient for Thorough Coverage	Prefar 4E	No Mention	10 to 50
Keystone	No Mention	Minimum 10	Prefix	No Mention for Ground Application	Minimum 10
Keystone LA NXT	No Mention	Minimum 10	Prequel	C or Larger	Min 15 (10 for Lightly Scattered Weeds)
Keystone NXT	No Mention	Minimum 10	Princep 4L	C or Coarser	Minimum 20
Krenite S	Largest Droplet Size*	20 to 50	Princep Cal 90	C or Coarser	Minimum 20
Krovar1DF	Largest Droplet Size*	Minimum 10	Prowl 3.3EC	Largest Droplet Size*	10 or More
Landmaster BW	Avoid Fine Droplets or Mist	3 to 1-	Prowl H2O	M or Coarser	Minimum 10
Latir	M or Coarser to	5 to 10 & 7 to 10	Pummel	No Mention	10 to 40
Laudis	M to C	10	Pursuit	No Mention for Ground Application	Min 10; Min 20 for No Till
Lexar EZ	M to C	Pre: 10 to 80 & Post: 10 to 30	Python WDG	Largest Droplet Size*	10 to 40
Liberty	M	Minimum 10	Range Star	C	5 - 40
Lighting	Coarse Sprays with Minimal Fine Droplets	Minimum 10	Raptor	No Mention for Ground Application	Min 10; Nub 20 for No-Till
			Rave WDG	Use Large Droplet Size Sprays to Reduce Drift	5 - 20; Min 20 to Reduce Drift

Pesticides listing the recommended or required spray droplet size and carrier rate on the label. Always check label before applying.

Herbicides (continued)

Herbicides	Droplet Size Classification	Ground Application GPA	Herbicides	Droplet Size Classification	Ground Application GPA
Realm Q	C or Larger	Minimum 10 to 15	Surveil	No Mention	10 to 30, 15 to 30, 20 to 30
Reflex	NOT COARSE	Pre: Minimum 10 & Post: 10 - 20	Surveil	No Mention for Ground Application	Minimum 10 to 30
Reglone	Coarser Spray Quality	Minimum 15 to 20, Varies by Crop	Synchrony XP	M to C to VC	Minimum 10 to 15
Rely 280	No Mention for Ground Application	Minimum 10	Tailwind	No Mention	Minimum 10
Remedy Ultra	Not Fine	Minimum 20	Telar XP	C to VC	Min 10; 20 - 40 for heavy weed infestations
Resicore	M to C	Minimum 10 to 15	Tordon 22K	C	Minimum 10
Resolve Q	M	Minimum 10 to 15	Tordon RTU	M or Coarser	
Resource	M	Minimum 15	Torment	C or Coarser	Minimum 15
Reward AccuGel	Largest Droplet Size*		Transline	Coarse Sprays	Minimum 10
Rhythm	NOT large C droplets	Min 15; Min 20 for Dense Crofoliage Large Weeds	Trifluralin 4EC	M or Coarser	5 to 40
Rodeo	No Mention	3 to 40	Triflurex HFP	No Mention for Ground Application	5 to 40
Roundup PowerMax	Avoid Fine Mist	3 to 40	Tripleflex II	Large Droplet Spray, Not Fine	10 or More
Roundup Weather Max	Avoid Fine Mist	3 to 40	Trivence	C to VC; M for Cons. Tillage	Min 10; Min 15 Cons. Tillage
Rowel	No Mention	10 to 30, 15 to 60	Trust	No Mention	5 to 40
Rowell FX	No Mention	10 to 30, 15 to 60	Ultra Blazer	M to XC depending on wind speed & nozzle height	Min 10 to 20; up to 50 for dense crop or weeds; 20 to 40 for Strawberries
Rugged	C or Coarser; M or Coarser if mixed w/ product that requires M or Coarser	Minimum 5	Upbeet	C or Larger; Largest Droplet Size*	Minimum 10 to 15
Rumble	Not Large C Droplets	Minimum 15	Valor SX	No Mention	Pre: 10 to 30, Post: 15 to 30, & Burndown: 15 to 60
Sahara DG	C+	Minimum 7/A	Valor XLT	No Mention for Ground Application	Pre: 10 to 30 & Burndown 15 to 30
Salvo	C+	Minimum 5 or More	Varisto	M to C	10 to 20
Sandea	No Mention for Ground Application	Minimum 15	Velpar Alfamax	Largest Droplet Size*	Minimum 20
Sedgehammer	No Mention	44 to 88 gallons per acre	Velpar L	Largest Droplet Size*	Minimum 10 - 25
Select Max	Large Droplet Size Sprays	Min 5 to Max 40, Varies by Crop	Verdict	M to C	3 or More
Sequence	No Mention	10 - 40	Vida	Largest Droplets*	Minimum 10
Sharpen	M to C	Minimum 5 to 10	Viewpoint	C or Coarser	Minimum 10 to 50
Sinbar 80 WDG	Largest Droplet Size*	Varies by Crop Min 5, 20, 25	Vise	No Mention	Minimum 10
Solida	M	Minimum 15	Vista XRT	C or Larger	Minimum 5
Solstice	M	Minimum 10	Warrant	Large Droplet Size, Minimum Fine Mist	Minimum 10
Sonalan HFP	No Mention	Minimum 5	Warrant Ultra	Not Fine Droplets**	Minimum 10 to 15
Sonic	Largest Droplet Size*	10 to 40	Weedmaster	C or Coarser; M or Coarser if with other that requires M	5 - 40
Spartan 4F	Largest Droplet Size*	Minimum 10	Wide Match	Large Not Fine	Minimum 10
Spartan Charge	Largest Droplet Size*	Minimum 10	Yukon	Use Coarse Sprays to Avoid Potential Drift by Sensitive Crops	Minimum 10
Spartan Elite	Minimal Fine Spray Droplets	Minimum 10	Zemax	M to C	Pre: 10 - 80 & Post: 10 - 30
Spike 20P	No Mention	No Mention			
Spirit	M to C	Minimum 10			
Starane NXT	Large, Not fine	Minimum 8			
Starane Ultra	Large-droplet sprays	Minimum 8			
Status	No Mention	3 to 50			
Steadfast Q	M	Minimum 10 to 15			
Stinger	C or Coarser	Minimum 5 to 10			
Storm	M to XC depending on wind speed & nozzle height	Min 10 to 20; up to 50 for dense crop or weeds			
Streamline	C or Greater	Thorough Coverage			
SureStart	C	Minimum 10			
Surmount	Coarse or Larger	Minimum 5			
Surpass NXT	Large, Not Fine	Minimum 10			

*That Provides Coverage & Control

**Use sufficient spray volume to ensure adequate coverage with large droplet size sprays

While not currently required it's expected EPA may soon be suggesting (or requiring) the use of validated drift reduction technologies (DRT) to further reduce spray drift. These can include selection of the appropriate nozzle & adjuvant for the intended application as well as consideration of wind speed, application height, droplet size, and appropriate buffer zone.

Pesticides listing the recommended or required spray droplet size and carrier rate on the label. Always check label before applying

Insecticides

<i>Insecticides</i>	<i>Drop Size Classification</i>	<i>Ground Application GPA</i>
Alias 4F	Largest Droplet Spectrum*	Minimum 10
Artic 3.2E	M or Coarser	10 to 20
Asana XL	M or Coarser	3 to 100
Baythroid XL	M or Coarser	Minimum 10
Belt SC	M or Coarser	Minimum 10
Besiege	M or Coarser	Minimum 10
Blackhawk	F to C	Varies by Crop
Capture LFR	M or Coarser	10 to 40
Cobalt Advanced	M or Coarser	Minimum 10
Comite II	Coarsest Droplet Spectrum*	Minimum 20
Coragen	Largest Droplet Spectrum*	Minimum 10
Declare	M or Coarser	Minimum 10*
Dimethoate 4E	Largest Droplet Spectrum*	Minimum 5
Dimilin 2L	Largest Droplet Spectrum*	5 to 30
DiPel DF	No Mention	Minimum 20
Endigo ZC	M or Coarser	Minimum 10
Entrust	F to Coarse	5 to 10
Fanfare 2EC	Largest Droplet Spectrum*	Minimum 3 to 10
Fyfanon Ag	M or Coarse	Not Mentioned
Hero	M or Coarser	Minimum 10 to 20
Lannate LV	Use Larger Droplets	Minimum 10
Leverage 360	Medium - Largest Droplets*	Minimum 10
Lorsban Advanced	M to C	Minimum 10
Lorsban 4E	M to C	Minimum 10 to 20
Malathion 5EC	M or Coarser	Minimum 10
Mustang MAX EC	M or Coarser	Minimum 10
Nufos 4 E	M or C	Minimum 10
Oberon 4SC	Largest Droplet Spectrum*	Minimum 10
Onager	No Mention	15 to 20
Prevathon	Largest Droplet Spectrum*	Minimum 10
Radiant SC	M or Coarser/Also F to C	Minimum 5 to 10
Sevin 4F	No Mention	Varies
Sevin XLR Plus	No Mention	Minimum 15, 20, 25
Silencer	M or Coarser	Minimum 3 to 10
Skyraider	M or Coarser	Minimum 10 to 25
Steward EC	Largest Droplet Spectrum*	Minimum 5 & 20 to 100
Thionex 3EC	M or Coarser	Minimum 10
Warrior II w/Zeon Technology	M or Coarser	Minimum 10 Some 7
Zeal Miticide	No Mention	Minimum 25

*That Provides Sufficient Control & Coverage

While not currently required it's expected EPA may soon be suggesting (or requiring) the use of validated drift reduction technologies (DRT) to further reduce spray drift. These can include selection of the appropriate nozzle & adjuvant for the intended application as well as consideration of wind speed, application height, droplet size, and appropriate buffer zone.

Fungicides

<i>Fungicides</i>	<i>Drop Size Classification</i>	<i>Ground Application GPA</i>
Affiance	No Mention	Minimum 10
Alto 100SL	No Mention	Minimum 5
Bumper ES	No Mention	Minimum 1
Captan gold	M or Coarser	20 to 400
Captan 80WDG	Largest Droplets*	20 to 400 by Crop
Caramba	No Mention	Minimum 5
Custodia	No Mention	Minimum 10
Dithane F-45 Rainshield	No Mention	Thorough Coverage
Domark 230 ME	No Mention	Minimum 10 ???
Equus 720	No Mention	20 to 150
Evito	No Mention	Minimum 10
Headline AMP	No Mention	Minimum 10
Incognito 4.5	No Mention	Minimum 20
Manzate Max	No Mention	20 to 100
Manzate Pro-Stick	No Mention	20 to 100
Mastercop	M or Coarser	20 to 400
Orius 3.6F	No Mention	Minimum 10
Penncozeb 75DF	No Mention	Varies by Crop
Proline 480SC	No Mention	Minimum 10
PropiMax EC	No Mention	Varies by Crop
Prosaro SC	No Mention	Minimum 10
Quadris	No Mention	Minimum 10 Varies
Quadris Top	No Mention	Minimum 10 to 15
Quilt	No Mention	Minimum 10
Quilt Xcel	No Mention	Minimum 10
Stratego YLD	No Mention	Minimum 10
Stratego	M or Coarser	Minimum 10
Tebuzol 3.6F	M or Coarser	Minimum 10
Tilt	No Mention	Minimum 10
Toledo	No Mention	Minimum 10
Topguard	No Mention	Minimum 10
Twinline	Larger Droplets**	Minimum 5

*That Provide Sufficient Coverage & Control

**Reduce Drift Potential

While not currently required it's expected EPA may soon be suggesting (or requiring) the use of validated drift reduction technologies (DRT) to further reduce spray drift. These can include selection of the appropriate nozzle & adjuvant for the intended application as well as consideration of wind speed, application height, droplet size, and appropriate buffer zone.

The following charts list suggested nozzle tips, pressures, and speeds (lower speeds are preferred for application) for the various spray droplet sizes. To simplify the charts, only Spraying Systems Co. nozzles were included. Most nozzle manufacturers will have nozzles similar to the ones listed. Always check the pesticide label for the required or suggested application information.

Table 1. Recommended sprayer nozzle tips, pressures, and speeds to achieve various droplet sizes.

For Medium (M) Spray Quality 10 GPA				
Speed mph	Rate gpm	Nozzle Spacing		
		20-inch	Rate gpm	30-inch
6	0.202	TT11002@41psi	0.303	TT11003@41psi*
7	0.236	TT110025@36psi**	0.354	XRC11004-VK@31psi or TT11003@56psi
8	0.269	TT110025@ 46psi	0.404	XRC11005-VK@26psi or TT11004@41psi*
10	0.337	XRC11004-VK@28psi or TT11003@50psi**	0.505	XRC11006-VK@28psi
12	0.404	XRC11005-VK@26psi	0.606	XRC11006-VK@41psi
14	0.471	XRC11006-VK@25psi	0.707	XRC11008-VK@31psi*

*Just into the next larger spray drop size with water - many pesticides and additives reduce the spray drop size

**Just into spray drop size



TT110025



XRC11004-VK

For Coarse (C) Spray Quality 10 GPA				
Speed mph	Rate gpm	Nozzle Spacing		
		20-inch	Rate gpm	30-inch
6	0.202	TT110025@26psi	0.303	AIXR110025@59psi
7	0.236	TT11003@25psi	0.354	AIXR11003@56psi or TT11004@31psi
8	0.269	TT11003@32psi	0.404	TT11004@41psi**
10	0.337	AIXR11003@50psi or TT11004@28psi**	0.505	TT11005@41psi
12	0.404	TT11004@41psi** AIXR11003@73psi	0.606	XRC11008-VK@23psi or TT11006@41psi*
14	0.471	TT11005@36psi*	0.707	XRC11008-VK@31psi** or TT11006@56psi

*Just into the next larger spray drop size with water – many pesticides and additives reduce the spray drop size

**Just into spray drop size



TT11005



AIXR110025

For Very Coarse (VC) Spray Quality 10 GPA				
Speed mph	Rate gpm	Nozzle Spacing		
		20-inch	Rate gpm	30-inch
6	0.202	TT11003 @ 18 psi	0.303	TT11004 @ 23 psi
7	0.236	AIXR110025 @ 36 psi	0.354	TT11005 @ 20 psi
8	0.269	AIXR11003 @ 32 psi	0.404	TT11005 @ 26 psi
10	0.337	TT11005 @ 18 psi	0.505	TT11006 @ 28 psi
12	0.404	TT11005 @ 26 psi	0.606	TT11008 @ 23 psi
14	0.471	TT11006 @ 25 psi	0.707	TT11008 @ 31 psi



TT11006



AIXR11003

For Extremely Coarse (XC) Spray Quality 15 GPA						
Speed mph	Rate gpm	Nozzle Spacing				
		20-inch	Rate gpm	15-inch	Rate gpm	30-inch
6	0.303	AIXR11004@23psi	0.227	AIXR11003@23psi	0.455	AIXR11005@33psi
7	0.354	AIXR11004@31psi	0.265	AIXR11004@17psi*	0.530	AIXR11006@31psi
8	0.404	AIXR11005@26psi	0.303	AIXR11004@23psi	0.606	AIC11006-VK@41psi**
10	0.505	AIXR11006@28psi	0.379	AIXR11005@23psi	0.758	AIC11006-VK@64psi
12	0.606	AIC11006-VK@41psi	0.455	AIXR11006@23psi	0.909	AIC11008-VK@52psi
14	0.707	AIC11006-VK@56psi	0.530	AIXR11006@31psi	1.061	AIC11010-VK@45psi*

*Just into the next larger spray drop size with water - many pesticides and additives reduce the spray drop

**Just into spray drop size



AIXR11004



AIC11010-VK

For Ultra Coarse (UC) Spray Quality 15 GPA						
Speed mph	Rate gpm	Nozzle Spacing				
		20-inch	Rate gpm	15-inch	Rate gpm	30-inch
6	0.303	TTI11003@41psi	0.227	TTI110025@33psi	0.455	TTI11005@33psi
7	0.354	TTI11004@31psi	0.265	TTI11003@31psi	0.530	TTI11006@31psi
8	0.404	TTI11004@41psi	0.303	TTI11003@41psi	0.606	TTI11006@41psi
10	0.505	TTI11005@41psi	0.379	TTI11004@36psi	0.758	AIC11008-VK@36psi
12	0.606	TTI11006@41psi	0.455	TTI11005@33psi	0.909	AIC11010-VK@33psi
14	0.707	TTI11006@56psi	0.530	TTI11006@31psi	1.061	TF-VS7.5@20psi



TTI11004



TF-VS7.5

For Medium (M) Spray Quality 20 GPA				
Speed mph	Rate gpm	Nozzle Spacing		
		20-inch	Rate gpm	15-inch
6	0.404	XRC11005-VK@26psi	0.303	TT11003@41psi*
7	0.471	XRC11006-VK@25psi	0.354	XRC11004-VK@31psi or TT11003@56psi
8	0.539	XRC11006-VK@32psi	0.404	XRC11005-VK@26psi
10	0.673	XRC11008-VK@28psi*	0.505	XRC11006-VK@28psi*
12	0.808	XRC11008-VK@41psi	0.606	XRC11006-VK@41psi
14	0.943	XRC11008-VK@56psi	0.707	XRC11008-VK@31psi*

*Just into the next larger spray drop size with water - many pesticides and additives reduce the spray drop size



XRC11005-VK



TT11003

For Coarse (C) Spray Quality 20 GPA				
Speed mph	Rate gpm	Nozzle Spacing		
		20-inch	Rate gpm	15-inch
6	0.404	TT11004@41psi**	0.303	AIXR110025@59psi
7	0.471	TT11005@36psi*	0.354	TT11004@31psi or AIXR11003@56psi
8	0.539	TT11005@46psi	0.404	TT11004@41psi**
10	0.673	XRC11010-VP@18psi* or TT11006@50psi**	0.505	TT11005@41psi
12	0.808	XRC11010-VP@26psi	0.606	XRC11008-VK@23psi or TT11006@41psi*
14	0.943	TT11008@56psi	0.707	XRC11010-VP@20psi or TT11006@56psi

*Just into the next larger spray drop size with water – many pesticides and additives reduce the spray drop size

**Just into spray drop size



TT11004



XRC11010-VP

For Very Coarse (VC) Spray Quality 20 GPA				
Speed mph	Rate gpm	Nozzle Spacing		
		20-inch	Rate gpm	15-inch
6	0.404	TT11005@26psi	0.303	AIXR11003@41psi**
7	0.471	AIXR11004@56psi	0.354	TT11005@20psi
8	0.539	TT11006@32psi	0.404	TT11005@26psi
10	0.673	AIXR11006@50psi	0.505	TT11006@28psi
12	0.808	XR8010-VS@26psi**	0.606	AIXR11005@59psi**
14	0.943	XRC11015-VP@16psi	0.707	TT11008@31psi

**Just into spray drop size



AIXR11004



TT11008

For Extremely Coarse (XC) Spray Quality 20 GPA				
Speed mph	Rate gpm	Nozzle Spacing		
		20-inch	Rate gpm	15-inch
6	0.404	AIXR11005@26psi	0.303	AIXR11004@23psi
7	0.471	AIXR11005@36psi**	0.354	AIXR11004@31psi
8	0.539	AIXR11006@32psi	0.404	AIXR11005@26psi
10	0.673	AIC11006-VK@50psi	0.505	AIXR11006@28psi
12	0.808	TTI11006@73psi	0.606	AIC11006-VK@41psi
14	0.943	AIC11008-VK@56psi	0.707	AIC11006-VK@56psi

**Just into spray drop size



AIXR11005



TTI11006

For Ultra Coarse (UC) Spray Quality 20 GPA				
Speed mph	Rate gpm	Nozzle Spacing		
		20-inch	Rate gpm	15-inch
6	0.404	TTI11004@41psi	0.303	TTI11003@41psi
7	0.471	TTI11005@36psi	0.354	TTI11004@31psi
8	0.539	TTI11006@32psi	0.404	TTI11004@41psi
10	0.673	TTI11006@50psi	0.505	TTI11005@41psi
12	0.808	AIC11008-VK@41psi	0.606	TTI11006@41psi
14	0.943	AIC11010-VK@36psi	0.707	TTI11006@56psi



TTI11004



AIC11010-VK

For Glyphosate at 10 GPA				
Speed mph	Rate gpm	Nozzle Spacing		
		20-inch	Rate gpm	30-inch
6	0.202	AIXR11002@41psi	0.303	AIXR11003@41psi
7	0.236	AIXR110025@36psi	0.354	AIXR11004@31psi or AIXR11003@56psi
8	0.269	AIXR11003@32psi or AIXR110025@46psi	0.404	AIXR11004@41psi
10	0.337	AIXR11004@28psi or AIXR11003@50psi	0.505	AIXR11005@41psi
12	0.404	AIXR11004@41psi	0.606	AIXR11006@41psi
14	0.471	AIXR11005@36psi or AIXR11004@56psi	0.707	AIXR11006@56psi



AIXR11003



AIXR11005

For 15 and 20 GPA Fungicide and/or Insecticide <i>This is a general recommendation. See product label.</i>				
Speed mph	Rate gpm/gpa	Nozzle Spacing		
		20-inch	Rate gpm/gpa	30-inch
6	0.303/15	XRC11003-VK@41psi	0.455/15	XRC11004-VK@52psi
7	0.354/15	XRC11004-VK@31psi	0.530/15	XRC11005-VK@45psi
8	0.404/15	XRC11004-VK@41psi	0.606/15	XRC11006-VK@41psi
10	0.674/20	XRC11006-VK@50psi	0.505/20	15-inch Spacing XRC11005-VK@41psi
12	0.808/20	TJ60-11008@41psi	0.606/20	15-inch Spacing XRC11006-VK@41psi
14	0.942/20	TJ60-11008@56psi	0.707/20	15-inch Spacing XRC11006-VK@56psi



XRC11004-VK



TJ60-11008

Spray Boom Setup on Field Sprayers

Field sprayer booms are an important part of the pesticide delivery system and can influence application accuracy and efficiency. Booms come in all shapes and sizes, depending on their use, and deliver the spray solution to the nozzles and tips at the desired pressure for the target. A small hand boom may be only a single nozzle while a large field sprayer could have a 120-foot or wider boom.

Stability and Strength — Boom Features

Two attributes to look for when selecting a boom are stability and strength. Stability, the factor of major concern, ensures that the boom maintains a constant orientation to the target. Field conditions may vary widely, but if a spray boom is expected to provide a uniform application, stability must be maintained. Also important is a boom's strength or its ability to withstand operating conditions without becoming damaged.

Two systems are used to control boom stability. Passive systems, which include trapeze suspensions, center pivots, and dampening suspensions, all use balance. They minimize the amount of deflection transferred from the sprayer to the boom through various linkage designs. Active systems, on the other hand, use sensors and actuators in stabilizing the boom. An active system will usually have a sensor on the boom which is set to distinguish any fluctuation in distance between the target and the boom. If a difference in height is observed, the sensor signals the actuator on the boom linkage and it makes the appropriate adjustment. This usually means raising or lowering the boom in relation to the original setting.

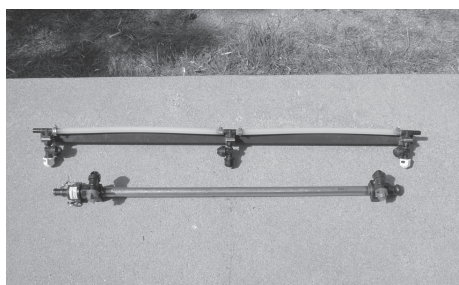


Figure 1. Sections of two booms — dry boom on top, wet boom on bottom.

Wet and Dry Booms

There are two types of booms: wet and dry. A boom is considered a wet boom (*Figure 1, bottom*) if the pipe span is not only used as a support mechanism for the spray nozzles but delivers spray solution to them as well, hence the name “wet boom.” A boom that is used merely as a span along which to space the nozzles, but which does not deliver the spray solution, is considered a dry boom (*Figure 1, top*). The solution is delivered to the nozzles via a separate hose line which runs along the boom span, using it as a support mechanism to mount each nozzle.

The advantages of a wet boom are less plugging of nozzle tips since there is less area where particles could build up and the ease of flushing the boom. On the dry boom, hose and nozzle assemblies are much more subject to being contaminated with residues than stainless steel tubing or pipe. Some adjuvants used with pesticides provide excellent cleaning of the tank, hose, etc., and may cause the spray solution to become contaminated. Even though the tank has been cleaned the spray booms have not.

Unless the boom is really long or a small size pipe is used, the spray boom on a wet boom needs only to be fed with the spray solution on the end. Since the nozzle assemblies on a dry boom greatly restrict the flow rate, the boom must be fed every few nozzles to prevent a pressure drop.

Another advantage of a wet boom is that the angle of the boom can be changed (*Figure 2*) and in most situations it is easier to change the height of a wet boom than a dry boom. Additional nozzle assemblies to accommodate various row spacings on a wet boom do not restrict the flow rate



Figure 2. Angle of boom can be changed by rotating the boom within the clamps.

(*Figure 3*) nearly as much as additional nozzle assemblies on a dry boom.

The two main disadvantages of a wet boom are initial cost and its potential for damage. If the boom contacts a non-moveable object, it may break or bend, destroying part of the boom.

Cost Comparison

The costs of a modern wet boom design versus a dry boom are summarized in *Table 1*. The cost of 1-inch outside diameter, 16-gauge stainless steel tubing is approximately \$4 per foot. The ends of the tubing are compressed and 1-inch stainless steel pipe nipples (304) are welded to each end of the stainless steel tubing. The nipples cost approximately \$2 and welding each one costs about \$3. The hose that feeds the boom and the plug can be attached to these nipples. Both are quick-attach couplers. Holes on the boom need to be precisely drilled at the nozzle spacing being used.

This example assumes the connectors and nozzle assemblies for the hose and stainless steel tubing will be about equal to the additional hose and fittings needed on the dry boom.

If the dry boom is left outside and unprotected, the hose may need to be replaced every two or three years. The stainless steel tubing should last for many years if not damaged.

The following photos help illustrate differences between wet and dry booms (*Figures 4 - 10*).

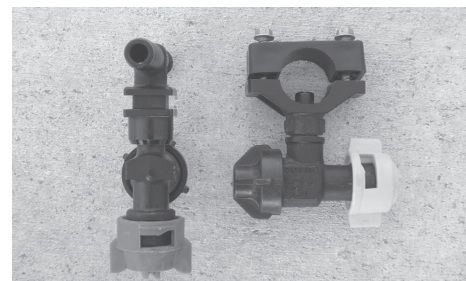


Figure 3. Nozzle assemblies for dry (left) and wet (right) booms.

Table I. Comparison of wet and dry boom costs

20-foot wet boom

20 feet of 1-inch OD 16-gauge stainless steel tubing — \$7/foot	= \$ 140.00
2 nipples — \$6 each	= \$ 12.00
Welding 2 nipples — \$8 each	= \$ 16.00
Total	<u>\$ 168.00</u>

20-foot dry boom

20 feet of 3/4-inch braided hose — \$0.80/foot	= \$ 16.00
If 30-inch nozzle spacing, 16 stainless steel clamps — \$0.80 each	= \$ 12.80
To keep from losing pressure, each 10-foot section of hose is fed in the middle	
Extra hose is 7 feet + 17 feet = 24 x \$0.80	= \$ 19.20
4 more clamps at \$0.80 each	= \$ 3.20
Two fittings at approximately \$6 each	= \$ 12.00
Total	<u>\$ 63.20</u>



Figure 4. The bracket to hold the wet boom. The rubber hose protects the boom and the stainless steel hose clamps hold the wet boom in place.

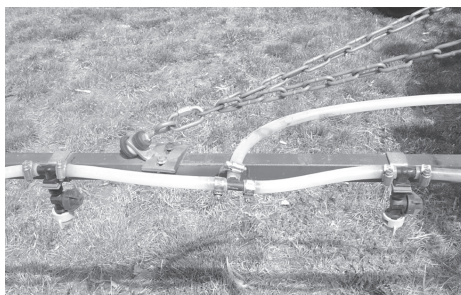


Figure 5. How dry boom is fed — note restriction to flow rate.



Figure 6. How wet boom is fed.



Figure 7. End cap on wet boom to drain and flush boom.

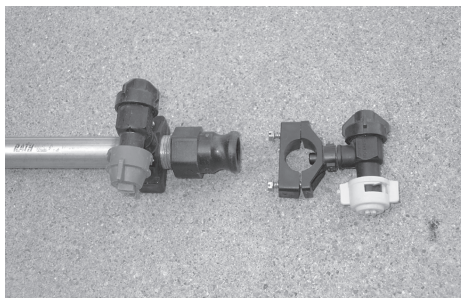


Figure 8. Wet boom nozzle body on and off boom.



Figure 9. Multiple nozzle body on wet boom.

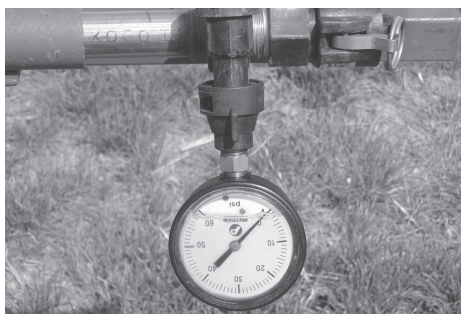


Figure 10. Gauge to check spray pressure on a wet boom.

Calibrating Sprayers

Applying the correct rate of a product is an important part of obtaining good results with pesticide sprayers. With a pesticide application, too little product can mean poor control, while too much can mean crop injury, extra costs, and possible residue on the crop and/or carryover.

Many methods can be used to calibrate sprayers, including the ounce calibration and formula-based methods. With the ounce calibration method, 128th of an acre is sprayed and the spray is collected. When measured in ounces, the amount collected would be equal to the number of gallons applied per acre since there are 128 ounces in a gallon. Other methods involve using formulas which need to be remembered or recorded for easy use. These methods also may require converting some of the information you have.

The methods discussed here are simple relationships and do not require remembering formulas. However, you do need a general understanding of cross multiplication. The important thing is to be consistent: if you put an item on top of an equation on one side, the same item also goes on the top on the other side.

Three factors determine sprayer application rate:

1. Speed
2. Nozzle spacing
3. Nozzle output (determined by orifice size, pressure, and density of spray solution)

Where:

Speed = Length or distance covered divided by time

Nozzle spacing = Width

Nozzle output = The quantity applied/unit time

How To Determine Speed In mph

To determine speed:

1 mile per hour (mph) is:

1 mile (5280 ft) in 1 hour (60 min)

$$\text{Or } 1 \text{ mph} = \frac{5280 \text{ ft}}{60 \text{ min}} = 88 \text{ ft/min}$$

Example 1

If we travel 440 feet (ft) in 30 seconds (sec) what is our speed?

The objective is to determine the distance traveled in 60 seconds (1 minute) and then divide by 88 (since 88 feet/minute is equal to 1 mph).

$$\frac{30 \text{ sec}}{440 \text{ ft}} = \frac{60 \text{ sec}}{D} \quad (\text{D is the distance we are solving the equation for})$$

We cross multiply to find the value of D

$$D = \frac{60 \times 440}{30 \times D}$$

$$D = \frac{26400}{30}$$

$$D = 880 \text{ ft/60 sec or } 880 \text{ ft/min}$$

Since every 88 ft traveled in 1 min is equal to 1 mph, we divide 880 by 88 to get 10 mph.

Example 2

If we travel 297 feet in 27 seconds, what is our speed?

$$\frac{27 \text{ sec}}{297 \text{ ft}} = \frac{60 \text{ sec}}{D}$$

$$D = \frac{297 \times 60}{27 \times D}$$

$$D = \frac{17820}{27}$$

$$D = 660 \text{ ft/60 sec}$$

Divide by 88 since 1 mph = 88 ft/60 sec (1 min)

$$\frac{660}{88} = 7.5 \text{ mph}$$

Example 3

If we travel 660 feet in 1 minute and 15 seconds, what is our speed?

First convert 1 minute and 15 seconds to seconds: $60 + 15 = 75$ seconds

$$\frac{75 \text{ (sec)}}{660 \text{ (ft)}} = \frac{60 \text{ (sec)}}{D}$$

$$\frac{660 \times 60}{75 \times D}$$

$$D = \frac{660 \times 60}{75}$$

$$D = \frac{39600}{75}$$

$$D = 528$$

$$\frac{528}{88} = 6 \text{ mph}$$

How to Determine Rate/Acre

If the sprayer is moving at 6 mph, the distance covered in one minute is 528 feet ($6 \text{ mph} \times 88 \text{ ft/min} = 528 \text{ feet}$).

To determine the area you cover with one nozzle in one minute if your sprayer has a 30-inch nozzle spacing:

Distance traveled: $6 \times 88 = 528 \text{ ft/min}$

Nozzle Spacing: $30 \text{ in} = 2.5 \text{ ft}$

Area Sprayed: $1320 \text{ sq ft } (2.5 \text{ ft} \times 528 \text{ ft/min})$

Collect the output of several nozzles and determine the average output per nozzle. All nozzles should be within 10 percent of the manufacturer's rating for that nozzle. For example an XR11003 delivers 0.3 gpm at 40 psi. If it delivers more than 0.33 gpm or 42.24 (128 x 0.33) ounces/min at 40 psi, the nozzle should be replaced. Any nozzle delivering 5 percent above or below the *average delivery* rate for all the nozzles should be replaced.

In this next example, the average nozzle output is 32 oz per minute or 32 (oz/min), 128 (oz/gallon) = 0.25 gpm

What is the rate per acre? One way to calculate application rate without remembering a formula is to use a relationship: The amount applied and the area sprayed per minute are the same as the amount applied and the area sprayed per acre. Rate (R) = gals/acre

Minute Box		Acre Box
0.25 gpm	=	R

We also know...

Distance — 6 x 88 = 528 ft

Nozzle Spacing — 30 in ÷ 12 = 2.5 ft

Area sprayed/minute = Distance x Nozzle Spacing = 528 ft x 2.5 ft = 1320 sq ft

$$\frac{\text{Avg. nozzle output gpm}}{\text{Area sprayed/Min}} = \frac{\text{Rate (R)}}{\text{Sq ft of acre (43560)}}$$

From minute box					From acre box
0.25	=	R			
1320		43560			

Again we use cross multiplication to lead us to ...

$$\frac{\text{Nozzle output gpm} \times 43560}{\text{Area sprayed/Min} \times \text{Rate (R)}}$$

$$R = \frac{0.25 \times 43560}{1320 \times R}$$

$$R = \frac{10890}{1320}$$

$$R = 8.25 \text{ gal/acre}$$

How To Determine The Acres Sprayed Per Minute

Travel distance in one minute = 616 ft

Nozzle spacing = 30 inches (20 nozzles on sprayer)

Nozzle output = 64 oz/min

What is travel speed? 616 ÷ 88 = 7 mph (Remember 88 ft/min = 1 mph)

What is sprayer width? 20 nozzles x 2.5 feet (30-inch spacing) per nozzle = 50 ft

$$\text{What is application rate? } \frac{64 \text{ oz/min}}{128 \text{ oz/gal}} = 0.5 \text{ gpm}$$

Minute Box		Acre Box
0.5 gpm	=	R

We also know...

Distance — 7 x 88 = 616 ft

Nozzle Spacing — 30 in ÷ 12 = 2.5 ft

Area sprayed/Minute = Distance x Nozzle Spacing = 616 ft x 2.5 ft = 1540 sq ft

From minute box					From acre box
0.5	=	R			
1540		43560			

This leads us to....

$$\frac{\text{Nozzle output gpm} \times 43560}{\text{Area sprayed/Min} \times \text{Rate (R)}}$$

$$R = \frac{0.5 \times 43560}{1540 \times R}$$

$$R = \frac{21780}{1540}$$

$$R = 14.14 \text{ gal/acre}$$

To determine the area covered in one minute:

1,540 sq ft/nozzle/min x 20 nozzles

$$(1,540 \times 20) \div 43,560 \text{ sq ft/A} = 0.71 \text{ acre/min}$$

How to Determine Nozzle Size Needed to Achieve the Operational Goal

What nozzle size do I need to purchase with the following operational goals?

Sprayer speed = 7 mph

Nozzle spacing = 20 inches

Application rate desired = 17 gpa

Nozzle flow rate = F

Minute Box		Acre Box
F = gpm	=	17 gpa

We also know...

Distance — 7 x 88 = 616 ft

Nozzle Spacing — 20 in ÷ 12 = 1.67 ft

Area sprayed/Minute = Distance x Nozzle spacing = 616 ft x 1.67 ft = 1029 sq ft

From minute box					From acre box
F	=	17			
1029		43560			

$$\frac{\text{Area sprayed/Min} \times R}{43560 \times F}$$

This leads us to...

$$F = \frac{1029 \times 17}{43560 \times F}$$

$$1029 \times 17 = 17493$$

$$F = \frac{17493}{43560}$$

$$F = 0.40 \text{ gpm}$$

This is the output from a 0.4 gpm nozzle, such as the XR8004, at 40 psi.

How to Adjust Pressure (psi) to Match Nozzles

In the previous problem we needed 0.40 gpm, by design; however, a 0.40 gpm nozzle may not always be available. Nozzle output varies by the square root of the pressure. For example, if you increase the pressure from 10 psi to 40 psi (a four-fold increase), you will only double the output.

$$\sqrt{10 \text{ psi}} = 3.16 \text{ psi}$$

$$\sqrt{40 \text{ psi}} = 6.32 \text{ psi}$$

$$\sqrt{4} = 2$$

If we needed 0.4 gpm output but we only had 0.5 gpm nozzles, we would need to reduce the output by adjusting the pressure. Therefore 0.4 gpm is 80 percent of 0.5 gpm nozzle output at 40 psi.

Now we take the square root of the original psi

$$\sqrt{40} = 6.32$$

and multiply by our 80 percent reduced output need.

$$6.32 \times 0.8 = 5.056$$

$$\sqrt{P} = 5.056$$

To solve for "P" you need to multiply the result by itself:

$$5.056 \times 5.056 = 25.6 \text{ psi}$$

A typical 0.5 gpm nozzle at 25.6 psi will give you 0.40 gpm

How to Calibrate a Hand Sprayer

First, fill sprayer with water to a known level, a mark you can later refill to accurately. (Best to spray test area over concrete so you can see evenness of application.)

Spray test area 100 sq ft = 10 ft x 10 ft
or 250 sq ft = 10 ft x 25 ft
or 500 sq ft = 10 ft x 50 ft or 20 ft x 25 ft

Refill sprayer to same level as before, measuring amount of water it takes to refill sprayer.

If the pesticide recommendation is 2 liquid ounces of product per 1000 sq ft, the amount to include per 1000 sq ft would be 1/4 cup, 4 tablespoons, or 12 teaspoons. (See *Weights and Measures Conversions* in this guide.)

If, during the test, 28 ounces of water were applied over 250 sq ft, how much water and pesticide should be added to a 3-gallon sprayer?

To find the volume of water applied to a 1000 sq ft area, use the following formula:

$$V = \frac{\text{Output} \times 1000 \text{ sq ft}}{\text{test area sq ft}}$$

The amount of water you applied in test area $\frac{28}{250} = \frac{V \text{ for volume}}{1000}$ How much water you will apply per 1000 sq ft

$$\frac{28 \times 1000}{250 \times v}$$

$$V = 112 \text{ oz or } \div 32 (\text{oz/qt}) = 3.5 \text{ qt}$$

3.5 qt is the amount of water you would apply per 1000 sq ft

This indicates that 2 oz of pesticide should be added for every 3.5 qt of sprayer capacity.

With a 3-gallon sprayer, 12 qt (3 x 4 qt/gal) of water should be added to the sprayer tank.

$$\frac{2 \text{ oz}}{3.5 \text{ qt}} = \frac{P \text{ for Pesticide}}{12 \text{ qt}}$$

$$3.5 P = 24$$

$$P = 6.86 \text{ oz or } 0.86 \text{ cup}$$

You would add 6.8 oz (0.86 cup) to a 3-gallon sprayer.

How to Determine the Density of Spray Solution

The rate a fluid flows through a spray orifice varies with its density. Since all the tabulations are based on spraying water, which weighs 8.34 lb per U.S. gallon, conversion factors must be used when spraying solutions which are heavier or lighter than water. To determine the proper size nozzle for the solution to be sprayed, first multiply the desired GPM or GPA of solution by the water rate conversion factor. The conversion factors are the square root of specific gravity. (See *Weight and Measures Conversion Chart* for additional common fertilizers.)

For example, the specific gravity of 28% nitrogen, which weighs 10.65 lb/gal, is:

$$\frac{10.65 (\text{Wt of 28-0-0/gal})}{8.34 (\text{Wt of water/gal})} = 1.28 \text{ specific gravity}$$

$\sqrt{1.28}$ Conversion factor for 28-0-0 fertilizer or 28% nitrogen is

Weight of Solution	Specific Gravity	Conversion Factors
8.34 lb per gallon - Water	1.00	1.00
10.65 lb per gallon - 28% nitrogen	1.28	1.13
11.06 lb per gallon - 32% nitrogen	1.33	1.15

Example on using conversion factor:

Desired application rate is 20 GPA of 28% nitrogen.

GPA (solution) x Conversion factor = GPA (water)

$$20 \text{ GPA (28\%)} \times 1.13 = 22.6 \text{ GPA (water)}$$

A nozzle size should be selected that will supply 22.6 GPA of water at the desired pressure, speed, and nozzle spacing.

Using another example, the following has been recommended for an ecofallow corn field:

75 lb of nitrogen from 28% UAN
Density of 28% N = 10.65 lb/gal
 $10.65 \times 0.28 = 2.982 \text{ lb N/gal}$

$$\frac{75 \text{ lb N}}{2.982 \text{ lb N/gal}} = 25.151 \text{ gal of 28\% solution}$$

Ingredient	Amount	Gallons
28% Nitrogen	75 lb N	25.151
Balance Pro	2.0 oz	0.016
Fultime	2.25 qt	0.563
Gramoxone Extra	2 pt	0.250
Crop Oil Concentrate	1 qt	0.250
2,4-D 6 LVE	1/2 pt	0.063
Total		26.293 or 26.3 gal/acre

To determine how this will spray out and how many gallons of water are needed to get 26.3 gal/A of this spray solution, three steps are required.

1. To determine specific gravity, weigh an equal amount of this spray solution and an equal amount of water.

Spray solution = 13.08 lb

Water = 10.3 lb

Determine specific gravity weight of spray solution:

$$\frac{13.08 \text{ lb (wt of spray solution)}}{10.3 \text{ lb (wt of water)}} = 1.27 \text{ specific gravity}$$

2. Determine conversion factor $\sqrt{1.27} = 1.13$
3. Determine the quantity of water to calibrate sprayer:
Spray rate x Conversion factor = Water amount equivalent
 $26.3 \text{ gal/A} \times 1.13 = 29.6 \text{ gal/A}$
Now you need to calibrate the equipment to apply 29.6 gal of water.

Remember, if you have a flow meter and it has been calibrated with water, it will read the same for a spray solution as with water. If connected to a rate controller, it will change the pressure to adjust the output if you do not make any other adjustment such as speed.

Preparing Spray Solutions — Mixing Order

The W-A-L-E or D-A-L-E method can help you remember the mixing order for herbicides. If you have any questions about the compatibility of the herbicides and carrier, **do a jar test first** (see *Tank-mixture Compatibility*). Some herbicides and/or some carriers require a compatibility agent and some are not compatible even with a compatibility agent. Always check the label for any special procedures.

The recommended mixing order is:

1. First fill the spray tank with one-third of the carrier (water, fertilizer, or mix) to be used. Have agitation on.
2. Add ammonium sulfate if used for glyphosate products.
3. If compatibility problems exist, the compatibility agent is usually added before the herbicides. Check the label for instructions.
4. If excessive foam is a problem, a defoamer may be required. The defoamer works best if added before foam is a problem. Check the label.

W The **W** or **D** refers to dry wettable powders, dry flowable materials or and water dispersible granules (WP, DF and WDG). These are added first to the tank. Some water soluble packets need to be allowed to soak in a small amount of water before being added to the tank. It is best to preslurry wettable powders and dry flowables at a 2:1 ratio with water before adding to the partially filled sprayer tank. With some pesticides it is recommended that they be presoaked.

A The **A** means agitation to disperse the herbicides added. Agitation means a rolling surface action. Do not use excessive agitation which can reduce compatibility and increase foaming.

It is best to continue the agitation until the spray solution is applied. If agitation is stopped, check that the products are back

in suspension before application. After these herbicides are dispersed, add carrier to 80 percent of spray solution to be used.

L The **L** chemicals — liquids and flowables — are added next.

E The **E** chemicals are added next. These are the emulsifiable concentrates (EC). Microencapsulated formulations should be added after the emulsifiable concentrates.

Surfactants and oils are added last. Some surfactants, especially silicone-based ones, can cause excessive foaming.

If drift is a problem, consider using a drift control agent.

The last step is to add carrier to 100 percent of the spray solution to be used and check to make sure the spray solution is mixed thoroughly before starting application.

Tank-Mixture Compatibility (Jar Test)

Compatibility should always be checked before mixing large quantities of pesticides and/or fertilizers. You will need containers and measuring spoons to do the test. This example is based on an application rate of 25 gallons per acre. See *Table 1* for other rates.

1. Use two quart jars. Larger containers will be needed for rates lower than 1/4 pound dry or 1/4 pint liquid (see herbicide rates and use, *Table 2*). If the carrier is water, put 1 pint of water in each of the two jars. If the carrier is fertilizer, add 1 pint of fertilizer to both jars. If a mixture of fertilizer and water, add them in the same ratio they will be used in tank. For example, with a 2:1 fertilizer to water ratio use 2/3 pint fertilizer to 1/3 pint water. Use water and fertilizer from the same source and at the same temperature as when you mix to spray.
2. To one jar marked "with" add 1/4 teaspoon (1.2 ml, 1 teaspoon = about 5 ml liquid) of a compatibility agent and stir. For comparison, no compatibility agent is added to the other jar.
3. To both jars add the appropriate amount of herbicide(s). Add dry herbicides first, flowables second, and emulsifiable concentrates last. Stir after adding each material for 5 to 10 seconds.

Dry herbicide: For each pound per acre to be applied, add 1 1/2 level teaspoons. For wettable powders and flowables, preslurrying of each product with water in the ratio of 2 parts product to 1 part water is recommended prior to its addition to the two jars.

Liquid herbicide: For each pint per acre to be applied, add 1/2 teaspoon or 2.5 ml. Also add crop oils, COC, etc.

4. Five to 10 minutes after the final addition and mixing, observe both jars for the formation of large flakes, sludge, gels, or other precipitates.

If the incompatibility as described occurs in the jar without the compatibility agent added, the use of a compatibility agent is recommended.

Table 1. Amount of dry and liquid herbicide to add to 1 pint of carrier.

Spray Volume Rate/A gal	Dry Herbicides tsp/lb*	Liquid Herbicides tsp/pt**
5	7 1/2	2 1/2
10	3 3/4	1 1/4
15	2 1/2	1
20	2	3/4
25	1 1/2	1/2
30	1 1/4	1/2
35	1 1/4	1/3
40	1	1/3

Table 2. Amount of dry and liquid herbicide to add to 2 gallons of carrier.

NOTE: Add 4 teaspoons (20 ml) of compatibility agent to one jar marked "with" and stir. See Steps 2, 3, and 4, but add according to the table.		
Spray Volume Rate/A gal	Dry Herbicides tsp/lb*	Liquid Herbicides tsp/pt**
5	7 1/2	2 1/2
10	3 3/4	1 1/4
15	2 1/2	1
20	2	3/4
25	1 1/2	1/2
30	1 1/4	1/2
35	1 1/4	1/3
40	1	1/3

*For dry herbicide rates of 1/4 lb use 1/4 the amount listed and for 1/2 lb use 1/2 the amount listed.

**For liquid herbicide rates of 1/4 pint and 1/2 pint, larger containers will be needed. For 1/4 pint use 4 pints of carrier and for 1/2 pint use 2 pints of carrier and the appropriate amount of compatibility agent. Then use the amount of liquid herbicide listed in this table. If other herbicides are used in the mix at pound or pint rates, it is necessary to increase their rates by the rate the carrier rate was increased.

If incompatibility in any of these forms occurs in the jar with the compatibility agent added, the carrier and the herbicide **SHOULD NOT BE TANK MIXED**.

Jars should be allowed to stand and be observed for 1/2 hour.

If the mixture is found to be compatible, start filling the tank. Strong agita-

tion with a rolling effect on the surface of the carrier is recommended. Remember to preslurry the wettable powders and flowables. Allow time for good dispersal and empty the tank as much as possible before mixing a new batch (See *Preparing Spray Solutions — Mixing Order*, page 49).

Herbicide and Fertilizer Compatibility

Most herbicide labels indicate specific fertilizer incompatibilities and restrictions. Be sure to read the herbicide label for specific mixing or impregnation instructions. Herbicide and fertilizer combinations can increase or decrease herbicide efficacy and increase crop response. Crop response can usually be decreased by adding water to the spray solution. Compatibility agents are required for many mixes. See *Tank-Mix Compatibility* for a method to test the compatibility of specific herbicide-fertilizer combinations.

Herbicide Compatibility with Fertilizers as Application Carriers

Herbicide	Fertilizer		Herbicide	Fertilizer	
	Fluid	Dry		Fluid	Dry
Burndown Herbicides			Small Grain Postemergence Herbicides		
2,4-D Amine	No	No	2,4-D Amine	No	No
2,4-D Ester	Yes	No	2,4-D Ester	Yes	No
Aim	Yes	No	Achieve	No	No
Gramoxone SL	Yes	No	Aim	Yes	No
Harmony Extra	Yes	No	Banvel	Yes	No
Roundup	No	No	Buctril	Yes	No
Touchdown	No	No	Bronate	Yes	No
			Harmony Extra	Yes	No
			Hoelon	Yes	No
			Peak	Yes	No
			Sencor	Yes	No

Preemergence Herbicides

Herbicide	Fertilizer		Herbicide	Fertilizer	
	Fluid	Dry		Fluid	Dry
Acuron	Yes	No	Harness	Yes	Yes
Anthem MAXX	Yes	Yes	Harness Xtra	Yes	Yes
Anthem ATZ	Yes	Yes	Hornet	Yes	Yes
Atrazine	Yes	No	Imperium	Yes	Yes
Authority First	Yes	No	Intro	Yes	No
Authority MTZ	Yes	No	Karmex	No	No
Authority Assist	Yes	No	Keystone NXT	Yes	Yes
Authority XL	Yes	No	Lariat	Yes	Yes
Balance Flexx	Yes	No	Linex	Yes	Yes
Banvel	Yes	No	Lumax EZ, Lexar EZ	Yes	No
Bicep II Magnum/Cinch ATZ	Yes	Yes	Outlook	Yes	Yes
Boundary	Yes	Yes	Prefix/Statement	Yes	No
Broadaxe	Yes	No	Prowl H ₂ O	Yes	Yes
Callisto	Yes	No	Pursuit	Yes	No
Canopy	No	No	Python	Yes	Yes
Canopy EX	No	No	Resolve	Yes	No
Clarity	Yes	No	Scepter	Yes	No
Command	Yes	Yes	Sencor	Yes	Yes
Corvus	Yes	No	Sharpen	Yes	Yes
Degree	Yes	Yes	Sonolan	Yes	Yes
Degree Xtra	Yes	Yes	Spartan Charge	Yes	No
Dual II Magnum/Cinch	Yes	Yes	TripleFLEX/SureStart II	Yes	Yes
Enlite	Yes	No	Surpass/Breakfree	Yes	Yes
Envive	Yes	No	Trifluralin	Yes	Yes
Eradicane	Yes	Yes	Valor SX	Yes	Yes
Expert	Yes	No	Valor XLT	Yes	Yes
Extreme	No	No	Verdict	Yes	Yes
FirstRate	Yes	Yes	Zemax	Yes	No
FulTime NXT	Yes	Yes	Zidua	Yes	Yes

Spray Additives

Spray additives, also called tank-mix adjuvants, are materials added to a tank mix to aid or modify the action of an agricultural chemical or the physical characteristics of the mixture, as defined by the American Society of Testing and Materials (ASTM International). Activator additives increase the postemergence activity of herbicides and include oils, surfactants, and fertilizers. Modifier additives alter the application characteristics of the spray solution and include anti-foaming agents, compatibility agents, and drift control agents.

Additives are commonly used with postemergence herbicides because they increase herbicide penetration of the treated plant surface and improve herbicide performance. Additive response varies with the herbicide, weed species, and environmental conditions. The degree of weed control and the potential for crop injury are influenced by additives. Additives that increase weed control also may increase crop injury. There can be a fine line between increased weed control and increased crop injury.

It is important that additives not be added indiscriminately to the spray mixture. In some cases combinations of multiple additives may negatively affect the spray pattern or reduce the activity of the herbicide and allow weed escapes. In other cases they may increase the activity of the mixture and cause unexpected crop injury and potential yield loss.

Adjuvant Certification

Spray additives are not regulated by the EPA in the same way as herbicides, insecticides, and fungicides. As a result, the company is not required to demonstrate that the product matches the claims of functionality, nor that the formulation is consistent between batches. The Chemical Producers and Distributors Association began a certification program in 2001 to increase the consistency of adjuvant product performance. The program is voluntary. Companies may submit products for certification, and must meet 17 separate standards that are based on scientific standards developed by ASTM International.

Some chemical manufacturers recommend the use of certified adjuvants. The language on the pesticide label will read, "When an adjuvant is to be used with this product, [name of registrant of the pesticide] recommends the use of a Chemical Producers and Distributors Association certified adjuvant." The list of certified adjuvants is available at <http://www.cpda.com/Adjuvant-Certification-Program>.

For a comprehensive list of spray additives (certified and non-certified) see a *Compendium of Herbicide Adjuvants*, available from: Bryan Young, Southern Illinois University, 1205 Lincoln Drive, Carbondale,

IL 62901. Further information is available on the Web at www.herbicide-adjuvants.com.

Oil Concentrates and Methylated Seed Oils

Oil concentrates (crop oil concentrates [COC] and methylated seed oils [MSO]) include both petroleum and seed-derived oils and usually are composed of 17% emulsifiers and 83% oil. Combining an emulsifier with the oil results in a unit with one portion highly oil soluble with the other portion water soluble. Without the emulsifier, the oil would not mix with water. Methylation improves the effectiveness of seed oils as spray additives. Oil concentrates are generally used at 1 percent v/v of spray solution or 1 to 2 pt/ac, depending upon the herbicide, oil, and spray volume. Oil concentrates disrupt the waxy cuticle of the leaf surface and increase herbicide penetration through the cuticle.

High surfactant oil concentrates (HSOC), sometimes called high surfactant oil blends (HSOB), are a new classification of herbicide adjuvants. They typically include a blend of 60% petroleum or seed-derived oil and 40% surfactant. With some herbicide products, they may replace COC or MSO and be added at a lower use rate (typically 0.5-1.0% v/v). One reason HSOCs were developed was to facilitate tank-mixtures of a product that requires an oil adjuvant with a product that requires a surfactant, without reducing the efficacy of either tank-mix partner. Consult with a pesticide label or herbicide manufacturer regarding the use of an HSOC for a specific herbicide or tank-mixture of herbicides.

Surfactants

A material is called a surfactant if it tends to concentrate on the surface of a liquid in which it is mixed. Compounds that function in this way generally consist of two components. One portion of the molecule is hydrophilic (water soluble) and the other portion is lipophilic (oil soluble). Surfactants concentrate at the interface of two surfaces binding them together.

Surfactants are classified by the hydrophilic portion of the molecule. There are three important classes of surfactants: 1) anionic, 2) cationic and 3) nonionic. Anionic surfactants ionize in water to form a negative ion. Cationic surfactants ionize in water to form a positively charged ion. Nonionic surfactants contain no ionizable groups and therefore carry no charge. Nonionic surfactants are by far the most commonly used surfactant type.

Organosilicone surfactants are a class of nonionic surfactants that are especially effective in reducing surface tension of water mixtures. This results in efficient wetting of

very waxy surfaces. Most other nonionic surfactants interfere with the function of organosilicones and should not be used with them. Organosilicones are most stable and most effective in solutions of pH 6 to 8. In more alkaline or acidic solutions, these compounds hydrolyze with a loss in activity.

Plant surfaces are composed of waxes while the spray mixture is primarily water. Surface tension causes water to bead on a waxy surface. Surfactants exert their effect on the leaf cuticle or spray droplet to enhance penetration of foliar-applied herbicides. This results from a reduction in surface tension of the spray droplets, causing them to spread out and wet the sprayed surface. The surfactant with the hydrophilic end associated with the spray mixture and the lipophilic portion oriented to the lipid-containing plant surface functions as a bond between the two. The result is fewer spray droplets "bounce off" on impact and more spread out over the surface. This improved wetting and retention generally results in increased herbicide uptake by the plant, hence increased herbicide activity.

Fertilizer Additives

Fertilizers containing ammonium are effective spray additives. The most commonly used ammonium fertilizers in herbicide applications are 28-0-0 and 32-0-0 UAN solutions and 21-0-0 spray grade ammonium sulfate (AMS). The ammonium in these fertilizers enhances the uptake of certain herbicides, especially weak acids, by a mechanism not well understood. While oils and surfactants function primarily at the waxy leaf surface, the ammonium ion is believed to function inside the cell wall. This enhanced activity due to the ammonium ion is pronounced with several postemergence herbicides. Fertilizers are not surfactants and do not replace the need for surfactants in the spray mixture.

AMS is the fertilizer additive that should be used with glyphosate. Calcium, magnesium, and iron in spray water antagonize glyphosate activity by reacting with glyphosate, forming salts that reduce activity. AMS added to the spray water reacts with calcium, magnesium, and iron in the water, forming insoluble sulfates that will not react with glyphosate, effectively preventing antagonism. Other nitrogen-containing fertilizers, including UAN, will not prevent the antagonism caused by calcium, magnesium, and iron and should not be used as an additive with glyphosate. AMS added at 1-2 percent by weight (8.5 - 17 lb/100 gal spray) will overcome spray water antagonism of glyphosate. Liquid forms of AMS are equally effective if used at equivalent rates. Some common liquid AMS products contain approximately 3.75 lb AMS per gallon.

Additives for Corn Herbicides

This table is intended as a quick reference. Use the higher adjuvant rates when conditions are arid or when weeds are large. If the spray volume is less than 10 gal/A and COC or MSO are recommended on a % v/v basis, apply COC or MSO on a per acre basis (minimum 1 pt/A) to ensure maximum efficacy. A dash indicates the additive is not recommended for use with that herbicide. Use of an NIS, COC, or MSO usually requires the addition of a nitrogen source. Use high quality adjuvants. NIS should generally be a minimum of 60-80% nonionic surfactant. COC and MSO generally should be 80% oil and 15-20% surfactant emulsifiers. AMS should be spray grade, and UAN should be free of impurities.

Herbicide	Timing	NIS ^a or	COC or	MSO	plus UAN or AMS ^b
2,4-D	Preplant	0.25%	1%	1%	2-4 qt/A or 2-4 lb/A
2,4-D	Post	—	—	—	—
Accent Q	Post	0.25-0.50%	1-2%	0.5%	2-4 qt/A or 2-4 lb/A
Accent Q + atrazine	Post	—	1 qt/A	1 qt/A	—
Acuron	Preplant/Post	0.25%	1%	—	—
Acuron Flexi	Preplant/Post	0.25%	1%	—	—
Aim EC	Preplant/Post	0.25%	1%	—	—
Anthem MAXX	Preplant/Post	0.25%	1-2 pt/A	1-2 pt/A	1-2 qt/A or 8.5-17 lb/100 gal
Anthem ATZ	Preplant/Post	0.25%	1-2 pt/A	1-2 pt/A	1-2 qt/A or 8.5-17 lb/100 gal
Armezon Pro	Post	0.25%	1%	1%	1-2%
Armezon/Impact/Armezon Pro	Post	—	1.0-1.5%	1.0-1.5%	1.25-2.5% or 1-2%
Armezon/Impact + atrazine	Post	—	1.0-1.5%	1.0-1.5%	1.25-2.5% or 1-2%
Atrazine	Post	—	1 qt/A	1 qt/A	—
Autumn Super	Preplant	—	1%	—	1.5-2.0 qt/A or 1.5-3.0 lb/A
Balance Flexx	Preplant	—	1%	1%	—
Banvel	Preplant/Post	0.25%	—	—	2-4 qt/A or 2.5 lb/A
Basis Blend	Preplant/Post	0.25-0.50%	1-2%	1-2%	2-4 qt/A or 2-4 lb/A
Beacon	Post	0.25%	1-2 pt/A	1-2 pt/A	2-4 qt/A or 2-4 lb/A
Buctril + atrazine	Post	—	—	—	—
Cadet	Post	0.25%	1.0-2.5%	—	1-2 qt/A or 1-2 lb/A
Callisto	Preplant	—	1%	1%	2.5% or 8.5 lb/100 gal
Callisto	Post	—	1%	—	2.5% or 8.5 lb/100 gal
Callisto + atrazine	Post	—	1%	—	2.5% or 8.5 lb/100 gal
Callisto GT	Post	0.25-0.50%	—	—	8.5-17 lb/100 gal
Capreno	Post	—	1.25 pt/A or 1%	—	1.5 qt/A or 1.5 lb/A
Capreno + atrazine	Post	—	1.25 pt/A or 1%	—	1.5 qt/A or 1.5 lb/A
Clarity	Preplant/Post	1-2 pt/100 gal	1 qt/A	—	2-4 qt/A or 2.5 lb/A
Corvus	Preplant	—	1%	1%	2-4 qt/A or 2.5 lb/A
Diflexx	Preplant	0.25%	1%	1%	2-4 qt/A or 8.5-17 lb/A
Enlist Duo	Post	0.25%	1%	1%	1-2%
Glyphosate	Preplant/Post	0.25-0.50% ^c	—	—	— or 8.5-17 lb/100 gal
Gramoxone SL	Preplant	0.25%	1%	—	—
Halex GT	Post	0.25-0.50%	—	—	— or 8.5-17 lb/100 gal
Harrow	Preplant/Post	0.25-0.50%	1-2%	1-2%	2-4 qt/A or 2-4 lb/A
Hornet	Post	0.25%	1%	1%	2.5% or 2-4 lb/A
Laudis	Post	—	—	1.0%	1.5 qt/A or 1.5 lb/A
Lexar EZ/Lumax EZ	Preplant	—	1%	1%	2-4 qt/A or 2.5 lb/A
Lexar EZ/Lumax EZ	Post	0.25%	—	—	—
Liberty	Preplant/Post	—	—	—	— or 3 lb/A
Permit	Post	0.25-0.50%	1%	1%	2-4 qt/A or 2-4 lb/A
Prequel	Preplant	—	1%	1%	—
Realm Q	Post	0.25%	1-2%	—	2 qt/A or 2 lb/A
Resolve SG, DF or Q	Preplant/Post	0.25%	1%	0.5%	2 qt/A or 2 lb/A
Resource	Post	—	1 pt/A	1 pt/A	1-2 qt/A or 2-2.5 lb/A
Sharpen	Preplant	—	—	1.0-1.5% or 1 pt/A	1.25-2.5% v/v or 8.5-17 lb/100 gal
Solida	Post	0.25%	1-2%	0.5-1.0%	2 qt/A or 2 lb/A
Solstice	Post	0.25%	0.5-1.0%	—	2.5% or 8.5 lb/100 gal
Spirit	Post	0.25-0.50%	1-4 pt/A	1-4 pt/A	2-4 qt/A or 2-4 lb/A
Starane ^d	Post	—	—	—	—
Status	Post	0.25%	1-2 pt/A	1-2 pt/A	1.25% or 5-17 lb/100 gal
Steadfast Q	Post	0.25-0.50%	1-2%	0.5%	2-4 qt/A or 2-4 lb/A
Steadfast Q + Callisto + atrazine	Post	—	1-2%	—	2-4 qt/A or 2-4 lb/A
Stout	Post	0.25-0.50%	1-2%	0.5%	2-4 qt/A or 2-4 lb/A
Valor	Burndown	0.25%	1%	1%	1-2 qt/A or 2-2.5 lb/A
Verdict	Preplant	—	1.0-1.5%	1-1.5%	1.25-2.5% v/v or 8.5-17 lb/100 gal
Yukon	Post	0.25-0.50%	1%	1%	2-4 qt/A or 2-4 lb/A
Zemax	Preplant	0.25%	1%	1%	2.5% or 8.5 lb/100 gal
Zemax	Post	0.25%	1%	—	2.5% or 8.5 lb/100 gal

^aNIS is nonionic surfactant (% v/v), COC is crop oil concentrate, MSO is methylated seed oil, UAN is urea ammonium nitrate (28-32% N), and AMS is spray grade ammonium sulfate.

^b1% AMS = 8.5 lb/100 gal, and 2% AMS = 17 lb/100 gal.

^cNot all glyphosate formulations require NIS, See page 193 for glyphosate formulation information.

^dUse a high quality adjuvant only when using low application rates or under adverse environmental conditions.

Additives for Ecofallow Herbicides

This table is intended as a quick reference. Use the higher adjuvant rates when conditions are arid or when weeds are large. If the spray volume is less than 10 gal/A and COC or MSO are recommended on a % v/v basis, apply COC or MSO on a per acre basis (minimum 1 pt/A) to ensure maximum efficacy. A dash indicates the additive is not recommended for use with that herbicide. Use of an NIS, COC, or MSO usually requires the addition of a nitrogen source. Use high quality adjuvants. NIS should generally be a minimum of 60-80% nonionic surfactant. COC and MSO generally should be 80% oil and 15-20% surfactant emulsifiers. AMS should be spray grade, and UAN should be free of impurities.

Herbicide	Timing	NIS ^a or	COC or	MSO	plus UAN or AMS ^b
2,4-D	Preplant/Fallow	0.25%	1%	1%	2-4 qt/A or 2-4 lb/A
Atrazine	Preplant/Fallow	—	1 qt/A	1 qt/A	2-4 qt/A or 2.5 lb/A
Banvel	Preplant/Fallow	0.25%	—	—	2-4 qt/A or 2.5 lb/A
Fallowstar	Preplant/Fallow	—	—	—	— or 17 lb/100 gal
Glyphosate	Preplant/Fallow	0.25% ^c	—	—	— or 17 lb/100 gal
Gramoxone SL	Preplant/Fallow	0.25%	1%	—	—
Landmaster BW	Preplant/Fallow	—	—	—	— or 17 lb/100 gal
Rugged	Preplant/Fallow	0.25%	1%	1%	—
Sharpen	Preplant/Fallow	—	—	1%	1.25-2.5% or 1-2%
Spartan Charge	Preplant/Fallow	0.25%	1.5%	1%	2-4 gal/A or 2-4 lb/A
Valor	Preplant/Fallow	0.25%	1%	1%	1-2 qt/A or 2 lb/A
Weedmaster	Preplant/Fallow	2-4 pt/100 gal	1%	—	2-4 qt/A or —

^aNIS is nonionic surfactant (% v/v), COC is crop oil concentrate, MSO is methylated seed oil, UAN is urea ammonium nitrate (28-32% N), and AMS is spray grade ammonium sulfate.

^b1% AMS = 8.5 lb/100 gal, and 2% AMS = 17 lb/100 gal.

^cNot all glyphosate formulations require NIS. See page 193 for glyphosate formulation information.

Additives for Sorghum Herbicides

This table is intended as a quick reference. Use the higher adjuvant rates when conditions are arid or when weeds are large. If the spray volume is less than 10 gal/A and COC or MSO are recommended on a % v/v basis, apply COC or MSO on a per acre basis (minimum 1 pt/A) to ensure maximum efficacy. A dash indicates the additive is not recommended for use with that herbicide. Use of an NIS, COC, or MSO usually requires the addition of a nitrogen source. Use high quality adjuvants. NIS should generally be a minimum of 60-80% nonionic surfactant. COC and MSO generally should be 80% oil and 15-20% surfactant emulsifiers. AMS should be spray grade, and UAN should be free of impurities.

Herbicide	Timing	NIS ^a or	COC or	MSO	plus UAN or AMS ^b
2,4-D	Preplant	0.25%	1%	1%	2-4 qt/A or 2-4 lb/A
2,4-D	Post	—	—	—	—
Aim	Preplant	0.25%	1.5-2.0%	1.5-2.0%	2-4 qt/A or 2-4 lb/A
Aim	Post	0.25%	—	—	—
Atrazine	Preplant	—	1 qt/A	1 qt/A	2-4 qt/A or 2.5 lb/A
Atrazine	Post	—	1 qt/A	1 qt/A	—
Atrazine + dicamba	Post	0.25%	—	—	2-4 qt/A or 2.5 lb/A
Banvel	Preplant/Post	0.25%	—	—	2-4 qt/A or 2.5 lb/A
Buctril + atrazine	Post	0.25%	—	—	—
Cadet	Post	0.25%	1%	—	—
Clarity	Preplant/Post	1-2 pt/A	1 qt/A	1 qt/A	2-4 qt/A or 2.5 lb/A
Glyphosate	Preplant	0.25-0.50% ^c	—	—	— or 8.5-17 lb/100 gal
Gramoxone SL	Preplant	0.25%	1%	—	—
Huskie	Post	0.25-0.5%	—	—	1-2 qt/A or 0.5-1.0 lb/A
Lexar EZ/Lumax EX	Preplant	—	1%	1%	2-4 qt/A or 2.5 lb/A
Peak	Post	0.25-0.50%	1-4 pt/A	1-4 pt/A	2-4 qt/A or 2 lb/A
Permit	Post	0.25-0.50%	1%	1%	2-4 qt/A or 2-4 lb/A
Sharpen	Preplant	—	—	1%	1.25-2.5% or 1-2%
Solstice	POST	0.25%	0.5-1.0%	Not recommended	2.5% or 8.5 lb/100 gal
Starane ^d	Post	—	—	—	—
Verdict	Preplant	—	—	1%	1.25-2.5% or 8.5-17 lb/100 gal
Yukon	Post	0.25-0.50%	1%	1%	2-4 qt/A or 2-4 lb/A

^aNIS is nonionic surfactant (% v/v), COC is crop oil concentrate, MSO is methylated seed oil, UAN is urea ammonium nitrate (28-32% N), and AMS is spray grade ammonium sulfate.

^b1% AMS = 8.5 lb/100 gal, and 2% AMS = 17 lb/100 gal.

^cNot all glyphosate formulations require NIS. See page 193 for glyphosate formulation information.

^dUse a high quality adjuvant only when using low application rates or under adverse environmental conditions.

Additives for Soybean Herbicides

This table is intended as a quick reference. Use the higher adjuvant rates when conditions are arid or when weeds are large. If the spray volume is less than 10 gal/A and COC or MSO are recommended on a % v/v basis, apply COC or MSO on a per acre basis (minimum 1 pt/A) to ensure maximum efficacy. A dash indicates the additive is not recommended for use with that herbicide. Use of an NIS, COC, or MSO usually requires the addition of a nitrogen source. Use high quality adjuvants. NIS should generally be a minimum of 60-80% nonionic surfactant. COC and MSO generally should be 80% oil and 15-20% surfactant emulsifiers. AMS should be spray grade, and UAN should be free of impurities.

Herbicide	Timing	NIS ^a or	COC or	MSO	plus UAN or AMS ^b
Afforia	Post	0.25-0.5%	1-2%	—	—
Aim	Preplant	0.25%	1.5-2.0%	1.5-2.0%	2-4 qt/A or 2-4 lb/A
Anthem Max	Preplant/Post	0.25%	1-2 pt/A	1-2 pt/A	1-2 qt/A or 8.5-17 lb/100 gal
Arrow	Post	—	1 qt/A	—	1-2 qt/A or 2.5-4 lb/A
Assure II	Post	0.25%	1-2%	—	2-4 qt/A or 2-4 lb/A
Authority Assist	Preplant	—	1-2%	1-2%	2-4 qt/A or 2-4 lb/A
Authority First/Sonic	Preplant	0.25%	1.2%	—	— or 17 lb/100 gal
Authority MTZ	Preplant	—	1-2%	1-2%	2-4 qt/A or 2-4 lb/A
Authority XL/Max	Preplant	0.25%	1%	1%	2-4 qt/A or 8.5-17 lb/100 gal
Basagran/Broadloom	Post	0.125-0.25%	—	—	1-2 qt/A or 1-2 lb/A
Cadet	Post	0.25%	1-2 pt/A	1-2 pt/A	1-2 qt/A or 1-2 lb/A
Canopy EX	Preplant	0.25-0.5%	1-2%	—	—
Classic	Post	0.25%	1%	1%	2-4 qt/A or 2-4 lb/A
Cobra	Post	0.25% ^c	0.5-1.0%	—	4% v/v or 2-4 lb/A
Enlist Duo	Post	—	—	—	—
Envive/Enlite	Preplant	0.25-0.5%	1-2%	—	—
Extreme	Preplant/Post	0.125%	—	—	— or 8.5-17 lb/100 gal
Fierce/Fierce XLT	Preplant	0.25%	1%	1%	1-2 qt/A or 2-2.5 lb/A
FirstRate	Preplant/Post	0.125-0.25%	1.2%	1.2%	2.5% v/v or 2 lb/A
Flexstar	Preplant/Post	0.25-0.50%	0.5-1.0%	0.5-1.0%	1.0-2.5% or 8.5 lb/100 gal
Flexstar GT	Preplant/Post	0.25-0.50%	0.5-1.0%	0.5-1.0%	— or 8.5-17 lb/100 gal
Fusilade DX	Post	0.25-0.50%	0.5-1.0%	0.5-1.0%	4 qt/A or —
Fusion	Post	0.25-0.50%	0.5-1.0%	0.5-1.0%	2-4% or 2-4 lb/A
Glyphosate	Preplant/Post	0.25-0.50% ^c	—	—	— or 8.5-17 lb/100 gal
Gramoxone SL	Preplant	0.25%	1%	—	—
Harmony SG	Post	0.125-0.25%	0.5%	—	2-4 qt/A or 2-4 lb/A
Liberty	Preplant/Post	—	—	—	— or 3 lb/A
Marvel	Post	0.25-0.5%	0.5-1%	0.5-1%	1-2 qt/A or 8.5-17 lb/100 gal
Metribuzin	Preplant	—	1%	—	2-4 qt/A or 2-4 lb/A
Optill/Optill Pro	Preplant	—	—	1%	1.25-2.5% v/v or 8.5-17 lb/100 gal
Phoenix	Post	0.125-0.25%	1 pt/A	—	—
Pursuit	Preplant/Post	0.25%	1.25%	1.0%	1.25-2.5% or 12-15 lb/100 gal
Raptors	Post	0.5%	0.5-1%	0.5-1%	—
Raptor	Post	0.25%	1-2%	1-2%	2.5% or 12-15 lb/100 gal
Reflex	Preplant/Post	0.25-0.50%	0.5-1.0%	—	2.5% or 10 lb/100 gal
Resource	Post	—	1 qt/A	1 qt/A	1-2 qt/A or 2 lb/A
Rhythm	Preplant/Post	—	0.5-1.0%	0.5-1.0%	1.0-2.5% or 8.5 lb/100 gal
Scepter	Preplant/Post	0.25%	—	—	—
Select Max	Post	0.25%	1 qt/A	1 qt/A	— or 2.5-4.0 lb/A
Select Max + glyphosate	Post	0.25% ^d	—	—	— or 8.5-17 lb/100 gal
Sharpen	Preplant	—	1%	1%	1.25-2.5% v/v or 8.5-17 lb/100 gal
Synchrony XP	Preplant/Post	0.25-0.50%	1-2%	1-2%	2-4 qt/A or 2-4 lb/A
Tackle	Preplant/Post	0.125%	—	—	— or 8.5-17 lb/100 gal
Targa	Post	0.25%	1-2%	—	2-4 qt/A or 2-4 lb/A
Ultra Blazer	Post	0.125-0.25%	1 pt/A	1 pt/A	1-2 qt/A or 1-2 lb/A
Valor	Preplant	0.25%	1%	1%	1-2 qt/A or 2-2.5 lb/A
Valor XLT	Preplant	0.25%	1-2%	—	1-2 qt/A or 2-2.5 lb/A
Warrant	Post	—	—	—	Do not apply in fluid fertilizer carrier

^aNIS is nonionic surfactant (% v/v), COC is crop oil concentrate, MSO is methylated seed oil, UAN is urea ammonium nitrate (28-32% N), and AMS is spray grade ammonium sulfate.

^b1% AMS = 8.5 lb/100 gal, and 2% AMS = 17 lb/100 gal.

^cNot all glyphosate formulations require NIS, see page 193 for glyphosate formulation information.

^dUse only if humidity is greater than 80%. Do not add a nitrogen source.

How to Spray a Field to Prevent Overlap and Reduce Drift Injury

The method used to spray a field can affect pest control and potential crop injury to the targeted crop and adjacent crops. Start spraying a field on the side where the drift potential is greatest when wind speeds are low or blowing away from the susceptible area. Sometimes an applicator may need to return to a site later to spray when weather conditions are more favorable and would not cause spray drift. These factors should be considered and can make a difference on how you start and stop spraying a field (see *Figure 1*).

Global Positioning Systems (GPS)

Many applicators/producers now use Global Positioning Systems (GPS) for sprayer application guidance. The advantages of GPS over foam and other markers include:

- GPS is usually more reliable and accurate.
- New GPS systems are usually easy to use.
- GPS can be used under low light, at night, low temperatures, low humidity, and on large fields.

Other GPS advantages include no mixing, no effect from wind or boom bounce, reduced set-up time, and reduced operator fatigue and eye strain. Much of the following test applies to both GPS and other marking systems used for sprayer guidance.

Controlled Traffic

Controlled traffic reduces soil compaction and can maximize the benefits of no-till. With controlled traffic all field operations such as planting or seeding, fertilizer application, spraying, harvesting, and grain carts use the same traffic rows. For example, the same 120-inch spacing would be used on all equipment and tractors. Duals are discouraged since they compact both sides of a row in row crop farming.

Fields With Rows

In fields with rows, usually it is best to follow the rows and set the sprayer and planter to the same row spacing. For example, with 30-inch rows and 6-, 12-, 18- and 24-row planters, sprayers with boom lengths of 30, 45, 60, 75, 90, 105, and 120 feet work best. With 30-inch rows and 8-, 16- and 24-row planters, sprayers with boom lengths of 40, 60, 80, 100 and 120 feet work best. Do watch for narrow and wide guess rows. In some situations with row widths less than 22 inches and wide sprayer tires, growers will spray perpendicular to rows so the tires cause less crop damage. In most situations two passes are needed on each end of the field to provide space for the sprayer to slow down, turn around and get back up to speed.

Fields Without Rows or When Not Following the Rows

When not using rows, start by spraying the ends and one side of the field with two initial rounds on three sides of the

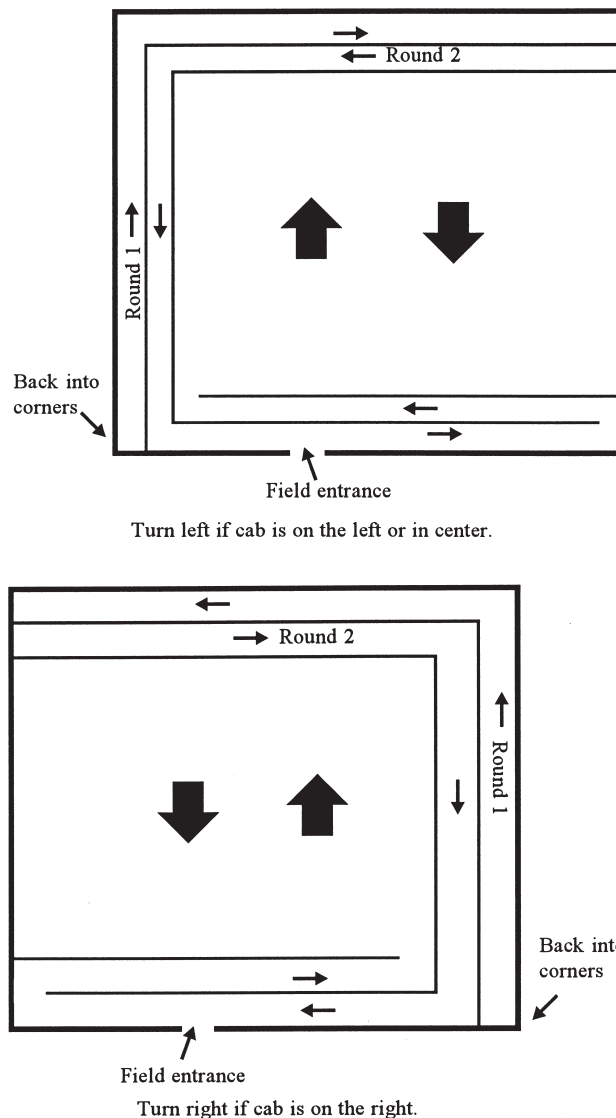


Figure 1. How to start spraying a field — spraying three sides.

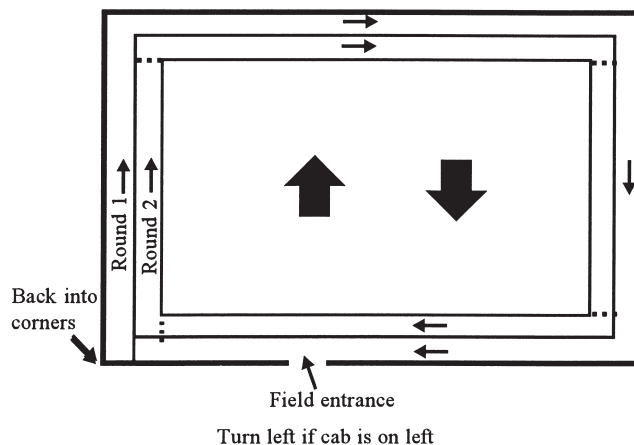


Figure 2. How to start spraying a field when spraying four sides.

field. This will provide turning room for the tractor and sprayer. Spraying the ends first allows one to go around trees, power poles, guy wires and other obstructions, but requires backing into the corners for complete coverage (see *Figure 1*).

If wind is blowing in the direction of susceptible crops, avoid spraying these areas until conditions permit.

Use previous wheel tracks as an approximate marker, depending on the length of the sprayer and whether the booms are positioned on the rear of the sprayer. In most situations shut off booms as front wheels cross the previous wheel tracks.

Another method is to spray all four sides (see *Figure 2*). The disadvantage of this is that a partial boom width often occurs in the last pass and many times the foam mark or other mark has disappeared before the applicator returns to that side of the field. Also, even with GPS, applicators can forget that they already made two passes on the other side of the field.

Spraying Field Borders

Field borders are visible to the public and an important part of the field. The presence of poor crops, damage from weeds, herbicides, insects, and pesticides or nutrient deficiencies along field borders presents a bad appearance. Many factors can increase the potential for problems in field borders, including:

- trashy conditions next to a fence line with minimum tillage;
- weed and insect pressure from fence rows;
- higher potential for overlaps and skips;
- soil compaction from turning and frequent traffic;
- high soil pH from overapplication of lime or dust from a nearby crushed limestone road (high pH increases crop injury from triazine and sulfonyleurea herbicides); and
- inconsistent sprayer application. (The outer most sprayer nozzles along the field edge will not apply a full pesticide rate (*Figure 3*) since most nozzles are designed for some pattern overlap. To avoid this, add a nozzle at the end of the boom (*Figure 4*) that can be turned on to give a full rate on field borders.

Use an off-center nozzle at the end of the boom to provide 100 percent overlap. For example, spraying systems OC, an Air Induction Underleaf Banding Spray tip (AIUB), or an Underleaf Banding Spray tip (UB) could be used at the end of the boom to provide 100 percent overlap. Most sprayer tip companies have nozzle tips like these. Ideally these nozzles are one-half the size of other nozzles. Select the nozzle tip based on boom height and spray volume.

Spraying While Turning

Spraying while making sharp turns (*Figure 5*) can result in three to four times the desired pesticide rate along the inner boom and as high as 40 to 50 times in the pivot position. The rate of pesticide near the outer end of the turn can be 1/2 to 1/10 the desired rate. To eliminate this as much as possible, spray in a straight line and eliminate turning while spraying.

Handling Irregular Shaped Fields

Achieving pesticide coverage of point rows is difficult. Following are some guidelines for improving results.

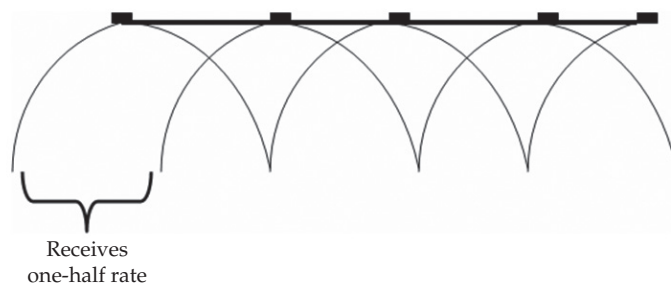


Figure 3. Shows one-half rate of pesticide from end nozzle.

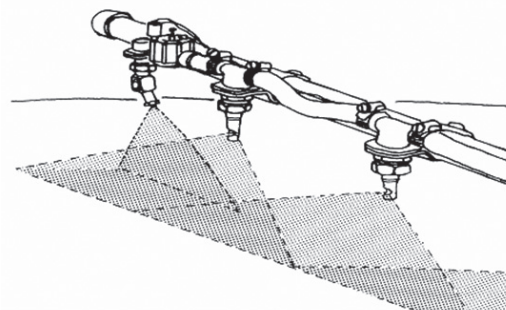


Figure 4. An additional nozzle on the end ensures that a full rate of pesticide is applied. This configuration should only be used on ends and field borders and must be turned off when swathing (spraying field).

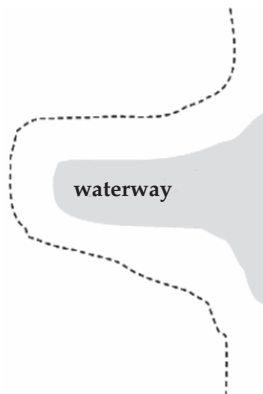


Figure 5. Problems can develop from spraying while making sharp turns. it would be better to turn off the sprayer and back into a corner.

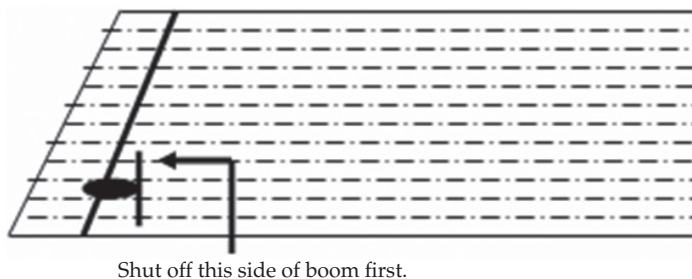


Figure 6. Spraying uneven row lengths.

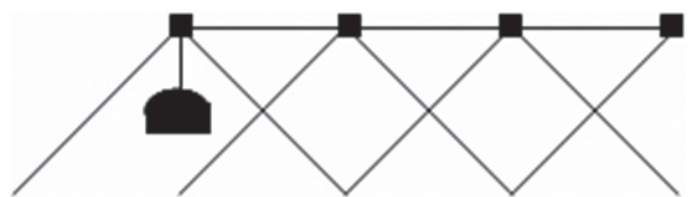
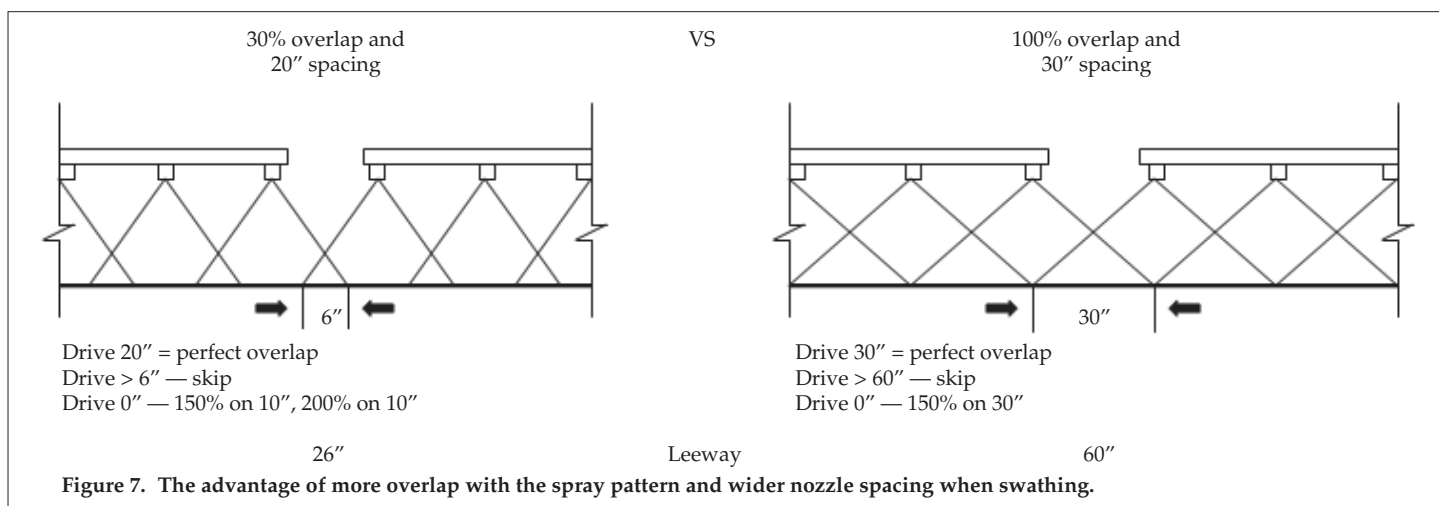


Figure 8. With a foam marker located with the last nozzle, one must move over the width of the nozzle spacing.



Figure 9. With a foam marker located one-half the distance between nozzles beyond the end nozzle, the marker is directly over the foam.

Do you prefer to overlap applications on irregular areas or leave these areas untreated? Often these areas are difficult to cultivate and many would rather risk crop injury from overlapping pesticides than inadequate weed control. In the case of point rows or uneven row lengths (Figure 6), applicators do not always select the longest distance of travel. Consider the degree of angle into the point and minimize double spraying. Placing switches on each boom section or even on every two or three nozzles allows controlled treatment of narrow swathes on terraces, point rows and other irregular areas.

Should fence rows, waterways, terrace back slopes, and other areas be treated? Treating terraced fields can be very difficult. Farmable terraces often are sprayed as normal fields with the applicator traveling over the terraces. Other types of terraces, parallel and non-parallel, require one border along each terrace. The points between the terraces are filled in as necessary. Operating foam markers on both ends of the boom can prevent excessive double spraying.

In irregularly shaped fields avoid using pesticides that could cause carryover concerns or water quality problems if applications were overlapped.

Check Areas or "Strips"

Untreated areas (checks) are invaluable for later evaluation of a chemical or fertilizer application. Often, a planned check area provides the only means of evaluating results in terms of pest control, crop injury, or fertilizer effectiveness. Checks are especially essential when using new products or the value of the treatment is uncertain.

The check area:

- should be used with the grower's consent;
- is often placed in an area not readily visible to the passerby;
- need not be large — a few feet the length of the boom or spreader is usually sufficient; and
- should be identified on the field record sheet.

Proper Swath Overlap

Nozzle pattern overlap at the end of the boom should be the same as for the rest of the nozzles along the boom (Figure 7). For example, if the overlap is 100 percent along the boom, the overlap at the edge of the swath should be 100 percent. The increased overlap of spray pattern and wider nozzle spacing increases the distance with a double rate or no rate of pesticide.

The location of a foam marker can affect the positioning of the end of the boom relative to the foam. In the following example, the marker is placed at the end of the boom, even with the last nozzle. If the nozzle spacing is 30 inches, one would move over 30 inches from the foam mark (see Figure 8).

Some sprayers have the foam marker placed on an extension that is 50 percent of the nozzle spacing. In this situation one would have the foam marker directly above the foam on the return pass (see Figure 9).

Treating the Field

Wind Direction. Be aware of nearby crops and the drift potential of the pesticides, fertilizers, etc. Doubling the wind speed (7 to 14 mph) will increase the amount of pesticide 90 feet from the sprayer by 700 percent.

Field Speed. Base your field speed on the slowest speed that the most difficult to negotiate part of the field will permit. This will avoid wide variation in speed which makes uniform application difficult.

Driving too fast:

- increases boom bouncing and whipping;
- distorts pattern (for example, at 12 mph wind will decrease the pattern width by 15-20 percent for a nozzle placed at a height of 4-5 feet);
- creates a wind eddy behind the machine; this can be a serious problem behind large machines driven at high speeds; and
- creates more dust which deactivates certain herbicides.

Reducing Drift Injury

With a rate controller that changes output by pressure, drift may be reduced by slowing down near susceptible vegetation. For example, if an applicator is spraying at 10 mph and 40 psi and slows to 7 mph, the pressure should drop to 20 psi. One needs to stay above the minimum operating pressure for the nozzle tip being used (see *Table I*). This table also shows how pressure is affected as speed increases. When using the table for speeds other than 10 mph, use a percentage. For example if you travel 7 mph use 70 percent, and if you travel 12 mph use 120 percent.

The boom height also can be lowered when going slower. Boom height is the second biggest factor in drift — wind is first. These two factors, reducing pressure and lowering the boom, are two big steps in reducing drift while spraying fields. Boom height must be kept at a minimum height so that patterns will have the correct overlap.

Table I. How changing the speed of the sprayer affects pressure on sprayers with rate controllers. (Do not operate sprayer so that nozzle tips are outside their recommended pressure range.) The example in each speed range is for 40 psi. The pressures are rounded to the nearest whole number. The $\sqrt{40} = 6.32$.

Speed Present - changed to:	Pressure Present - changed to:
10 mph to 9 mph $0.9 \times \sqrt{40} = (5.69)^2 = 32.4$ -----	60 psi to 49 psi 50 psi to 41 psi 40 psi to 32 psi 30 psi to 24 psi 20 psi to 16 psi
10 mph to 8 mph $0.8 \times \sqrt{40} = (5.06)^2 = 25.6$ -----	60 psi to 38 psi 50 psi to 32 psi 40 psi to 26 psi 30 psi to 19 psi 20 psi to 13 psi
10 mph to 7 mph $0.7 \times \sqrt{40} = (4.42)^2 = 19.5$ -----	60 psi to 29 psi 50 psi to 25 psi 40 psi to 20 psi 30 psi to 15 psi 20 psi to 10 psi
10 mph to 6 mph $0.6 \times \sqrt{40} = (3.79)^2 = 14.4$ -----	60 psi to 22 psi 50 psi to 18 psi 40 psi to 14 psi 30 psi to 11 psi 20 psi to 7 psi
10 mph to 11 mph $1.1 \times \sqrt{40} = (6.95)^2 = 48.3$ -----	60 psi to 73 psi 50 psi to 61 psi 40 psi to 48 psi 30 psi to 36 psi 20 psi to 24 psi
10 mph to 12 mph $1.2 \times \sqrt{40} = (7.58)^2 = 57.5$ -----	60 psi to 86 psi 50 psi to 72 psi 40 psi to 58 psi 30 psi to 43 psi 20 psi to 29 psi
10 mph to 13 mph $1.3 \times \sqrt{40} = (8.22)^2 = 67.6$ -----	60 psi to 101 psi 50 psi to 85 psi 40 psi to 68 psi 30 psi to 51 psi 20 psi to 34 psi
10 mph to 14 mph $1.4 \times \sqrt{40} = (8.85)^2 = 78.3$ -----	60 psi to 118 psi 50 psi to 98 psi 40 psi to 78 psi 30 psi to 59 psi 20 psi to 39 psi

Cleaning the Sprayer

Herbicide residues in the sprayer can be dissolved by herbicides, solvents and/or adjuvants added to the tank later.

Pesticides may settle to the bottom of the tank if agitation is not adequate. The pesticides also may settle out in the tank, hoses, boom, etc. if the sprayer is shut down. Always end the workday, if possible, with an empty tank. A tank for fresh water mounted on the sprayer will provide water to flush the system in the field and the rinsate can be sprayed on the field of the product's labeled use.

Always keep the sprayer's inside and outside clean. Sprayers with stainless steel booms, which reduce the number of hoses and fittings on the sprayer, are easier to keep clean and have less area for pesticide to build up in the spray booms. Screens and strainers need to be cleaned or replaced. Sumps and pumps along with the inside of the sprayer tank, especially the top and around baffles and plumbing, should be checked.

Select a location to clean the sprayer where any spilled rinsate will not contami-

nate water supplies, streams, crops or other plants and where puddles will not be accessible to children, pets, livestock, or wildlife.

Preferably the area should be impervious to water and have a wash rack or cement apron with a sump to catch contaminated wash water and pesticides. If such a facility is not available, catch or contain the rinsate and spray the rinse water or the cleaning solution on a field in a manner consistent with the intended use of the agrichemical. Avoid discharging all the cleaning solution in a small area.

The quickest and easiest way to rinse a tank and spraying equipment and dispose of waste safely is to carry a 50- to 100-gallon drum of fresh water with the spraying equipment. When spraying is finished, flush the system in the field and spray the rinsate on the field in a manner consistent with the product's intended use.

If spray material is spilled on the sprayer during loading or mixing, wash the outside of the sprayer immediately. As a general rule, plastic or polyethylene tanks and hoses tend to require more extensive cleaning than stainless steel tanks. Screens and strainers also should be cleaned or replaced frequently as they can be a major source of contamination. Residues also can accumulate in weather-checked or cracked hoses. Inspect the inside of hoses and replace if necessary. Pay special attention to the following areas that may be missed or difficult to clean:

- sprayer surfaces or components where buildup might occur due to repeated coats of spray followed by drying
- sprayer sumps and pumps
- inside the top of the spray tank and around baffles
- irregular surfaces inside tanks caused by baffles, plumbing fixtures, agitation units, etc.

When going between crops, follow the specific cleanup procedures listed on the label. Some cleanups require special cleaning agents. Sprayer-cleaning agents (see below) should be selected according to the herbicide and formulation to be removed. These agents should penetrate and dissolve pesticide residues which will be removed in the rinsate. Commercial tank

cleaning agents are generally preferred because they do a better job than household detergents and can deactivate some herbicides. Following is the spray cleanout procedure listed in University of Missouri publication G4852, *Cleaning Field Sprayers to Avoid Crop Injury*, available on the Web at muextension.missouri.edu/xplor/agguides/crops/g04852.htm.

This procedure is recommended for all herbicides unless the label specifies a different cleanout procedure. With sensitive crops the best method to avoid herbicide injury from residual in the tank, is to use a separate sprayer for the crops. When some herbicides, such as glyphosate, are left in the tank for a period of time, they absorb products such as Banvel, Clarity or Sterling Blue and hence crop injury can result.

1. Add one-half tank of fresh water and flush tanks, lines, booms, and nozzles for at least five minutes using a combination of agitation and spraying. Rinsate sprayed through the booms is best sprayed onto cropland for which the pesticide is labeled to avoid accumulation of pesticide-contaminated rinsate.

Thoroughly rinse the inside surfaces of the tank, paying particular attention to the surfaces around the tank fill access, baffles, and tank plumbing fixtures. The use of a 360-degree nozzle, such as the TeeJet Model 27500E-TEF rinsing nozzle, permanently installed to the spray system can automate the cleaning of tops and sides of the tanks. Several nozzles may need to be carefully positioned to clean tanks with baffles. Pressure sprayers are useful for removing caked-on internal

and external residues. Hot water can increase penetration of dried residues, but adding a hot water rinse may cause unacceptable health hazards due to the vapors produced. Carefully review labeled safety precautions for the agrichemicals and cleaning products used.

2. Fill the tank with fresh water and the recommended cleaning solutions or a commercially available tank cleaner and agitate the solution for 15 minutes. To make a cleaning solution, add one of the following to each 50 gallons of water:

- 2 quarts of household ammonia (let stand in sprayer overnight for growth regulator herbicides such as 2,4-D or dicamba), or
- 4 pounds of trisodium phosphate cleaner detergent.

Operate the spray booms long enough to ensure that all nozzles and boom lines are filled with the cleaning solution. Let the solution stand in the system for several hours, preferably overnight. Agitate and spray the solution onto areas suitable for the rinsate solution, according to label instructions.

3. Add more water and rinse the system again by using a combination of agitation and spraying. Remove nozzles, screens, and strainers and clean separately in a bucket of cleaning agent and water.
4. Rinse and flush the system once again with clean water.

Recommended Cleaning Agents for Selected Herbicides

Herbicide	Recommended Cleaning solution	Sensitive Crops
2,4-D amine	Ammonia + water	All broadleaf crops
2,4-D ester	Kerosene or diesel followed by Ammonia + water	All broadleaf crops
Accent	Ammonia + water	Sorghum, sunflower, canola
Acuron	Ammonia or commercial tank cleaner + water	Soybean, sunflower, sugarbeet, dry bean
Affinity	Ammonia or commercial tank cleaner + water	Sunflower, canola, soybean, sugarbeet
Agility SG	Ammonia + water	Corn, soybean, sorghum, sunflower
Aim	Ammonia or commercial tank cleaner + water	Sunflower, canola
Ally	Ammonia + water	Soybean, sunflower, corn, canola
Ally Extra	Ammonia + water	Corn, soybean, sorghum, canola
Alluvex	Water	Soybean, sorghum, sunflower, wheat
Amber	Ammonia + water	Corn, soybean, sorghum, sunflower, canola
Anthem Maxx	Ammonia + water	Sugarbeet, oats
Armezon	Commercial tank cleaner + water	Soybean, sugarbeet, dry bean, sunflower
Arrow (clethodim)	Ammonia + water	Corn, sorghum, wheat
Arsenal Powerline	Water	All Broadleaf and grasses
Assure II/Targa	Ammonia + water	Corn, sorghum, wheat, other grasses
Atrazine	Detergent + water	Wheat, sunflower, soybean
Authority Assist	Ammonia or commercial tank cleaner + water	Canola, crambe, flex, potato, sugarbeet
Authority Elite	Ammonia + water	Corn, sorghum, sunflower, wheat
Authority First DF/Sonic	Ammonia or commercial tank cleaner + water	Canola, sugarbeet, sunflower
Authority MTZ	Ammonia or commercial tank cleaner + water	Canola, sugarbeet
Authority XL	Ammonia or commercial tank cleaner + water	Corn, sorghum, sunflower, sugarbeet
Autumn Super 51 WDG	Ammonia + water	Corn (30 day), soybean (60 day), sorghum, sunflower, wheat, alfalfa
Axial XL	Detergent + water	Corn, soybean, sorghum, sunflower
Balance Flexx	Commercial tank cleaner + water	--
Banvel/Sterling	Ammonia + water	All broadleaf crops
Basagran 5L	Commercial tank cleaner + water	Sunflower, wheat
Basis Blend	Ammonia + water	Soybean, canola
Beacon	Ammonia + water	Sorghum, sunflower, soybean, canola
Beyond	Water	Sunflower, corn, canola, sorghum
Bicep II Lite Magnum	Water	Soybean, sunflower, wheat
Blazer	Ammonia or commercial tank cleaner + water	Corn, sorghum
Boundary 6.5 EC	Ammonia + water	Corn, sorghum, sunflower, wheat
Broadaxe XC	Ammonia + water	Corn, sorghum, wheat
Buctril + atrazine	Ammonia or commercial tank cleaner + water	Wheat, sunflower, soybean
Buctril/Moxy/Moxynil	Ammonia or commercial tank cleaner + water	--
Butyrac 200	Detergent + water	Corn, sorghum, sunflower, wheat
Cadet	Ammonia or commercial tank cleaner + water	Sunflower, canola
Canopy/Canopy EX	Ammonia or commercial tank cleaner + water	Corn, sorghum, sunflower, canola
Capreno	Ammonia or commercial tank cleaner + water	Soybean, sunflower
Cascade	Ammonia or commercial tank cleaner + water	All crops
Celebrity Plus	Ammonia or commercial tank cleaner + water	All broadleaf crops, sorghum, wheat
Chapparral	Ammonia or commercial tank cleaner + water	All crops
Chateau SW	Commercial tank cleaner	Corn, sorghum, sunflower, wheat
Cimarron Plus, Extra/Escort	Ammonia + water	Soybean, sunflower, corn, canola
Cimarron Max	Ammonia + water	All broadleaf crops
Clarity	Detergent or commercial tank cleaner + water	All broadleaf crops

Recommended Cleaning Agents for Selected Herbicides *(continued)*

Herbicide	Recommended Cleaning solution	Sensitive Crops
Classic	Ammonia or commercial tank cleaner + water	Corn, sorghum, sunflower, canola
Cobra	Ammonia or commercial tank cleaner + water	Corn, sorghum
Command	Water	Corn, sorghum, wheat, oat
Contour	Ammonia or commercial tank cleaner + water	Soybean, canola, sorghum, wheat, sunflower
Corvus	Commercial tank cleaner + water	--
Curtail	Ammonia + water	Corn, soybean, sorghum, sunflower
Degree Extra	Water	Soybean, sunflower, wheat
Diflexx	Detergent or commercial tank cleaner + water	--
Distinct	Ammonia or commercial tank cleaner + water	All broadleaf crops
Diuron 80DF	Ammonia + water	Corn, soybean, sorghum, sunflower, wheat
Dual/Dual Magnum/Cinch	Ammonia or commercial tank cleaner + water	--
Durango DMA	Water	Sorghum, sunflower, wheat
Enlist Duo	All clear spray tank decontaminator or 1 ton reload ammonia	--
Enlite	Ammonia or commercial tank cleaner + water Or valent tank cleaner	Canola, carrot, corn, onion, potato , sorghum, sugar-beet, wheat
Envive	Ammonia or commercial tank cleaner + water Or valent tank cleaner	Canola, carrot, corn, onion, potato, sorghum, sugar-beet, wheat
Eptam 7E	Detergent + water	Corn, soybean, sorghum, sunflower, wheat
Equip	Ammonia + water	Sorghum, sunflower, canola
Eradicane	Detergent + water	Soybean, sorghum, wheat
Evik DF	Detergent + water	Soybean, sorghum, sunflower, wheat
Expert	Ammonia + water	Sorghum, canola, sunflower
Express SG Total SOL Granules	Ammonia + water	Corn, soybean, sorghum, sunflower, canola
Extreme	Ammonia or commercial tank cleaner + water	All crops
Fallow Star	Ammonia + water	Soybean, sorghum, sunflower, wheat
Far-Go	Detergent + water	Soybean, corn, sorghum
Fierce/Fierce XLT	Valent tank cleaner + water	Corn, wheat, sorghum
Finesse Cereal and Fallow	Ammonia + water	Soybean, sunflower, corn, sorghum, canola
First Rate	Ammonia + water	Sunflower, sorghum, canola, corn
Fultime NXT	Water	Soybean, sunflower, wheat
Fusilade/Fusion	Ammonia or commercial tank cleaner + water	Corn, sorghum, wheat, other grasses
Glean	Ammonia + water	Soybean, sunflower, corn, sorghum, canola
Glory	Detergent + water	Sorghum, sunflower, wheat
Glyphosate	Usually water; consult label	All sensitive crops
Goal 2XL	Ammonia + water	Corn, sorghum, sunflower, wheat
Gramoxone SL	Ammonia or commercial tank cleaner + water	All crops
Grazon P&D	Ammonia + water	Corn, soybean, sorghum, sunflower, wheat
Habitat	Ammonia + water	Corn, soybean, sorghum, sunflower, wheat
Harmony Extra, SG	Ammonia or commercial tank cleaner + water	Canola, corn, soybean, sorghum, sunflower
Harmony SG	Ammonia + water	Sunflower, canola
Harness/Surpass/Confidence/Breakfree/Keystone	Ammonia or commercial tank cleaner + water	--
Hornet	Ammonia or commercial tank cleaner + water	Soybean, sunflower
Huskie	Ammonia + water	--
Impact	Commercial tank cleaner + water	Soybean, sugarbeet, dry bean, sunflower
Imperium	Detergent + water	Sorghum, soybean, wheat
Instigate	Ammonia + water	Soybean, sorghum, sunflower, wheat
Intrro	Ammonia or commercial tank cleaner + water	--
Journey	Ammonia or commercial tank cleaner + water	All crops

Recommended Cleaning Agents for Selected Herbicides (continued)

Herbicide	Recommended Cleaning solution	Sensitive Crops
Karmex	Ammonia or commercial tank cleaner + water	--
Latir	Ammonia + water	Corn, sorghum, sunflower, wheat
Laudis	Ammonia or commercial tank cleaner + water	Soybean, sunflower
Liberty	Commercial tank cleaner + water	--
Lightning	Ammonia or commercial tank cleaner + water	Soybean, sorghum, wheat, sunflower, canola
Lumax EZ/Lexar EZ	Ammonia or commercial tank cleaner + water	Soybean, sunflower, sugarbeet, dry bean
Marvel	Ammonia + water	Sorghum, sunflower
Metribuzin 75 DF	Detergent + water	Sorghum, sunflower, wheat
MSMA / DSMA	Ammonia or commercial tank cleaner + water	--
Northstar	Commercial tank cleaner + water	All broadleaf crops, sorghum, wheat
Olympus Flex	Ammonia + water	--
OpTill / OpTill Pro	Detergent or commercial tank cleaner + water	Sunflower, canola, sorghum
Outflank	Commercial tank cleaner + water	Sorghum, sunflower, wheat
Outlook	Commercial tank cleaner + water	Sorghum, sunflower, canola
Parallel	Water	Corn, soybean, sunflower, wheat
Peak	Ammonia + water	Soybean, sunflower, canola
Permit/Sandea/Sledgehammer/Yukon	Ammonia + water	Soybean, canola, sunflower
Phoenix	Ammonia + commercial tank cleaner + water	Corn, sorghum
Poast	Ammonia, commercial tank cleaner, or detergent + water	Corn, sorghum, wheat, other grasses
PowerFlex HL	Ammonia + water	Corn, soybean, sorghum, sunflower
Prefix	Commercial tank cleaner + water	Sorghum, corn
Prequel	Ammonia + water	Soybean, sorghum, sunflower, wheat
Prowl H ₂ O	Commercial tank cleaner + water	--
Pummel	Ammonia + water	Corn, sorghum, sunflower, wheat
Pursuit	Ammonia or commercial tank cleaner + water	Sunflower, canola, sorghum
Python	Ammonia + water	Sunflower, sorghum, canola
Raptor	Water	Corn, sorghum, sunflower
Rave WDG	Ammonia + water	Corn, soybean, sorghum, sunflower
Realm Q	Ammonia + water	Sorghum + all broadleaf crops
Reflex/Flexstar/Flexstar GT	Ammonia or commercial tank cleaner + water	Sorghum
Resicore	Ammonia + water	Soybean, sorghum, sunflower, wheat
Resolve	Ammonia + water	Soybean, sorghum, sunflower, wheat
Resource	Ammonia or commercial tank cleaner + water	Sorghum + all broadleaf crops
Rhythm	Commercial tank cleaner + water	Corn, sorghum, sunflower, wheat
Roundup Products	Water	All sensitive crops
Rowel	Valent tank cleaner + water	--
Rugged	Ammonia + water	Sunflower
Rumble	Commercial tank cleaner + water	Corn, sorghum, sunflower, wheat
Sahara DG	Commercial tank cleaner + water	All crops
Scepter	Ammonia or commercial tank cleaner + water	Sunflower, canola, corn
Select Max	Ammonia or commercial tank cleaner + water	Corn, sorghum, wheat, other grasses
Sencor	Detergent + water	--
Sequence	Water	All sensitive crops
Sharpen	Detergent or commercial tank cleaner + water	All broadleaf crops
Shotgun	Commercial tank cleaner + water	All broadleaf crops
Solida	Water	Soybean, sorghum, sunflower, wheat
Solstice	Ammonia + water or commercial tank cleaner	Canola, soybean, sunflower

Recommended Cleaning Agents for Selected Herbicides *(continued)*

Herbicide	Recommended Cleaning solution	Sensitive Crops
Sonalan HFP	Ammonia + water	Sorghum, sunflower, wheat
Spartan	Ammonia or commercial tank cleaner + water	Canola, sugarbeet
Spirit	Ammonia + water	Sorghum, soybean, wheat, sunflower
Staple	Ammonia+water	Corn, Canola, sorghum, sunflower
Status	Ammonia or commercial tank cleaner + water	All broadleaf crops
Starane NXT	Ammonia + water	Corn, soybean, sorghum, sunflower
Steadfast Q	Ammonia + water	Sorghum, sunflower, canola
Steel	Ammonia or commercial tank cleaner + water	Sunflower, canola, corn
Stinger/Surestart/TripleFLEX	Ammonia + water	Soybean, sunflower
Storm	Detergent + water	Corn, sorghum, sunflower, wheat
Surveil	Ammonia + water	Corn, sorghum, sunflower, wheat
Synchrony XP	Ammonia + water	Corn, sorghum, sunflower, wheat
Tackle	Ammonia or commercial tank cleaner + water	Sunflower, canola, sorghum
Tailwind	Ammonia + water	Corn, sorghum, sunflower, wheat
Targa	Water	Corn, sorghum, sunflower, wheat
Torment	Commercial tank cleaner + water	Corn, sorghum, sunflower, wheat
Touchdown	Commercial tank cleaner + water	All sensitive crops
Treflan	Ammonia or commercial tank cleaner + water	--
Trifluralin 4EC	Ammonia + water	Corn, sorghum, sunflower, wheat
Trifluralin 10G	Ammonia + water	Corn, sorghum, sunflower, wheat
Tri-Scept	Ammonia or commercial tank cleaner + water	Sunflower, canola, corn
Trivence	Ammonia + water	Corn, sorghum, sunflower, wheat
Trust	Ammonia + water	Corn, sorghum, sunflower, wheat
Turbo	Detergent or commercial tank cleaner + water	--
Ultra Blazer	Ammonia or commercial tank cleaner + water	Corn, sorghum
Valor SX/Valor XLT/Gangster	Valent tank cleaner + water	Corn, wheat, canola, sorghum
Verdict	Detergent or commercial tank cleaner + water	Sunflower, canola, sorghum
Vise	Ammonia + water	Corn, sorghum, sunflower, wheat
Warrant	Water	Sunflower, wheat
WeedMaster	Ammonia or commercial tank cleaner + water	All broadleaf crops
Wide Match	Ammonia + water	Corn, soybean, sorghum, sunflower
Zemax/Halex GT/Callisto Xtra	Ammonia or commercial tank cleaner + water	Sunflower, soybean, sugarbeet, dry bean,
Zorial/Rapid 80	Ammonia or commercial tank cleaner + water	Corn, wheat

Moss or Algae in Stock, Nurse, Spray and Other Water Tanks

Dissolve 1 ounce copper sulfate in 1 pint of water in a glass jar. Add 7.5 tablespoons of the prepared solution to each 1,000 gallons of water. Mix thoroughly. Water can be used for crop

spraying and livestock watering except NOT for sheep. Increase rate if water is extra hard. An alternative practice is to paint the tank black to prevent algae growth.

Using UAN to Keep Sprayer from Freezing

In the spring and fall, overnight temperatures may drop below 32°F, causing damage to the sprayer.

What can you do to avoid damage?

One possibility would be to add 28% or 32% UAN to the sprayer tank. Make sure it is agitated because it is heavier than water. Then spray out through the booms. See *Table 1* for the amount needed for the temperature expected.

NOTE: A few herbicides may not be compatible with 28% and 32% UAN. (See page 44.) Also, UAN in the spray solution may cause injury with some herbicides, especially at higher concentrations. Surfactants plus UAN can cause crop injury. The higher UAN concentrations cause the most injury. This injury can be reduced or eliminated by adding more water and herbicide before starting to spray.

Table 1. Amount of 28% and 32% UAN to add to different amounts of water to keep sprayer from freezing.

Nitrogen	Freezing Temperature	28-0-0	32-0-0
%	°F	gal/100 gal water	
0	32	0	0
2	27	6.1	5.2
4	23	13.1	11.2
6	18	21.5	18.2
8	14	31.5	26.2
10	9	43.7	35.6
12	5	59.0	47.2
14	0	78.7	61.2

Individual Plant Treatment Techniques

Individual plant treatment can be an efficient, cost-effective alternative to broadcast applications to control brush, shrubs, or vines. Individual plant treatments include spot-applied concentrate, high volume foliar, low volume basal, and cut stump applications.

Spot-applied concentrate: Soil-applied spot applications of certain undiluted herbicides can be used to control brush species including eastern redcedar and other junipers. Apply undiluted herbicide with a spot gun, which automatically premeasures the amount of herbicide. Apply to the soil inside the dripline in a ring around the plant.

High volume foliar: The high-volume foliar technique is ideal for small trees,

vines, bushes with canes or stems, such as multiflora rose, or low-growing shrubs like buckbrush. Apply diluted herbicide directly and uniformly to the plant foliage. The treated plant should have healthy foliage. Insects, hail, freezing temperatures, drought or other conditions that damage foliage may reduce control. For best results, spray after full leaf expansion when the plants are actively growing.

Low volume basal: This method uses a high percentage of herbicide, so less spray volume is needed than with other forms of basal application. Generally, the mix ratios are 20-30% herbicide plus 70-80% diesel fuel or basal bark oils. Use low-volume basal applications to control woody species with trunks less than 6 inches in diameter at the base of the tree. Apply enough of

the spray to wet the lower 15 to 20 inches of the trunk, including the root collar area, but not to the point of runoff. Use this method any time of the year, except when snow or water prevents spraying to the groundline.

Cut stump: Apply a solution of herbicide similar to that used for low volume basal treatments to a freshly cut stump. Spray the sides of the stump and the outer portion of the cut surface, including the cambium ring along the inner bark. Thoroughly wet the stem and root collar area, but not to the point of runoff. Treat stumps any time of the year, as long as snow or water doesn't prevent proper application.

Cut Stump Treatments

Herbicide	Herbicide Concentration	Remarks and Cost
2,4-D ESTER (4L)	64.0 oz/10.0 gal diesel	Use to prevent resprouting of cut stumps. Apply to runoff to freshly cut surface. Delayed applications are less effective. Cost for 10 gal of solution: 2,4-D ester \$112.50 + diesel.
GLYPHOSATE♦	50-100% solution	Apply immediately after cutting. Cost: \$13.50/gal
GARLON 4 ULTRA / REMEDY ULTRA	20-30% with basal bark oil or diesel fuel	Basal bark application — Use with bark-penetrating basal bark oil or diesel fuel. Apply enough bark oil spray to wet the lower 15 to 20 inches of the trunk, including the root collar; do not spray to the point of runoff. Cost: Garlon \$100.00/gal; Remedy Ultra \$70.00/gal. Cut stump application — Spray sides of stump and the outer portion of the cut surface, including the cambium ring along the inner bark; thoroughly wet the stem and root collar but not to the point of runoff; treat any time of year, as long as snow or water doesn't prevent proper application.
HABITAT + GARLON 4 ULTRA	3.5% + 15-20% with basal bark oil or diesel fuel	Use for basal bark applications with bark-penetrating basal oil or diesel fuel. Cost: Habitat \$125.00/gal; Garlon 4 Ultra \$100.00/gal.
LINEAGE CLEARSTAND	5.0 oz/1.0 gal water	Cut stump application — Used to control woody vegetation by applying a solution of the herbicide in water to the cambium area of a freshly cut stump. Most effective in late summers or early fall. Cost: \$18.75.
PATHFINDER II	Do not dilute	Cut stump application — Spray sides of the stump and the outer portion of the cut surface, including the cambium ring along the inner bark; thoroughly wet the stem and root collar but not to the point of runoff; treat any time of year, as long as snow or water doesn't prevent proper application. Cost: \$51.00/gal.
TORDON RTU	Do not dilute	Cut stump application — Spray sides of stump and the outer portion of the cut surface, including the cambium ring along the inner bark; thoroughly wet the stem and root collar but not to the point of runoff; treat any time of year, as long as snow or water doesn't prevent proper application; treat immediately after the tree is cut. Injury to nearby trees may result from Tordon. Cost: \$13.00/qt.

♦Glyphosate rates are based on a 4.0 ai/gal or 3.0 lb ae/gal formulation. See pages 186-199 for information on common glyphosate formulations. Cost estimates are based on anticipated prices for generic glyphosate formulations. Costs for branded glyphosate (like Roundup) will be approximately 50% higher.

Alfalfa

Weed Response to Selected Herbicides

		Broadleaves																Grasses							
Site of Action†	Herbicide	Black Nightshade (3.5)	Common Sunflower (10)	Dandelion	Field Pennycress (10)	Henbit	Kochia (2.5)	Kochia, ALS-Resistant (2.5)	Kochia, Glyphosate-Resistant (2.5)	Kochia, Triazine-Resistant (2.5)	Lambsquarters (1.5)	Pigweed (2.5)	Russian Thistle (2.3)	Shepherdspurse (10)	Tall Waterhemp (2.5)	Tansymustard (10)	Velvetleaf (4.2)	Annual Bluegrass	Barnyardgrass	Downy Brome	Yellow Foxtail (1)	Perennial Bluegrass	Sandbur	Crop Tolerance▯	
		Preplant																							
8	Eptam-PPI	7	3	2	2	4	7	7	7	7	6	5	4	2	6	2	2	7	6	9	9	1	8	3	
3	Balan DF-PPI	1	1	1	1	1	8	8	8	8	8	7	9	1	6	1	1	8	9	7	9	1	7	3	
3	Trust-PPI	1	1	1	1	1	8	8	8	8	8	7	7	1	6	1	1	8	9	7	9	1	8	3	
		Seedling																							
3	Prowl H ₂ O-POST	2	1	1	1	1	6	6	6	6	6	6	6	1	6	1	1	7	8	4	8	1	7	1	
6	Buctril/Moxy 2E (seedling only)-POST	6	6	2	7	4	7	7	7	7	10	6	10	9	6	6	7	1	2	1	2	1	1	3	
4	Butyrac 200-POST	6	6	2	5	4	6	6	6	6	6	3	5	5	7	5	6	1	2	1	2	1	1	2	
1	Poast-POST	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	5	9	7	8	5	8	1	
2+6	Pursuit + Buctril-POST	8	8	2	9	7	9	9	9	9	7	9	8	8	8	9	8	1	5	2	5	1	4	3	
2+6	Raptor + Buctril-POST	9	9	5	8	8	9	9	9	9	8	9	9	8	9	9	8	6	7	8	7	1	4	3	
2+4	Raptor + Butyrac 200-POST	8	9	5	8	8	8	8	8	8	8	9	8	8	9	8	8	6	7	8	7	1	4	2	
9	RoundupWeatherMAX-POST (Roundup Ready® Alfalfa only)	9	10	8	9	8	9	9	1	9	7	10	10	9	8	9	9	9	10	10	10	9	10	1	
1	Select Max/Arrow-POST	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	8	9	9	8	7	8	1	
14	AIM	10	2	3	8	6	6	6	6	6	8	7	6	7	7	10	1	1	1	1	1	1	1	2	
14	Chateau-PRE	8	2	7	7	7	8	8	8	8	7	9	7	8	8	7	8	7	6	8	7	1	3	2	
7	Karmex DF-PRE	8	8	3	7	5	10	10	10	1	7	7	8	10	6	10	5	6	9	5	7	4	6	2	
3	Prowl H ₂ O-POST	4	1	1	3	1	7	7	7	7	7	7	7	4	7	5	2	7	8	7	8	1	7	1	
5	Metribuzin 75-DF-PRE	5	8	8	9	7	9	9	9	1	8	8	7	10	7	10	6	1	8	9	2	1	3	3	
5	Sinbar-PRE	8	8	6	9	7	10	10	10	1	8	8	7	10	8	10	6	6	5	9	3	5	6	3	
3	Treflan TR-10 / Bayonet-PRE	4	1	1	3	1	7	7	7	7	7	7	7	4	7	5	2	7	8	6	8	1	7	1	
5	Velpar DF-PRE	6	6	6	8	5	9	9	9	1	7	7	8	10	5	10	5	7	5	9	3	3	6	3	
5+7	Velpar AlfaMax-PRE	6	6	6	8	5	9	9	9	1	7	7	8	9	5	9	5	7	7	9	7	5	6	3	
9	Glyphosate-POST (conventional)	1	1	4	5	7	4	4	1	4	1	1	4	5	1	8	1	4	1	8	1	4	1	3	
22	Gramoxone SL-POST	4	8	2	4	6	6	6	6	6	8	8	6	4	5	4	4	4	5	8	6	1	5	4	
4	MCP amine 4-POST	7	7	5	8	5	5	5	5	5	7	7	6	8	7	8	6	1	1	1	7	1	1	3	
2	Pursuit-POST	7	7	2	8	7	9	5	5	9	5	9	7	7	6	8	8	1	5	2	5	1	4	2	
2	Raptor-POST	8	8	5	8	8	8	5	5	8	5	9	8	8	8	8	8	6	7	8	7	1	4	3	
1	Select Max/Arrow-POST	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	8	9	9	8	7	8	1	

¶Hybrids vary in their response to herbicides. Crop safety ratings less than 3 indicate that crop yield should not be affected by any direct injury.

†See pages 8-10 for more information on classification of herbicides by mode and site of action.

Alfalfa Herbicide Program

Area or Use	Herbicide	Commercial Product per Acre	Application Time	Remarks and Approximate Cost Per Acre Broadcast
ALFALFA (Establishing new stands)	EPTAM	2.5-4.5 pt	Preplant Use higher rate on soils with more than 2% OM	Apply to dry surface soil and immediately incorporate by cross tandem disking or equivalent soil mixing. Use lower rate on sandy soil. Early legume injury may occur. Primarily controls annual grasses. Cost: Eptam \$15.75-\$28.25; Balan \$28.00-\$35.00; Trust \$4.00-\$5.75.
	BALAN DF	2.0-2.5 lb		
	TRUST	1.0-1.5 pt		
ALFALFA (Seedling)	BUCTRIL/MOXY	1.0-1.5 pt	Weeds less than 2" tall. Alfalfa with at least 2 trifoliate leaves	Apply when the majority of alfalfa has 2 trifoliate leaves. Temperatures above 80°F following Buctril application may result in crop injury. Do not cut spring-treated alfalfa for feed within 30 days following treatment. Cost: Buctril \$10.00-\$15.00; Buctril + Pursuit \$20.75.
	BUCTRIL + PURSUIT	1.0 pt 3.0 oz		
	BUCTRIL + RAPTOR	1.0 pt 4.0 oz	Weeds less than 2" tall. Alfalfa with at least 2 trifoliate leaves	Cost: \$28.25.
	BUTYRAC 200	1.0-3.0 qt	POST Weeds less than 3" tall. Alfalfa with at least 2-4 trifoliate leaves	DO NOT use treated forage for 60 days after treatment on new stands and 30 days on established stands. Use when temperature is above 50°F. Cost: \$8.50-\$25.50.
ALFALFA (Seedling or established)	BUTYRAC 200 + RAPTOR	2.0 qt 4.0 oz	Weeds less than 2" tall. Alfalfa with at least 2 trifoliate leaves	Cost: \$35.25.
	POAST	1.0-2.25 pt	Grasses 4" or less	Good coverage necessary. Use higher rate for sandbur, volunteer cereals, or winter annual grasses. Poast will not control over-wintered downy brome. Add COC or MSO plus AMS at 2.5 lb/A to the spray solution. Do not graze or cut for (undried) forage for 7 days or 14 days before cutting for dry hay. Cost: Poast \$13.25-\$29.50.
	PROWL H ₂ O	1.1-2.1 pt	Seedling alfalfa, 2nd trifoliate stage before weeds emerge	Do not cut or harvest for 28 days after application. Alfalfa less than 6" tall. Cost: \$6.75-\$12.75.
	ROUNDUP WEATHERMAX (Roundup-tolerant variety required.)	22.0-44.0 oz	Weeds 2-3"	Not all glyphosates may be labeled. On new seedlings apply glyphosate twice — once at the first trifoliate and again two weeks later. Check with seed supplier for availability of Roundup-tolerant alfalfa seed. Use higher glyphosate rate on larger weeds and perennial grasses. Cost: \$3.75-\$7.50.
ALFALFA (Seedling or established for one year)	PURSUIT	3.0-6.0 oz	Seedling alfalfa, 2nd trifoliate stage. Established alfalfa, less than 3" of new growth	Do not feed, graze, or harvest alfalfa for 30 days following Pursuit treatment. Both Pursuit and Raptor require adding 1% COC or MSO plus 1 qt/A UAN. Cost: Pursuit \$10.75-\$21.50; Raptor \$18.25-\$27.25.
	RAPTOR	4.0-6.0 oz	Seedling alfalfa, 2nd trifoliate stage. Established alfalfa, less than 3" of new growth	
	ARROW + COC	6.0-16.0 oz	Grasses 2-6"	Controls downy brome, annual and perennial bluegrass. Do not feed, graze or harvest alfalfa for 15 days following applications. Cost: Arrow \$3.75-\$10.00; Select Max \$8.50-\$15.25.
	SELECT MAX + NIS + AMS	9.0-16.0 oz		

Alfalfa Herbicide Program *(continued)*

Area or Use	Herbicide	Commercial Product per Acre	Application Time	Remarks and Approximate Cost Per Acre Broadcast
ALFALFA (Established one year or more. For dodder control see <i>Troublesome Weeds Section</i> , page 150)	AIM	1-2.5 oz	Spray emerged weeds in dormant alfalfa or between cuttings up to 3" growth	21 days preharvest intervals. Cost: \$4.50-12/A
	CHATEAU WDG	4.0 oz	Late fall to early spring before alfalfa has 6" of new growth	Do not apply within 25 days of harvest or grazing. Chateau will not control established weeds. Cost: \$30.00.
	GRAMOXONE SL	2.0-3.0 pt	Dormant alfalfa	For control of downy brome and winter annual weeds. Do not apply after alfalfa has broken dormancy. Do not cut or harvest for 42 days after application. Cost: \$9.50-\$14.25.
	KARMEX 80DF	1.5-3.0 lb	Late fall to early spring to dormant alfalfa	For control of winter and summer annual weeds. Cost: \$12.00-\$24.00.
	MCPA AMINE (4L)	4.0-8.0 oz	Cereal is well tillered in the 4-leaf stage; alfalfa is 2-3" tall	Wheat, oats, barley, and rye underseeded with alfalfa. Cost: \$0.75-\$1.50.
	METRIBUZIN 75DF	0.5-1.0 lb	Late fall to early spring to dormant alfalfa	For control of downy brome, winter annual weeds, and suppression of dandelions. Do not cut or harvest for 28 days after application. Cost: Metribuzin 75DF \$7.00-\$14.00; Sinbar \$25.00-\$50.00.
	SINBAR (80W)	0.5-1.0 lb		
	PROWL H ₂ O	2.0-8.0 pt	Apply prior to weed emergence and before alfalfa is 6" tall	Do not cut or harvest for 28 days after application if applying 4 pt or less. Do not harvest for 50 days after application if applying more than 4 pt. Cost: \$12.25-\$49.00.
	ROUNDUP POWERMAX	6.0-8.0 oz	Apply in spring to alfalfa that is dormant	Glyphosate should not be applied after alfalfa has broken dormancy and initiated trifoliate leaf expansion. Do not use additional surfactant. Allow 45 days after application before harvesting. Check label for local recommendations. Cost: \$1.00-\$1.25.
	TREFLAN TR-10/ BAYONET/ TRUST 10G	20.0 lb	During dormancy, fall or prior to cutting, prior to weed emergence	Rainfall or irrigation of 0.5 inch within three days needed for activation. If not activated, use mechanical incorporation. Do not harvest for 20 days after application. Cost: Treflan TR-10 \$24.00; Trust 10G \$17.00.
	VELPAR ALFA-MAX	1.5-4.3 lb	Late fall to early spring to dormant alfalfa	Do not use on sandy loam or loamy sand soils with less than 1% organic matter. Do not apply within 30 days of harvest or grazing. Cost: \$25.50-\$73.00.
	VELPAR DF VELPAR L	0.66-2.0 lb 2.0-6.0 pt	Late fall to early spring to dormant alfalfa	The 0.66 lb/A rate of Velpar is for low OM soils for downy brome control. Do not cut or harvest for 30 days after application. Cost: Velpar DF \$23.00-\$70.00; Velpar L \$23.00-\$69.00.

Chicory Herbicide Program

Herbicide	Commercial Product per Acre	Application Time, Remarks, and Approximate Cost Per Acre Broadcast
	Sandy Loam <1% -1.5% OM	
Basis Blend + NIS	0.8 oz 1.0 qt/100gal	POST. Can only be applied to the "chrysolite" variety of sulfonyleurea-tolerant chicory available from Florimond Desprez seed company. Apply after chicory has two fully expanded true leaves. Split applications: 0.4 oz at the two-leaf stage followed by 0.4 oz at the six-leaf stage. Cost: \$6.75
RAPTOR + NIS (NONIONIC SURFACTANT) + UAN	4.0 oz 1.0 qt/100.0 gal 2.0 qt	POST. Apply after the chicory plant has two expanded true-leaves. Cost: \$18.25.
SELECT MAX + NIS	9.0-16.0 oz 0.25% v/v	POST. Apply when grass weeds are less than 4 inches tall. Cost: \$8.50-\$15.25.
TREFLAN	1.0 pt	PPI. Apply and incorporate mechanically immediately after application. Cost: \$3.50.

Corn

Weed Response to Fall Burndown Herbicides¹

Winter annual weeds (henbit, horseweed, pennycress, etc.) are often more susceptible to herbicide applied in the fall than in the spring. Herbicides can be applied in the fall, weather permitting, from late September to early December. Before using a particular herbicide, check to see if it is labeled for fall application.

Plant response may be altered by growing conditions, genetic variation in crops and weeds, soil type, pH, organic matter, temperature, growth stage and application rates. Ratings may vary from season to season and from area to area within the state. Ratings apply when herbicides are used as suggested in this publication and represent control that may be expected when using the higher rate when a rate range is presented. See pages 155-167 for additional problem weeds and their control.

Site of Action†	Response Ratings: Ratings are for light to moderate weed densities, favorable conditions and weed growth stage as specified on product label. High weed densities, adverse conditions, or large weeds will reduce control. 10 = 96-100% 6 = 70-79% 9 = 90-95% 5 = 60-69% 8 = 85-90% 4-2 = less than 60% 7 = 80-84% 1 = 0											
	Herbicide	Alfalfa	Dandelion	Downy Brome	Field Pansy	Field Pennycress	Henbit	Marestail	Marestail, Glyphosate-Resistant	Prickly Lettuce	Shepherdspurse	Tansymustard
4	2,4-D ester 4L	7	8	1	2	10	9	9	9	9	10	8
4	2,4-D + dicamba●/Diflexx	9	9	1	4	10	9	9	9	10	10	9
2+4	Autumn Super + 2,4-D	6	8	1	7	10	9	8	8	8	9	10
2+4	Basis Blend + 2,4-D	6	8	4	7	10	8	9	8	9	10	9
4	Clarity/Banvel●	7	8	1	2	9	9	9	9	8	9	8
9	Glyphosate◆	5	6	10	8	9	9	8	4	8	10	8
9+4	Glyphosate◆ + 2,4-D ester	8	8	10	6	10	9	9	8	8	10	9
22	Gramoxone SL	4	5	7	6	10	9	7	7	8	9	8
5+4	Princep + 2,4-D	6	6	7	5	9	9	8	8	9	9	8
2+4	Python + 2,4-D	6	6	1	5	9	9	9	9	9	9	9
14+9	Sharpen + glyphosate◆	9	9	10	8	10	9	10	9	10	10	10
14+4	Valor SX + 2,4-D ester	8	8	4	4	10	9	9	9	9	10	9

¹This table presents fall burndown herbicide information only. It does not reflect residual control.

[•]Dicamba rates are based on a 4.0 ae/gal formulation, like those found in Clarity. See page 203 or the *Herbicide Dictionary* for other products containing dicamba.

[♦]Glyphosate rates are based on a 4.0 ai/gal or 3.0 lb ae/gal formulation. See pages 186-199 for information on common glyphosate formulations.

[†]See pages 8-10 for more information on classification of herbicides by mode and site of action.

Using 2,4-D or Dicamba Before Planting

The University of Nebraska–Lincoln recommends following these guidelines when applying 2,4-D or dicamba before planting corn, soybean, or sorghum. Please note that these recommendations are applicable to both the ester and amine formulations of 2,4-D.

<u>2,4-D Preplant Interval</u>	<u>Use Rate</u>	<u>Use Rate</u>	<u>Dicamba Preplant Interval</u>	<u>Use Rate</u>	<u>Use Rate</u>
<u>Crop</u>	<u>16 oz</u>	<u>>16 oz</u>	<u>Crop</u>	<u>4 oz</u>	<u>8 oz</u>
Corn	7 days	14 days	Corn	5 days	7 days
Soybean (use ester only)	7 days	30 days	Soybean	DO NOT USE	DO NOT USE
Sorghum	10 days	21 days	Sorghum	7 days	10 days

Corn

Broadleaf Weed Response to Spring Burndown Herbicides¹

Site of Action†	Response Ratings: Ratings are for light to moderate weed densities, favorable conditions and weed growth stage as specified on product label. High weed densities, adverse conditions, or large weeds will reduce control. 10 = 96-100% 6 = 70-79% 9 = 90-95% 5 = 60-69% 8 = 85-90% 4-2 = less than 60% 7 = 80-84% 1 = 0	Broadleaves																							
		Alfalfa	Chickweed	Dandelion	Evening Primrose	Field Pansy	Field Pennycress	Giant Ragweed	Giant Ragweed, Glyphosate-Resistant	Henbit	Kochia	Kochia, Glyphosate-Resistant	Kochia, Triazine-Resistant	Lambsquarters	Marestail	Marestail, Glyphosate-Resistant	Prickly Lettuce	Purslane Speedwell	Russian Thistle	Shepherdspurse	Sunflower	Sweetclover	Tansymustard	Velvetleaf	
4	2,4-D ester 4L ²	5	5	5	7	2	10	9	9	5	7	7	4	9	7	7	9	7	9	10	10	7	7	8	
4	2,4-D ester 4L + dicamba ^{●2} /Diflexx	9	10	7	8	2	10	10	10	7	9	9	9	9	8	8	9	7	9	10	10	8	9	8	
27+27+15+5	Acuron/ Acuron Flexxi (27 + 27 + 15)	6	10	7	9	9	9	8	8	10	9	9	7	9	9	9	9	10	9	10	10	6	9	9	
14+4	Aim + 2,4-D	7	6	8	8	6	10	9	9	7	9	7	9	9	8	8	9	10	9	10	10	8	10	9	
14+15+4	Anthem MAXX	5	6	8	7	4	9	9	9	6	7	7	7	9	8	8	9	8	9	10	10	7	8	10	
14+15+5+4	Anthem ATZ + 2,4-D	6	10	9	10	8	10	10	10	10	9	9	7	10	9	9	10	10	9	10	10	8	9	10	
5	Atrazine	4	10	4	9	8	9	8	8	9	9	9	1	9	7	7	9	10	9	9	10	3	8	9	
5+4	Atrazine + dicamba ^{●2}	7	10	8	10	9	10	10	10	10	10	10	10	10	10	10	10	10	9	10	10	9	9	9	
5+4	Atrazine + 2,4-D ester 4L ²	5	10	6	10	8	10	10	10	10	10	10	6	10	10	10	10	10	9	10	10	8	9	10	
2	Autumn Super ³	4	7	8	6	7	9	7	7	9	6	6	6	8	7	7	7	8	6	9	8	5	9	8	
27+5	Balance Flexx + atrazine	4	9	6	-	-	9	8	8	9	9	9	8	10	9	9	9	9	9	10	8	2	9	10	
2+4+5	Basis Blend + 2,4-D ester 4L + atrazine	5	9	6	8	8	10	9	9	8	8	8	3	9	9	9	9	9	9	10	10	3	9	8	
2+27	Corvus	2	8	5	-	5	7	7	7	8	8	8	8	9	8	8	8	8	8	8	6	1	9	10	
2+27+5	Corvus + atrazine	5	10	5	9	9	9	8	9	9	9	9	8	9	8	8	9	10	9	9	10	3	9	10	
19+4	Distinct ³	9	10	8	7	2	9	9	9	8	9	9	9	7	9	9	9	4	9	7	10	8	7	7	
4	Dicamba ^{●2} /Diflexx	9	10	8	7	5	9	9	9	7	9	9	9	9	8	8	8	9	5	9	10	8	8	8	
4+27	Diflexx Duo	9	10	8	7	5	9	9	9	7	9	9	9	9	8	8	8	9	5	9	10	8	8	8	
15+5+9	Expert	5	10	7	9	7	10	8	6	9	9	6	9	9	9	7	8	10	9	10	10	4	8	10	
14+15+5	Fierce + atrazine	6	9	7	8	8	9	6	6	6	7	7	6	7	7	7	8	9	9	9	9	6	8	8	
9	Glyphosate ^{◆4}	5	10	6	8	8	10	8	2	9	8	1	8	8	8	6	7	10	9	10	9	4	8	9	
9+4	Glyphosate [◆] + 2,4-D ester 4L ⁴	6	10	8	9	2	10	9	9	9	9	7	9	9	9	8	9	10	9	10	10	5	9	10	
9+5	Glyphosate [◆] + atrazine ⁴	4	10	6	8	8	10	9	6	8	7	5	8	7	8	8	8	10	8	10	9	3	9	8	
22	Gramoxone SL	4	10	5	7	4	10	6	6	9	9	9	9	7	7	7	8	6	6	9	10	6	8	8	
22+5	Gramoxone SL + atrazine	5	10	5	10	8	10	8	8	9	10	10	9	10	9	9	10	10	9	10	10	7	9	10	
9+4	LandMaster II	6	10	8	9	7	10	9	8	9	9	4	9	9	9	9	9	10	9	10	10	5	9	10	
27+15+5	Lexar EZ	6	10	7	9	9	9	8	8	10	9	9	7	9	9	9	9	10	9	10	10	5	9	9	
27+15+5	Lumax EZ	5	10	7	9	8	9	8	8	10	8	8	6	9	8	8	9	10	9	10	9	4	9	9	
2+27	Prequel	4	9	5	-	-	9	6	6	9	8	8	8	9	8	8	8	8	-	9	9	3	9	9	
14+9	Sharpen + glyphosate [◆]	6	8	7	9	8	10	9	7	9	8	7	8	9	10	8	10	10	10	10	10	9	10	10	
14+9+4	Sharpen + glyphosate [◆] + 2,4-D	7	8	8	9	8	10	9	9	9	9	9	9	9	10	9	10	10	10	10	9	10	10	10	
14+9+4	Valor SX + glyphosate [◆] + 2,4-D	6	10	8	9	8	10	10	9	9	9	9	9	9	9	8	9	10	9	10	10	6	10	10	
14+15+9	Verdict + glyphosate [◆]	6	8	7	10	8	10	9	7	9	9	8	8	8	9	7	10	10	10	10	10	9	10	10	

See footnotes on page 63.

[†]See pages 8-10 for more information on classification of herbicides by mode and site of action.

Corn

Grass Weed Response to Spring Burndown Herbicides¹

Site of Action [†]	Response Ratings: Ratings are for light to moderate weed densities, favorable conditions and weed growth stage as specified on product label. High weed densities, adverse conditions, or large weeds will reduce control. 10 = 96-100% 6 = 70-79% 9 = 90-95% 5 = 60-69% 8 = 85-90% 4-2 = less than 60% 7 = 80-84% 1 = 0	Grasses					
		Annual Bluegrass	Downy Brome	Foxtail Barley	Volunteer Conventional Corn	Volunteer RR Corn	Winter Wheat or Rye
4	2,4-D ester 4L ²	1	1	1	1	1	1
4	2,4-D ester 4L + dicamba ^{•2} /Diflexx	1	1	1	1	1	1
27+27+15+5	Acuron / Acuron Flexxi (27 + 27 +15)	7	7	7	1	1	5
14+4	Aim + 2,4-D	1	1	1	1	1	1
14+15+4	Anthem MAXX + 2,4-D	1	1	1	1	1	1
14+15+5+4	Anthem ATZ + 2,4-D	10	8	9	2	2	7
5	Atrazine	9	7	9	1	1	6
5+4	Atrazine + dicamba ^{•2}	10	8	10	1	1	5
5+4	Atrazine + 2,4-D ester 4L ²	10	8	10	2	2	7
2	Autumn Super ³	1	1	1	2	2	1
27	Balance Flexx	-	5	2	2	2	3
27+5	Balance Flexx + atrazine	8	6	5	4	4	4
2+4+5	Basis Blend + 2,4-D ester 4L + atrazine	9	6	8	2	2	6
2+27	Corvus	5	5	5	2	2	-
2+27+5	Corvus + atrazine	9	7	9	2	2	6
19+4	Distinct ³	1	1	1	1	1	1
4	Dicamba ^{•2} /Diflexx	1	1	1	1	1	1
4+27	Diflexx Duo	4	4	4	4	4	4
15+5+9	Expert	10	10	9	10	2	10
14+15+5	Fierce + atrazine	9	7	9	1	1	6
9	Glyphosate ^{♦4}	10	10	9	10	1	10
9+4	Glyphosate [♦] + 2,4-D ester 4L ⁴	10	10	9	10	1	10
9+5	Glyphosate [♦] + atrazine ⁴	10	10	8	10	1	10
22	Gramoxone SL	9	7	7	4	4	6
22+5	Gramoxone SL + atrazine	10	10	10	5	5	10
9+4	LandMaster II	10	10	9	10	2	10
27+15+5	Lexar EZ	7	6	7	1	1	5
27+15+5	Lumax EZ	4	3	4	1	1	4
2+27	Prequel	9	6	8	4	4	6
14+9	Sharpen + glyphosate [♦]	10	10	10	10	3	10
14+9+4	Sharpen + glyphosate [♦] + 2,4-D	10	10	10	10	3	10
14+9+4	Valor SX + glyphosate [♦] + 2,4-D	10	10	9	10	3	10
14+15+9	Verdict + glyphosate [♦]	10	10	10	10	3	10

¹This table presents burndown preplant herbicide information only. It does not reflect residual weed control.

²See table entitled *Using 2,4-D and Dicamba Before Planting* on page 70.

³Apply at least 7 days prior to planting corn.

⁴During cool weather (day/night temperatures less than 50-60°F), glyphosate performance can be reduced.

[•]Dicamba rates are based on a 4.0 ae/gal formulation, like those found in Clarity. See page 203 or the *Herbicide Dictionary* for other products containing dicamba.

[♦]Glyphosate rates are based on a 4.0 ai/gal or 3.0 lb ae/gal formulation. See pages 186-199 for information on common glyphosate formulations.

[†]See pages 8-10 for more information on classification of herbicides by mode and site of action.

Corn

Broadleaf Weed Response To Soil-Applied Herbicides

Plant response may be altered by growing conditions, genetic variation in crops and weeds, soil type, pH, organic matter, and application rates. Ratings may vary from season to season and area to area within the state. Ratings apply when herbicides are used as suggested in this publication and represent control that may be expected when using the higher rate when a rate range is presented (pages 70-76). See pages 155-167 for additional problem weeds and their control.

Site of Action†	Response Ratings: Ratings are for light to moderate weed densities, favorable conditions and weed growth stage as specified on product label. High weed densities, adverse conditions, or large weeds will reduce control. 10 = 96-100% 9 = 90-95% 8 = 85-90% 7 = 80-84% 6 = 70-79% 5 = 60-69% 4-2 = less than 60% 1 = 0	Broadleaves																	
		Cocklebur (5.5)§	E. Black Nightshade (3.5)	Kochia (2.5)	Kochia, ALS-Resistant (2.5)	Kochia, Triazine-Resistant (2.5)	Lambsquarters (1.5)	Morningglories (5.5)	Pigweed (2.5)	Pigweed, Triazine-Resistant (2.5)	Ragweed, Common and Giant (4.5)	Russian Thistle (2.3)	Smartweed (1.5)	Sunflower (10)	Velvetleaf (4.2)	Waterhemp (2.5)	Waterhemp, ALS-Resistant (2.5)	Waterhemp, Glyphosate-Resistant (2.5)	Waterhemp, Triazine-Resistant (2.5)
5	AAtrex /atrazine	7	9	9	9	2	9	5	9	1	8	9	8	7	7	9	9	9	1
27+27+15+5	Acuron /Acuron Flexxi (27 + 27 + 15)	8	9	10	10	9	9	8	10	10	9	9	9	9	9	9	9	9	9
14+15	Anthem Maxx	2	8	6	6	6	7	5	9	9	6	5	5	1	7	8	8	8	8
14+15+5	Anthem ATZ	7	9	9	9	6	9	7	10	9	8	9	7	5	9	10	10	10	9
27+5	Balance Flexx + atrazine	7	8	10	10	9	9	5	9	8	8	8	9	7	10	9	9	9	8
15+5	Bicep II Magnum/Cinch ATZ/Parallel Plus	7	8	9	9	2	9	6	8	8	8	8	8	6	6	9	9	9	8
27	Callisto	7	9	9	9	9	9	6	10	10	8	8	9	9	9	9	9	9	9
2+27	Corvus	5	8	9	9	9	8	4	8	8	8	7	8	6	9	8	8	8	8
2+27+5	Corvus + atrazine	7	9	9	9	9	9	5	9	8	8	9	8	8	9	9	9	9	8
15	Degree/Topnotch	3	8	2	2	2	8	1	8	8	6	5	3	2	3	8	8	8	8
15+5	Degree Xtra/Fultime NXT	7	9	9	9	2	9	6	9	7	8	8	8	6	6	9	9	9	7
15	Dual II Magnum/Cinch/Parallel	2	7	2	2	2	7	1	7	7	5	3	2	2	2	8	8	8	8
15+5	G-Max Lite	6	9	7	7	5	8	5	9	8	8	8	8	6	6	9	9	9	7
15+5	Guardsman Max	7	9	9	9	5	9	6	9	8	8	8	9	6	6	9	9	9	8
15	Harness/Surpass NXT/Confidence/Breakfree NXT	2	7	2	2	2	7	1	7	7	5	3	2	2	2	8	8	8	8
15+5	Harness Xtra/Keystone LA NXT/Confidence Xtra	7	9	9	9	2	9	6	9	7	8	8	8	6	6	9	9	9	7
4+2	Hornet	8	7	9	4	9	9	8	9	9	7	8	8	9	8	9	5	9	9
27+2	Instigate	8	9	9	9	9	9	6	10	10	8	8	8	8	9	9	8	9	9
15+5	Keystone/Volley ATZ/Breakfree ATZ	7	9	9	9	2	9	6	9	7	8	8	8	6	6	9	9	9	7
27+15+5	Lexar EZ or Lumax EZ	7	9	10	10	9	9	7	10	10	8	3	9	9	9	9	9	9	9
15	Outlook	2	8	2	2	3	7	1	8	8	5	3	2	2	2	8	8	8	8
2+27	Prequel	6	8	9	9	9	8	4	9	9	8	7	8	6	9	8	8	8	8
3+5	Prowl H ₂ O + atrazine	6	9	9	9	5	9	6	9	7	7	7	8	6	7	9	9	9	6
2	Resolve SG	5	4	8	1	8	7	1	9	9	3	3	1	1	5	6	1	6	6
15+27+4	Resicore	8	7	9	6	9	9	8	9	9	7	8	8	9	8	9	9	9	9
14	Sharpen	9	9	7	7	7	8	8	9	9	9	8	7	9	8	8	8	8	8
15+4+2	SureStart II/TripleFLEX	8	7	9	4	9	9	8	9	9	7	8	8	9	8	9	5	9	9
15	Surpass/Breakfree	2	7	2	2	2	8	1	8	8	5	3	2	2	2	8	8	8	8
14+15	Verdict	9	10	7	7	7	9	9	10	10	10	9	8	9	9	9	9	9	9
27+15	Zemax/Callisto + Dual II Magnum	7	9	9	9	9	9	6	10	10	8	8	9	9	9	9	9	9	9
15	Zidua	6	7	7	7	7	7	5	8	8	7	6	6	5	8	8	8	8	8

See footnotes on page 72.

†See pages 8-10 for more information on classification of herbicides by mode and site of action.

Corn

Grass Weed Response To Soil-Applied Herbicides

Plant response may be altered by growing conditions, genetic variation in crops and weeds, soil type, pH, organic matter, and application rates. Ratings may vary from season to season and area to area within the state. Ratings apply when herbicides are used as suggested in this publication and represent control that may be expected when using the higher rate when a rate range is presented (pages 72-84). See pages 155-167 for additional problem weeds and their control.

Site of Action†	Response Ratings: Ratings are for light to moderate weed densities, favorable conditions and weed growth stage as specified on product label. High weed densities, adverse conditions, or large weeds will reduce control. 10 = 96-100% 6 = 70-79% 9 = 90-95% 5 = 60-69% 8 = 85-90% 4-2 = less than 60% 7 = 80-84% 1 = 0 §Weed Competitive Index — See page 11.	Grasses										Crop Safety¶	Labeled for				
		Barrygrass (0.3)§	Crabgrass (0.5)	Fall Panicum (0.4)	Giant Foxtail (2)	Green Foxtail (1)	Yellow Foxtail (1)	Sandbur (1)	Shattercane/Sorghum (3.5)	Shattercane, ALS-Resistant (3.5)	Woolly Cupgrass (2.5)		Field Corn	Popcorn	Field Corn Grown for Seed	Field Corn Grown for Silage	Sweet Corn
5	AAtrax/atrazine	6	4	2	6	7	6	5	1	1	3	1	Y	Y	Y	Y	Y
27+27+15+5	Acuron/Acuron Flexxi (27 + 27 + 15)	9	9	9	9	9	9	7	4	4	6	2	Y	Y	Y	Y	Y
14+15	Anthem Maxx	9	9	9	9	9	9	7	6	6	7	1	Y	Y	Y	Y	Y
14+15+5	Anthem ATZ	9	9	9	9	9	9	7	6	6	7	1	Y	Y	Y	Y	Y
27+5	Balance Flexx + atrazine	8	7	7	8	9	6	7	5	5	8	2	Y	N	Y	Y	N
15+5	Bicep II Magnum/Cinch ATZ/Parallel Plus	9	9	9	9	9	9	6	4	4	6	2	Y	Y	Y	Y	Y
27	Callisto	1	7	1	1	1	1	1	1	1	1	1	Y	Y	Y	Y	Y
2+27	Corvus	9	9	7	9	9	9	7	7	7	8	2	Y	N	Y	Y	N
2+27+5	Corvus + atrazine	9	9	7	9	9	9	7	7	7	8	2	Y	N	Y	Y	N
15	Degree/Topnotch	9	9	9	9	9	9	6	4	4	7	2	Y	Y	Y	Y	Y
15+5	Degree Xtra/Fultime NXT	9	9	9	9	9	9	6	4	4	7	2	Y	Y	Y	Y	Y
15	Dual II Magnum/Cinch/Parallel	9	9	9	9	9	9	5	4	4	6	2	Y	Y	Y	Y	Y
15+5	G-Max Lite	9	9	9	9	9	9	7	4	4	8	2	Y	Y	Y	Y	Y
15+5	Guardsman Max	9	9	9	9	9	9	7	4	4	8	2	Y	Y	Y	Y	Y
15	Harness/Surpass NXT/Confidence/Breakfree NXT	9	9	9	9	9	9	6	4	4	7	2	Y	Y	Y	Y	Y
15+5	Harness Xtra/Keystone LA NXT/Confidence Xtra	9	9	9	9	9	9	6	4	4	8	2	Y	Y	Y	Y	Y
4+2	Hornet	1	1	1	1	1	1	1	1	1	1	2	Y	N	N	Y	N
27+2	Instigate	8	7	1	7	7	7	1	8	1	-	2	Y	N	N	Y	N
15+5	Keystone/Volley ATZ/Breakfree ATZ	9	9	9	9	9	9	6	4	4	6	2	Y	Y	Y	Y	Y
27+15+5	Lexar EZ or Lumax EZ	9	9	9	9	9	9	6	4	4	6	2	Y	Y	Y	Y	Y
15	Outlook	9	9	9	9	9	9	5	4	4	6	2	Y	Y	Y	Y	Y
2+27	Prequel	9	7	7	8	9	8	6	5	5	8	2	Y	N	N	Y	N
3+5	Prowl H ₂ O + atrazine	8	9	9	9	9	9	7	3	3	7	2	Y	Y	Y	Y	Y
2	Resolve SG	9	5	1	8	8	8	1	8	1	-	2	Y	N	N	Y	N
15+27+4	Resicore	9	9	9	9	9	9	6	4	4	7	2	Y	Y	Y	Y	Y
14	Sharpen	2	2	2	2	2	2	1	2	2	2	1	Y	Y	Y*	Y	N
15+4+2	SureStart/TripleFLEX	9	9	9	9	9	9	6	4	4	7	2	Y	N	N	Y	N
15	Surpass/Breakfree	9	9	9	9	9	9	6	4	4	7	2	Y	Y	Y	Y	Y
14+15	Verdict	9	9	9	9	9	9	6	5	5	6	1	Y	Y	Y*	Y	N
27+15	Zemax/Callisto + Dual II Magnum	9	9	9	9	9	9	6	5	5	6	2	Y	Y	Y	Y	Y
15	Zidua	8	7	7	8	8	8	7	6	6	5	2	Y	N	N	Y	N

¶Hybrids vary in their response to herbicides. Crop safety ratings less than 3 indicate that crop yield should not be affected by any direct injury.

†See pages 8-10 for more information on classification of herbicides by mode and site of action.

*Consult the supplemental label for use rates.

Corn

Broadleaf Weed Response To Foliar-Applied Herbicides

Plant response may be altered by growing conditions, genetic variation in crops and weeds, soil type, pH, organic matter, and application rates. Ratings may vary from season to season and area to area within the state. Ratings apply when herbicides are used as suggested in this publication and represent control that may be expected when using the higher rate when a rate range is presented (pages 70-76). See pages 155-167 for additional problem weeds and their control.

Site of Action [†]	Herbicide	Broadleaves																	
		Cocklebur (5.5) [§]	E. Black Nightshade (3.5)	Giant Ragweed (4.5)	Giant Ragweed, Glyphosate-Resistant (4.5)	Kochia	Kochia, ALS-Resistant (2.5)	Kochia, Glyphosate-Resistant	Kochia, Triazine-Resistant (2.5)	Lambsquarters (1.5)	Marestail, Glyphosate-Resistant (2)	Morningglories (5.5)	Pigweed (2.5)	Pigweed, Triazine-Resistant (2.5)	Russian Thistle (2.3)	Smartweed (1.5)	Sunflower (10)	Velvetleaf (4.2)	Waterhemp (2.5)
4	2,4-D	10	6	8	8	5	5	5	5	8	6	9	7	7	4	5	7	8	8
5	AAtrex/atrazine	9	8	8	8	9	9	9	1	8	5	7	8	1	8	4	9	7	8
2	Accent Q	5	3	1	1	6	1	6	6	4	5	6	7	7	3	7	4	4	7
2+5	Accent Q + atrazine	9	9	9	9	9	9	9	6	9	6	8	9	7	4	9	9	8	9
14	Aim	7	9	6	6	6	6	6	6	9	7	7	8	8	6	8	5	10	7
27	Armezon/Impact	9	9	7	7	6	6	6	6	9	6	6	9	9	9	9	9	9	9
27+15+9	Armezon Pro + Glyphosate	9	8	8	5	8	8	4	8	8	5	7	9	9	7	8	9	8	9
27+5	Armezon/Impact + atrazine	9	9	8	8	8	8	8	6	9	7	8	10	9	9	9	9	10	10
5+4	Atrazine + dicamba [•]	9	9	9	9	8	8	8	8	9	7	9	9	8	7	9	9	8	9
2	Basis Blend	9	3	5	5	3	1	3	3	7	5	5	9	9	4	8	7	8	8
2	Beacon	8	8	9	9	8	1	8	8	5	3	6	8	8	5	8	9	6	8
6+5	Buctril + atrazine	9	8	8	8	9	9	9	8	8	8	8	8	6	8	6	9	7	8
6+4	Buctril + dicamba [•]	9	7	7	7	8	8	8	8	7	8	9	8	8	9	6	8	7	7
14	Cadet	6	6	4	4	6	6	6	6	8	5	6	6	6	6	6	4	10	5
27	Callisto	9	9	7	7	6	6	6	6	9	4	6	9	9	9	9	8	9	9
27+5	Callisto + atrazine	9	9	8	8	8	8	8	6	9	5	8	10	9	9	9	9	10	10
27+5+2	Callisto + atrazine + Steadfast Q	9	9	8	8	8	8	8	6	9	5	8	10	9	9	9	9	10	10
27+9	Callisto GT	9	9	9	6	8	8	6	8	9	6	6	9	9	9	9	9	9	9
2+27	Capreno	9	9	7	7	8	8	8	8	9	6	6	9	9	9	9	9	9	9
2+27+5	Capreno + atrazine	10	9	8	8	9	9	9	8	9	7	7	9	9	9	9	9	9	9
4	Dicamba [•] /Diflexx	9	7	8	8	8	8	8	8	8	6	9	8	8	9	9	8	6	7
4+27	Diflexx Duo	9	9	8	8	8	8	8	8	9	8	9	9	9	9	9	9	9	9
9+4	Enlist Duo	9	9	9	7	9	8	7	8	8	6	8	9	9	8	9	9	9	9
15+5+9	Expert	9	8	7	6	9	9	6	6	8	6	7	9	8	8	8	9	9	9
9	Glyphosate [♦] (32 oz)	9	8	8	2	8	8	1	8	8	3	6	9	9	7	8	9	8	9
15+27+9	Halex GT	9	9	9	5	8	8	6	8	9	6	6	9	9	9	9	9	9	9
4+2	Hornet	9	7	8	8	6	6	6	6	8	8	7	7	7	5	8	9	8	6
27	Laudis	9	9	7	7	7	7	7	7	9	6	6	9	9	9	8	9	9	9
27+5	Laudis + atrazine	9	9	8	8	8	8	8	7	9	7	9	9	7	9	9	9	10	10
10	Liberty	9	8	7	7	7	7	7	7	7	5	9	9	9	7	8	9	8	9
10+5	Liberty + atrazine	9	8	8	8	8	8	8	7	9	7	9	9	9	8	8	9	8	9
2	Permit	9	3	9	9	6	1	6	6	5	5	5	9	9	4	7	9	9	8
2+27	Realm Q	8	8	6	6	6	6	6	6	7	8	5	9	9	6	9	8	9	9
2+4	Require Q	8	6	7	7	8	7	8	8	7	5	8	8	8	8	8	7	6	7
2	Resolve SG/Solida or Resolve Q	4	4	3	3	8	1	8	8	6	8	3	8	8	3	3	3	5	7
14	Resource	5	4	7	7	3	3	3	3	7	3	5	5	5	3	4	4	10	5
27+2	Revolin Q	9	9	7	7	7	6	6	6	9	5	7	9	9	9	9	8	9	9
14+27	Solstice	9	9	7	7	6	6	6	6	9	5	6	9	9	9	8	8	9	9
14+27+5	Solstice + atrazine	9	9	8	8	8	8	8	6	10	6	9	9	9	9	9	9	10	9
2	Spirit	8	8	7	7	8	1	8	8	6	3	6	8	8	4	8	9	7	8
4	Starane Ultra	6	5	8	8	9	9	9	9	2	6	8	2	2	5	2	6	7	2
19+4	Status	9	7	8	8	8	8	8	8	8	8	9	8	8	9	9	8	6	7
2	Steadfast Q	5	3	1	1	6	1	6	6	6	3	5	7	7	3	7	7	5	7
4+2	Yukon	9	6	9	9	7	7	7	7	8	6	8	9	9	7	8	9	9	8

See footnotes on page 71. Enlist Duo can be applied only on Enlist corn.

[†]See pages 8-10 for more information on classification of herbicides by mode and site of action.

Corn

Grass Weed Response To Foliar-Applied Herbicides

Plant response may be altered by growing conditions, genetic variation in crops and weeds, soil type, pH, organic matter, and application rates. Ratings may vary from season to season and area to area within the state. Ratings apply when herbicides are used as suggested in this publication and represent control that may be expected when using the higher rate when a rate range is presented (pages 70-76). See pages 155-167 for additional problem weeds and their control.

Site of Action†	Response Ratings: Ratings are for light to moderate weed densities, favorable conditions and weed growth stage as specified on product label. High weed densities, adverse conditions, or large weeds will reduce control. 10 = 96-100% 6 = 70-79% 9 = 90-95% 5 = 60-69% 8 = 85-90% 4-2 = less than 60% 7 = 80-84% 1 = 0	Grasses										Crop Safety¶	Labeled for				
		Barleygrass (0.3)§	Crabgrass (0.5)	Fall Panicum (0.4)	Giant Foxtail (2)	Green Foxtail (1)	Yellow Foxtail (1)	Sandbur (1)	Shattercane /Sorghum (3.5)	Shattercane, ALS-Resistant (3.5)	Woolly Cupgrass (2.5)		Field Corn	Popcorn	Field Corn Grown For Seed	Field Corn Grown For Silage	Sweet Corn
4	2,4-D	2	2	2	1	1	1	2	2	2	1	3	Y	Y	N	Y	Y
5	AAtrex/atrazine	5	4	2	5	6	6	4	2	2	5	1	Y	Y	Y	Y	Y
2	Accent Q	8	4	8	8	8	8	8	10	1	7	2	Y	Y	Y	Y	Y
2+5	Accent Q + atrazine	8	3	8	8	8	8	8	10	1	8	2	Y	Y	Y	Y	Y
14	Aim	1	1	1	1	1	1	1	1	1	1	2	Y	Y	Y	Y	Y
27	Armezon/Impact	6	7	3	7	4	4	1	3	3	3	1	Y	Y	Y	Y	Y
27+5	Armezon/Impact + atrazine	8	8	2	8	6	5	4	3	3	4	1	Y	Y	Y	Y	Y
27+15+9	Armezon Pro + glyphosate	10	9	10	10	10	10	10	10	10	9	1	Y	N	N	Y	N
5+4	Atrazine + dicamba●	2	2	2	2	2	2	2	2	2	5	2	Y	Y	Y	Y	N
2	Basis Blend	7	7	7	7	8	7	7	10	1	4	3	Y	N	N	Y	N
2	Beacon	2	3	7	5	4	5	4	10	1	2	2	Y	Y	Y	Y	N
6+5	Buctril + atrazine	5	4	2	5	6	6	4	2	2	5	2	Y	Y	N	Y	N
6+4	Buctril + dicamba●	2	2	2	2	2	2	2	2	2	1	3	Y	Y	N	Y	N
14	Cadet	1	1	1	1	1	1	1	1	1	1	2	Y	Y	N	Y	Y
27	Callisto	1	8	1	1	1	1	1	1	1	1	1	Y	Y	Y	Y	Y
27+5	Callisto + atrazine	5	8	2	6	6	6	4	2	2	5	1	Y	Y	Y	Y	Y
27+5+2	Callisto + atrazine + Steadfast Q	8	9	8	8	8	8	7	10	1	7	2	Y	N	N	Y	N
27+9	Callisto GT	10	9	10	10	10	10	10	10	10	9	1	Y	N	N	Y	N
2+27	Capreno	9	8	8	8	8	8	7	9	8	6	2	Y	N	N	Y	N
2+27+5	Capreno + atrazine	9	8	8	8	8	8	9	9	8	3	2	Y	N	N	Y	N
4	Dicamba●/Diflexx	2	2	2	2	2	2	2	2	2	1	3	Y	Y	Y	Y	N
4+27	Diflexx Duo	6	6	6	6	6	6	6	6	6	6	3	Y	Y	Y	Y	N
9+4	Enlist Duo	10	9	10	9	10	9	10	10	10	9	2	Y	N	N	N	N
15+5+9	Expert	9	9	9	9	9	9	9	9	9	8	1	Y	Y	N	Y	N
9	Glyphosate◆ (32 oz)	10	9	10	10	10	10	10	10	10	9	1	Y	N	N	Y	N
15+27+9	Halex GT	10	9	10	10	10	10	10	10	10	9	1	Y	N	N	Y	N
4+2	Hornet	1	1	1	1	1	1	1	1	1	1	3	Y	N	N	Y	N
27	Laudis	6	7	2	7	4	7	1	8	8	3	1	Y	Y	Y	Y	Y
27+5	Laudis + atrazine	8	8	2	7	6	7	4	8	8	4	1	Y	Y	Y	Y	Y
10	Liberty	7	8	7	8	7	6	6	8	8	7	1	Y	N	N	Y	N
10+5	Liberty + atrazine	7	8	7	8	7	6	6	8	8	7	1	Y	N	N	Y	N
2	Permit	1	1	1	1	1	1	1	1	1	1	2	Y	Y	Y	Y	Y
2+27	Realm Q	5	5	5	5	6	5	5	7	1	3	2	Y	N	N	N	N
2+4	Require Q	9	4	7	8	8	8	-	8	1	4	2	Y	N	N	Y	N
2	Resolve SG/Solida or Resolve Q	9	4	7	8	8	8	-	8	1	4	2	Y	N	N	Y	N
14	Resource	1	1	1	1	1	1	1	1	1	1	2	Y	N	N	Y	N
2+27	Revolin Q	8	8	8	8	8	8	8	10	1	7	2	Y	Y	Y	Y	Y
14+27	Solstice	1	1	1	1	1	1	1	1	1	1	1	Y	Y	N	Y	Y
14+27+5	Solstice + atrazine	1	8	1	1	1	1	1	1	1	1	2	Y	Y	N	Y	N
2	Spirit	2	2	5	4	3	5	3	10	1	3	2	Y	Y	Y	Y	Y
4	Starane Ultra	1	1	1	1	1	1	1	1	1	1	1	Y	N	N	Y	Y
19+4	Status	6	2	6	4	7	5	2	6	6	3	3	Y	Y	Y	Y	N
2	Steadfast Q	8	7	8	8	8	8	8	10	1	7	2	Y	N	N	Y	N
4+2	Yukon	1	1	1	1	1	1	1	1	1	1	2	Y	N	Y	Y	N

¶Hybrids vary in their response to herbicides. Crop safety ratings less than 3 indicate that crop yield should not be affected by any direct injury.

●See page 203 or the *Herbicide Dictionary* for products containing dicamba.

◆Glyphosate rates are based on a 4.0 ai/gal or 3.0 lb ae/gal formulation. See page 78 for information on common glyphosate formulations.

†See pages 8-10 for more information on classification of herbicides by mode and site of action.

Corn

Burndown and Preplant (See page 52 for spray additives)

Herbicide	Commercial Product per Acre			Application Time	Remarks and Approximate Cost Per Acre Broadcast
	Sandy Loam	Silt Loam	Silty-Clay Loam		
TO REMOVE COOL-SEASON GRASS SOD (INCLUDING SMOOTH BROME AND BLUEGRASS)					
ATRAZINE DF■ + GRAMOXONE SL	1.6 lb 2.0-3.0 pt	2.2 lb 2.0-3.0 pt	2.2 lb 2.0-3.0 pt	When grass is 4-6" and before corn emerges	Cost: atrazine DF + Gramoxone SL \$14.75-\$21.50.
GLYPHOSATE◆	48.0-64.0 oz	48.0-64.0 oz	48.0-64.0 oz	On new growth in the fall	Cost: \$5.00-\$6.75.
TO REMOVE ALFALFA/CLOVER SOD					
2,4-D ester (4L) + DICAMBA●	48.0 oz 8.0 oz	48.0 oz 8.0 oz	48.0 oz 8.0 oz	Fall or Apr.-May to alfalfa growth	Do not apply with 28% UAN or atrazine. If perennial grasses are present, include glyphosate. Follow with appropriate herbicide for corn. Delay corn planting 10-14 days after application. Cost: \$12.25.
TO REMOVE RYE OR WINTER WHEAT ²					
ATRAZINE DF■ + BALANCE FLEXX ¹ + GRAMOXONE SL	1.4 lb 1.0-3.0 oz 2.0 pt	1.6 lb 3.0-5.0 oz 2.0 pt	1.7 lb 3.0-6.0 oz 2.0 pt	When rye or wheat is 2-4" and before corn is planted	On dryland fields, soil moisture following a grass cover crop may be inadequate for corn. Cost: atrazine + Balance + Gramoxone SL \$19.50-\$48.00.
ATRAZINE DF■ + GRAMOXONE SL	1.4 lb 2.0 pt	1.6 lb 2.0 pt	1.7 lb 2.0 pt	When rye or wheat is 2-4" and before corn is planted	Cost: atrazine + Gramoxone SL \$14.00-\$15.00.
EXPERT	2.5-3.75 qt	3.0-3.75 qt	3.0-3.75 qt	When rye or wheat is 2-4" and before corn is planted	Cost: \$23.25-\$34.75.
GLYPHOSATE◆	20.0-24.0 oz	20.0-24.0 oz	20.0-24.0 oz	When rye or wheat is 2-4" and before corn is planted	Cost: \$2.00-\$2.50.

¹Do not use Balance Flexx on coarse-textured soils of less than 2% organic matter if the water table is less than 25 feet. Do not use on fields prone to runoff or flooding. Crop response is most likely to occur where soils are coarse, organic matter content is less than 1.5%, and the pH is greater than 7.4. Corn seed must be covered with 1.5 to 2.0 inches of soil. Avoid planting when the surface soil is wet.

²When using rye as a cover crop, do not plant corn until at least 10 days after the rye has been sprayed.

◆Glyphosate rates are based on a 4.0 ai/gal or 3.0 lb ae/gal formulation. See page 195 for information on common glyphosate formulations.

■Do not apply atrazine within 66 feet of where water runoff from a field will enter a stream, river, or standpipe. The total amount of atrazine applied cannot exceed 2.5 lb ai/A per calendar year. Use no more than 1.6 lb ai/A on highly erodible land with less than 30% crop residue. Using atrazine on soils with less than 1% organic matter increases carryover injury risk to susceptible crops, especially high pH soils. Do not use on sandy soils if water table is shallower than 30 ft to prevent atrazine contamination of groundwater.

●Dicamba rates are based on a 4.0 ae/gal formulation, like those found in Clarity. See page 203 or the *Herbicide Dictionary* for other products containing dicamba.

Corn

Burndown and Preplant (See page 52 for spray additives)

Herbicide	Commercial Product per Acre			Application Time	Remarks and Approximate Cost Per Acre Broadcast	
	Sandy Loam	Silt Loam	Silty-Clay Loam			
CONTINUOUS CORN OR CORN-SOYBEAN ROTATIONS						
2,4-D ester (4L) + DICAMBA [•]	16.0 oz 8.0 oz	16.0 oz 8.0 oz	16.0 oz 8.0 oz	At least 14 DBP	Plant Back Restrictions: 7 days for 16 oz, and 14 days for 17-32 oz. See adjuvant table on page 46. May be tank-mixed with fluid fertilizers. Cost: \$6.50.	
ACURON/ACURON FLEXXI	2.0 qt	2.0 qt	2.25 qt	0-14 DBP		COST:\$4.00-4.50
AIM EC + 2,4-D	0.5-1.0 oz 8.0-32.0 oz	0.5-1.0 oz 8.0-32.0 oz	0.5-1.0 oz 8.0-32.0 oz	7-14 DBP	Plant Back Restrictions: 7 days for 16 oz, and 14 days for 17-32 oz. See adjuvant table on page 46. May be tank-mixed with fluid fertilizers. Cost: \$4.75-\$12.25.	
ANTHEM/ANTHEM MAXX + 2,4-D	8-10 oz\ 4-5 oz 1.0-1.5 pt	8-10 oz\ 4-5 oz 1.0-1.5 pt	8-10 oz\ 4-5 oz 1.0-1.5 pt	0-45 DBP		Add COC or MSO plus nitrogen fertilizer for more effective burndown prior to planting. Cost: \$22.00-\$27.00.
ANTHEM ATZ + 2,4-D	2 pt 1.0 pt	2.0-2.5 pt 1.0 pt	2.5-2.75 pt 1.0 pt	0-45 DBP	Add COC or MSO plus nitrogen fertilizer for more effective burndown prior to planting. Cost: \$24.00-\$30.00.	
ATRAZINE DF [■]	1.6 lb	2.2 lb	2.2 lb	0-45 DBP	Use a COC and N fertilizer with atrazine for more effective burndown if the crop has not emerged. Add 0.5-1 pt of 2,4-D ester or 0.5 pt dicamba for additional control of broadleaf weeds. Add glyphosate for greater control of emerged grass. Add Gramoxone SL for partial control of volunteer Roundup Ready corn. Cost: atrazine DF \$5.25-\$7.25; atrazine DF + 2,4-D + Aim \$11.00-\$16.75; atrazine DF + Aim \$9.00-\$14.75; atrazine DF + dicamba \$9.00-\$11.00; atrazine DF + glyphosate \$7.50; atrazine DF + Gramoxone SL \$13.50.	
ATRAZINE DF [■] + 2,4-D (4L) ester	1.6 lb 16.0 oz	2.2 lb 16.0 oz	2.2 lb 16.0 oz	At least 7-10 DBP		
ATRAZINE DF [■] + AIM EC + 2,4-D	1.0-1.5 lb 0.5-1.0 oz 16.0 oz	1.0-1.5 lb 0.5-1.0 oz 16.0 oz	1.0-1.5 lb 0.5-1.0 oz 16.0 oz	0-45 DBP		
ATRAZINE DF [■] + DICAMBA [•]	1.6 lb 8.0 oz	2.2 lb 8.0 oz	2.2 lb 8.0 oz	At least 7-10 DBP		
ATRAZINE DF [■] + GLYPHOSATE [◆]	1.2 lb 32.0 oz	1.2 lb 32.0 oz	1.2 lb 32.0 oz	1-2 weeks preplant		
ATRAZINE DF [■] + GRAMOXONE SL	1.2 lb 2.0 pt	1.2 lb 2.0 pt	1.2 lb 2.0 pt	1-2 weeks preplant		
AUTUMN SUPER	0.5 oz	0.5 oz	0.5 oz	Fall to 30 DBP corn in spring		Add 2,4-D for control of larger broadleaves or glyphosate for control of grasses and larger broadleaves. Has residual activity for 2-3 weeks. Use 0.3 oz/A on soils having a pH of 7 to 8. Apply in minimum 10 GPA. Cost: \$11.50.
BALANCE FLEXX ¹	3.0 oz	3.0-5.0 oz	3.0-6.0 oz	30 DBP to V2 corn		Balance Flexx includes a safener which reduces the risk of injury to corn. If weeds have emerged prior to application, Balance Flexx may be tank-mixed with glyphosate or 2,4-D and appropriate adjuvants for improved burndown. Cost: \$16.50-\$33.00.
BALANCE FLEXX ¹ + ATRAZINE DF [■]	1.0-3.0 oz 0.90 lb	2.0-5.0 oz 0.90 lb	3.0-6.0 oz 1.3 lb	30 DBP to V2 corn	Use higher rate for longer residual activity or in fields with greater grass weed density. In fields with heavy grass pressure, add Dual II Magnum/Cinch (1-1.33 pt) or Resolve (1.0-1.5 oz) to the tank mixture for improved residual control of grasses and some broadleaf weeds. Cost: \$8.50-\$37.25.	

¹Do not use Balance Flexx on coarse-textured soils of less than 2% organic matter if the water table is less than 25 feet. Do not use on fields prone to run-off or flooding. Crop response is most likely to occur where soils are coarse, organic matter content is less than 1.5%, and the pH is greater than 7.4. Corn seed must be covered with 1.5 to 2.0 inches of soil. Avoid planting when the surface soil is wet.

[■]Do not apply atrazine within 66 feet of where water runoff from a field will enter a stream, river, or standpipe. The total amount of atrazine applied cannot exceed 2.5 lb ai/A per calendar year. Use no more than 1.6 lb ai/A on highly erodible land with less than 30% crop residue. Using atrazine on soils with less than 1% organic matter increases carryover injury risk to susceptible crops, especially high pH soils. Do not use on sandy soils if water table is shallower than 30 ft.

[◆]Glyphosate rates are based on a 4.0 ai/gal or 3.0 lb ae/gal formulation. See pages 186-199 for information on common glyphosate formulations.

[•]Dicamba rates are based on a 4.0 ae/gal formulation, like those found in Clarity. See page 203 or the *Herbicide Dictionary* for other products containing dicamba.

Corn

Burndown and Preplant (See page 52 for spray additives) (continued)

Herbicide	Commercial Product per Acre			Application Time	Remarks and Approximate Cost Per Acre Broadcast
	Sandy Loam	Silt Loam	Silty-Clay Loam		
BALANCE FLEXX ¹ + BICEP II MAGNUM/ CINCH ATZ [■] or FULTIME [■] or HARNESX XTRA 5.6L/ CONFIDENCE XTRA 5.6L [■]	1.0-3.0 oz 1.5 qt 1.3 qt 1.3 qt	3.0-5.0 oz 1.8 qt 1.5-2.0 qt 1.5-2.0 qt	3.0-5.0 oz 2.1 qt 1.75-2.7 qt 1.75-2.7 qt	30 DBP to V2 corn	The tank-mixtures listed will provide broad spectrum weed control if activated by adequate precipitation. Cost: Balance Flexx + Bicep II Magnum \$25.50-\$55.25; Balance Flexx + Fultime \$20.25-\$58.00; Balance Flexx + Harness Xtra 5.6 \$24.25-\$66.75.
BASIS BLEND + 2,4-D ESTER + ATRAZINE [●]	0.83-1.25 oz 16.0 oz 1.0 qt	0.83-1.25 oz 16.0 oz 1.0 qt	0.83-1.25 oz 16.0 oz 1.0 qt	7-14 DBP	Basis also may be applied as a fall burndown herbicide. In the fall, use the 0.5 oz rate, but do not apply with atrazine unless allowed by the atrazine product label. Cost: \$13.25-\$16.75.
BICEP II MAGNUM/ CINCH ATZ [■]	1.8 qt	2.1 qt	2.1-2.6 qt	0-45 DBP	Cost: \$23.75-\$34.50.
BICEP LITE II MAGNUM/ CINCH ATZ LITE [■]	1.5 qt	1.5-1.9 qt	1.5-2.2 qt	0-45 DBP	Cost: \$26.25-\$38.50.
CORVUS or CORVUS + ATRAZINE	3.33 oz 3.33 oz 1.0 qt	3.33-5.6 oz 3.33-5.6 oz 1.0 qt	3.33-5.6 oz 3.33-5.6 oz 1.0 qt	30 DBP-V2 corn	Corvus includes a safener which reduces the risk of isoxaflutole injury to corn. Corvus may be tank-mixed with atrazine (1 qt), glyphosate, 2,4-D, Liberty or Laudis. Cost: Corvus \$23.75-\$40.00; Corvus + atrazine \$28.75-\$45.00.
DEGREE XTRA/FULTIME NXT [■]	2.9 qt	2.9-3.7 qt	3.2-3.7 qt	0-14 DBP	Cost: \$34.75-\$44.50.
DICAMBA/DIFLEXX	8.0 oz	8.0 oz	8.0 oz	At least 7 DBP	Cost: \$3.75.
DIFLEXX DUO	24 oz	32 oz	40 oz		
DISTINCT	4.0-6.0 oz	4.0-6.0 oz	4.0-6.0 oz	At least 7 DBP	Cost: \$5.00-\$7.25.
EXPERT	2.5 qt	3.0 qt	3.0-3.8 qt	0-30 DBP	Cost: \$28.25-\$56.25.
FIERCE + ATRAZINE	3 oz 1 qt	3 oz 1 qt	3 oz 1 qt	Apply 7-30 days EPP.	Cost: \$24.25.
FULTIME NXT [■]	Do not use 2.5-3.0 qt 2.5-3.0 qt	2.7-4.0 qt 2.7-3.3 qt 2.7-3.3 qt	3.3-5.0 qt 3.0-5.0 qt 3.0-4.0 qt	14-40 DBP 0-14 DBP PRE	Cost: \$28.25-\$56.25.
GLYPHOSATE [◆]	32.0 oz	32.0 oz	32.0 oz	EPP, PPSA, PRE	Glyphosate provides excellent control on annual grasses less than 6" tall and good to excellent control on broadleaves less than 6" tall. Cost: glyphosate \$3.50; glyphosate + 2,4-D LV4 \$6.25; glyphosate + dicamba \$7.25; glyphosate + Resolve SG \$12.75.
GLYPHOSATE [◆] + 2,4-D	32.0 oz 16.0 oz	32.0 oz 16.0 oz	32.0 oz 16.0 oz	7-30 DBP	
GLYPHOSATE [◆] + DICAMBA [●]	32.0 oz 8.0 oz	32.0 oz 8.0 oz	32.0 oz 8.0 oz	At least 7 DBP	
GLYPHOSATE [◆] + RESOLVE SG	32.0 oz 1.0 oz	32.0 oz 1.0 oz	32.0 oz 1.0 oz	Before planting	
GMAX LITE [■]	2.0 pt	2.5 pt	3.5 pt	0-45 DBP	Cost: \$21.00-\$36.75.
GRAMOXONE SL	2.0-3.0 pt	2.0-3.0 pt	2.0-3.0 pt	Before corn emerges	Tank-mix with atrazine for increased spectrum of weeds controlled. Cost: \$9.50-\$14.25.
GUARDSMAN MAX [■]	2.5-3.0 pt	3.0-4.0 pt	4.0-4.6 pt	0-45 DBP	Cost: \$20.25-\$37.50.

¹Do not use Balance Flexx on coarse-textured soils of less than 2% organic matter if the water table is less than 25 feet. Do not use on fields prone to run-off or flooding. Crop response is most likely to occur where soils are coarse, organic matter content is less than 1.5%, and the pH is greater than 7.4. Corn seed must be covered with 1.5 to 2.0 inches of soil. Avoid planting when the surface soil is wet.

[◆]Glyphosate rates are based on a 4.0 ai/gal or 3.0 lb ae/gal formulation. See pages 186-199 for information on common glyphosate formulations.

[■]Do not apply atrazine within 66 feet of where water runoff from a field will enter a stream, river, or standpipe. The total amount of atrazine applied cannot exceed 2.5 lb ai/A per calendar year. Use no more than 1.6 lb ai/A on highly erodible land with less than 30% crop residue. Using atrazine on soils with less than 1% organic matter increases carryover injury risk to susceptible crops, especially high pH soils. Do not use on sandy soils if water table is shallower than 30 ft.

Corn

Burndown and Preplant (See page 52 for spray additives) (continued)

HARNESS XTRA/ KEYSTONE LA NXT/ CONFIDENCE XTRA [■]	1.8 qt	2.3 qt	2.3 qt	14 DPB	Formulated for use on fields where annual grass density is high. Cost: \$29.25-\$37.50.
Herbicide	Commercial Product per Acre			Application Time	Remarks and Approximate Cost Per Acre Broadcast
	Sandy Loam	Silt Loam	Silty-Clay Loam		
HARNESS XTRA 5.6/ CONFIDENCE XTRA 5.6L [■]	1.4 qt	2.3-2.6 qt	2.3-3.0 qt	0-14 DBP	Cost: \$20.25-\$43.50.
KEYSTONE/ BREAKFREE ATZ [■]	Do not use 2.2-2.6 qt 2.2-2.6 qt	2.4-3.4 qt 2.4-2.8 qt 2.4-2.8 qt	2.8-3.4 qt 2.6-3.4 qt 2.6-3.4 qt	14-30 DBP 0-14 DBP PRE	See label for pre and post tank-mix combinations. Cost: Keystone \$36.75-\$57.00; Breakfree ATZ \$19.75-\$30.50.
LANDMASTER BW	40.0-64.0 oz	40.0-64.0 oz	40.0-64.0 oz	0-30 DBP	Use higher rates for older winter annuals and bigger weeds. Add a preemergence herbicide for residual weed control. Cost: \$6.00-\$9.50.
LUMAX EZ [■]	2.7 qt	2.7 qt	2.7-3.25 qt	0-14 DBP	See label if soil organic matter is greater than 3%. Cost: \$47.00-\$56.25.
PREQUEL	1.33 oz	1.66 oz	1.66 oz	0-21 DBP	Prequel contains isoxaflutole, which is the active ingredient in Balance Flexx. Follow the environmental restrictions described for Balance Flexx. If weeds are taller than 3", add glyphosate or another tank-mix partner. Cost: \$12.25-\$15.25.
PRINCEP + 2,4-D	1.0 qt 16.0 oz	1.0 qt 16.0 oz	1.0 qt 16.0 oz	Fall before corn	Use to burn down winter annual weeds and provide residual control of some weeds in the spring. Cost \$8.50.
PYTHON + 2,4-D	0.9 oz 16.0 oz	1.1 oz 16.0 oz	1.2 oz 16.0 oz	Fall or at least 7 DBP	Do not apply to frozen soils. Cost: \$15.50-\$20.00.
SHARPEN + GLYPHOSATE + 2,4-D	2.0 oz 32.0 oz 1.0 pt	2.5 oz 32.0 oz 1.0 pt	3.0 oz 32.0 oz 1.0 pt	0-30 DBP	Apply with MSO and ammonium nitrogen fertilizer. Cost: \$18.50-\$24.75.
SURESTART II	1.5 pt	1.5-1.75 pt	2.0 pt	0-30 DBP	Use Surestart as a foundation residual herbicide in herbicide-tolerant crops. Application closer to planting provides optimal weed control. May apply to corn up to 11" tall. Cost: \$18.00-\$24.00.
SURPASS/BREAKFREE + ATRAZINE DF [■]	1.5-2.25 pt 1.2 lb	1.5-2.5 pt 1.4 lb	1.5-2.75 pt 1.7 lb	0-14 DBP	Cost: \$26.50-\$46.75
TOPNOTCH	2.5 qt	2.5-3.0 qt	3.0-3.7 qt	30-40 DBP	Cost: Topnotch \$33.75-\$50.00; Topnotch + atrazine DF \$37.75-\$55.50.
TOPNOTCH + ATRAZINE DF [■]	2.0-2.5 qt 1.2 lb	2.0-2.5 qt 1.4 lb	2.5-3.0 qt 1.7 lb	0-30 DBP	
TRIPLEFLEX	1.5 pt	1.75 pt	2.0 pt	0-30 DBP	Provides early season weed control in a two-pass weed management program. Cost: \$17.25-\$23.00.
VALOR SX + GLYPHOSATE + 2,4-D	2.0 oz 32.0 oz 16.0 oz	2.0 oz 32.0 oz 16.0 oz	2.0 oz 32.0 oz 16.0 oz	After Oct. 15 or 7-28 DBP	Do not apply to frozen soils. Do not till after application. Can rotate to dry beans next cropping season. Cost: \$19.00.
VERDICT + GLYPHOSATE	32 oz	13.0-15.0 oz 32 oz	16.0-18.0oz 32 oz	0-30 DBP	If weeds are present at application, tank-mix with glyphosate (32 oz). Apply with MSO (1 pt/A) + nitrogen source (1-2% AMS or 1 qt/A UAN). Cost: \$18.00-\$28.75.

cannot exceed 2.5 lb ai/A per calendar year. Use no more than 1.6 lb ai/A on highly erodible land with less than 30% crop residue. Using atrazine on soils with less than 1% organic matter increases carryover injury risk to susceptible crops, especially high pH soils. Do not use on sandy soils if water table is shallower than 30 ft.

Corn

Preemergence

Herbicide (See <i>Weed Response Charts</i> on pages 61-67 before selecting herbicides)	Commercial Product per Acre			Application Time, Remarks and Approximate Cost Per Acre Broadcast
	Sandy Loam < 1% OM	Silt Loam 1-2% OM	Silty-Clay Loam > 2% OM	
AATREX / ATRAZINE DF [■]	Do not use [Ⓞ]	1.0-2.2 lb	1.0-2.2 lb	EPP, PPSA, PPI, PRE, SURFACE MIX or EARLY POST — Residual activity will be shorter at lower use rates. May affect sensitive crops the following year, especially on high pH soils. Cost: \$3.25-\$7.25.
ACURON / ACURON FLEXX	2.0 qt	2.0 qt	2.25 qt	EPP, PPSA, PPI, PRE-EARLY POST UPJO V5 corn. Cost: \$40.00-\$45.00
ANTHEM MAXX	4 oz	4-5 oz	4-5 oz	EPP, PPI, Surface Mix, PRE, Early Post. Can be applied through V4 corn. Tank-mix with atrazine, Balance Flexx, Hornet, Sharpen, or Callisto to broaden weed spectrum. Cost: \$20.00-\$30.00.
ANTHEM ATZ	2.0 pt	2.0-2.5 pt	2.25-3.0 pt	EPP, PPI, Surface Mix, PRE, Early Post. Can be applied through V4 corn. Tank-mix with Balance Flexx, Hornet, Sharpen, or Callisto to broaden weed spectrum. Cost: \$24.00-\$36.00.
BALANCE FLEXX ¹	3.0 oz	3.0-5.0 oz	3.0-6.0 oz	30 DBP to V2 corn. EPP, PPSA, PRE, SURFACE MIX or EARLY POST — Balance Flexx includes a safener which reduces the risk of injury to corn. Balance Flexx may also be tank-mixed with other preemergence corn herbicides for improved residual control of some weeds. Cost: \$18.00-\$36.00.
BALANCE FLEXX ¹ + ATRAZINE DF [■]	1.0-3.0 oz 1.0 lb	3-5 oz 1.3 lb	3-6 oz 1.5 lb	30 DBP to V2 corn. EPP, PRE, SURFACE MIX or EARLY POST. Balance + atrazine improves cocklebur and sunflower control. Tank-mix Balance + atrazine with a grass herbicide (Dual, Bicep, Harness, Surpass NXT, etc.) to improve grass control. Cost: Balance Flexx + atrazine \$8.50-\$37.50.
BICEP II MAGNUM/ CINCH ATZ [■]	1.8 qt	1.8-2.1 qt	2.1 qt	EPP, PPSA, PPI, PRE, SURFACE MIX or EARLY POST — Bicep Lite at 1.5 qt/A has 40% less atrazine than Bicep II Magnum at 2.1 qt/A. Both products at these rates contain 1.25 lb S-metalochlor. Cost: Bicep II Magnum \$23.75-\$27.75; Bicep Lite II Magnum \$17.50-\$28.00.
BICEP LITE II MAGNUM/ CINCH ATZ LITE [■]	1.0 qt	1.1-1.6 qt	1.6 qt	
CALLISTO alone	6.0 oz	6.0 oz	6.0 oz	PRE. Callisto can be tank-mixed with other PRE herbicides to broaden weed control spectrum. For postemergence application, refer to post-emergence section. Cost: Callisto \$36.00; Callisto + Dual \$54.00-\$59.25; Callisto + Bicep II Magnum \$59.75-\$63.75; Callisto + Bicep Lite \$64.00-\$74.50.
or with DUAL II MAGNUM/CINCH	1.0 pt	1.3 pt	1.3 pt	
or BICEP II MAGNUM/ CINCH ATZ [■]	1.8 qt	1.8-2.1 qt	2.1 qt	
or BICEP LITE II MAGNUM/ CINCH ATZ LITE [■]	1.6 qt	1.6 qt	1.6-2.2 qt	
CORVUS + ATRAZINE	3.33 oz 1.0 qt	3.33-5.6 oz 1.0 qt	3.33-5.6 oz 1.0 qt	30 DBP to V2 corn. EPP, PPSA, PRE, SURFACE MIX or EARLY POST. Corvus includes a safener which reduces the risk of isoxaflutole injury to corn. Corvus may be tank-mixed with atrazine (0.5-1.0 lb/A) to increase the weed control and residual activity. Cost: \$27.25-\$43.50.
DEGREE	2.3-3.2 pt	3.2-4.0 pt	3.2-4.0 pt	PPSA, PRE, SURFACE MIX, or EARLY POST. Cost: \$16.00-\$28.00.
DEGREE XTRA/FULTIME NXT	2.7 qt	3.5 qt	3.5 qt	PPSA, PRE, SURFACE MIX, or EARLY POST. Cost: \$32.50-\$42.00.
DUAL II MAGNUM/CINCH or DUAL IIG MAGNUM	1.0 pt 6.0-8.0 lb	1.3 pt 8.0-10.0 lb	1.7 pt 10.0-12.0 lb	EPP, PPSA, PRE or SURFACE MIX — Dual II Magnum and Dual II Magnum + AAtrex may be applied early post. Dual II may be applied layby. Cost: Dual II Magnum \$18.00-\$30.50; Dual II Magnum + AAtrex \$21.50-\$36.25.
DUAL II MAGNUM + ATRAZINE DF [■]	1.0 pt 1.1 lb	1.3 pt 1.4 lb	1.3 pt 1.8 lb	
EXPERT	2.5 qt	3.0 qt	3.75 qt	EPP, PPSA or PRE. Cost: \$23.25-\$34.75.
FULTIME NXT	2.5-2.7 qt	2.7-3.3 qt	3.0-3.5 qt	EPP, PPSA, PRE or SURFACE MIX. See label if soil organic matter is greater than 3.0%. Cost: \$26.25-\$36.75.
G-MAX LITE [■]	2.0 pt	2.5 pt	3.5 pt	PPSA, PRE or PPI. Cost: \$21.00-\$36.75.
GUARDSMAN MAX [■]	2.4-2.8 pt	2.8-3.4 pt	3.4-4.0 pt	PPSA, PRE, PPI or EARLY POST. Cost: \$19.50-\$32.50.

¹Do not use Balance Flexx on coarse-textured soils of less than 2% organic matter if the water table is less than 25 feet. Do not use on fields prone to runoff or flooding. Crop response is most likely to occur where soils are coarse, organic matter content is less than 1.5%, and the pH is greater than 7.4. Corn seed must be covered with 1.5 to 2.0 inches of soil. Avoid planting when the surface soil is wet.

[■]Do not apply atrazine within 66 feet of where water runoff from a field will enter a stream, river, or standpipe. Do not apply atrazine within 66 feet of where water runoff from a field will enter a stream, river, or standpipe. The total amount of atrazine applied cannot exceed 2.5 lb ai/A per calendar year. Use no more than 1.6 lb ai/A on highly erodible land with less than 30% crop residue. Using atrazine on soils with less than 1% organic matter increases carryover injury risk to susceptible crops, especially high pH soils. Do not use on sandy soils if water table is shallower than 30 ft.

[Ⓞ]Rate required may pose risk of groundwater contamination.

Corn

Preemergence *(continued)*

Herbicide (See <i>Weed Response Charts</i> on pages 67-68 before selecting herbicides)	Commercial Product per Acre			Application Time, Remarks and Approximate Cost Per Acre Broadcast
	Sandy Loam < 1% OM	Silt Loam 1-2% OM	Silty-Clay Loam > 2% OM	
HARNESS/SURPASS NXT/ CONFIDENCE/BREAKFREE NXT	1.25-1.75 pt	1.75-2.25 pt	1.75-2.25 pt	PPSA, PRE, SURFACE MIX or EARLY POST. Cost: Harness/ Confidence \$19.00-\$34.25.
HARNESS XTRA/KEYSTONE LA NXT ■ or HARNESS XTRA 5.6L/ CONFIDENCE XTRA 5.6L ■	1.8 qt 1.4 qt	1.8-2.3 qt 1.7-2.4 qt	2.0-2.3 qt 2.3-2.6 qt	PPSA, PRE, SURFACE MIX, or EARLY POST. Harness XTRA applied at 2.3 qt provides 2.8 pt Harness and 1.1 lb atrazine 90DF and is designed for high-grass pressure fields. Harness XTRA 5.6L applied at 2.3 qt provides 2.0 pt Harness and 1.6 lb atrazine 90DF. Cost: Harness XTRA 5.6L \$20.25-\$37.75.
HORNET WDG	4.0 oz	4.0 oz	4.0-5.0 oz	PPSA, PRE, SURFACE MIX or EARLY POST — Controls broadleaf weeds only. Hornet WDG at 3.0-4.0 oz/A can be tank-mixed with other premix herbicides containing atrazine to broaden weed control spec- trum. Cost: \$20.00-\$25.00.
INSTIGATE	Do not use	5.25-7.0 oz	5.25-7.0 oz	PPI, PPSA, PRE, EARLY POST up to V2 corn. Can be applied up to 14 DBP. Cost: \$17.25-\$23.00.
KEYSTONE/ BREAKFREE ATZ	2.2-2.4 qt	2.4-2.8 qt	2.6-3.0 qt	PPSA, PRE or EARLY POST. See label for pre and post tank-mix combinations. See label if soil organic matter is greater than 3.0%. Cost: \$33.50-\$45.75.
KEYSTONE LA/ BREAKFREE ATZ LITE	1.6-1.8 qt	1.8-2.1 qt	1.9-2.2 qt	EPP, PPSA, PRE or EARLY POST. Contains less atrazine than Keystone. See label if soil organic matter is greater than 3.0%. Cost: \$27.50-\$38.00.
LEXAR EZ ■	3.0 qt	3.0 qt	3.0 qt	PPSA, PRE or EARLY POST — EARLY POST up to 12-inch corn. Cost: \$45.75.
LUMAX EZ ■	2.7 qt	2.7 qt	2.7-3.25 qt	PPSA, PRE or EARLY POST. Apply preplant up to 14 days before plant- ing. EARLY POST up to 12-inch corn. Cost: \$47.00-\$56.25.
OUTLOOK	10.0-14.0 oz	14.0-16.0 oz	16.0-18.0 oz	PPSA, PPI, PRE or EARLY POST. Tank mix with other PRE herbicides to broaden weed control spectrum. Cost: \$11.00-\$19.75.
PREQUEL	Do not use	1.66-2.5 oz	1.66-2.6 oz	PRE, PPSA, PPI, PP. Prequel contains isoxaflutole, which is the active ingredient in Balance Flexx. Follow the environmental restrictions de- scribed for Balance Flexx. Cost: \$15.25-\$24.00.
PROWL H ₂ O + ATRAZINE DF ■	Do not use	1.8 qt 1.33 lb	1.8 qt 1.77 lb	PRE — Corn injury may occur if replanting is necessary. Do not apply PPSA or PPI. Rainfall or irrigation shortly after application is required for weed control. Cost: \$15.25-\$16.75.
RESOLVE SG + ATRAZINE DF	Do not use	1.0-1.5 oz 0.8-1.1 lb	1.0-1.5 oz 1.0-1.5 lb	Resolve may be applied preemergence or preplant. See label for tank-mix partners. Control of emerged weeds will require the addition of a non- ionic surfactant and an ammonium nitrogen fertilizer. Cost: \$11.25-\$17.50.
RESICORE	2.25 qt	2.50 qt	2.75 qt	Cost: \$18.00-\$22.00
SHARPEN	2.0 oz	2.5 oz	3.0 oz	PPSA, PRE, SURFACE MIX. Do not apply during or after crop emergence. Controls many broadleaf weeds. For control of grasses, tank-mix with a grass herbicide if weeds are present. (Outlook, Dual, Harness, Surpass NXT, etc.). For seed corn do not exceed 2 oz/A. Cost: \$12.25-\$18.50.
SURESTART II/ TRIPLEFLEX	1.5 pt	1.5-1.75 pt	2.0 pt	0-30 DBP. Use SureStart as a residual herbicide in herbicide-tolerant crops. Application closer to planting provides optimal weed control. Tank-mix with atrazine (0.5-1.0) to enhance weed control. May apply to corn up to 11" tall. Can rotate to dry beans the next cropping season. Cost: \$18.00-\$24.00.
SURPASS/BREAKFREE	1.5-2.25 pt	1.5-2.5 pt	1.5-2.75 pt	PPSA, PRE, SURFACE MIX or EARLY POST. See label if soil organic matter is greater than 3.0%. Cost: Surpass \$22.50-\$41.25.
TOPNOTCH alone or with ATRAZINE DF ■	2.0 qt 1.1 lb	2.0-2.5 qt 1.3 lb	2.5-3.0 qt 1.5 lb	EPP, PPSA, PRE or SURFACE MIX. Cost: Topnotch \$27.00-\$40.50; Topnotch with atrazine \$30.50-\$45.50.
VERDICT	10.0-12.0	13.0-15.0	16.0-18.0	PPSA, PRE, SURFACE MIX. Controls unemerged broadleaf and grass weeds. For seed corn do not exceed 10 oz/A. Do not apply during or after crop emergence. Can rotate to dry beans or sugarbeet the next cropping season. Cost: \$18.00-\$28.75.
ZEMAX	2.0 qt	2.0 qt	2.0 qt	PPSA, PRE or EARLY POST. Do not apply more than 14 days before planting, or to corn taller than 5". Tank-mix with atrazine (0.5-1.0 lb/A) to improve broadleaf weed control. Cost: \$40.00.
ZIDUA	1.5-2.75 oz	2.0-3.0 oz	2.5-4.0 oz	PPSA, PRE, SURFACE MIX. Control unemerged broadleaf and grass weeds. If weeds are present at application, tank-mix with glyphosate. Cost: TBD.

■ Do not apply atrazine within 66 feet of where water runoff from a field will enter a stream, river, or standpipe. The total amount of atrazine applied cannot exceed 2.5 lb ai/A per calendar year. Use no more than 1.6 lb ai/A on highly erodible land with less than 30% crop residue. Using atrazine on soils with less than 1% organic matter increases carryover injury risk to susceptible crops, especially high pH soils. Do not use on sandy soils if water table is shallower than 30 ft.

Corn

Postemergence (See page 52 for spray additives)

Herbicide	Rate Per Acre	Application Time	Remarks and Approximate Cost Per Acre Broadcast
2,4-D ESTER (4L) or 2,4-D AMINE (4L)	8.0-16.0 oz 8.0-16.0 oz	Spike to 36" Broadleaves 2-6 leaf	When corn is taller than 8", reduce rate and use drop nozzles to keep spray out of corn whorl. Later applications may cause brittleness and increase greensnap risk. Hybrids vary in sensitivity to growth regulators. Cost: \$1.50-\$2.75.
ACCENT Q	0.9 oz	Corn to 20" (V6) broadcast, corn 20-36" (V10) with drops	Accent Q contains a safener to reduce crop response and is labeled for use in popcorn, sweet corn, and seed corn up to the V5 growth stage. Refer to the label for precautions on hybrid/inbred sensitivity. Do not use if Counter, Lorsban, or Thimet were applied to the crop. Do not tank-mix with Basagran, Laddock, 2,4-D or organophosphate insecticides. Apply at 15 GPA and use an NIS or COC + an ammonium nitrogen fertilizer. Cost: \$31.50.
ACCENT Q + ATRAZINE DF [■]	0.9 oz 1.1 lb	With atrazine, corn less than 12"	Refer to cautions above. To increase the weed control spectrum or residual weed control Accent also may be tank-mixed with Callisto (1.5-3.0 oz/A), Cinch or Cinch ATZ, dicamba (2.0-4.0 oz/A), Lexar EZ (2.0 pt/A), or Lumax EZ (2.0 pt/A). Cost: \$35.00.
AIM EC	0.5 oz	Corn less than V14, but if greater than V8, use drop nozzles Broadleaves 1-4" Velvetleaf up to 36"	Aim is a contact herbicide so thorough spray coverage is required. Aim increases nightshade, velvetleaf, pigweed, morningglory, and lambs-quarter control in tank mixtures with other herbicides. Aim may be tank-mixed with atrazine DF (0.5-1.1 lb/A), dicamba (6.0-8.0 oz/A), or atrazine + dicamba (0.56 lb + 4.0 oz). See dicamba precautions when using with dicamba. Cost: Aim \$3.75.
ARMEZON	0.75 oz	Emergence to V8	Cost: \$13.50.
ARMEZON + ATRAZINE DF	0.5-0.75 oz 0.3-0.55 lb	Emergence to 12"	Cost: \$10.00-\$15.25.
ARMEZON PRO + GLYPHOSATE	14-20 oz 32 oz	Emergence to V8	
ATRAZINE DF [■]	1.4-2.2 lb	Corn less than 12" Broadleaves 2-6" Grass weeds 1" or less	Apply with 1 qt/A COC or MSO. Use higher rates to control larger broadleaf weeds or if grass weeds are present. Cost: \$4.50-\$7.25.
ATRAZINE DF [■] + DICAMBA [●]	0.56-1.0 lb 9.0-16.0 oz	Corn less than V5	Observe precautions regarding dicamba use near sensitive crops. Use lower rates on sandy soils or soil with less than 2% organic matter. Cost: \$6.00-\$12.50.
BASIS BLEND	0.825-1.5 oz	Corn spike to V2 Grasses 1-2" Broadleaves 1-3"	Do not use if Counter was applied to the crop. Do not apply 3 days before or 7 days after foliar-applied organophosphate insecticides. Tank-mix Basis with 4-8 oz dicamba, or 0.5 lb atrazine for additional broadleaf control. Cost: \$7.00.
BEACON	0.38-0.76 oz	Corn 4-20" Shattercane 4-12" Broadleaves 1-4" Grasses 1-3"	Do not use if Counter insecticide was applied to the crop. Do not use Beacon within 20 days of a planting or cultivation application of any organophosphate insecticide. Do not apply Beacon within 10 days of a foliar POST organophosphate insecticide. Beacon may be applied at 0.38 oz followed by a second 0.38 oz treatment if required. Beacon (0.38 oz) may be applied with drops from 20" height and before tassel emergence. Corn hybrids vary in tolerance. Beacon may be tank-mixed with atrazine, dicamba, Buctril, or 2,4-D. Cost: Beacon \$14.50-\$29.00.
BUCTRIL + ATRAZINE [■]	1.0-1.5 pt 0.55-1.1 lb	Corn 3-leaf to 12" Broadleaves 2-6" tall	Thorough coverage and small weed size is critical for control. Cost: Buctril + atrazine \$11.75-\$18.50; Buctril + dicamba \$13.75-\$18.75.
BUCTRIL + DICAMBA [●]	1.0-1.5 pt 8.0 oz		
CADET	0.6-0.9 fl oz	Corn emergence to 48"	Cadet effectively controls velvetleaf and lambsquarters. Use with NIS (0.25% v/v) or COC (1% v/v). Apply in a minimum of 15 GPA. Tank-mix with other herbicides for added broadleaf control. If tank-mixed with glyphosate, Cadet may be applied at 0.4-0.9 fl oz/A. Preharvest interval is 70 days. Cost: \$8.00-\$12.00.

[■]Do not apply atrazine within 66 feet of where water runoff from a field will enter a stream, river, or standpipe. The total amount of atrazine applied cannot exceed 2.5 lb ai/A per calendar year. Use no more than 1.6 lb ai/A on highly erodible land with less than 30% crop residue. Using atrazine on soils with less than 1% organic matter increases carryover injury risk to susceptible crops, especially high pH soils. Do not use on sandy soils if water table is shallower than 30 ft.

[●]Dicamba rates are based on a 4.0 ae/gal formulation, like those found in Clarity. See page 203 or the *Herbicide Dictionary* for other products containing dicamba.

Corn

Postemergence (continued) (See page 52 for spray additives)

Herbicide	Rate Per Acre	Application Time	Remarks and Approximate Cost Per Acre Broadcast
CALLISTO	3.0 oz	Corn to 30" or V8 Broadleaves less than 5"	Do not apply if Counter was applied to corn. Do not apply within 7 days of a foliar organophosphate or carbamate insecticide. Cost: Callisto \$18.00.
CALLISTO + ATRAZINE [■]	2.5 oz 0.5 lb	Corn less than 12"	See precautions listed under Callisto. Apply with 1% COC. Cost: \$16.75.
CALLISTO GT	2.0 pt	Corn to 30" or V8	Only for use on glyphosate-tolerant corn hybrids. See precautions listed under Callisto. Cost: TBD
CALLISTO XTRA [■]	20.0-24.0 oz	Corn less than 12" Weeds less than 4"	See precautions listed under Callisto. Cost: \$15.25-\$18.50.
CAPRENO	3.0 oz	V1-V6 or up to 20" corn	Capreno contains an ALS herbicide (thiencarbazone-methyl) and an HPPD-inhibitor (tembotrione). Do not apply to varieties sensitive to ALS herbicides. Capreno may be tank-mixed with atrazine (0.5-1.0 lb), Liberty (22 oz), or glyphosate (32 oz) for a broader weed spectrum or improved control. If applied alone, add a COC (1% v/v) and UAN (1.5 qt/A). Cost: \$20.75.
CAPRENO + ATRAZINE DF	2.0-3.0 oz 0.55-1.1 lb	V1 to 12"	Capreno contains an ALS herbicide (thiencarbazone-methyl) and an HPPD-inhibitor (tembotrione). Do not apply to varieties sensitive to ALS herbicides. If applied alone, add a COC (1% v/v) and UAN (1.5 qt/A). Cost: \$15.75-\$24.25.
CURTAIL	2.0 pt	Spike to V4	For suppression of Canada thistle and control of broadleaf weeds. May be tank-mixed with 2-6 fl oz of Stinger to increase Canada thistle control. Do not apply to sweet corn or popcorn. Cost: \$14.75.
DIFLEXX DUO	24.0-40.0 oz	Spike to 36"; if greater than 8", use drops Broadleaves 2-6 leaf	Later applications may cause brittleness and increase greensnap risk. Use lower rate for good growing conditions to reduce corn injury. Do not use dicamba within 1/2 mile of sugarbeet, fieldbean, alfalfa, soybean, gardens, vineyards, and ornamentals unless drop tips are used and corn is over 8". Do not apply between June 20 and Sept. 1 if sensitive crops are nearby. Use higher rate of dicamba only on corn at spike to 8" and on silty clay loam containing more than 2.0% organic matter. Hybrids vary in sensitivity to growth regulator herbicides. Cost: dicamba \$3.75-\$7.50; dicamba + 2,4-D \$4.50-\$8.25.
DICAMBA [●] /DIFLEXX	8.0-16.0 oz		
DICAMBA [●] + 2,4-D ESTER (4L) or 2,4-D AMINE (4L)	8.0 oz 4.0 oz 4.0 oz		
*ENLIST DUO	3.5-4.7 qt	Up to V8 corn	Cost: \$11.00-\$15.00
EXPERT (Roundup Ready or GT corn only)	2.75-3.75 qt	Corn 0-12"	Do not tank-mix with other herbicides after corn emergence. Cost: \$25.50-\$34.75.
GLYPHOSATE [◆] (Roundup Ready Corn 2 hybrid required)	up to 48.0 oz	Corn to 48" (V12); if over 24", use drops	Can apply twice in crop with a 96 oz/A [◆] in-crop limit. Wait at least 10 days between applications. Consider using a preemergence herbicide or tank mixing glyphosate with another postemergence herbicide that matches your weed spectrum to improve weed control and reduce the risk of glyphosate resistance. Check specific glyphosate label for use details. Cost: up to \$5.00.
NOTE: Not all corn hybrids are Roundup Ready 2 hybrids. Ask your seed company about specific hybrid status. DROP NOZZLES ARE RECOMMENDED FOR ALL GLYPHOSATE APPLICATIONS AFTER CORN REACHES 24 INCHES. DROP NOZZLES MUST BE SPACED TO AVOID SPRAYING IN THE WHORL. Non-Roundup Ready 2 hybrids should not be treated with glyphosate after the corn reaches 30 inches or V8. Roundup Ready 2 hybrids should not be treated with glyphosate after reaching 48 inches or V12. Treating after corn reaches the labeled height restriction may result in crop injury and yield loss. NOT ALL GLYPHOSATE BRANDS ARE LABELED FOR APPLICATION TO CORN TALLER THAN 30 INCHES. Check the specific glyphosate brand label or label supplement for compliance.			
HALEX GT (Roundup Ready Corn 2 or GT corn only)	3.6-4.0 pt	Corn to 30" (V8); before weeds exceed 4"	Do not apply if Counter, Lorsban, or another organophosphate soil insecticide was applied. May be tank-mixed with atrazine (0.5 lb) or Status (2.5 oz). Cost: \$25.25-\$28.00.

[■]Do not apply atrazine within 66 feet of where water runoff from a field will enter a stream, river, or standpipe. The total amount of atrazine applied cannot exceed 2.5 lb ai/A per calendar year. Use no more than 1.6 lb ai/A on highly erodible land with less than 30% crop residue. Using atrazine on soils with less than 1% organic matter increases carryover injury risk to susceptible crops, especially high pH soils. Do not use on sandy soils if water table is shallower than 30 ft.

[◆]Glyphosate rates are based on a 4.0 ai/gal or 3.0 lb ae/gal formulation. See pages 186-199 for information on common glyphosate formulations.

[●]Dicamba rates are based on a 4.0 ae/gal formulation, like those found in Clarity. See page 203 or the *Herbicide Dictionary* for other products containing dicamba.

*Enlist Duo for use on Enlist corn only.

Corn

Postemergence (continued) (See page 52 for spray additives)

Herbicide	Rate Per Acre	Application Time	Remarks and Approximate Cost Per Acre Broadcast
HORNET WDG	2.0-5.0 oz	Spike to 20", if greater than 20", use drops Broadleaf weeds less than 8"	Use higher rate for control of larger weeds, dense weed populations, or when a longer residual is desired. For field corn grown for silage, application must occur before corn reaches 20" or V6. May be tank-mixed with atrazine, Buctril, dicamba, Distinct, Callisto, 2,4-D or glyphosate. Cost: \$10.00-\$25.00.
IMPACT	0.75-1.0 oz	Broadleaf weeds 2-6" For corn 24-48", apply with drop nozzles	Thorough coverage is necessary. Use higher carrier volume when treating larger weeds or dense infestations. For best results, apply with an MSO (1-1.5% v/v) plus UAN (1.25-2.5%) or AMS (1-2% v/v). Use higher adjuvant rates during dry weather. COC can be used instead of MSO if required in tank-mixes with other herbicides. No restrictions on tank additives for field, sweet, or seed corn or popcorn. Cost: \$18.75-\$25.00.
IMPACT + ATRAZINE DF [■]	0.75 oz 0.3-1.6 lb	Corn less than 12"	Use higher rates of atrazine for extended soil residual control. Apply with appropriate spray additives. Cost: \$19.75-\$30.25.
LAUDIS	3.0 oz	Corn emergence-V9 Broadleaf weeds less than 6" Grass weeds less than 3"	For sweet corn, apply up to the V7 stage. Use minimum 10 gal water. May be tank-mixed with atrazine, glyphosate, Accent, Ignite, Option, or Steadfast. Use 1% COC or MSO + 1.5 qt UAN/A or 8.5 lb AMS/100 gal. When applied in a tank-mixture with glyphosate or Liberty, use only AMS at 8.5 lb/100 gal. Can rotate to dry beans the next cropping season if corn is grown under sprinkler irrigation. Cost: \$17.00.
LAUDIS + ATRAZINE 90 DF [■]	3.0 oz 0.5 lb	Corn less than 12" Weeds 1-6"	Use minimum of 10 gal water carrier. Atrazine will increase the speed and consistency of control of some weeds and extend residual weed control. Use 1% COC or MSO + 1.5 qt UAN/A or 1.5 lb AMS/A. Cost: Laudis + Atrazine \$18.75; Laudis + Buctril \$20.75.
LAUDIS + BUCTRIL	3.0 oz 6.0 oz	Corn less than 12" Weeds 1-6"	
LIBERTY (Liberty Link hybrid required)	22.0-29.0 oz	Corn at 24" (V7) For corn 24-36", use drop nozzles to avoid spraying in whorl	For best results, apply under conditions of warm temperatures, high humidity, and bright sunlight. Apply at 15-30 GPA to ensure thorough coverage. Do not apply more than 44 oz to corn per growing season. Sequential applications should be at least 10-14 days apart. Add AMS at 3 lb/A. Cost: \$15.75-\$20.75.
LIBERTY (Liberty Link hybrid required) + ATRAZINE DF	22.0-24.0 oz 0.55-1.1 lb	Up to 12" Weeds 1-4"	Add AMS at 3 lb/A. Apply at 15-30 GPA and 35-40 psi. Use higher rates on bigger weeds. Liberty also may be tank-mixed with Capreno (2.0-3.0 oz), Callisto (2.0-3.0 oz), Armezon/Impact (0.75 oz), Laudis (2.0-3.0 oz) or Lexar EZ (2.0 qt). Cost: Liberty + atrazine \$24.25-\$37.75.
PERMIT	0.66-1.33 oz	Corn spike-layby greater than 20" use drops Broadleaf weeds 2-6"	Dicamba may be added for control of ALS-resistant weeds. Cost: \$14.50-\$29.25.
REALM Q	4.0 oz	Corn up to 20" or V7	If applied alone, add COC and UAN. May be tank-mixed with glyphosate or glufosinate. Cost: \$21.50.
REQUIRE Q	4.0 oz	V2-V7 corn 1-3" weeds	Do not apply if corn exceeds 20" tall or V7, whichever is most restrictive. May be tank-mixed with glyphosate. If applied alone, add NIS (1/4% v/v) and UAN (2 qt/A) or AMS (2 lb/A). Cost: \$12.75.
RESOLVE Q	1.25 oz	Corn up to 20" or V7	May be tank-mixed with glyphosate herbicides if applied to Roundup Ready corn, or with Liberty if applied to LibertyLink corn. For additional control of kochia, Resolve may be tank-mixed with Starane or dicamba. Cost: \$12.50.
RESOURCE	4.0-6.0 oz	Corn V2-V10 Broadleaf weeds less than 4"	Especially effective for controlling velvetleaf. Rate may be increased to 8 oz when using drop nozzles. Cost: \$8.75-\$13.25.

[■] Do not apply atrazine within 66 feet of where water runoff from a field will enter a stream, river, or standpipe. The total amount of atrazine applied cannot exceed 2.5 lb ai/A per calendar year. Use no more than 1.6 lb ai/A on highly erodible land with less than 30% crop residue. Using atrazine on soils with less than 1% organic matter increases carryover injury risk to susceptible crops, especially high pH soils. Do not use on sandy soils if water table is shallower than 30 ft.

*Glyphosate rates are based on a 4.0 ai/gal or 3.0 lb ae/gal formulation. See pages 186-199 for information on common glyphosate formulations.

•Dicamba rates are based on a 4.0 ae/gal formulation, like those found in Clarity. See page 203 or the *Herbicide Dictionary* for other products containing dicamba.

Corn

Postemergence (continued) (See page 52 for spray additives)

Herbicide	Rate Per Acre	Application Time	Remarks and Approximate Cost Per Acre Broadcast
REVULIN-Q	3.4-4 oz	Spike-V6 corn 20"	
SOLIDA	1.0 oz	Corn up to 12" or V6, whichever is most restrictive	Apply to weeds less than 3" tall. May be tank-mixed with glyphosate (for Roundup Ready hybrids), glufosinate (for Liberty Link hybrids), and other herbicides labeled for corn. Cost \$13.00
SOLSTICE	2.5-3.15 oz	Emergence up to V8 or 30"	Apply with NIS or COC. Do not apply within 7 days of OP insecticide. Addition of atrazine 0.5-1.0 lb will enhance performance. Cost: \$12.30-\$15.50.
SPIRIT	1.0 oz	Corn 4-24" If greater than 20" (V6), use drops Weeds 2-8"	Soybean rotation interval is 10 months south of I-80 and 18 months north of I-80. More rotation restrictions on soils with pH greater than 7.8. Refer to Beacon for OP insecticide restrictions. Cost: \$14.00.
STARANE ULTRA	0.4 pt	VE-V5 corn Sweet corn up to V4 Weeds less than 8"	Especially effective for controlling kochia. Can be tank-mixed with other postemergence herbicides to improve broadleaf weed control. Cost: \$15.00.
STATUS	5.0 oz	Corn 4-24"	Do not mix with products containing dicamba, 2,4-D or clopyralid. Use NIS or COC plus ammonium nitrogen fertilizer. Do not exceed 12.5 oz per season. Suppresses grasses less than 3" tall. Allow a minimum of 15 days between applications of Status. Cost: \$18.00.
STATUS + GLYPHOSATE♦	2.5 oz 32.0 oz	Corn 4-24"	Use NIS or a high surfactant oil blend plus an ammonium nitrogen fertilizer. Cost: \$12.75.
STEADFAST Q	1.5 oz	Corn to 20" or V6 Weeds 2-4"	Steadfast may be tank-mixed with atrazine (0.5-1.0 lb), Callisto + atrazine (1.5-3.0 oz + 0.5 lb), dicamba (4-8 oz), or Hornet (2-3 oz) to broaden weed control spectrum. Follow directions of the most restrictive label. Do not tank-mix with OP insecticides. Cost: Steadfast \$9.75.
STOUT	0.5-0.75 oz	Corn to 16" or V5	May be tank-mixed with other labeled postemergence herbicides to broaden weed control spectrum. Do not tank-mix with OP insecticides. Use COC or NIS and ammonium nitrogen fertilizer. Do not use liquid N as a carrier. Cost: \$13.00-\$19.50.
WIDEMATCH	1.33 pt	Corn spike to V5 Weeds less than 8"	For control of kochia and Canada thistle. Applications made after V5 must use drop nozzles. Do not apply less than 90 days before harvest. Crop injury (stem curvature, stunting, brace root injury) may occur with some hybrids. Cost: \$12.50.
YUKON	4.0-8.0 oz	Spike to 36" Weeds 1-6"	For corn more than 20", use drop nozzles. Observe dicamba label precautions. Add Accent for grass control. Cost: \$13.25-\$26.50.

■ Do not apply atrazine within 66 feet of where water runoff from a field will enter a stream, river, or standpipe. The total amount of atrazine applied cannot exceed 2.5 lb ai/A per calendar year. Use no more than 1.6 lb ai/A on highly erodible land with less than 30% crop residue. Using atrazine on soils with less than 1% organic matter increases carryover injury risk to susceptible crops, especially high pH soils. Do not use on sandy soils if water table is shallower than 30 ft.

♦ Glyphosate rates are based on a 4.0 ai/gal or 3.0 lb ae/gal formulation. See pages 186-199 for information on common glyphosate formulations.

Corn

Postemergence (continued) (See page 52 for spray additives)

Layby

Herbicide	Rate Per Acre	Application Time	Remarks and Approximate Cost Per Acre Broadcast
DUAL II MAGNUM/ CINCH	0.67-1.5 pt	Layby	Apply after furrowing or final cultivation. Cost: \$12.00-\$26.75.
OUTLOOK	10.0-21.0 oz	Corn 12-36"	Apply after furrowing or final cultivation. Cost: \$11.00-\$23.00.
PROWL H ₂ O	1.5-2.0 pt	Corn spike to layby Weeds unemerged	Rate varies by soil type. Consult label for appropriate rate. Cover brace roots by cultivation before application. Incorporate by tillage, irrigation, or rain within a week. Can be tank-mixed with glyphosate. Cost: \$9.25-\$18.50.
TRIFLURALIN	1.5-2.0 pt	Corn 2-leaf to layby Weeds unemerged	Incorporate with rainfall, sprinkler irrigation, or cultivation within 24 hours. Cost: \$4.25-\$5.75.

Harvest Aid

AIM ALONE or + 2,4-D	1.0-2.0 oz + 1.5-2 pt	Apply after beginning dent	For control and dessication of velvetleaf, morningglory, bindweed, waterhemp and other later merging weeds. Apply after hard-dough stage of corn. Pre-harvest interval: Aim-3day or 7days if mixed with 2,4-D.
2,4-D ESTER (4L)	32.0 oz	After hard dough stage (dent)	For control of sunflower, cocklebur, velvetleaf, and other late emerging broadleaf weeds. Only certain brands labeled for this use. Brittleness and kernel fill not affected if silks are dry. Cost: \$5.75.
GLYPHOSATE♦	32.0-96.0 oz	After black layer Corn less than 35% moisture	Allow a minimum of 7 days before harvest. Do not treat corn grown for seed. Cost: \$3.50-\$10.25.
GRAMOXONE SL	2.0 pt	After black layer	The pre-harvest interval (PHI) is 7 days. Add 0.25% NIS and use 20 gal per acre for ground applications or 5 gal per acre by air. Cost: \$9.50.

♦Glyphosate rates are based on a 4.0 ai/gal or 3.0 lb ae/gal formulation. See pages 186-199 for information on common glyphosate formulations.

Dry Bean

Weed Response to Selected Herbicides

Plant response may be altered by growing conditions, genetic variation in crops and weeds, soil type, pH, organic matter, and application rates. Ratings may vary from season to season and geographical areas within the state. Ratings apply when herbicides are used at rates suggested.

Site of Action†	Response Ratings: Ratings are for light to moderate weed densities, favorable conditions and weed growth stage as specified on product label. High weed densities, adverse conditions, or large weeds will reduce control. 10 = 96-100% 6 = 70-79% 9 = 90-95% 5 = 60-69% 8 = 85-90% 4-2 = less than 60% 7 = 80-84% 1 = 0	Broadleaves																Grasses						Crop Safety☐	
		Annual Morningglory	Cocklebur	Jimsonweed	Kochia	Kochia, ALS-Resistant	Kochia, Glyphosate-Resistant	Kochia, Triazine-Resistant	Lambsquarters	Nightshade (Hairy)	Pigweed	Pigweed, ALS-resistant	Ragweed	Russian Thistle	Smartweed	Sunflower	Velvetleaf	Wild Buckwheat	Barnyardgrass	Crabgrass	Fall Panicum	Foxtail	Sandbur		Shattercane/Sorghum
	Herbicide	PPI & PRE																							
15	Dual II Magnum/Dual Magnum PPI/PRE	4	4	4	4	4	4	4	7	7	8	8	5	4	5	1	5	2	8	9	9	9	7	7	2
8	Eptam-PPI	6	4	5	7	7	7	7	7	7	7	7	6	4	5	3	5	6	6	9	9	9	9	9	1
8+15	Eptam + Dual II Magnum-PPI	5	5	5	6	6	6	6	8	8	9	9	5	5	5	3	5	6	9	9	9	9	9	8	2
8+2	Eptam + Permit-PPI	6	9	8	7	7	7	7	7	7	9	7	9	5	7	9	9	6	6	9	9	9	9	9	2
8+3	Eptam + Sonalan-PPI	5	5	7	9	9	9	9	9	9	9	9	5	5	5	1	5	6	9	9	9	9	9	9	1
8+3	Eptam + Treflan or Prowl H ₂ O-PPI	5	6	6	9	9	9	9	9	7	9	9	5	5	5	1	5	6	9	9	9	9	9	9	1
15	Intro-PPI	4	4	5	6	6	6	6	6	7	9	9	7	4	4	1	4	5	7	9	9	9	7	4	2
15+8	Intro + Eptam-PPI	5	4	7	7	7	7	7	7	8	9	9	5	5	5	1	5	5	9	9	9	9	9	7	2
15+3	Intro + Treflan-PPI	5	5	5	9	9	9	9	8	8	9	9	5	5	5	1	5	5	7	9	9	9	9	7	2
15+8	Outlook + Eptam-PPI	5	4	5	7	7	7	7	9	8	9	9	5	5	5	1	5	5	9	9	9	9	9	9	2
15+3	Outlook + Sonalan-PPI	5	4	5	8	8	8	8	9	8	9	9	5	9	5	1	5	5	9	9	9	9	8	9	2
15	Outlook-PRE	1	2	1	2	2	2	2	7	6	8	8	5	3	3	1	2	1	8	8	8	9	6	3	1
15+3	Outlook + Prowl H ₂ O-PRE	5	4	5	8	8	8	8	8	7	9	9	5	9	5	1	5	5	9	9	9	9	8	9	2
2	Permit-PRE	1	9	8	6	4	4	6	5	1	9	2	9	5	7	9	9	5	1	1	1	1	1	1	2
3	Prowl H ₂ O - PPI/PRE	5	5	5	8	8	8	8	7	6	8	8	5	8	5	1	5	5	8	8	8	8	8	9	2
		POST																							
1	Arrow + COC	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	8	9	9	9	9	9	1
1	Assure II + COC	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	8	8	8	9	6	9	1
6	Basagran	5	7	8	8	8	8	8	8	7	5	5	5	4	8	8	7	6	1	1	1	1	1	1	2
1	Poast	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	6	9	9	9	9	9	1
2	Pursuit	7	8	7	8	4	8	8	4	7	8	2	7	7	7	7	7	4	5	5	1	5	4	9	4
2+6	Pursuit + Basagran	7	8	8	8	8	8	8	7	8	8	5	7	7	8	8	7	6	5	5	1	5	4	8	2
2+6	Raptor + Basagran	7	8	8	8	8	8	8	8	9	9	5	7	7	8	8	7	7	5	7	1	7	5	8	2
14	Reflex + COC	8	4	8	8	8	8	8	6	7	9	9	7	4	4	4	4	5	2	2	2	2	2	2	1
1	Select Max + COC	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	8	9	9	9	9	9	1
2+6	Varisto	7	8	8	8	6	8	7	8	9	9	5	7	7	8	8	7	7	5	7	1	7	5	8	2

☐Varieties differ in their response to herbicides. Crop safety ratings less than 3 indicate that crop yield should not be affected by any direct injury.

†See pages 8-10 for more information on classification of herbicides by mode and site of action.

Dry Bean

Preplant

Herbicide	Commercial Product per Acre			Application Time, Remarks and Approximate Cost Per Acre Broadcast
	Sandy Loam < 1% OM	Silt Loam 1-2% OM	Silty-Clay Loam > 2% OM	
DUAL II MAGNUM/ DUAL MAGNUM/CINCH	1.0 pt	1.33 pt	1.67 pt	PPI or PRE — Surface mixing will improve weed control and reduce crop injury. Cost: \$16.00-\$27.00.
EPTAM 20G or EPTAM 7E	15.0 lb 3.5 pt	20.0 lb 4.5 pt	— —	PPI or Layby — Apply to dry surface soil; immediately incorporate with disk or field cultivator. Apply layby at time of last cultivation as a directed spray or direct granules to the base of the plants before bean pods start to form. Do not feed or pasture vines within 45 days after application. Cost: \$24.00-\$31.00.
EPTAM with SONALAN or with PROWL H ₂ O or with TRIFLURALIN or with PERMIT	3.0 pt 5.0 pt 5.2 pt 3.0 pt 0.66 oz	3.0 pt 2.0 pt 2.0 pt 1.0 pt 0.66 oz	— — — — 0.66 oz	PPI — Apply to dry surface soil, immediately incorporate with a disk or field cultivator. Sonalan, Treflan, or Prowl may injure fall seeded small grains, or spring seeded sugarbeet or sorghum the following year. Cost: Eptam + Sonalan \$33.25; Eptam + Prowl H ₂ O \$33.75; Eptam + Trifluralin \$24.50; Eptam + Dual Magnum/Cinch \$36.25; Intro \$32.75; Eptam + Permit \$31.25-\$38.25.
EPTAM with DUAL MAGNUM 125/CINCH	3.0 pt 1.0 pt	3.0 pt 1.0 pt	— —	
INTRRO	3.0 qt	3.0 qt	—	
INTRRO + EPTAM (7E) or with TRIFLURALIN	2.5 qt 2.5 pt 1.0 pt	2.5 qt 2.5 pt 1.0 pt	— — —	PPI — Apply to dry surface soil, immediately incorporate. Trifluralin at 1 pt may injure fall seeded small grain or spring seeded sugarbeet or sorghum the following year. Cost: Intro + Eptam \$37.00; Intro + Trifluralin \$24.38; Trifluralin + Dual Magnum \$20.50.
TRIFLURALIN with DUAL MAGNUM	1.0 pt 1.0 pt	1.0 pt 1.0 pt	— —	
OUTLOOK	13.0 oz	14.0 oz	16.0 oz	PPI, PRE or early POST (first to third trifoliate stage) — Dry beans may be harvested 70 days or more after application. Cost: \$14.25-\$17.50.
OUTLOOK with PROWL H ₂ O or with SONALAN or with EPTAM	13.0 oz 2.0 pt 2.0 pt 2.5 pt	14.0 oz 2.0 pt 2.0 pt 2.5 pt	— — — —	PPI — Apply to dry surface soil, immediately incorporate with a disk or field cultivator. Outlook + Prowl H ₂ O can be applied PRE. Cost: Outlook + Prowl H ₂ O \$26.50-\$29.75; Outlook + Sonalan \$26.25-\$29.50; Outlook + Eptam \$30.00-\$33.25.
PERMIT	0.5 oz	0.66 oz	0.66 oz	PPI, PRE — Apply before crop and weed emergence or as a row middle/furrow application. Cost: \$11.25-\$15.00.
PROWL H ₂ O	2.0 oz	2.0 oz	—	PPI, PRE — Apply before crop and weed emergence. Cost: \$12.00.

Dry Bean

Postemergence

Herbicide	Commercial Product per Acre	Application Time, Remarks and Approximate Cost Per Acre Broadcast
ASSURE II/TARGA + COC	5.0-10.0 oz 1.0 qt	POST — Susceptible grasses less than 4" tall. Dry bean tolerant at all growth stages. Do not apply within 30 days of harvest. Selected rate for volunteer corn — 9 oz. Cost: \$4.00-\$8.25.
BASAGRAN 5L + COC + UAN	1.2-1.6 pt 1.0 qt + 2.0 qt	POST — First trifoliolate leaf stage. Broadleaf weeds 1-2" tall. Weeds showing moisture stress or over 6 inches tall are poorly controlled. Controls hairy but not eastern black nightshade. Cost: \$15.00-\$30.00.
POAST + COC	16.0-24.0 oz 1.0 qt	POST — Susceptible weeds less than 4" tall. Dry bean tolerant at all growth stages. Good coverage essential. Suggested rate for volunteer corn — 24 oz. Cost: \$13.25-\$19.75.
PURSUIT + BASAGRAN 5L + NONIONIC SURFACTANT (NIS) + UAN	3.0 oz 1.2 pt 1.0 qt/100.0 gal 2.0 qt/A	POST — Dry bean must have one trifoliolate leaf. Apply Pursuit prior to bloom stage. Pursuit and Pursuit + Basagran require the addition of an adjuvant. Pursuit will carry over. Do not plant sugarbeet for 40 months. Allow at least 60 days between Pursuit application and harvest. Cost: Pursuit \$10.75; Pursuit + Basagran \$25.75.
PURSUIT + NONIONIC SURFACTANT (NIS) + UAN	3.0 oz 1.0 qt/100.0 gal 2.0 qt/A	
RAPTOR + BASAGRAN 5L + NONIONIC SURFACTANT (NIS) + UAN	4.0 oz 1.2 pt 1.0 qt/100.0 gal 2.0 qt/A	POST — Dry bean must have at least one fully expanded trifoliolate leaf. Apply Raptor prior to bloom stage, do not apply when beans are blooming. Raptor will carry over. Do not plant sugarbeet for 18 months. Cost: \$33.25.
REFLEX	1.0 pt	POST — For use only where dry beans are grown under sprinkler or center pivot irrigation. Susceptible weeds 1-2" tall. Do not plant sugarbeet, alfalfa, sunflowers, or sorghum for 18 months following Reflex. Do not apply within 45 days of harvest. Cost: \$17.75.
ARROW + COC	6.0-16.0 oz 1.75 qt/A	POST — Grasses 6" tall. Do not apply within 30 days of dry bean harvest, cutting, or pulling plants from ground. Suggested rate for volunteer corn — Select Max at 9 oz. Cost: Select Max \$8.50-\$11.50; Arrow \$5.75-\$7.50.
SELECT MAX + NIS + AMS	9.0-12.0 oz 1.0 qt	
VARISTO + MSO + UAN	21.0 oz 1% 2.5%	POST — Dry bean must have at least one fully expanded trifoliolate leaf. Cost: \$30.50 an acre.

Harvest Aid

AIM EC	2.5-3.0 oz/A	Add COC or MSO 1-2% V/V. Apply when pods are buckskin colored and no more than 30% of leaves remain. 3-day preharvest interval. Can be tank-mixed with gramoxone or glyphosate.
GRAMOXONE SL	2.0 pt	Desiccant. Add NIS at 1 qt per 100 gal spray solution. Apply when at least 80% of pods are yellowing and no more than 30% of leaves are still green. Do not harvest within 7 days of application. Add 1 qt nonionic surfactant/100 gal. It can be combined with 15 gallons or more of 32-0-0 per acre for increased dessication. Cost: \$8.50.
ROUNDUP WEATHERMAX	22.0 oz	Add AMS at 17 lb/100 gal of spray solution. Apply at the hard dough stage of dry bean seed (30% grain moisture or less). Do not harvest within 7 days of application and do not feed treated vines to livestock. Cost: \$3.25.
SHARPEN	1.0-2.0 oz	Desiccant. Add 1 pt. MSO/A and VAN or AMS. Apply when at least 80% of pods are yellow and no more than 30% of the leaves are green. Do not harvest for a minimum of 2 days after application, but results may take up to 7 days.. Cost: \$6.25-\$12.50.
VALOR + MSO	2.0 oz	Add MSO at 1 qt/A. Apply when 80% of pods are yellowing. Do not harvest within 5 days of application. Cost \$13.50.

Ecofarming

Ecofarming (ecofallow) is a system based on quality winter wheat stubble and timely weed control. Good quality stubble is the result of growing adapted winter wheat varieties competitive with weeds along with good disease and insect resistance. Proper planting date, fertilization according to needs, weed control in the growing wheat, harvest with minimum grain loss and good chaff and long straw distribution all contribute to the success of this program. Herbicides should be applied within 30 days after wheat harvest for wheat grown with a 10- to 14-month fallow period. If winter wheat is planted following soybean, corn, or grain sorghum, herbicides should be applied within 15 to 20 days after wheat harvest. Weather and weed conditions need to be correct for good results.

Glyphosates (generic), Fallow Star, Gramoxone SL plus atrazine and Landmaster BW will control established broadleaf and grass weeds, and volunteer wheat, depending on herbicide rate, plant height, density, and species. Check labels for use and additives. If rain is expected within six hours, Gramoxone plus atrazine is a good choice. The rainfall period required for glyphosate products can be shortened by increasing the rate and not adding atrazine to the tank-mix. Mixing atrazine with glyphosate products can create antagonism and decrease performance.

Maximum benefits from ecofarming, including moisture conservation and prevention of weed seed production, usually occur when treatments are timely. This is on the condition that weeds are not under drought stress, the straw has settled, dust is not press-

ent on the plants, and good coverage of the plants is possible with the spray solution. Small weeds are easier to control with the nonselective translocating herbicides containing glyphosate. Gramoxone SL plus atrazine is usually more effective in controlling small weeds or when they approach maturity.

If weeds recover from initial after-harvest herbicide applications or if volunteer wheat emerges, retreat with glyphosate. More effort is needed to prevent weeds from producing seeds in the wheat stubble.

Volunteer winter wheat and/or downy brome or jointed goatgrass are not always controlled with July and early August atrazine treatments. A split after-harvest treatment with an early application of Fallow Star, glyphosates, or Landmaster BW followed by 1 lb/A or more of atrazine plus Gramoxone SL (if needed) applied in September can be an effective control measure. If maximum rates of atrazine are applied in the fall, do not add additional atrazine in the spring. Lower rates of atrazine (or none at all) need to be used on eroded areas, on soils with less than 1.2% organic matter, on soils with a pH of 7.0 or greater, some terraces, Canyon and Rosebud soils, and caliche outcroppings.

High atrazine rates may carry over and destroy wheat on these areas. Do not apply more than 2.25 lb active ingredient of atrazine per acre per year. This equates to 2.5 lb 90DF or 2.25 qt atrazine 4L.

In the spring, use glyphosate to kill volunteer wheat and annual bromes in March to prevent soil moisture loss. Consider banding

over the row in weedy fields at planting for planters which disturb the soil and remove some of the preplant herbicide. Therefore, herbicides might not be as effective and grain yields may be poorer than fields treated in late summer and fall. Also, the soil moisture lost after harvest may be critical to the crop if the moisture during the winter and spring is limited.

If a producer wants to try the spring-only treatment, the following is suggested. Apply glyphosate, Fallow Star, RT Master, Landmaster BW, or Touchdown with atrazine as soon as good growing conditions exist in the early spring to control volunteer wheat and downy brome. Add or increase the AAtrex/atrazine to the lower of the maximum labeled rate or the amount the crop can tolerate and still not cause damage to the succeeding crop. Be sure to add a grass herbicide. Add Gramoxone SL or glyphosate products at 1.5 to 2.0 pt/A after April 15 depending upon size of weeds. Rates depend on soil type, pH, organic matter, time of application, and weed size. For corn or sorghum use 1.4-1.8 lb/A atrazine.

Dual II Magnum or Bicep II Magnum, Fultime NXT, or Lumax EZ should be applied up to 20 days before corn or sorghum planting. Balance Flexx should not be applied more than seven days before corn planting unless a planned sequential application of a POST herbicide is used. For sorghum, use a seed treatment for Dual II Magnum, Bicep II Magnum, or Lumax EZ to prevent herbicide injury.

Into Last Year's Spring Small Grain Stubble Planting Row Crops No-till (Oat, Spring Wheat, and Spring Barley)

The spring small grains are not as competitive with weeds as winter wheat. This is because the winter wheat is established in the fall and starts growth early in the spring before most weeds germinate. With good stands of winter wheat most weeds, except for winter annual weeds, are not a problem.

The quality and quantity of winter wheat stubble and straw is also superior and longer lasting than the spring grain crops. The winter wheat stubble and straw is more effective in suppressing weeds. While planting crops no-till into last year's small grain can be successful, it also can be a disaster if the

herbicide treatments are not timely, properly selected, applied properly, and results are not evaluated to determine if retreatment or other weed control measures are necessary.

The key to this program is weed control after spring small grain harvest. Keeping the weeds from producing seeds and using stored soil moisture is done with a timely herbicide treatment after harvest. The herbicide treatments listed for winter wheat after harvest can be used in spring small grain stubble in most situations. The higher labeled rates of herbicides are usually required. Glyphosate, Fallow Star, and Landmaster BW are usually

the choice nonselective herbicides for control of emerged summer annual grass weeds that are growing rapidly. As weeds approach maturity, Gramoxone SL plus atrazine may be used. If atrazine is used in the fall treatment, the next crop must be tolerant to it at the rate used (check label).

The spring herbicide treatment is necessary. Again, check the rates, etc. for the crop in the ecofarming section. Check labels and be sure to control volunteer crops. Also, do not disturb the herbicide treatment with tillage if a residual herbicide was applied last fall.

Continuous Winter Wheat and Winter Wheat Following Soybean

Continuous Winter Wheat. Select winter wheat fields that are free of downy brome, hairy chess, Japanese brome, and jointed goatgrass. Apply glyphosate, Fallow Master or Landmaster BW within 30 days after winter wheat harvest but before summer annual weeds head. Apply glyphosate about 10 days before winter wheat planting.

No-till Wheat Following Soybean Harvest. Select early maturing soybean cultivars so that winter wheat can be planted within the optimum window. Plant wheat at 90 lb/A dryland and 120 lb/A irrigated with a no-till drill equipped to apply starter fertilizer in the row with the seed. Weeds such as kochia are a

problem in late planted winter wheat. Therefore, a herbicide treatment is usually needed in the spring. Use Ally or Amber plus 2,4-D as 2,4-D is ineffective on triazine-resistant kochia because late seeded wheat is less competitive. Buctril or Starane may not be effective because of multiple flushes of kochia.

Ecofarming

Weed Response to Herbicides Applied After Winter Wheat Harvest

Site of Action	Response Ratings: Ratings are for light to moderate weed densities, favorable conditions and weed growth stage as specified on product label. High weed densities, adverse conditions, or large weeds will reduce control. 10 = 96-100% 5 = 60-69% 9 = 90-95% 4-2 = less than 60% 8 = 85-90% 7 = 80-84% 1 = 0 6 = 70-79%	Broadleaf Weeds													Summer Annual Grasses													Winter Annual Grasses		
		Buffalobur	Common Sunflower	Kochia	Kochia, Glyphosate-Resistant	Lambsquarters	Marestail	Penn. Smartweed	Pigweed spp.	Prickly Lettuce	Russian Thistle	Spurge (Toothed or Spotted)	Tall Knotweed	Wild Buckwheat	Barnyardgrass	Crabgrass	Fall Panicum	Green Foxtail	Prairie Cupgrass	Sandbur	Shattercane	Stinkgrass	Witchgrass	Yellow Foxtail	Downy Brome	Jointed Goatgrass	Volunteer Wheat			
	Herbicide	6 inches tall or less													4 inches tall													4 inches tall		
9+4	Fallow Star ¹	10	10	10	8	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
9	Glyphosate	10	10	8	1	9	8	9	10	8	8	5	8	6	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
9+5	Glyphosate + atrazine	10	10	7	5	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
22	Gramoxone SL ¹	10	10	10	10	10	10	5	10	10	9	10	10	10	4	2	2	7	2	5	5	8	8	4	10	10	10	10	10	10
22+5	Gramoxone SL ¹ + atrazine	10	10	10	10	10	10	10	10	10	10	10	10	10	9	7	7	10	6	9	7	10	10	9	10	10	10	10	10	10
9+4	Landmaster BW	10	10	10	6	10	10	10	10	8	10	9	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
9+4+5	Landmaster BW + atrazine	10	10	8	7	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
14+9	Sharpen (2.0 oz) + glyphosate	10	10	8	8	10	9	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
		12 inches tall													Tillered to boot													Tillered to boot		
9+4	Fallow Star	10	10	8	8	10	8	10	8	8	8	7	9	8	8	8	8	10	6	8	10	10	8	8	10	10	10	10	10	10
9	Glyphosate	8	8	5	7	6	6	6	6	4	6	2	6	3	7	7	7	10	5	7	9	9	7	7	10	10	10	10	10	10
9+5+4	Glyphosate + atrazine + 2,4-D	9	9	7	1	9	9	9	9	7	9	6	9	8	4	5	5	9	3	7	9	9	7	5	10	10	10	10	10	10
22	Gramoxone SL	7	7	7	6	7	7	4	7	7	7	7	7	9	3	1	1	4	1	3	3	5	4	4	6	6	6	6	6	6
22+5+4	Gramoxone SL + atrazine + 2,4-D	10	10	10	7	10	10	8	10	10	10	10	10	9	3	2	2	4	2	3	3	7	6	4	9	9	9	9	9	9
9+4	Landmaster BW	10	10	8	10	10	8	9	8	8	8	7	9	8	8	8	8	10	6	8	10	10	8	8	10	10	10	10	10	10
9+4+5	Landmaster BW + atrazine	10	10	8	5	10	10	10	10	8	9	8	10	10	5	6	6	10	4	8	10	10	8	7	10	10	10	10	10	10
9	Glyphosate (48.0 oz)	9	10	7	6	8	7	7	8	6	7	3	8	5	8	8	8	10	6	8	10	10	8	8	10	10	10	10	10	10
9+5	Glyphosate (48.0 oz) + atrazine + 2,4-D	9	9	7	1	9	9	9	9	7	9	6	9	9	7	7	7	10	5	7	9	9	7	7	10	10	10	10	10	10
14+9	Sharpen (2.0 oz) + glyphosate + MSO	9	9	7	6	9	8	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9
		24 inches tall													Headed													Headed		
9+4	Fallow Star	8	7	6	5	7	8	8	8	8	8	5	7	6	8	9	9	10	6	10	10	10	10	8	10	10	10	10	10	10
9	Glyphosate (48.0 oz)	7	7	4	1	5	6	6	6	4	7	2	6	3	8	9	9	10	6	10	10	10	8	8	10	10	10	10	10	10
9+5+4	Glyphosate (48.0 oz) + atrazine + 2,4-D	9	10	7	4	8	7	7	8	6	7	3	8	5	8	8	8	10	6	8	10	10	8	8	10	10	10	10	10	10
22	Gramoxone SL	8	7	8	8	8	9	4	8	8	7	6	7	8	6	6	6	7	6	7	4	8	8	8	9	9	9	9	9	9
22+5+4	Gramoxone SL + atrazine + 2,4-D	10	10	10	10	9	10	7	10	10	10	9	8	10	8	9	9	10	7	10	6	10	10	10	10	10	10	10	10	10
9+4	Landmaster BW	8	7	5	4	7	8	8	8	8	8	5	7	5	8	9	9	10	5	10	10	10	8	8	10	10	10	10	10	10
9+5+4	Landmaster BW + atrazine	10	10	7	5	9	8	9	10	10	8	6	8	10	7	8	8	10	6	9	10	10	8	9	10	10	10	10	10	10

¹Rate is: 90.0 oz/A Fallow Star, 2.25 pt/A for Gramoxone SL, 80.0 oz/A for Landmaster BW, 32.0 oz/A for glyphosate. These rates should be helpful in preventing weeds from developing resistance to glyphosate. Atrazine rate is 2.0 qt/A and the 2,4-D amine rate (3.8 lb EC) is 1.5 pt/A when weeds are above 8 inches tall. Increasing the rate of glyphosate products will improve control of difficult weeds. For example, to control barnyardgrass, yellow foxtail, or prairie cupgrass may require 24.0 oz/A of glyphosate alone or 16.0-32.0 oz/A when mixed with atrazine. All ratings include the addition of the recommended additives.

♦See pages 186-199 for information on common glyphosate formulations.

Ecofarming (See page 52 for spray additives)

Herbicides to use after winter wheat harvest, with winter wheat planted in 2 to 3 months (continuous winter wheat), in 12 to 14 months (fall treatment in winter wheat-fallow), or in 4-5 months (spring treatment in winter wheat-fallow). Where split treatments are listed, they give the best results.

Herbicide	Commercial Product per Acre			Application Time	Remarks and Approximate Cost Per Acre Broadcast
	Sandy Loam < 1% OM	Silt Loam 1-2% OM	Silty-Clay Loam > 2% OM		
Winter wheat stubble to be seeded 2-3 months later to winter wheat (continuous wheat) Herbicides to be used within 30 days after wheat harvest.					
2,4-D ESTER (4L) or RUGGED or WEEDMASTER	32.0 oz	32.0 oz	32.0 oz	For common purslane when growing actively	Do not plant small grains for 15 days. Cost: \$4.50.
GLYPHOSATE♦ + WEEDMASTER	32.0 oz 16.0 oz	32.0 oz 16.0 oz	32.0 oz 16.0 oz	POST; two or more applications required. Wait 15 days before planting wheat with Landmaster BW	If volunteer wheat develops close to planting, treat with glyphosate. To facilitate drilling, stubble should be no taller than 12" with good straw and chaff distribution. Cost: glyphosate + weedmaster \$7.25; Landmaster BW \$8.00-\$12.00.
LANDMASTER BW	54.0-80.0 oz	54.0-80.0 oz	54.0-80.0 oz		
SHARPEN + GLYPHOSATE♦	2.0 oz 32.0 oz	2.0 oz 32.0 oz	2.0 oz 32.0 oz	Apply anytime up to wheat emergence	Add MSO at 1% v/v or 1 pt/A minimum. Add AMS at 1-2%. Cost: \$15.75-\$17.25.
VALOR SX	2.0 oz	2.5 oz	3.0 oz		Add Roundup or 2,4-D for emerged weeds. Wait 30 days before planting wheat with the 2 oz rate, and 60 days with the 3 oz rate. Cost: \$15.00-\$23.00.
Winter wheat stubble to be seeded to winter wheat 12-14 months later (fallow aid) ————— Single Application —————					
ATRAZINE DF■ + GRAMOXONE SL	0.6 lb 2.0-3.0 pt	1.1 lb 2.0-3.0 pt	1.1 lb 2.0-3.0 pt	Aug 10-Sept 10 (12 months or more before seeding)	Spray before weeds produce seed and when they are not under drought stress. Volunteer wheat and downy brome control are better with late August and early September application. Adding 1 pt 2,4-D ester to atrazine + Gramoxone SL to improve control of broadleaf weeds may decrease control of grasses. Cost: atrazine + Gramoxone SL \$9.50-\$14.25; atrazine + Gramoxone SL + 2,4-D \$11.75-\$18.75; atrazine + Landmaster BW \$11.50-\$15.75; glyphosate + atrazine \$5.25-\$7.00.
ATRAZINE DF■ + GRAMOXONE SL + 2,4-D ESTER (4L) or RUGGED or WEEDMASTER	0.6 lb 2.0-3.0 pt 16.0 oz	1.1 lb 2.0-3.0 pt 32.0 oz	1.1 lb 2.0-3.0 pt 32.0 oz		
ATRAZINE DF■ + LANDMASTER BW or GLYPHOSATE♦ + WEEDMASTER	0.6 lb 64.0-80.0 oz 32.0 oz 16.0 oz	1.1 lb 64.0-80.0 oz 32.0 oz 16.0 oz	1.1 lb 64.0-80.0 oz 32.0 oz 16.0 oz		
AUTHORITY MTZ + ATRAZINE + LANDMASTER BW	10.0-14.0 oz 1.0 lb 64.0-80.0 oz	10.0-14.0 oz 1.0 lb 64.0-80.0 oz	10.0-14.0 oz 1.0 lb 64.0-80.0 oz		
GLYPHOSATE♦ + VALOR SX	32.0 oz 2.0 oz	32.0 oz 3.0 oz	32.0 oz 4.0 oz		Improved burndown and control of certain weeds. Downy brome suppressed. Cost: glyphosate + Valor \$18.75-\$34.00.
SHARPEN + GLYPHOSATE♦	2.0 oz 32.0 oz	2.0 oz 32.0 oz	2.0 oz 32.0 oz	Apply anytime up to wheat emergence	Add MSO at 1% v/v or 1 pt/A minimum. Add AMS at 1-2%. Cost: \$17.25.
SPARTAN CHARGE + ATRAZINE + LANDMASTER BW	6.5-8.0 oz 1.0 lb 64.0-80.0 oz				Spartan aids in kochia control. Cost: \$35.00-\$42.75.

♦Glyphosate rates are based on a 4.0 ai/gal or 3.0 lb ae/gal formulation. See pages 186-199 for information on common glyphosate formulations.

■Using atrazine on soils with less than 1% organic matter increases carryover injury risk to susceptible crops, especially high pH soils. Do not use on sandy soils if water table is shallower than 30 ft.

Ecofarming *(continued) (See page 52 for spray additives)*

Herbicide	Commercial Product per Acre			Application Time	Remarks and Approximate Cost Per Acre Broadcast
	Sandy Loam < 1% OM	Silt Loam 1-2% OM	Silty-Clay Loam > 2% OM		
Two Applications — Split Treatments					
LANDMASTER BW or GLYPHOSATE♦ followed by ATRAZINE DF■	54.0-80.0 oz 32.0 oz 0.6-1.1 lb	54.0-80.0 oz 32.0 oz 1.1 lb	54.0-80.0 oz 32.0 oz 1.1 lb	Apply glyphosate product after harvest. Apply atrazine Aug. 20 - Sept 10. A burn-down treatment may be needed with this application.	Good for weeds that are present early. Use Gramoxone SL or Roundup Original with atrazine on weeds present in late August to early September. A burndown herbicide may be needed with this application. Cost: Landmaster BW followed by atrazine \$10.00-\$15.75; glyphosate fb atrazine \$5.25-\$7.00.
Winter wheat stubble to be seeded to winter wheat 4-5 months later (fallow aid)					
AUTHORITY MTZ	8.0 oz	8.0-10.0 oz	12.0-14.0 oz	Prior to weed emergence	A residual treatment for kochia, Russian thistle, and pigweed. Apply at least 4 months prior to planting corn or wheat and 10 months prior to planting sorghum. Cost: \$14.00-\$24.50.
GLYPHOSATE♦ + VALOR	32.0 oz 2.0 oz	32.0 oz 2.5 oz	32.0 oz 3.0 oz	April or before boot stage of grass weeds	Improved burndown and control of certain weeds. Downy brome suppressed. Cost: glyphosate + Valor \$18.75-\$26.25; glyphosate \$3.25; Landmaster BW \$8.00-\$12.00.
GLYPHOSATE♦	32.0 oz	32.0 oz	32.0 oz		
LANDMASTER BW	54.0-80.0 oz	54.0-80.0 oz	54.0-80.0 oz		
SHARPEN + GLYPHOSATE♦	2.0 oz 32.0 oz	2.0 oz 32.0 oz	2.0 oz 32.0 oz	Apply anytime up to wheat emergence	Add MSO at 1% v/v or 1 pt/A minimum. Add AMS at 1-2%. Cost: \$17.25.
TORDON 22K + 2,4-D ester (4L) or RUGGED or WEEDMASTER	1.5 oz 12.0 oz	1.5 oz 12.0 oz	1.5 oz 12.0 oz	May 15 to June 15	Helps control wild buckwheat. 2,4-D ester (4L) \$1.75.
Winter wheat stubble to be planted to corn or sorghum the next spring (also see page 70)					
Herbicides to be used within 30 days after winter wheat harvest and 4 to 6 weeks later for split treatments.					
Single Application					
AUTHORITY MTZ + LANDMASTER BW	8.0 oz 64.0-80.0 oz	10.0 oz 64.0-80.0 oz	12.0 oz 64.0-80.0 oz		Spartan Charge and Authority MTZ have a 4-month restriction to plant wheat. Aids in control of kochia, Russian thistle, pigweed. Cost: \$31.50-\$45.50. Apply at least 4 months prior to planting corn or wheat and 10 months prior to planting sorghum.
BICEP II MAGNUM■	2.67 qt	2.67 qt	2.67 qt	In fall after frost and soils are less than 50°F.	Apply to untilled wheat stubble. Cost: \$32.00.
GRAMOXONE SL + ATRAZINE DF■ + 2,4-D or RUGGED or WEEDMASTER	2.0-3.0 pt 2.2 lb 16.0 oz	2.0-3.0 pt 2.2 lb 16.0 oz	2.0-3.0 pt 2.2 lb 16.0 oz	July-Aug. depending upon temperature and rainfall	Spray after wheat harvest and before weeds produce seed. If weeds recover, kill weeds before they develop seed. Volunteer wheat and downy brome control is better with late Aug.-Oct. applications. Barnyardgrass and yellow foxtail control requires 86.0 oz/A of Landmaster BW. Cost: atrazine + Gramoxone SL \$16.75-\$21.50; atrazine + Landmaster BW \$16.75-\$19.25; atrazine + glyphosate \$10.50.
LANDMASTER BW or GLYPHOSATE♦ + ATRAZINE DF■	64.0-80.0 oz 32.0 oz 2.2 lb	64.0-80.0 oz 32.0 oz 2.2 lb	64.0-80.0 oz 32.0 oz 2.2 lb		
GLYPHOSATE♦ + VALOR	32.0 oz 2.0 oz	32.0 oz 2.5 oz	32.0 oz 3.0 oz		

♦Glyphosate rates are based on a 4.0 ai/gal or 3.0 lb ae/gal formulation. See pages 193-199 for information on common glyphosate formulations.

■Using atrazine on soils with less than 1% organic matter increases carryover injury risk to susceptible crops, especially high pH soils. Do not use on sandy soils if water table is shallower than 30 ft.

Ecofarming (continued) (See page 52 for spray additives)

Herbicide	Commercial Product per Acre			Application Time	Remarks and Approximate Cost Per Acre Broadcast
	Sandy Loam < 1% OM	Silt Loam 1-2% OM	Silty-Clay Loam > 2% OM		
HARNESS XTRA/KEYSTONE LA NXT	2.3 qt	3.0 qt	3.0 qt		Cost: \$34.00-\$45.00.
SHARPEN + GLYPHOSATE♦	2.0 oz 32.0 oz	2.0 oz 32.0 oz	2.0 oz 32.0 oz		Cost: \$15.75.
SPARTAN CHARGE + LANDMASTER BW	4.0 oz 64.0-80.0 oz	5.0 oz 64.0-80.0 oz	6.0 oz 64.0-80.0 oz		Spartan Charge and Authority MTZ have a 4-month restriction to plant wheat. For control of spring emerging kochia and Russian thistle. Cost: \$27.95-\$39.65.

Two Applications — Split Treatments

BICEP II MAGNUM followed by BICEP II MAGNUM	1.8 qt. 1.0 qt	1.8 qt 1.0 qt	1.8 qt 1.0 qt	Fall Spring	Apply to untilled wheat stubble. For split application apply spring rate within two weeks of planting. Cost: \$33.50.
GLYPHOSATE♦ + WEEDMASTER or LANDMASTER BW or FALLOW STAR followed by	32.0 oz 64.0-80.0 oz 48.0-70.0 oz	32.0 oz 64.0-80.0 oz 48v-70.0 oz	32.0 oz 64.0-80.0 oz 48.0-70.0 oz	July to early Aug.	Spray after wheat harvest as soon as good growing conditions for the weeds occur and the crop residue does not protect the weeds from spray coverage. Cost: glyphosate \$3.25; Landmaster BW \$9.50-\$12.00; Fallow Star \$8.00-\$11.50.
GRAMOXONE SL + ATRAZINE DF■	2.5 pt 1.7 lb	2.5 pt 2.2 lb	2.5 pt 2.2 lb	Late Aug. to early Sept.	Purpose is to control escaped weeds and volunteer wheat. The later application of atrazine is more effective in controlling volunteer wheat. Cost: Gramoxone SL + atrazine \$17.50-\$19.25.

Winter wheat stubble to be planted to soybean or sunflower the following spring

Herbicides to be used within 30 days after winter wheat harvest.

(Consider soybean only in areas with over 20" rainfall.)

Herbicide	Commercial Product per Acre			Application Time	Remarks and Approximate Cost Per Acre Broadcast
	Sandy Loam < 1% OM	Silt Loam 1-2% OM	Silty-Clay Loam > 2% OM		
GLYPHOSATE♦ + VALOR	32.0 oz 2.0 oz	32.0 oz 2.5 oz	32.0 oz 3.0 oz		Cost: \$18.75-\$26.25.
LANDMASTER BW or GLYPHOSATE♦	64.0-80.0 oz 32.0 oz	64.0-80.0 oz 32.0 oz	64.0-80.0 oz 32.0 oz	2 applications with second one at lower rate	See spring treatments for soybean, pages 106-107, or sunflower on page 122. Cost: two Landmaster applications \$19.00-\$24.00; glyphosate \$3.25.
SHARPEN + GLYPHOSATE♦	2.0 oz 32.0 oz	2.0 oz 32.0 oz	2.0 oz 32.0 oz	Apply anytime up to wheat emergence	Add MSO at 1 pt/A minimum. Add AMS at 1-2%. Cost: \$17.25.
SPARTAN CHARGE + GLYPHOSATE + 2,4-D or DICAMBA	5.0 oz	6.0 oz	7.0 oz		Aids in kochia, Russian thistle, pigweed control, spartan. Cost: \$17.25-\$24.00.

♦Glyphosate rates are based on a 4.0 ai/gal or 3.0 lb ae/gal formulation. See pages 193-199 for information on common glyphosate formulations.

■Using atrazine on soils with less than 1% organic matter increases carryover injury risk to susceptible crops, especially high pH soils. Do not use on sandy soils if water table is shallower than 30 ft.

Ecofarming *(continued) (See page 70 for spring burndown. See page 52 for spray additives.)*

Corn to be planted into winter wheat stubble Herbicides to be used for ecofallow corn in the spring

If volunteer wheat and/or downy brome were not controlled in the fall, spray in April or earlier with glyphosate, Fallow Master, Roundup, Landmaster BW, or Touchdown. Low rates (less than 2 lb/A active ingredient) of atrazine usually do not give satisfactory volunteer wheat and downy brome control when applied in July or early August of the previous summer. Adding 0.5 to 1 pt/A of 2,4-D LV4 ester improves control of broadleaf weeds.

Herbicide	Commercial Product per Acre			Application Time	Remarks and Approximate Cost Per Acre Broadcast
	Sandy Loam < 1% OM	Silt Loam 1-2% OM	Silty-Clay Loam > 2% OM		
ANTHEM MAXX + ATRAZINE	4 oz 1-1.5 lb	4-5 oz 1-1.5 lb	4.5-5.5 oz 1.25-2.0 lb	0-30 DBP	Cost: \$16.75-\$25.00.
ATRAZINE DF [■]	1.4 lb	1.6 lb	1.8 lb	15-30 DBP	Cost: Atrazine \$4.50-\$6.00; Balance + atrazine \$17.50-\$41.50.
BALANCE FLEXX ¹ + AATREX/ATRAZINE DF [■]	2.7-4.0 oz 0.4 lb	3.4-5.0 oz 1.4 lb	4.0-6.0 oz 1.7 lb	8-30 DBP	
BALANCE FLEXX ¹ + BICEP II MAGNUM [■] or FULTIME NXT [■] or HARNESS XTRA 5.6L/ BREAKFREE NXT ATZ [■] or KEYSTONE LA NXT	2.0-3.0 oz 0.75-1.25 qt 1.25-1.75 qt 1.0-1.5 qt	2.7-4.0 oz 1.0-1.5 qt 1.5-2.25 qt 1.2-1.8 qt	3.4-5.0 oz 1.25-1.75 qt 1.75-2.5 qt 1.5-2.0 qt	0-7 DBP	If applied 8-21 DBP, increase herbicide rate 20%. Use higher rate in fields with greater grass weed density. Lower rates can be used in fields with good stubble that are sprayed timely after harvest. Rates may have to be increased if weed density was great in the wheat stubble. If soil pH is greater than 7.4, reduce Balance rate by 0.25 oz. Follow and do not exceed labeled rates. Cost: Balance + Bicep II Magnum \$21.00-\$51.00; Balance + Fultime \$26.00-\$58.25; Balance + Harness Xtra 5.6L 27.00-\$60.00.
BALANCE FLEXX ¹ + ATRAZINE DF [■] followed by GLYPHOSATE [◆] (Requires Roundup Ready Corn)	2.0-3.0 oz 0.6 lb 32.0 oz	2.7-4.0 oz 1.2 lb 32.0 oz	3.4-5.0 oz 1.7 lb 32.0 oz	0-7 DBP POST	
(Preplant) CORVUS	Do not use	5.6 oz	5.6 oz	0-21 DBP	Plant RR Corn. This is a low cost treatment for low weed density fields. If needed, apply glyphosate about 20 to 30 days after corn emergence. Cost: Corvus (preplant) + atrazine DF fb glyphosate \$51.00-\$52.50; Corvus (pre-emergence) + atrazine fb glyphosate. Cost: \$51.00-\$52.50.
CORVUS + ATRAZINE DF followed by GLYPHOSATE [◆] (Requires Roundup Ready Corn)	Do not use	5.6 oz 1.2 lb 32.0 oz	5.6 oz 1.7 lb 32.0 oz	21 DBP POST	
ATRAZINE DF [■] + SURPASS NXT or HARNESS/BREAKFREE NXT or OUTLOOK	0.9 lb 1.5-2.0 pt 1.5-2.0 pt 10.0 oz	1.2 lb 2.0-2.5 pt 2.0-2.5 pt 12.0 oz	1.2 lb 2.0-3.0 pt 2.0-3.0 pt 14.0 oz	For 16-30 days preplant, increase rates 20%	If annual grasses produced seed in the wheat stubble or if field areas have a history of high grass density, use 20% higher rates. Do not exceed labeled rates. Cost: Harness + atrazine \$27.50-\$52.75; Surpass + atrazine \$28.25-\$54.75; Outlook + atrazine \$14.75-\$20.50.
DUAL II MAGNUM/CINCH BICEP II MAGNUM/CINCH ATZ [■] DUAL II MAGNUM/CINCH + ATRAZINE DF [■]	1.3 pt 1.8 qt 1.25 pt 0.9 lb	1.3 pt 2.1 qt 1.5 pt 1.2 lb	1.67 pt 2.4 qt 1.67 pt 1.2 lb	0-20 DBP	
LEXAR EZ [■]	3.0 qt	3.0 qt	3.0 qt	0-14 DBP	If annual grasses produced seed in the wheat stubble or if areas of field have history of high grass density, use 20% higher rates of grass herbicides. Do not exceed labeled rates. Cost: Bicep II Magnum \$21.50-\$28.75; Dual II Magnum \$23.25-\$29.75; Dual II Magnum + atrazine \$23.25-\$31.25; Lexar \$52.50; Lumax \$50.00-\$60.00.
LUMAX EZ [■]	2.5 qt	2.5 qt	2.5-3.0 qt	0-10 DBP	
EXPERT	2.5 qt	3.0 qt	3.75 qt	PRE 0-30 DBP	Cost: \$23.25-\$34.75.
GLYPHOSATE [◆] (Requires Roundup Ready Corn)	32.0 oz	32.0 oz	32.0 oz	POST	Excellent for fields with high grass densities. Cost: glyphosate \$3.25.

¹The use rate of Balance Flexx is affected by soil texture, organic matter, and soil pH. Consult the label for additional information on the effect of variable soils on use rate. Corn seed must be covered with 1.5 to 2.0 inches of soil. Do not use if water table is shallower than 25 ft.

◆Glyphosate rates are based on a 4.0 ai/gal or 3.0 lb ae/gal formulation. See pages 181-182 for information on common glyphosate formulations.

■The total amount of atrazine applied cannot exceed 2.5 lb ai/A per calendar year. Use no more than 1.6 lb ai/A on highly erodible land with less than 30% crop residue. Using atrazine on soils with less than 1% organic matter increases carryover injury risk to susceptible crops, especially high pH soils. Do not use on sandy soils if water table is shallower than 30 ft.

Ecofarming (continued) (See page 52 for spray additives)

Herbicide	Commercial Product per Acre			Application Time	Remarks and Approximate Cost Per Acre Broadcast
	Sandy Loam < 1% OM	Silt Loam 1-2% OM	Silty-Clay Loam > 2% OM		
HALEX GT (Requires Roundup Ready Corn or glyphosate-tolerant corn)	3.6-4.0 pt	3.6-4.0 pt	3.6-4.0 pt	POST to 40" corn	Early POST to weeds 1-4" in height. Add NIS and AMS. Cost: \$29.25-\$32.50.
FULTIME NXT [■]	2.5-3.0 qt	2.7-3.3 qt	3.0-4.0 qt	POST to 11" corn	Cost: FulTime \$28.25-\$45.00
VERDICT	10.0-12.0 oz	13.0-15.0 oz	16.0-18.0 oz	0-21 DBP	MSO at 1 pt/A min. Add AMS at 1-2%. Cost: \$20.00-\$35.75.

Soybean to be planted into winter wheat stubble (See page 122-124 for spring burndown) (For areas with over 20" rainfall and fields with low weed density)

AUTHORITY ASSIST	6.0 oz	8.0 oz	10.0 oz	14 DBP - 3 DAP	Tank-mix with 2,4-D and/or glyphosate for burndown control of emerged weeds. Cost: \$20.25-\$33.50.
AUTHORITY ELITE	22.0 oz	26.0 oz	28.0 oz	14 DBP - 3 DAP	Tank-mix with 2,4-D and/or glyphosate for burndown control of emerged weeds. Cost: \$22.25-\$28.50.
AUTHORITY FIRST/SONIC	4.0 oz	5.0 oz	6.4 oz	14 DBP - 3 DAP	Tank-mix with 2,4-D and/or glyphosate for burndown control of emerged weeds. Cost: \$23.75-\$38.00.
AUTHORITY MTZ	12.0 oz	16.0 oz	20.0 oz	14 DBP - 3 DAP	Tank-mix with 2,4-D and/or glyphosate for burndown control of emerged weeds. Cost: \$21.00-\$35.00.
FIERCE	3.0 oz	3.5 oz	3.75 oz	14 DBP - 3 DAP	Tank-mix with 2,4-D and/or glyphosate for burndown control of emerged weeds. Cost: \$23.50-\$29.25.
OPTILL	Do not use	2.0 oz	2.0 oz		Use MSO 15 or min 1 pt/A and AMS 1-2%. Cost: \$16.00.
PURSUIT* + DUAL II MAGNUM or OUTLOOK	4.0 oz 1.0 pt 10.0 oz	4.0 oz 1.25 pt 12.0 oz	4.0 oz 1.33 pt 14.0 oz	0-30 DBP	Add 16-24 oz/A of glyphosate ¹ if there are emerged weeds. Control weeds when they are small to conserve moisture and improve performance. Check fields within 30 days after planting to determine if postemergence Pursuit + Dual II Magnum \$31.50-\$36.75; Pursuit + Outlook \$27.00-\$31.75; Extreme \$12.00; glyphosate \$3.25.
GLYPHOSATE ^{1♦} (Requires Roundup Ready soybean)	32.0 oz	32.0 oz	32.0 oz	POST	
EXTREME (Requires Roundup Ready soybean)	3.0 pt	3.0 pt	3.0 pt		
EXTREME + SHARPEN	3.0 pt 1.0 oz	3.0 pt 1.0 oz	3.0 pt 1.0 oz	0-21 DBP	Use MSO 1% or 1 pt/A min + AMS 1-2%. Cost: \$19.00.
VALOR	2.0 oz	2.5 oz	3.0 oz	14 DBP - 3 DAP	Tank-mix with 2,4-D and/or glyphosate for burndown control of emerged weeds.

*See rotational crop restrictions on the Pursuit label.

Sunflower to be planted into winter wheat stubble

BROADAXE/SPARTAN ELITE	20.0 oz	22.0 oz	24.0 oz	30 DBP to 3 DAP	Risk of injury increased on high pH soil or applications close to planting, especially on light soils. Cost: \$22.00-\$26.25.
DUAL MAGNUM	1.0 pt	1.33 pt	1.33 pt		PRE, EPP. Cost: \$15.00-\$20.00.
LANDMASTER BW + PROWL H ₂ O followed by GLYPHOSATE [♦] + PROWL H ₂ O	54.0-64.0 oz 2.0 pt 32.0 oz 0.4 pt	54.0-64.0 oz 2.0 pt 32.0 oz 1.0 pt	54.0-64.0 oz 2.0 pt 32.0 oz 1.5 pt	The first treatment should be applied before May 1 and a minimum of 30 days prior to planting. The second treatment is to be applied pre-emergence.	Adjust rate of Prowl depending on rainfall timing and amount after first application. This is a two-treatment program for control of volunteer winter wheat and downy brome. Both treatments are required for optimum efficacy. Adjust the rate of Prowl for the second treatment. The appropriate rate will depend on the timing and amount of rainfall after the first treatment. Cost: Landmaster BW + Prowl H ₂ O \$21.00-\$22.50; glyphosate + Prowl H ₂ O \$5.75-\$13.00.

¹Add NIS (0.25% v/v) which is 1 quart per 100 gal spray solution for Gramoxone Inteon. For LandMaster BW, Fallow Star, and glyphosate add 17 lb ammonium sulfate (spray grade) per 100 gal and apply in 10 gpa of spray solution. Read label to determine when to add AMS or additional surfactant.

[♦]Glyphosate rates are based on a 4.0 ai/gal or 3.0 lb ae/gal formulation. See pages 186-199 for information on common glyphosate formulations.

[■]The total amount of atrazine applied cannot exceed 2.5 lb ai/A per calendar year. Use no more than 1.6 lb ai/A on highly erodible land with less than 30% crop residue. Using atrazine on soils with less than 1% organic matter increases carryover injury risk to susceptible crops, especially high pH soils. Do not use on sandy soils if water table is shallower than 30 ft.

Ecofarming (continued) (See page 52 for spray additives)

Herbicide	Commercial Product per Acre			Application Time	Remarks and Approximate Cost Per Acre Broadcast
	Sandy Loam < 1% OM	Silt Loam 1-2% OM	Silty-Clay Loam > 2% OM		
SPARTAN CHARGE + PROWL H ₂ O	3.5-4.5 oz 2.0 pt	4.5-4.5 oz 2.5 pt	4.5-6.0 oz 3.0 pt		Apply PRE up to 30 days prior to planting. Risk of crop injury increases as soil pH increases and/or soil organic matter decreases. Cost: \$25.00-\$40.25.

Winter wheat to be planted in fall (fallow aid)

Herbicides to be used in spring on corn or sorghum stubble when followed with winter wheat

2,4-D ESTER (4L)	32.0 oz			Common purslane, when growing actively	Do not plant small grains for 15 days. Cost: \$4.50.
AUTHORITY MTZ	8.0 oz	10.0 oz	12.0 oz		Authority MTZ aids in control of kochia, Russian thistle, pigweed. Cost: \$14.00-\$21.00.
GLYPHOSATE [♦]	32.0 oz	32.0 oz	32.0 oz	Apr 16-May 1	Application time depends on year and weed species. If downy brome or volunteer wheat are present, they must be controlled before May 1.
LANDMASTER BW	64.0 oz	64.0 oz	64.0 oz		Early application is necessary to control winter annuals. Use glyphosate for control of downy brome before heading. Do not plant wheat for 20 days after Landmaster BW. Follow-up weed control may be necessary if you want to use no-till. Glean can only be used once every 36 months in western Nebraska. Cost: Landmaster BW \$9.50; glyphosate \$3.25; Amber + glyphosate \$7.00-\$10.50; Glean + glyphosate \$11.25.
AMBER + GLYPHOSATE [♦]	0.28-0.56 oz 32.0 oz	0.28-0.56 oz 32.0 oz	0.28-0.56 oz 32.0 oz	Before May 1	
GLEAN + GLYPHOSATE [♦]	0.33 oz 32.0 oz	0.33 oz 32.0 oz	0.33 oz 32.0 oz		
FACET L + 2,4-D	32 oz 16.0 oz	32 oz 16.0 oz	32 oz 16.0 oz		Cost: + 2,4-D \$34.25.
SHARPEN + GLYPHOSATE [♦]	1-2 oz 32 oz	1-2 oz 32 oz	1-2 oz 32 oz		Add MSO 1% - 1 pt/A min + AMS 1-2%. Cost: \$10.25-\$17.25.
SPARTAN CHARGE + GLYPHOSATE [♦] OR LANDMASTER BW	4.0 oz 32.0 oz 64.0 oz	5.0 oz 32.0 oz 64.0 oz	6.0 oz 32.0 oz 64.0 oz		Aids in residual control on kochia including glyphosate resistant kochia. Wheat may be planted 4 months following application. Cost: Spartan Charge \$13.75-\$20.75; glyphosate \$3.25; Landmaster BW \$9.50.

Grain sorghum to be planted into winter wheat stubble (See page 111-112 for spring burndown)

If volunteer wheat and/or downy brome were not controlled in the fall, spray in April or control earlier with glyphosate, RT Master or Landmaster BW. Low rates (less than 2 lb active) of atrazine usually do not give satisfactory volunteer wheat and downy brome control when applied in July or early August of previous summer. If atrazine-resistant kochia is a problem, see *Troublesome Weeds and Woody Plants*, pages 155-167.

BICEP II MAGNUM/CINCH ATZ [■]	Do not use	1.8 qt	2.1 qt	0-30 DBP	Add 2-3 pt Gramoxone SL ¹ or 54.0 oz. Landmaster BW for emerged weeds. When using Landmaster BW, wait 20 days prior to planting. Seed must be treated with approved seed safener. Cost: Bicep II Magnum \$21.50-\$25.25; Bicep Lite II Magnum \$25.25-\$28.25; Dual II Magnum + atrazine \$22.25-\$31.25; Outlook + atrazine \$13.75-\$25.00.
BICEP LITE II MAGNUM/ CINCH ATZ LITE [■]	Do not use	1.6 qt	1.8 qt		
DUAL II MAGNUM or OUTLOOK + ATRAZINE DF [■]	1.25 pt 10.0-14.0 oz 0.6 lb	1.33 pt 14.0-16.0 oz 1.2 lb	1.67 pt 16.0-18.0 oz 1.2 lb	0-28 DBP	
EXPERT	Do not use	2.5 qt	3.0 qt	Preplant to PRE	Use for burndown of existing weeds. Cost: \$23.25-\$27.75.
LEXAR [■]	Do not use	3.0 qt	3.0 qt	7-14 DBP	Cost: \$52.50.
LUMAX [■]	Do not use	2.5 qt	2.5 qt	7-14 days DBP	Cost: \$50.00.
VERDICT	10.0-12.0 oz	13.0-15.0 oz	16.0-18.0 oz	0-21 DBP	Add MSO at 1 pt/A minimum. Add AMS at 1-2%. Cost: \$20.0-\$35.75.

Postemergence

See corn, sorghum, soybean, sunflower, or winter wheat sections for herbicide choices.

¹Add NIS (0.25% v/v) which is 1 quart per 100 gal spray solution for Gramoxone Inteon. For LandMaster BW, Fallow Star, and glyphosate add 17 lb ammonium sulfate (spray grade) per 100 gal and apply in 10 gpa of spray solution. Read label to determine when to add AMS or additional surfactant.

[♦]Glyphosate rates are based on a 4.0 ai/gal or 3.0 lb ae/gal formulation. See pages 193-199 for information on common glyphosate formulations.

[■]The total amount of atrazine applied cannot exceed 2.5 lb ai/A per calendar year. Use no more than 1.6 lb ai/A on highly erodible land with less than 30% crop residue. Using atrazine on soils with less than 1% organic matter increases carryover injury risk to susceptible crops, especially high pH soils. Do not use on sandy soils if water table is shallower than 30 ft.

Field Pea

Weed Response to Selected Herbicides

Site of Action ¹	Response Ratings: Ratings are for light to moderate weed densities, favorable conditions and weed growth stage as specified on product label. High weed densities, adverse conditions, or large weeds will reduce control. 10 = 96-100% 6 = 70-79% 9 = 90-95% 5 = 60-69% 8 = 85-90% 4-2 = less than 60% 7 = 80-84% 1 = 0	Broadleaves								Grasses					Crop Safety
		Kochia	Lambsquarters	Lanceleaf Sage	Marestail	Redroot Pigweed	Prickly Lettuce	Russian-thistle	Wild Buckwheat	Barnyardgrass	Crabgrass	Downy Brome ¹	Fall Panicum	Millet	
Herbicide	PRE														
14 + 15	BroadAxe XC / SpartanElite	9	9	4	6	9	6	9	6	9	8	9	9	8	2
15	Dual II Magnum	5	7	6	2	8	5	4	3	8	8	9	9	7	2
3	Prowl H2O	7	7	6	6	7	7	8	5	8	7	8	8	8	2
3	Treflan (PPI)	7	6	3	5	6	5	7	4	8	8	8	8	8	1
14	Spartan Charge	9	8	4	7	8	7	8	6	6	6	6	6	6	2
14 + 2	Optill	8	8	8	8	6	8	8	8	6	2	6	6	6	2
14	Sharpen	8	8	7	8	5	7	8	7	2	4	3	2	2	2
14	Spartan	9	8	4	6	7	6	8	5	6	6	6	6	6	2
		POST													
1	Assure II	1	1	1	1	1	1	1	1	8	8	7	8	8	1
6	Basagran 5L	7	7	5	4	5	7	4	6	1	1	1	1	1	2
1	Poast	1	1	1	1	1	1	1	1	6	9	9	9	9	1
2	Pursuit	7	4	4	5	8	7	7	7	5	6	7	1	8	3
2 + 6	Pursuit + Basagran 5L	8	7	6	6	8	8	7	6	5	5	7	5	6	2
2 + 6	Raptor + Basagran 5L	8	8	6	6	9	8	7	7	5	7	6	1	2	2
1	Select Max	1	1	1	1	1	1	1	1	9	9	9	9	9	1
2 + 6	Varisto	8	8	6	6	9	8	7	7	5	7	6	1	2	2

¹Field pea PRE herbicides used to control downy brome must be tank mixed with glyphosate or follow a glyphosate burn-down application to obtain these levels of control.

Field Pea *(continued)*

Herbicide	Rate Per Acre	Application Time	Remarks and Approximate Cost Per Acre Broadcast
Fall Applied			
BroadAxe XC / SpartanElite	19.0-32.0 oz	Fall	Cost: \$20.75-\$35.00.
Optill	1.5 oz	Fall	Can be tank mixed with other herbicides such as glyphosate for burndown. Cost: \$12.00.
Spartan	3.5-8.0 oz	Fall	Application rate depends on soil type and organic matter. Cost: \$16.50-\$37.50.
Spartan Charge	4.0-10.0 oz	Fall	Use with other herbicides and COC for burndown purposes. Application rate depends on soil type and organic matter. Cost: \$13.75-\$34.50.
Valor SX	2.0-3.0 oz	Fall	Use only with appropriate tank mix partner such as 2,4-D, dicamba, or glyphosate. Cost: \$15.50-\$23.00.
Burndown and Preemergence			
BroadAxe XC / SpartanElite	19.0-32.0 oz	Preplant burndown, EPP, or PRE	Rate depends on soil texture, pH, and organic matter. DO NOT use on coarse textured soils with organic matter <1.5%. Cost: \$20.75-\$35.00.
Spartan Charge	3.0-8.0 oz	Preplant burndown, EPP, or PRE	Apply with COC, AMS, and glyphosate for burndown purposes. Application rate depends on soil type and organic matter. Cost: \$10.25-\$27.50.
Optill	1.5 oz	EPP, PPI, or PRE	Can be tank mixed with other herbicides such as glyphosate for burndown. Cost: \$12.00.
Sharpen	1.0 oz	EPP	If needed, sequential applications can be made at least 30 days apart (no more than 4 ozs/A/plant season). Sharpen can be tank mixed with other Group 14 herbicides. Cost: \$7.00.
Prowl H2O	1.5-3.2 pt	Preplant burndown	Rate based on soil texture and organic matter. Tank mix with or apply a postemergence herbicide following application. Irrigation or rainfall is required to infiltrate the herbicide into the upper soil surface. Cost: \$9.75-\$20.75.
Dual II Magnum	1.0-1.67 pt	PPI, or PRE	Rate based on soil texture and organic matter. Cost: \$15.00-\$25.00.
Pursuit	3.0 oz	Preplant, PPI, or PRE	Must be incorporated into the soil for best results. Postemergence application require use of an adjuvant and nitrogen fertilizer. Can be tank mixed with grass herbicides. Cost: \$11.50.
Postemergence			
Assure II	5.0-10.0 oz	Grasses less than 4" tall	Apply with COC. Cost: \$4.00-\$8.25.
Basagran 5L	1.0-2.0 pt	After 3 pairs of leaves or 4 nodes are present on peas	Best performance when daily temperatures exceed 75 degrees. Apply with UAN or AMS. May tank mix with MCPA, Pursuit, or Raptor. 30 day PHI. Cost: \$10.00-\$20.00.
Poast	1.0-2.0 pt	Grasses less than 4" tall	Apply with 2.5 pounds AMS or 4 to 8 pints of UAN. Maximum seasonal application rate is 4 pints per acre. PHI is 30 days. Cost: \$12.00-\$28.00.
Pursuit	3 oz	Peas have at least one trifoliate leaf but before 5 nodes and flowering	Apply with NIS at 2 pints/acre. Cost: \$11.50.
Pursuit + Basagran 5L	3 oz + 0.8 pt	After 3 trifoliate leaves are present until 5 nodes are on the peas	Apply with 1.25 at 2.5 gallons UAN or 12 to 15 pounds of AMS per 100 gallons. 30 day PHI. Cost: \$11.50.
Raptor + Basagran 5L	4.0 oz + 1.0 pt	After 3 pairs of leaves are present and prior to bloom	Apply with COC at 1-2% v/v. Cost: \$29.00.
Select Max	9.0-16.0 oz	Before bloom	Apply with NIS at 0.25% v/v. PHI is 21 days. Cost: \$7.75-\$13-75.
Varisto	16.0-21.0 oz	After 3 pairs of leaves are present and prior to bloom	Apply with COC at 1-2% v/v. PHII is 30 days. Cost: \$20.75-\$27.00.
Harvest Aid			
Gramoxone	1.2 - 2.0 pt	Apply when at least 80% of pods are yellowing	Apply using a minimum carrier of 20 GPA for ground or 5 GPA for air. Add NIS at 1qt/100 gal. Do not graze or harvest treated fields for 7 days after spraying.

Garbanzo Bean (Chickpeas)

Weed Response to Selected Herbicides

Plant response may be altered by growing conditions, genetic variation in crops and weeds, soil type, pH, organic matter and application rates. Ratings may vary from season to season and geographical areas within the state. Ratings apply when herbicides are used at rates suggested.

Site of Action†	Response Ratings: Ratings are for light to moderate weed densities, favorable conditions and weed growth stage as specified on product label. High weed densities, adverse conditions, or large weeds will reduce control. 10 = 96-100% 6 = 70-79% 9 = 90-95% 5 = 60-69% 8 = 85-90% 4-2 = less than 60% 7 = 80-84% 1 = 0	Broadleaves														Grasses						Crop Safety☐	
		Annual Morningglory	Cocklebur	Jimsonweed	Kochia	Kochia, Triazine-Resistant	Lambsquarters	Nightshade (Hairy)	Pigweed	Ragweed	Russian Thistle	Smartweed	Sunflower	Velvetleaf	Wild Buckwheat	Barnyardgrass	Crabgrass	Fall Panicum	Foxtail	Sandbur	Shattercane/Sorghum		
Herbicide																							
		PPI & PRE																					
14+15	Broadaxe	8	5	8	8	8	8	8	8	5	8	8	1	8	5	8	8	8	8	5	7	1	
15	Dual Magnum-PPI	4	4	5	6	6	6	7	9	7	4	5	3	5	5	7	9	9	8	7	5	2	
15	Outlook-PPI	1	2	1	2	2	7	6	8	5	3	3	2	2	1	8	8	8	9	6	3	2	
3	Prowl H ₂ O-PPI	1	2	4	7	7	7	5	8	4	4	4	2	2	4	6	8	7	8	6	7	2	
14	Sharpen-PRE	4	8	4	7	7	7	8	8	8	8	9	9	9	4	2	2	2	2	1	2	2	
14	Spartan-PRE	8	5	8	8	8	8	5	7	5	8	8	1	8	5	6	6	8	6	5	5	1	
14+15	Spartan + Dual Magnum-PRE	8	5	8	8	8	8	8	8	5	8	8	1	8	5	8	8	8	8	5	7	1	
14+3	Spartan + Prowl H ₂ O-PRE	8	6	8	9	9	8	5	8	5	8	8	1	8	6	8	7	8	8	7	8	1	
		POST																					
1	Assure II	1	1	1	1	1	1	1	1	1	1	1	1	1	1	8	8	8	9	8	9	1	
1	Poast	1	1	1	1	1	1	1	1	1	1	1	1	1	1	6	9	9	9	9	9	1	
1	Select Max	1	1	1	1	1	1	1	1	1	1	1	1	1	1	9	9	9	8	8	9	1	

☐ Varieties differ in their response to herbicides. Crop safety ratings less than 3 indicate that crop yield should not be affected by any direct injury.

†See pages 8-10 for more information on classification of herbicides by mode and site of action.

Herbicide Treatments

Herbicide	Commercial Product per Acre			Application Time, Remarks and Approximate Cost Per Acre Broadcast
	Sandy Loam < 1% OM	Silt Loam 1-2% OM	Silty-Clay Loam > 2% OM	
ASSURE II/TARGA + COC	8.0 oz 1.0 qt	8.0 oz 1.0 qt	8.0 oz 1.0 qt	POST before susceptible grasses are 4-6" tall. Use with crop oil concentrate. Cost: \$6.50.
BROADAXE/SPARTAN ELITE	19.0-22.0 oz	19.0-24.0 oz	24.0-28.0 oz	Do not use on soils classified as sand that have less than 1% OM. Cost: \$22.25-\$32.75.
DUAL MAGNUM	1.0 pt	1.3 pt	1.3 pt	PPI or PPE — Do not cut for hay within 120 days following Dual II Magnum. Cost: \$17.25-\$22.50.
OUTLOOK	12.0 oz	12.0 oz	14.0 oz	PPI or PRE — Incorporation will improve weed control. Cost: \$13.25-\$15.25.
POAST + COC	16.0 oz 1.0 qt	16.0 oz 1.0 qt	16.0 oz 1.0 qt	POST before susceptible grasses are 4" tall. Use with crop oil concentrate. Cost: \$13.25.
PROWL H ₂ O	1.5 pt	2.0 pt	2.0 pt	PPI — Apply and incorporate before planting. Cost: \$9.25-\$12.25.
SELECT MAX	9.0-16.0 oz	9.0-16.0 oz	9.0-16.0 oz	POST before susceptible grasses are 6" tall. Use with NIS at 0.25% and AMS at 2 lb/A. Do not harvest within 30 days following application. Cost: \$8.50-\$15.25.
SHARPEN	2.0 oz	2.0 oz	2.0 oz	PREPLANT or PRE — Do not apply if garbanzo bean has reached the cracking stage or after crop emergence. If weeds have emerged add glyphosate. Cost: \$12.50.
SPARTAN 4F	3.0 oz	3.75 oz	4.5 oz	EPP or PRE — Use higher rate of Spartan for EPP greater than 14 days ahead of planting. Cost: Spartan \$14.00-\$21.00; Spartan + Prowl H ₂ O \$23.25-\$35.50; Spartan + Dual Magnum \$35.00-\$43.50.
SPARTAN 4F + PROWL H ₂ O	3.0 oz	3.75 oz	4.5 oz	
or DUAL MAGNUM	1.5 pt	2.0 pt	2.0 pt	
	1.0 pt	1.3 pt	1.3 pt	

Melons, Pumpkins and Other Cucurbits

Weed Response to Selected Herbicides

Site of Action†	Response Ratings: Ratings are for light to moderate weed densities, favorable conditions and weed growth stage as specified on product label. High weed densities, adverse conditions, or large weeds will reduce control. 10 = 96-100% 6 = 70-79% 9 = 90-95% 5 = 60-69% 8 = 85-90% 4-2 = less than 60% 7 = 80-84% 1 = 0	Broadleaves															Grasses						Crop Safety☐
		Annual Morningglory	Cocklebur	Jimsonweed	Kochia	Kochia, Triazine-Resistant	Lambsquarters	Nightshade (Hairy)	Pigweed	Ragweed	Russian Thistle	Smartweed	Sunflower	Velvetleaf	Wild Buckwheat	Barnyardgrass	Crabgrass	Fall Panicum	Foxtail	Sandbur	Shattercane/Sorghum		
	Herbicide	PRE																					
13	Command 3ME ¹	3	2	6	7	7	5	2	2	3	-	6	6	8	-	6	6	6	6	5	5	2	
3	Curbit ²	4	4	4	7	7	7	6	7	4	7	4	2	2	4	9	9	9	9	7	7	2	
3	Dacthal 75W ³	4	4	4	4	4	9	6	9	4	4	4	4	4	4	7	9	4	9	7	4	2	
8+19	Prefar 4E + Alanap-L ³	2	7	1	1	1	7	1	7	7	1	1	7	1	7	9	9	6	9	6	6	3	
3+13	Strategy ²	4	6	8	8	8	9	8	7	8	7	9	6	9	5	9	9	9	9	7	7	2	
3	Treflan ³	4	4	4	7	7	7	4	7	4	7	4	2	2	4	9	9	9	9	7	7	2	
		POST																					
1	Poast ²	1	1	1	1	1	1	1	1	1	1	1	1	1	1	6	9	9	9	9	9	1	
2	Sandea ²	5	9	-	6	6	5	9	9	9	-	7	9	9	-	1	1	1	1	1	1	2	
1	Select Max ²	1	1	1	1	1	1	1	1	1	1	1	1	1	1	8	9	9	9	9	9	1	

†See pages 8-10 for more information on classification of herbicides by mode and site of action.

Herbicide Treatments

Herbicide	Commercial Product per Acre	Application Time	Remarks and Approximate Cost Per Acre Broadcast
ARROW ² + COC	6.0-8.0 oz 1% v/v	Grasses 6" tall	Do not apply Select within 14 days of squash, cucurbit, or melon harvest. Cost: \$3.75-\$5.00.
COMMAND (3ME) ¹	0.67-1.33 pt	Preplant	Do not use on jack 'o lantern pumpkins. Cost: \$14.25-\$28.25.
CURBIT ²	3.0-4.5 pt	PRE	Apply postplant to the soil surface prior to weed emergence. Apply to seeded crop prior to crop emergence or apply as a banded spray between rows after crop emergence or transplanting. Do not preplant incorporate or use under plastic mulch. Cost: \$23.00-\$34.25.
DACTHAL W-75	8.0-14.0 lb	Directed application; crop 4-5 true leaves	Crop should be weeded before application. Controls primarily annual grasses. Use lower rate on sandy soil. Cost: \$208.00-\$364.00.
POAST ² + COC	16.0-24.0 oz 1.0 qt	Grasses most susceptible under 4"	Do not apply within 14 days of harvest. Crop oil concentrate and good coverage essential for effective control. Cost: \$13.50-\$20.00.
PREFAR 4E + ALANAP-L ³	4.0-6.0 qt 4.0-8.0 qt	Preplant	Immediately incorporate to a depth of 1". Controls many annual grasses and broadleaf weeds. Cost: \$111.00-\$188.00.
SANDEA ²	0.5-1.0 oz	Crop 2-5 leaf; broadleaf weeds 1-3"	Add NIS at 1 qt/100 gallon spray mixture. Cost: \$21.00-\$42.00.
SELECT MAX + NIS	9.0-16.0 oz 0.25% v/v	Grasses 6" tall	Do not apply Select Max within 14 days of squash, cucurbit or melon harvest. Cost: \$8.50-\$15.25.
STRATEGY ²	2.0-6.0 pt	PRE	Use lower rate on sandy soil. Controls many annual grasses and broad-leaf weeds. Cost: \$36.00-\$108.00.
TRIFLURALIN ³	1.0-2.0 pt	Crop 3-4 true leaves	Direct material to soil between the rows and mechanically incorporate. Controls germinating annual grasses and some broadleaves. Use the lower rate on sandy soil. Cost: \$3.00-\$5.75.

¹Winter squash and processing pumpkins.

²Cucumber, melon, pumpkin, squash.

³Cucumber and melon.

☐ Varieties differ in their response to herbicides. Crop safety ratings less than 3 indicate that crop yield should not be affected by any direct injury.

Onion

Weed Response to Selected Herbicides

Site of Action†	Response Ratings: Ratings are for light to moderate weed densities, favorable conditions and weed growth stage as specified on product label. High weed densities, adverse conditions, or large weeds will reduce control. 10 = 96-100% 6 = 70-79% 9 = 90-95% 5 = 60-69% 8 = 85-90% 4-2 = less than 60% 7 = 80-84% 1 = 0	Broadleaves														Grasses						Crop Safety▣	
		Annual Morningglory	Cocklebur	Jimsonweed	Kochia	Kochia, Triazine-Resistant	Lambsquarters	Nightshade (Hairy)	Pigweed	Ragweed	Russian Thistle	Smartweed	Sunflower	Velvetleaf	Wild Buckwheat	Barnyardgrass	Crabgrass	Fall Panicum	Foxtail	Sandbur	Shattercane /Sorghum		
	Herbicide	PRE																					
3	Dacthal 75W	4	4	4	4	4	9	6	9	4	4	4	4	4	4	7	9	4	9	7	4	2	
8	Nortron	1	5	1	6	6	6	6	8	1	6	7	4	5	7	5	7	7	8	6	1	2	
3	Prowl H ₂ O	1	2	4	7	7	7	5	8	4	4	4	4	2	4	6	8	7	7	6	7	2	
		POST																					
6	Buctril	9	7	9	6	6	7	9	7	9	7	9	9	9	9	1	2	2	2	2	2	3	
1	Fusilade DX	4	1	1	1	1	1	1	1	1	1	1	1	1	1	7	9	9	8	7	7	1	
14	Goal 2XL	4	7	1	6	6	7	6	7	1	6	1	6	1	7	4	2	4	4	4	2	3	
1	Select Max	1	1	1	1	1	1	1	1	1	1	1	1	1	1	8	9	9	9	9	10	1	

‡Varieties differ in their response to herbicides. Crop safety ratings less than 3 indicate that crop yield should not be affected by any direct injury.

†See pages 8-10 for more information on classification of herbicides by mode and site of action.

Herbicide Treatments

Herbicide	Commercial Product per Acre	Application Time	Remarks and Approximate Cost Per Acre Broadcast
BUCTRIL/MOXY	1.0-1.5 pt	POST; onion should have 2-5 true leaves	Water volume is important. Use 50-70 gallons of water per acre. Do not add surfactants. Cost: \$10.00-\$15.00.
DACTHAL 75W/DCPA	8.0-14.0 lb	PRE at seeding or transplanting and/or at layby	Preplant incorporation not recommended. Use lower rate on soils with less than 1% organic matter. Cost: \$208.00-\$364.00.
FUSILADE DX + COC	6.0 oz 1.0 qt	Shattercane and corn 12-18"; other annual grasses less than 4"	Crop oil concentrate and good coverage are essential for effective control. Don't tank-mix with Buctril. Cost: \$8.00.
GOAL 2 XL	0.5-1.0 pt	Onion, 2 fully developed true leaves; weeds, 2-4 leaves	Do not apply to onion under drought stress. Do not mix Goal with oil, surfactant or fertilizer. Cost: \$5.38-\$10.75.
NORTRON	16.0 oz	PRE at seeding POST up to 4 foliar applications at evenly spaced intervals	Apply after planting but before crop and weed emergence; irrigate with 0.5 inch of sprinkler irrigation. Do not exceed 48 oz per season. The last application should be 30 days before harvest. Cost: \$13.13.
OUTLOOK	12.0-18.0 oz	POST apply after onions have reached the 2 true-leaf stage	Do not apply within 30 days of harvest. Cost: \$13.25-\$19.75.
PROWL H ₂ O	1.5-3.0 pt	PRE to weeds; onion must have 2 to 9 true leaves	Do not apply within 45 days of harvest. Prowl can also be applied as a sequential application with the first treatment applied at the loop stage and the second when the crop has 2 to 6 true leaves. Cost: \$9.25-\$18.50.
SELECT MAX + NIS	9.0-16.0 oz 0.25% v/v	Grass 2-6"	Do not apply within 45 days of harvest. Crop oil concentrate and good coverage are essential for effective control. Cost: \$8.50-\$15.25.

Potato

Weed Response to Selected Herbicides

Plant response may be altered by growing conditions, genetic variation in crops and weeds, soil type, pH, organic matter and application rates. Ratings may vary from season to season and geographical areas within the state. Ratings apply when herbicides are used at rates suggested.

Site of Action†	Response Ratings: Ratings are for light to moderate weed densities, favorable conditions and weed growth stage as specified on product label. High weed densities, adverse conditions, or large weeds will reduce control. 10 = 96-100% 6 = 70-79% 9 = 90-95% 5 = 60-69% 8 = 85-90% 4-2 = less than 60% 7 = 80-84% 1 = 0	Broadleaves															Grasses						Crop Safety☐	
		Annual Morningglory	Cocklebur	Jimsonweed	Kochia	Kochia, ALS-Resistant	Kochia, Triazine-Resistant	Lambsquarters	Nightshade (Hairy)	Pigweed	Ragweed	Russian Thistle	Smartweed	Sunflower	Velvetleaf	Wild Buckwheat	Barnyardgrass	Crabgrass	Fall Panicum	Foxtail	Sandbur	Shattercane/Sorghum		
Herbicide																								
		PPI & PRE																						
15	Dual II Magnum/Dual Magnum-PPI/PRE	4	4	5	6	6	6	6	7	9	7	4	5	3	5	5	7	9	9	8	7	5	2	
8	Eptam-PPI	7	4	4	6	6	6	7	7	7	6	4	4	2	4	7	9	9	9	9	9	9	2	
8+5	Eptam + Sencor-PPI	6	6	4	8	8	6	9	8	9	7	6	6	6	6	7	7	9	7	9	7	7	3	
8+3	Eptam + Treflan or Prowl H ₂ O-PPI	6	4	4	9	9	9	7	7	7	4	6	4	2	4	6	9	9	9	9	9	9	2	
14	Chateau-PRE	5	2	8	8	8	8	8	8	8	7	7	6	3	8	5	7	6	5	7	3	3	1	
14+2	Chateau + Matrix/Solida-PRE	7	5	8	8	8	8	8	9	9	7	7	7	3	8	6	9	6	6	8	5	8	1	
14+5	Chateau + Metribuzin DF-PRE	7	8	8	9	9	9	9	9	9	9	9	8	7	9	9	9	8	8	8	5	4	1	
2	Matrix/Solida-PRE	1	5	1	8	3	8	5	4	9	-	3	1	1	5	1	9	5	1	8	1	1	1	
15	Metribuzin DF-PRE	4	6	7	6	6	2	9	5	9	9	7	7	6	7	9	7	7	7	7	4	4	2	
5	Metribuzin DF + Dual II Magnum-PRE	4	6	7	6	6	2	9	7	9	9	7	7	6	7	9	9	6	9	9	6	4	2	
5+15	Outlook-PRE	1	2	1	2	2	2	7	6	8	5	3	3	1	2	1	8	8	8	9	6	3	2	
		POST																						
1	Poast	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	8	9	9	9	9	9	1	
1	Metribuzin	4	7	4	7	7	2	4	4	9	7	9	7	7	6	4	4	6	4	6	6	4	3	
5	Select Max	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	9	9	9	9	9	10	1	

[□]Varieties differ in their response to herbicides. Crop safety ratings less than 3 indicate that crop yield should not be affected by any direct injury.

[†]See pages 8-10 for more information on classification of herbicides by mode and site of action.

Potato

Soil-Applied

Herbicide	Commercial Product per Acre			Application Time, Remarks and Approximate Cost Per Acre Broadcast
	Sandy Loam < 1% OM	Silt Loam 1-2% OM	Silty-Clay Loam > 2% OM	
BOUNDARY	1.5-2.0 pt	2.0-2.4 pt	2.4-2.9 pt	PRE or DRAG-OFF — Can be applied through a center pivot. Do not use more than 1.5 pt per acre on sandy soils. Cost: \$17.25-\$33.35.
CHATEAU WDG	1.5 oz	1.5 oz	1.5 oz	PRE UP to DRAG OFF — Apply before weeds or potatoes emerge. Potato sprouts must have at least 2" of soil cover or crop injury may occur. Cost: Chateau WDG \$11.25; Chateau WDG + Matrix \$39.75; Chateau WDG + Metribuzin DF \$15.75-\$20.50.
CHATEAU WDG + MATRIX/SOLIDA	1.5 oz	1.5 oz	1.5 oz	
CHATEAU WDG + METRIBUZIN DF	1.5 oz 0.33 lb	1.5 oz 0.33 lb	1.5 oz 0.66 lb	
DUAL II MAGNUM/ DUAL MAGNUM/CINCH	1.0 pt	1.33 pt	1.67 pt	PPI, PRE, or DRAG OFF — If cool, wet soil conditions occur after application, Dual II Magnum may delay maturity or injure early maturing potato varieties. Do not harvest within 60 days of application. Cost: \$16.00-\$27.25.
EPTAM	3.5 pt	3.5 pt	7.0 pt	PPI, DRAG-OFF, or LAYBY — Apply and incorporate before planting or after potato plants have emerged. Minimum time from application to harvest is 45 days. The Superior variety potato is sensitive to Eptam and under stress conditions, early season stunting may occur. Cost: \$24.00-\$48.25.
EPTAM + TREFLAN	2.5 pt 1.0 pt	2.5 pt 1.0 pt	3.5 pt 1.0 pt	PRE UP TO and JUST BEFORE DRAG-OFF — Incorporate chemical immediately after application. Set incorporation equipment so that herbicide is not concentrated over the row. The Superior variety potato is sensitive to Eptam and under stress conditions, early season stunting may occur. Cost: Eptam + Treflan \$20.25-\$25.75; Eptam + Prowl H ₂ O \$27.00-\$34.25.
EPTAM + PROWL/PROWL H ₂ O	2.5 pt 1.8 pt/1.5 pt	2.5 pt 2.4 pt/2.0 pt	3.5 pt 2.4 pt/2.0 pt	
EPTAM + METRIBUZIN DF	3.5 pt 0.33 lb	4.5 pt 0.33 lb	4.5 pt 0.66 lb	PPI, DRAG-OFF, or Early POST — Incorporate through an irrigation sprinkler system. Most thin-skinned varieties such as Atlantic and Shepody are sensitive to Metribuzin. Cost: \$28.75-\$40.25.
MATRIX/SOLIDA	1.0-1.5 oz	1.0-1.5 oz	1.0-1.5 oz	Apply after hilling or drag-off but before potatoes or weeds emerge. For activation supply moisture by rainfall or sprinkler; is labeled for chemigation. Can be tank-mixed with Eptam, Prowl, Dual, or Metribuzin. Maximum 2.0 oz/season; cannot be used on potatoes grown for seed; some varieties may show injury. Cost: \$17.50-\$26.50.
METRIBUZIN DF	0.33 lb	0.5 lb	1.0 lb	PRE, PPI, or DRAG-OFF AS PER LABEL — Do not plant treated area to sensitive crops such as onion or sugarbeet during the next growing season. Most thin-skinned varieties such as Atlantic and Shepody are sensitive to Metribuzin. Cost: Dual + Metribuzin \$20.25-\$35.50; Metribuzin \$4.75-\$14.00; Prowl H ₂ O + Metribuzin \$14.50-\$22.25.
METRIBUZIN DF with DUAL II MAGNUM/ DUAL MAGNUM/CINCH	0.33 lb 1.0 pt	0.33 lb 1.33 pt	0.66 lb 1.67 pt	
or with PROWL/PROWL H ₂ O	1.8 pt/1.5 pt	2.4 pt/2.0 pt	2.4 pt/2.0 pt	
OUTLOOK	12.0-14.0 oz	14.0-18.0 oz	18.0-21.0 oz	PRE or DRAG-OFF — Apply before weeds or potatoes emerge. Cost: \$14.00-\$24.75.

Potato (Soil-Applied) (continued)

Herbicide	Commercial Product per Acre			Application Time, Remarks and Approximate Cost Per Acre Broadcast
	Sandy Loam < 1% OM	Silt Loam 1-2% OM	Silty-Clay Loam > 2% OM	
Postemergence				
BOUNDARY	1.5 pt-2.2 pt			POST — Must be applied through a center pivot. Do not apply within 60 days of harvest. Cost: \$17.25-\$25.30.
POAST	1.0-1.5 pt			POST before susceptible grasses are 4” tall. Potatoes tolerant at all growth stages. Add 2 pints of crop oil concentrate. Minimum time from application to harvest is 30 days. Good coverage essential for effective control. Cost: \$13.75-\$20.50.
MATRIX/SOLIDA	1.0-1.5 oz			POST when susceptible weeds are 1” tall. Add NIS at 0.25% v/v or COC at 1% v/v. Follow Matrix with irrigation no sooner than 4 hours after application. Cost: \$19.00-\$28.50.
METRIBUZIN DF /DIMETRIC	0.33-0.66 lb			POST before weeds are 1” tall. Highest rate for common sunflower and kochia; will not control triazine-resistant kochia. Do not use on red skinned or early maturing white varieties or within 60 days of harvest. Cost: \$4.25-\$8.75.
SELECT MAX	9.0-16.0 oz			POST before most grasses are 6” tall. Potatoes tolerant at all growth stages. Add NIS at 0.25% v/v and AMS at 2 lb/A. Do not harvest within 30 days following application. Cost: \$7.50-\$15.25.
Harvest Aid				
AIM EC		3.2-5.8 oz		Harvest Aid — Preharvest interval is 7 days. Use with MSO or COC. Cost: \$24.00-\$43.50.
GRAMOXONE SL		2.0 pt		Harvest Aid — Apply when potato leaves begin to age. Preharvest interval is 3 days. Fresh market potatoes only. Do not use on potatoes going into storage. Not labeled for seed potatoes. Cost: \$8.25.
REGLONE		1.0-2.0 pt		Preharvest interval is 7 days. May be used on potatoes going into storage. Cost: \$10.75-\$21.25.
RELY		3.0 pt		Apply at the beginning of natural senescence of potato vines. Do not harvest potatoes until 9 days after application. Not labeled for seed potatoes. Cost: \$32.25.

Sorghum

Grass Weed Response to Spring Burndown Herbicides¹

Plant response may be altered by growing conditions, genetic variation in crops and weeds, soil type, pH, organic matter, temperature, growth stage, and application rates. Rating may vary from season to season and from area to area within the state. Ratings apply when herbicides are used as suggested in this publication. See pages 155-167 for additional problem weeds and their control.

Site of Action [†]	Herbicide	Grasses					
		Annual Bluegrass	Downy Brome	Foxtail Barley	Volunteer Corn, Conventional	Volunteer Corn, Roundup Ready	Winter Wheat or Rye
4	2,4-D ester 4L ²	1	1	1	1	1	1
4	2,4-D ester 4L + dicamba ^{•2}	1	1	1	1	1	1
14+4	Aim + 2,4-D	1	1	1	1	1	1
5	Atrazine + COC	9	7	9	1	1	6
5+4	Atrazine + dicamba ^{•2}	10	8	10	2	2	5
5+4	Atrazine + 2,4-D ester 4L ²	10	8	10	2	2	7
4	Dicamba ^{•2}	1	1	1	1	1	1
15+9+5	Expert	10	10	9	10	1	10
9	Glyphosate ^{♦3}	10	10	9	10	1	10
9+4	Glyphosate [♦] + 2,4-D ester 4L ²	10	10	9	10	1	10
9+5	Glyphosate [♦] + atrazine ³	10	10	8	10	1	10
22	Gramoxone SL	9	7	7	4	4	6
22+5	Gramoxone SL + atrazine	10	10	10	5	5	10
4+9	LandMaster II	10	10	9	10	1	10
27+15+5	Lexar EZ	7	6	7	1	1	5
27+15+5	Lumax EZ	4	3	4	1	1	4
14	Sharpen	2	2	4	2	2	4
14+9	Sharpen + glyphosate	10	10	10	10	2	10
14+15	Verdict	2	2	5	2	2	5

¹This table presents burndown preplant herbicide information only. It does not reflect residual weed control.

²See table entitled *Using 2,4-D and Dicamba Before Planting* on page 111.

³During cool weather (day/night temperatures less than 50-60°F), glyphosate performance can be reduced.

[•]Dicamba rates are based on a 4.0 ae/gal formulation, like those found in Clarity. See page 203 or the *Herbicide Dictionary* for other products containing dicamba.

[♦]Glyphosate rates are based on a 4.0 ai/gal or 3.0 lb ae/gal formulation. See pages 193-199 for information on common glyphosate formulations.

[†]See pages 8-10 for more information on classification of herbicides by mode and site of action.

Sorghum

Broadleaf Weed Response To Selected Soil- and Foliar-Applied Herbicides

Plant response may be altered by growing conditions, genetic variation in crops and weeds, soil type, pH, organic matter, temperature, growth stage, and application rates. Rating may vary from season to season and from area to area within the state. Ratings apply when herbicides are used as suggested in this publication. See pages 155-167 for additional problem weeds and their control.

Site of Action†	Response Ratings: Ratings are for light to moderate weed densities, favorable conditions and weed growth stage as specified on product label. High weed densities, adverse conditions, or large weeds will reduce control. 10 = 96-100% 9 = 90-95% 8 = 85-90% 7 = 80-84% 6 = 70-79% 5 = 60-69% 4-2 = less than 60% 1 = 0	Broadleaves																
		Cocklebur (5.5)§	E. Black Nightshade (3.5)	Kochia (2.5)	Kochia, ALS-Resistant (2.5)	Kochia, Triazine-Resistant (2.5)	Lambsquarters (1.5)	Morningglories (5.5)	Pigweed (2.5)	Pigweed, Triazine-Resistant (2.5)	Ragweed (4.5)	Russian Thistle (2.3)	Smartweed (1.5)	Sunflower (10)	Velvetleaf (4.2)	Waterhemp (2.5)	Waterhemp, ALS-Resistant (2.5)	Waterhemp, Triazine-Resistant (2.5)
	Herbicide	PRE																
5	Atrazine	7	9	9	9	2	9	5	9	1	8	9	8	7	7	9	9	1
15+5	Bicep II Magnum/Cinch ATZ	7	9	9	9	2	9	6	9	7	9	9	7	7	6	9	9	7
15+5	Degree Xtra/FulTime NXT	7	9	9	9	2	9	6	9	7	8	8	8	6	6	9	9	7
15	Dual II Magnum/Cinch	2	6	2	2	2	7	2	7	7	4	2	2	2	2	7	7	7
15+5	Guardsman Max	7	9	9	9	2	9	6	9	7	8	8	8	6	6	9	9	7
27+15+5	Lexar EZ/Lumax EZ	7	9	9	9	8	9	7	10	10	8	8	9	8	10	10	10	10
15	Outlook	2	6	2	2	2	7	2	7	7	4	2	2	2	2	7	7	7
14	Sharpen (2.0 oz)	8	9	8	8	8	8	8	9	9	9	9	8	9	8	8	8	8
14+15	Verdict	8	9	8	8	8	8	8	9	9	9	9	8	9	8	8	8	8
15	Warrant	8	9	8	8	8	8	8	9	9	9	9	8	9	8	8	8	8
		POST: Weed size influences performance — see label																
4	2,4-D	10	4	4	4	4	7	10	8	8	7	9	3	7	7	8	8	8
5	AAtrex/atrazine	9	8	9	9	1	8	7	8	1	8	8	4	9	7	8	8	1
14	Aim	7	9	6	6	6	9	7	8	8	6	6	8	5	10	7	7	7
14+5	Aim + atrazine	8	8	8	8	6	9	8	9	8	7	6	7	6	10	8	8	7
14+4	Aim + dicamba●	8	9	8	8	8	9	9	9	9	8	9	9	7	10	8	8	8
5+4	Atrazine + dicamba●	9	9	8	8	7	9	9	9	8	9	8	9	9	8	9	9	8
6	Buctril/Moxy	8	8	6	6	6	9	6	5	5	7	5	8	8	7	5	5	5
6+5	Buctril + atrazine	9	8	9	9	8	9	7	8	6	8	8	8	9	8	8	8	6
4	Dicamba●	9	7	8	8	8	7	9	8	8	7	9	9	8	6	8	8	8
9	Glyphosate (ropewick, wipers, etc.)◆	8	-	6	6	6	4	-	5	5	7	4	7	7	4	5	5	5
27+6	Huskie	8	7	8	8	8	9	7	9	9	7	6	8	9	9	9	9	9
4	Paramount	-	-	5	5	5	4	9	5	5	5	4	-	5	5	4	4	4
4+5	Paramount + atrazine	9	8	9	9	5	9	8	9	5	8	7	7	9	8	8	8	5
2	Peak	9	3	6	1	6	5	8	8	8	9	-	7	9	8	9	1	8
2+4	Peak + dicamba●	9	7	8	7	8	7	9	9	9	9	7	9	9	8	9	8	8
2	Permit	9	3	6	1	6	5	6	8	8	9	-	7	9	8	8	1	8
4	Starane Ultra	6	5	9	9	9	2	8	2	2	8	5	2	6	7	2	2	2
2+4	Yukon	9	7	8	8	8	7	8	8	8	9	7	8	8	8	8	6	8

*See footnotes on page 105.

†See pages 8-10 for more information on classification of herbicides by mode and site of action.

Sorghum

Grass Weed Response To Selected Soil- and Foliar-Applied Herbicides

Plant response may be altered by growing conditions, genetic variation in crops and weeds, soil type, pH, organic matter, temperature, growth stage, and application rates. Rating may vary from season to season and from area to area within the state. Ratings apply when herbicides are used as suggested in this publication. See pages 155-167 for additional problem weeds and their control.

Site of Action†	Response Ratings: Ratings are for light to moderate weed densities, favorable conditions and weed growth stage as specified on product label. High weed densities, adverse conditions, or large weeds will reduce control. 10 = 96-100% 6 = 70-79% 9 = 90-95% 5 = 60-69% 8 = 85-90% 4-2 = less than 60% 7 = 80-84% 1 = 0	Grasses											Labeled for
		Barnyardgrass (0.3)§	Crabgrass (0.5)	Fall Panicum (0.4)	Giant Foxtail (2)	Green Foxtail (1)	Yellow Foxtail (1)	Sandbur (1)	Shattercane /Sorghum (3.5)	Shattercane, ALS-Resistant (3.5)	Woolly Cupgrass (2.5)	Crop Safety▣	
	Herbicide												
		PRE											
5	Atrazine	6	4	2	6	7	6	4	1	1	3	2	Y
15+5	Bicep II Magnum/Cinch ATZ	9	9	9	9	9	9	4	2	2	6	2	Y
15+5	Degree Xtra/FulTime NXT	9	9	9	9	9	9	6	4	4	7	2	N
15	Dual II Magnum/Cinch	9	9	9	9	9	9	4	2	2	6	2	Y
15+5	Guardsman Max	9	9	9	9	9	9	4	3	3	6	2	N
15	Micro-Tech	9	9	9	9	9	9	6	4	4	6	2	N
27+15+5	Lexar EZ/Lumax EZ	9	9	9	9	9	9	6	4	4	6	2	N
15	Outlook	9	9	9	9	9	9	4	2	2	6	2	N
14	Sharpen (2.0 oz)	4	4	4	5	5	5	2	4	4	2	1	N
14+15	Verdict	9	9	8	8	8	8	4	2	2	6	2	N
15	Warrant	9	8	8	9	9	7	5	6	4	6	1	Y
		POST: Weed size influences performance — see label											
4	2,4-D	2	2	2	1	1	1	2	3	2	1	4	N
5	AAtrex/atrazine	5	4	2	5	6	6	4	2	2	5	2	Y
14	Aim	1	1	1	1	1	1	1	1	1	1	2	Y
14+5	Aim + atrazine	3	2	1	2	2	2	1	1	1	2	2	Y
14+4	Aim + dicamba●	1	1	1	1	1	1	1	1	1	1	4	Y
5+4	Atrazine + dicamba	5	4	2	5	6	6	4	2	2	4	2	Y
6	Buctril/Moxy	2	2	2	1	1	1	2	2	2	1	2	Y
6+5	Buctril + atrazine	5	4	2	5	6	6	4	2	2	3	2	Y
4	Dicamba●	2	2	2	2	2	2	2	2	2	1	4	Y
9	Glyphosate (ropewick, wipers, etc.)◆	-	-	-	-	-	-	-	8	8	-	1	Y
27+6	Huskie	2	2	2	2	2	2	2	2	2	2	3	N
4	Paramount	7	7	-	8	8	7	5	2	2	7	2	N
4+5	Paramount + atrazine	8	8	-	9	9	8	-	2	2	8	2	N
2	Peak	1	1	1	1	1	1	1	1	1	1	2	N
2+4	Peak + dicamba●	1	1	1	1	1	1	1	1	1	1	4	N
2	Permit	1	1	1	1	1	1	1	1	1	1	2	Y*
4	Starane Ultra	1	1	1	1	1	1	1	1	1	1	1	Y
2+4	Yukon	1	1	1	1	1	1	1	1	1	1	3	Y

§Weed Competitive Index—See page 11.

¶Hybrids vary in their response to herbicides. Crop safety ratings less than 3 indicate that crop yield should not be affected by any direct injury.

●Dicamba rates are based on a 4.0 ae/gal formulation, like those found in Clarity. For dicamba formulations other than Banvel or Clarity, See page 203 or the *Herbicide Dictionary*.

◆Glyphosate rates are based on a 4 lb ai/gal or 3.0 lb ae/gal formulation. See pages 193-199 for information on common glyphosate formulations.

* Grain sorghum only.

†See pages 8-10 for more information on classification of herbicides by mode and site of action.

Sorghum

Burndown and Preplant (See page 52 for spray additives)

When the interval between herbicide application and planting is expected to be 28 days or more, split applications will generally give better control. If a split application was not made and planting is delayed, a burndown treatment may be needed. Grasses should be 1.5 inches or less for control with atrazine.

Using 2,4-D or Dicamba Before Planting

The University of Nebraska–Lincoln recommends following the guidelines below when applying 2,4-D or dicamba before planting corn, soybean and sorghum. Please note that these recommendations are applicable to both the ester and amine formulations of 2,4-D.

2,4-D Preplant Interval	Use Rate	Use Rate	Dicamba Preplant Interval	Use Rate	Use Rate
Crop	16 oz	>16 oz	Crop	4 oz	8 oz
Corn	7 days	14 days	Corn	5 days	7 days
Soybean (use ester only)	7 days	30 days	Soybean	DO NOT USE	DO NOT USE
Sorghum	10 days	21 days	Sorghum	7 days	10 days

Herbicide	Commercial Product per Acre			Application Time	Remarks and Approximate Cost Per Acre Broadcast
	Sandy Loam < 1% OM	Silt Loam 1-2% OM	Silty-Clay Loam > 2% OM		
TO REMOVE COOL-SEASON GRASS SOD (INCLUDING SMOOTH BROME AND BLUEGRASS)					
GLYPHOSATE ♦	48.0-64.0 oz	48.0-64.0 oz	48.0-64.0 oz	Fall or new growth	Use appropriate herbicide at planting. Cost: \$11.25-\$15.00.
TO REMOVE ALFALFA OR CLOVER SOD					
2,4-D ester (4L) + DICAMBA •	48.0 oz 8.0 oz	48.0 oz 8.0 oz	48.0 oz 8.0 oz	Apply in fall or April to alfalfa with 4" new growth	Don't plant sorghum for 30 days. If smooth brome or bluegrass is present, add glyphosate. Don't apply with UAN or atrazine. Use an appropriate herbicide at sorghum planting. Cost: \$12.35.
TO REMOVE RYE OR WINTER WHEAT					
ATRAZINE DF ■ + GRAMOXONE SL	Do not use	2.2 lb 2.0-3.0 pt	2.2 lb 2.0-3.0 pt	Apply when rye or wheat is 4-10" tall and before sorghum emerges	Use safened seed with Dual II Magnum. Cost: atrazine + Gramoxone SL \$20.65-\$26.00; atrazine + glyphosate + Intro \$23.50-\$29.50; atrazine + glyphosate + Dual II Magnum \$31.30-\$37.15; Expert \$23.15-\$34.70.
ATRAZINE DF ■ + GLYPHOSATE ♦ + DUAL II MAGNUM	1.4 lb 20.0-24.0 oz 1.3 pt	1.6 lb 20.0-24.0 oz 1.3 pt	1.8 lb 20.0-24.0 oz 1.5 pt		
EXPERT	2.5 qt	3.0 qt	3.75 qt		

♦Glyphosate rates are based on a 4.0 ai/gal or 3.0 lb ae/gal formulation. See pages 193-199 for information on common glyphosate formulations.

•Dicamba rates are based on a 4.0 ae/gal formulation, like those found in Clarity. See page 203 or the *Herbicide Dictionary* for other products containing dicamba.

■Do not apply atrazine within 66 feet of where water runoff from a field will enter a stream, river, or standpipe. The total amount of atrazine applied cannot exceed 2.5 lb ai/A per calendar year. Use no more than 1.6 lb ai/A on highly erodible land with less than 30% crop residue. Using atrazine on soils with less than 1% organic matter increases carryover injury risk to susceptible crops, especially high pH soils. Do not use on sandy soils if water table is shallower than 30 ft.

Sorghum

Burndown and Preplant (See page 52 for spray additives)

Herbicide	Commercial Product per Acre			Application Time	Remarks and Approximate Cost Per Acre Broadcast
	Sandy Loam < 1% OM	Silt Loam 1-2% OM	Silty-Clay Loam > 2% OM		
CONTINUOUS ROW CROP					
AIM + 2,4-D	1.0 oz	1.0 oz	1.0 oz	10-30 DBP	Apply at least 10 days before planting. Use COC (1.5-2%) or MSO (1-2%) plus UAN (2-4%) or AMS (2.0-4.0 lb/A). May be tank-mixed with glyphosate for grass control or atrazine for residual activity. Cost: \$8.80.
	16.0 oz	16.0 oz	16.0 oz		
ATRAZINE DF [■]	Do not use	2.2 lb	2.2 lb	0-45 DBP	Atrazine may injure sorghum on sandy, low organic matter soils. If weeds have emerged, add COC (1%) + UAN (2-4 qt/A) to increase control. If weeds are large, tank-mix with Gramoxone or a glyphosate herbicide. Do not exceed 2.5 lb ai/A of atrazine per year. Cost: \$10.00.
BICEP II MAGNUM/ CINCH ATZ [■] or BICEP LITE II MAGNUM/ CINCH ATZ LITE [■]	Do not use	1.8 qt	2.1 qt	0-30 DBP	Use safened seed. May injure sorghum on sandy, low organic matter soils. If weeds have emerged, add Gramoxone SL (2.0-3.0 pt/A) or glyphosate (24.0-32.0 fl oz/A). Cost: Bicep II Magnum \$22.50-\$26.25; Bicep II Lite Magnum \$52.00-\$58.50.
		1.1 fb 0.5 qt 1.6 qt	1.2 fb 0.6 qt 1.8 qt	30-45 DBP fb 1 DAP 0-30 DBP	
DEGREE XTRA [■]	2.7 qt	2.7-3.5 qt	3.0-3.5 qt	After planting, before sorghum emergence	Use safened seed. Add glyphosate to control emerged weeds. Cost: \$32.60-\$43.75.
FULTIME NXT	2.9 qt	2.9-3.7 qt	3.2-3.7 qt		
GUARDSMAN MAX [■]	2.4-2.8 pt	2.8-3.4 pt	3.4-4.0 pt	16-30 DBP	Use safened seed. Use higher rate for heavy residues. Do not exceed 4.6 pt/A. Cost: \$19.50-\$32.50.
GLYPHOSATE [◆]	32.0 oz	32.0 oz	32.0 oz	Prior to crop emergence	Apply before weeds are 6" tall. If broadleaf weeds not controlled by glyphosate are present, add 2,4-D ester (1.0 pt/A) and delay planting 10 days. Cost: \$5.10-\$7.70.
GRAMOXONE SL	2.0-3.0 pt	2.0-3.0 pt	2.0-3.0 pt	Prior to crop emergence	Apply to weeds 6" or less. To minimize soil water lost to weeds, apply 1-3 weeks preplant. May be tank-mixed with many residual herbicides. Cost: \$10.75-\$16.10.
LEXAR EZ [■]	Do not use	3.0 qt	3.0 qt	7-21 DBP	Applying Lexar less than 7 DBP increases risk of injury. Lexar may be applied as a split application of 1.5-1.75 qt/A early preplant (7-21 DBP), followed by 1.25-1.5 qt/A prior to sorghum emergence. Do not exceed 3.0 qt/A. If weeds are present, add COC (1% v/v) and UAN (2.5% v/v). Cost: \$43.50.
LUMAX EZ [■]	Do not use	2.7 qt	2.7 qt	7-14 DBP	Applying Lumax less than 7 DBP increases risk of injury. Lumax may be applied as a split application. Apply 1.25-1.5 qt/A early preplant (7-21 DBP), and 1.0-1.25 qt/A preemergence (at planting). Total Lumax applied cannot exceed 2.5 qt/A. If weeds have emerged prior to application, add NIS (0.25% v/v) + UAN (2.5% v/v) or COC (1% v/v) + UAN (2.5% v/v). Cost: \$43.90.

◆Glyphosate rates are based on a 4.0 ai/gal or 3.0 lb ae/gal formulation. See pages 193-199 for information on common glyphosate formulations.

■Do not apply atrazine within 66 feet of where water runoff from a field will enter a stream, river, or standpipe. The total amount of atrazine applied cannot exceed 2.5 lb ai/A per calendar year. Use no more than 1.6 lb ai/A on highly erodible land with less than 30% crop residue. Using atrazine on soils with less than 1% organic matter increases carryover injury risk to susceptible crops, especially high pH soils. Do not use on sandy soils if water table is shallower than 30 ft.

Sorghum

Preemergence

Herbicide	Commercial Product per Acre			Application Time, Remarks and Approximate Cost Per Acre Broadcast
	Sandy Loam < 1% OM	Silt Loam 1-2% OM	Silty-Clay Loam > 2% OM	
ATRAZINE DF [■]	Do not use	1.1-2.2 lb	1.1-2.2 lb	EPP, PPSA, PP, PRE, or SURFACE MIX — Preplant applications should be made only on fine-textured soils. Preplant applications may be made 0-45 DBP. Do not exceed 2.5 lb ai/A per year. Do not use atrazine on sandy, high pH, or calcareous soils. Rain may leach herbicides and cause sorghum injury. Cost: \$5.00-\$10.00.
BICEP II MAGNUM/ CINCH ATZ [■]	Do not use	1.6-2.1 qt	2.1 qt	EPP, PPSA, PRE, or SURFACE MIX — Seed safener required. Cost: \$16.00-\$26.25.
BICEP LITE II MAGNUM/ CINCH ATZ LITE [■]	Do not use	1.2 qt	1.6 qt	EPP, PPSA, PRE or SURFACE MIX — Seed safener required. Cost: \$15.90-\$26.00.
DEGREE XTRA [■]	2.7 qt	2.7-3.5 qt	3.0-3.5 qt	PPI, PRE — Seed safener required. Degree Xtra/FulTime NXT may be applied after crop emergence but will not control emerged weeds. May be tank-mixed with dicamba. Cost: \$32.60-\$43.75.
FULTIME NXT	2.9 qt	2.9-3.7 qt	3.2-3.7 qt	
DUAL II MAGNUM/CINCH or DUAL IIG	1.3 pt	1.3 pt	1.3 pt	EPP, PPSA, PRE or SURFACE MIX — Seed safener required. Cost: \$17.00-\$20.30.
GUARDMAN MAX [■]	2.4 pt	2.8 pt	3.4 pt	0-30 DBP. Seed safener required. Cost: \$19.50-\$27.75.
LEXAR EZ [■]	Do not use	3.0 qt	3.0 qt	7-21 DBP. Seed safener required. Applying Lexar less than 7 DBP increases risk of injury. Lexar may be applied as a split application of 1.5-1.75 qt/A early preplant (7-21 DBP), followed by 1.25-1.5 qt/A prior to sorghum emergence. Do not exceed 3.0 qt/A. Cost: \$43.50.
LUMAX EZ [■]	Do not use	2.7 qt	2.7 qt	7-14 DBP; EPP, PPSA, PPI, PRE. Seed safener required. Applying Lumax less than 7 DBP increases risk of injury. Lumax may be applied as a split application. Apply 1.25-1.5 qt/A early preplant (7-21 DBP), and 1.0-1.25 qt/A preemergence (at planting). Total Lumax applied cannot exceed 2.5 qt/A. If weeds have emerged prior to application, add NIS (0.25% v/v) + UAN (2.5% v/v) or COC (1% v/v) + UAN (2.5% v/v). Cost: \$43.90.
OUTLOOK	13.0 oz	15.0 oz	18.0-21.0 oz	0-30 days. Increase rate 2-5 fluid oz for heavy residues. Do not exceed 32 oz/A. Seed safener required. Cost \$6.80-\$13.60.
SHARPEN	1.0-2.0 oz	1.0-2.0 oz	1.0-2.0 oz	Preplant or PRE. Do not apply if sorghum has emerged. If weeds have emerged prior to application, add MSO (1% v/v) glyphosate (32 oz/A) + AMS (1-2% v/v). Cost: \$6.25-\$12.25.
VERDICT	10.0-12.0 oz	13.0-15.0 oz	16.0-18.0 oz	Preplant or PRE. Do not apply if sorghum has emerged. If weeds have emerged prior to application, add MSO (1% v/v), glyphosate (32.0 oz/A) + AMS (1-2% v/v). Cost: \$19.90-\$35.90.
WARRANT	1.25-2.25 qt	1.5-2.25 qt	2.25-3.0 qt	Preplant, PRE or POST to sorghum before the crop exceeds 11" in height. This product will not control emerged weeds. Do not exceed 4.0 qt/A per season. Cost: \$12.80-\$30.75.

[■]Do not apply atrazine within 66 feet of where water runoff from a field will enter a stream, river, or standpipe. The total amount of atrazine applied cannot exceed 2.5 lb ai/A per calendar year. Use no more than 1.6 lb ai/A on highly erodible land with less than 30% crop residue. Using atrazine on soils with less than 1% organic matter increases carryover injury risk to susceptible crops, especially high pH soils. Do not use on sandy soils if water table is shallower than 30 ft.

Sorghum

Postemergence *(See page 52 for additives)*

Herbicide	Rate Per Acre	Application Time	Remarks and Approximate Cost Per Acre Broadcast
2,4-D AMINE (4L) or 2,4-D ESTER (4L)	16.0 oz 8.0 oz	5" sorghum to early boot Broadleaf weeds 2-6"	Spraying 2,4-D before sorghum is 5" tall may inhibit root development. Use drop tips for all treatments after 8". Spraying 2,4-D without drop tips after 8" through early boot may inhibit head development. Do not use from early boot through soft dough stage. Cost: \$1.30-\$1.90.
AIM EC alone or with ATRAZINE DF [■] or DICAMBA [●]	0.5 oz 0.6 lb 8.0 oz	Aim alone: Sorghum prior to boot stage Sorghum less than 12" Sorghum 3-5 leaf	Aim is a contact herbicide so thorough spray coverage is required. Aim may also be tank-mixed with atrazine (0.6 lb) + dicamba (4.0 oz) or atrazine (0.6 lb) + 2,4-D (8.0 oz). Cost: Aim \$3.15; Aim + atrazine \$5.85; Aim + dicamba \$7.85; Aim + atrazine + dicamba \$10.55.
ATRAZINE DF [■]	1.1-2.2 lb	Weeds 2-4" Sorghum less than 12"	Atrazine may give partial control of grass weeds under 1". Do not use on sand or loamy sand. Cost: \$5.00-\$10.00.
ATRAZINE DF [■] + DICAMBA	0.5 lb 9.0 oz	Sorghum 2-5 leaf Broadleaf weeds 2-4"	Observe precautions regarding dicamba use near sensitive crops. Use drop tips when over 8". Cost: \$7.50.
BUCTRIL + ATRAZINE DF [■]	1.0-1.5 pt 0.55-1.1 lb	Sorghum 3-leaf to 12" Broadleaf weeds 2-6"	Buctril + atrazine may also be tank-mixed with dicamba (2.0-4.0 oz). Cost: \$11.75-\$14.50.
BUCTRIL + DICAMBA [●]	0.5-0.75 pt 2.0-8.0 oz	Sorghum 3-leaf to 12"	Cost: \$6.00-\$11.25.
DICAMBA [●]	8.0 oz	Sorghum 3-5 leaf	Observe label precautions when sensitive crops are nearby. Cost: \$4.70.
HUSKIE	12.8-16.0 oz	Sorghum 3 leaf to 18"	Apply with AMS at 1 lb/A. May cause a temporary bleaching of some leaves. Cost: \$12.50-\$15.00.
HUSKIE + ATRAZINE	16.0 oz 0.5 lb	Sorghum 3 leaf to 12"	Apply when weeds are less than 4" tall. Add AMS at 1 lb/A to the spray solution. Additional tank-mix partners include 2,4-D (8.0 oz/A) and dicamba (4.0 oz/A). Cost: \$17.25.
PARAMOUNT + ATRAZINE DF [■]	5.3-8.0 oz 0.5-1.0 lb	Emergence to 12" sorghum	Requires COC or MSO. UAN or AMS may be added. Best performance on annual grasses less than 2" tall. Works best on green foxtail. Cost: Paramount \$20.50-\$31.00; Paramount + atrazine \$22.25-\$34.25.
PEAK alone or with DICAMBA [●]	0.25-1.0 oz 2.0-8.0 oz	Sorghum 5-30" Sorghum less than 5 leaves	On soil above pH 7.5, carryover may injure soybean and other sensitive crops. Cost: Peak \$4.25-\$17.00; Peak + dicamba \$5.40-\$21.70.
PERMIT	0.67-1.0 oz	Sorghum 2-leaf to layby (before head emergence)	May be tank-mixed with AAtrex, Buctril, Banvel/Clarity, or 2,4-D. Cost: \$15.40-\$23.00.
STARANE ULTRA	0.4 pt	Sorghum 3-7 leaf; 8-leaf to boot use drop tips	Starane Ultra may be applied as a burndown treatment after planting but prior to sorghum emergence. For late postemergence applications, drop nozzles should be directed toward the soil surface to avoid contact with sorghum foliage. Do not apply after the boot stage. Cost: \$15.00; price has not changed.
YUKON	4.0-6.0 oz	Sorghum 2-leaf to 15"	Cost: \$12.80-\$19.20.

■Do not apply atrazine within 66 feet of where water runoff from a field will enter a stream, river, or standpipe. The total amount of atrazine applied cannot exceed 2.5 lb ai/A per calendar year. Use no more than 1.6 lb ai/A on highly erodible land with less than 30% crop residue. Using atrazine on soils with less than 1% organic matter increases carryover injury risk to susceptible crops, especially high pH soils. Do not use on sandy soils if water table is shallower than 30 ft.

●Dicamba rates are based on a 4.0 ae/gal formulation, like those found in Clarity. See page 203 or the *Herbicide Dictionary* for other products containing dicamba.

Sorghum

Postemergence (See page 52 for spray additives)

Harvest Aid

Herbicide	Rate Per Acre	Application Time	Remarks and Approximate Cost Per Acre Broadcast
DIQUAT	1.5-2.0 pt	1-2 weeks before harvest	Seed no more than 30% moisture. Cost: \$13.50-\$18.00.
GLYPHOSATE♦	32.0-64.0 oz	Grain moisture 30% or less 7 days before harvest	Not for use on seed fields. Cost: \$7.50-\$15.00.

♦Glyphosate rates are based on a 4.0 ai/gal or 3.0 lb ae/gal formulation. See pages 193-199 for information on common glyphosate formulations.

Soybean

Weed Response to Fall Burndown Herbicides¹

Winter annual weeds (henbit, horseweed, pennycress, etc.) can be quite susceptible to fall herbicide application. Herbicides can be applied in the fall, weather permitting, from late September up until early December. Before using a particular herbicide, check to see if it is labeled for fall application.

Plant response may be altered by growing conditions, genetic variation in crops and weeds, soil type, pH, organic matter, temperature, growth stage, and application rates. Rating may vary from season to season and from area to area within the state. Ratings apply when herbicides are used as suggested in this publication. See pages 155-167 for additional problem weeds and their control.

Site of Action†	Response Ratings: Ratings are for light to moderate weed densities, favorable conditions and weed growth stage as specified on product label. High weed densities, adverse conditions, or large weeds will reduce control.	Alfalfa	Dandelion	Downy Brome	Field Pansy	Field Pennycress	Henbit	Marestail	Marestail, Glyphosate-Resistant	Prickly Lettuce	Shepherdspurse	Tansymustard	
	10 = 96-100% 9 = 90-95% 8 = 85-90% 7 = 80-84%												6 = 70-79% 5 = 60-69% 4-2 = less than 60% 1 = 0
	Herbicide												
4	2,4-D ester 4L	7	7	1	4	10	9	8	8	9	10	7	
4	2,4-D + dicamba	9	9	1	4	10	10	9	9	10	10	9	
14+4	Aim + 2,4-D	7	8	1	5	10	10	9	10	9	10	9	
14+2+4	Authority MTZ + 2,4-D	6	8	1	6	9	10	8	9	10	10	9	
2+14+4	Authority XL + Aim + 2,4-D	9	9	9	6	8	10	9	9	10	10	10	
14+2	Canopy EX	5	8	2	8	10	9	9	9	9	10	7	
2+9	Envive/Enlite	4	6	2	8	9	8	8	7	8	8		
2+9	Extreme	4	8	10	8	10	9	9	9	9	10	8	
9	Glyphosate♦ ²	5	6	10	8	9	9	8	5	6	10	8	
9+4	Glyphosate♦ + dicamba♦ ²	10	8	10	8	9	10	9	9	9	9	9	
9+4	Glyphosate♦ + 2,4-D ²	8	8	10	8	10	9	9	9	8	10	9	
22	Gramoxone SL	4	5	7	8	10	9	7	7	8	9	8	
2+14+15	OpTill or OpTill PRO + MSO	7	8	1	7	10	8	9	9	9	9	9	
14+4	Sharpen + 2,4-D	8	9	2	6	10	9	9	9	9	10	9	
14+9	Sharpen + glyphosate♦ ²	9	10	10	8	10	8	8	6	10	10	10	
14+2+4	Valor XLT + 2,4-D	9	9	4	8	10	9	9	9	10	10	9	
14+9+4	Valor + glyphosate♦ + 2,4-D	9	9	10	8	10	9	9	9	9	10	9	

¹This guide presents burndown information only. It does not reflect residual weed control.

²During colder days/nights (less than 60°F/50°F) glyphosate performance can be reduced.

♦Glyphosate rates are based on a 4.0 ai/gal or 3.0 lb ae/gal formulation. See pages 193-199 for information on common glyphosate formulations.

•Dicamba rates are based on a 4.0 ae/gal formulation, like those found in Clarity. See page 203 or the *Herbicide Dictionary* for other products containing dicamba.

†See pages 8-10 for more information on classification of herbicides by mode and site of action.

Soybean

Broadleaf Weed Response to Spring Burndown Herbicides¹

Plant response may be altered by growing conditions, genetic variation in crops and weeds, soil type, pH, organic matter, temperature, growth stage, and application rates. Rating may vary from season to season and from area to area within the state. Ratings apply when herbicides are used as suggested in this publication. See pages 155-167 for additional problem weeds and their control.

Site of Action†	Response Ratings: Ratings are for light to moderate weed densities, favorable conditions and weed growth stage as specified on product label. High weed densities, adverse conditions, or large weeds will reduce control. 10 = 96-100% 6 = 70-79% 9 = 90-95% 5 = 60-69% 8 = 85-90% 4-2 = less than 60% 7 = 80-84% 1 = 0	Broadleaves																									
		Alfalfa	Chickweed	Dandelion	Evening Primrose	Field Pansy	Field Pennycress	Giant Ragweed, Glyphosate-Resistant	Hairy Vetch	Henbit	Kochia	Kochia, ALS-Resistant	Kochia, Glyphosate-Resistant	Kochia, Triazine-Resistant	Lambsquarters	Marestail	Marestail, Glyphosate-Resistant	Prickly Lettuce	Purslane Speedwell	Russian Thistle	Shepherdspurse	Smartweed	Sunflower	Sweetclover	Tansymustard	Velvetleaf	Virginia Pepperweed
4	2,4-D ester ²	5	4	7	7	4	8	9	7	4	6	6	6	4	9	7	7	9	7	9	8	7	10	6	7	8	7
14+2	Authority First/Sonic	4	7	7	7	8	8	6	4	6	8	6	8	8	9	9	9	7	7	8	9	8	10	4	9	9	9
14+2+4	Authority First/Sonic + 2,4-D	7	7	8	8	-	10	9	7	8	8	8	8	7	9	10	10	9	10	10	10	9	10	10	9	10	9
14+2+4	Authority Max + Aim+ 2,4-D	7	5	8	8	7	10	8	7	8	8	8	8	8	9	8	8	9	9	9	9	5	7	9	9	10	9
14+5+4	Authority MTZ + 2,4-D	5	5	8	8	-	8	9	8	9	9	9	8	9	8	8	10	8	10	9	9	10	10	7	9	10	10
14+2+4	Authorty XL + Aim + 2,4-D	8	6	9	8	-	10	9	8	9	8	8	8	9	9	9	10	10	9	9	9	5	8	10	8	10	9
2+5	Canopy	4	6	8	9	8	9	6	5	8	8	5	8	8	9	8	8	9	9	8	10	8	8	4	7	8	9
2+9	Extreme	4	10	8	8	9	10	6	7	9	9	8	6	9	10	9	8	9	9	10	10	10	10	3	8	10	9
9	Glyphosate ^{♦3,4}	5	10	7	8	9	10	2	6	9	8	8	2	8	9	8	5	7	10	9	10	8	9	4	7	9	9
9+4	Glyphosate ^{♦3,4} + 2,4-D ester 4L	6	10	8	9	-	10	9	7	9	9	9	6	9	9	9	7	8	10	9	10	9	10	5	8	10	9
9+2	Glyphosate ^{♦3,4} + Pursuit	6	9	8	8	9	10	6	7	9	9	8	6	9	9	9	8	9	9	10	10	10	10	3	9	10	9
9+5	Glyphosate ^{♦3,4} + Dimetric/Glory / Tricor	4	10	7	7	9	10	6	7	9	8	8	6	7	8	8	8	9	10	10	10	8	10	4	9	8	9
9+14	Glyphosate ^{♦3,4} + Sharpen	8	10	8	9	9	10	6	9	10	10	10	8	10	10	9	8	10	10	10	10	10	9	9	10	10	9
22	Gramoxone SL	4	10	5	7	6	10	6	7	9	9	9	9	9	8	7	7	8	6	9	9	6	10	4	8	8	9
14+2+15	OpTill or OpTill PRO + MSO	9	9	8	9	6	10	7	8	8	9	7	9	9	9	9	9	10	9	9	10	10	10	9	9	10	8
2	Pursuit	1	8	4	5	6	9	6	2	7	6	2	6	6	5	4	4	7	3	6	9	8	8	2	7	9	3
14+5+9+2	Ransom + glyphosate + 2,4-D	10	10	8	8	8	10	8	9	10	9	9	6	9	9	9	9	9	8	8	9	9	9	9	9	9	9
2	Scepter	1	9	4	5	-	9	6	3	7	7	2	7	7	5	4	4	6	3	5	9	7	8	1	7	7	1
2+9	Tackle	4	9	7	7	8	7	6	6	8	7	5	7	7	8	7	4	8	7	7	9	9	9	3	8	9	7
14+9	Valor or Outflank or Rowel + glyphosate	10	10	9	9	9	10	6	10	10	9	9	6	9	9	9	9	9	10	9	9	10	9	9	9	9	9
14+2+9+4	ValorXLT + RowelFX + glyphosate + 2,4-D	9	10	9	10	-	10	9	9	10	10	10	6	10	10	10	10	9	10	10	10	10	10	9	10	9	10
14+15	Verdict + MSO	6	7	5	8	5	10	6	8	7	8	8	8	8	8	8	8	10	10	10	10	9	9	8	9	10	9

See footnotes on page 113.

[†]See pages 8-10 for more information on classification of herbicides by mode and site of action.

Soybean

Grass Weed Response to Spring Burndown Herbicides¹

Plant response may be altered by growing conditions, genetic variation in crops and weeds, soil type, pH, organic matter, temperature, growth stage, and application rates. Rating may vary from season to season and from area to area within the state. Ratings apply when herbicides are used as suggested in this publication. See pages 155-167 for additional problem weeds and their control.

Site of Action†	Response Ratings: Ratings are for light to moderate weed densities, favorable conditions and weed growth stage as specified on product label. High weed densities, adverse conditions, or large weeds will reduce control. 10 = 96-100% 6 = 70-79% 9 = 90-95% 5 = 60-69% 8 = 85-90% 4-2 = less than 60% 7 = 80-84% 1 = 0	Grasses					
		Annual Bluegrass	Downy Brome	Foxtail Barley	Volunteer RR Corn ³	Volunteer Corn	Winter Wheat or Rye
4	2,4-D ester ²	1	1	1	1	1	1
14+2	Authority First/Sonic	1	1	1	1	1	1
14+2+4	Authority First/Sonic + 2,4-D	1	1	1	1	1	1
14+2+4	AuthorityMaxx + Aim + 2,4-D	1	1	1	1	3	3
14+5+4	Authority MTZ + 2,4-D	3	2	1	2	2	2
14+2+4	Authority XL + Aim + 2,4-D	1	1	1	1	4	3
2+5	Canopy	2	2	1	3	3	2
2+9	Extreme	10	10	9	3	10	9
9	Glyphosate ^{◆3,4}	10	10	9	1	10	10
9+4	Glyphosate ^{◆3,4} + 2,4-D ester 4L	10	10	9	1	10	10
9+2	Glyphosate ^{◆3,4} + Pursuit	10	10	9	4	10	9
9+5	Glyphosate ^{◆3,4} + Dimetric/Glory/Tricor	10	10	9	1	10	10
9+14	Glyphosate ^{◆3,4} + Sharpen + MSO	10	10	10	4	10	10
22	Gramoxone SL	8	7	8	4	4	6
14+2	OpTill + MSO	5	2	7	3	3	1
2	Pursuit	5	2	7	3	3	1
14+5+9+2	Ransom + glyphosate	10	10	10	1	10	10
2	Scepter	5	1	5	3	3	1
2+9	Tackle	9	9	9	1	9	9
14+9	Valor or Outflank or Rowel + glyphosate	10	10	10	1	10	10
14+2+9+4	ValorXLT+RowelFX+glyphosate+2,4-D	10	10	10	6	10	10
14+15	Verdict + MSO	2	2	2	3	3	2

¹This table presents burndown information only. It does not reflect residual weed control.

²See table entitled *Using 2,4-D and Dicamba Before Planting* on page 122.

³Glyphosate-based products will not control Roundup Ready volunteer corn. Refer to soybean section for listing of grass herbicides for control of volunteer Roundup Ready corn.

⁴During cool days/nights (less than 50-60°F), glyphosate performance can be reduced.

♦Glyphosate rates are based on a 4.0 ai/gal or 3.0 lb ae/gal formulation. See pages 193-199 for information on common glyphosate formulations.

†See pages 8-10 for more information on classification of herbicides by mode and site of action.

Soybean

Broadleaf Weed Response To Soil-Applied Herbicides

Plant response may be altered by growing conditions, genetic variation in crops and weeds, soil type, pH, organic matter, temperature, growth stage, and application rates. Rating may vary from season to season and from area to area within the state. Ratings apply when herbicides are used as suggested in this publication. See pages 155-167 for additional problem weeds and their control.

Site of Action†	Response Ratings: Ratings are for light to moderate weed densities, favorable conditions and weed growth stage as specified on product label. High weed densities, adverse conditions, or large weeds will reduce control. 10 = 96-100% 6 = 70-79% 9 = 90-95% 5 = 60-69% 8 = 85-90% 4-2 = less than 60% 7 = 80-84% 1 = 0	Broadleaves																			
		Cocklebur (5.5)§	E. Black Nightshade (3.5)	Kochia & Kochia Glyph. Resistant	Kochia, ALS-Resistant (2.5)	Kochia, Triazine-Resistant (2.5)	Lambsquarters (1.5)	Marestail (2)	Marestail, Glyphosate-Resistant (2)	Morningglories (5.5)	Pigweed (2.5)	Pigweed, Triazine-Resistant (2.5)	Ragweed, Common and Giant (3)	Russian Thistle (2.3)	Smartweed (1.5)	Sunflower (10)	Velvetleaf (4.2)	Waterhemp (2.5)	Waterhemp, ALS-Resistant (2.5)	Waterhemp, Glyphosate-Resistant	Waterhemp, Triazine-Resistant (2.5)
4+2+2	Afforia	7	9	9	8	9	9	8	8	7	9	9	8	8	9	9	8	9	8	8	8
14+15	Anthem Maxx	2	8	6	6	6	7	6	6	5	9	9	6	5	5	1	7	8	8	8	8
14+2	Authority Assist	8	9	9	9	9	9	5	5	8	9	9	6	8	9	7	8	9	9	9	9
14+15	Authority Elite/Broadaxe XC	4	8	9	9	9	9	3	3	6	9	9	4	7	8	1	4	9	9	9	9
14+2	Authority First/Sonic	8	8	9	9	9	8	8	8	8	9	9	8	9	7	8	7	9	9	9	9
14+5	Authority MTZ	6	8	9	9	9	9	7	7	8	9	9	7	8	8	5	6	9	9	9	9
14+2	Authority XL/ Authority Maxx	9	8	9	9	9	9	8	8	9	9	9	8	9	9	9	9	9	9	9	9
15+5	Boundary/Tailwind	4	7	4	4	2	9	7	7	2	9	8	9	7	8	4	6	9	9	9	7
2+5	Canopy	8	4	9	7	7	9	7	7	9	8	5	4	7	8	8	8	9	6	9	9
13	Command	6	4	9	9	9	8	4	4	2	2	2	4	5	8	4	10	2	2	2	2
15	Dual II Magnum/Parallel PCS	2	7	2	2	2	8	2	2	1	8	8	5	3	2	2	2	8	8	8	8
2+14	Envive/Enlite	9	9	9	8	9	9	8	8	8	9	9	9	8	9	9	9	9	9	9	9
14+15	Fierce	7	7	8	8	8	8	7	7	9	9	9	8	7	7	1	8	9	9	9	9
14+15+2	Fierce XLT	9	9	9	8	9	9	7	7	9	9	9	8	8	9	9	9	9	9	9	9
2	FirstRate	8	3	8	1	8	6	6	6	5	8	8	9	-	8	8	8	6	1	6	6
2+14	Surveil	8	9	8	8	8	8	8	8	7	9	8	9	7	8	8	8	8	8	8	8
14+2	Latir/Militia	6	8	9	6	9	9	7	7	6	9	9	7	7	9	7	9	9	6	9	9
5	Metribuzin (Dimetric/Glory/Tricor)	5	5	8	8	3	8	7	7	4	8	3	9	8	8	6	8	7	7	7	2
15	Outlook	2	6	2	2	2	7	2	2	2	8	8	5	3	2	2	2	8	8	8	8
14+2	OpTill	7	9	9	9	9	8	8	8	6	9	9	8	8	9	8	8	7	5	7	7
14+2+15	Optill Pro	7	9	9	9	9	8	8	8	6	9	8	8	9	8	8	8	8	8	8	8
15+14	Prefix/Vise/Statement	3	9	4	4	4	8	4	4	2	9	9	5	3	2	4	2	9	9	9	9
3	Prowl H ₂ O	2	2	7	7	7	7	2	2	2	7	7	2	7	2	2	4	7	7	7	7
3+5	Prowl H ₂ O + Metribuzin	4	2	7	7	7	9	7	7	2	9	7	9	9	7	4	7	9	9	9	7
2+15	Pummel	6	8	8	1	9	8	4	4	6	9	9	9	6	9	8	9	9	7	9	8
2	Pursuit	6	9	8	1	8	8	4	4	6	9	9	8	-	9	8	8	6	1	6	6
2+15	Pursuit + Dual II Magnum	6	8	8	2	9	9	4	4	6	9	9	9	-	9	8	8	9	7	9	9
14+5	Ransom	5	9	8	8	8	8	8	8	6	9	9	9	8	7	6	8	9	9	9	9
2+15	Scepter + Dual II Magnum	9	8	6	2	4	9	5	5	7	9	9	9	-	9	8	7	9	7	9	9
2+14	Torment	5	9	7	4	6	8	4	5	6	9	9	9	6	6	6	8	9	6	9	9
3+5	Trifluralin + Trifluralin + Metribuzin	4	2	7	8	7	9	7	7	2	8	7	9	9	7	4	7	9	9	9	7
2+5+14	Trivence	6	7	9	7	7	9	7	7	8	9	7	6	7	7	7	8	9	7	9	9
14	Valor/Outflank/Rowel	2	9	8	8	8	8	8	8	6	9	8	7	7	6	3	7	9	9	9	9
14+2	Valor XLT/Rowel FX	9	9	9	8	9	9	8	8	9	8	9	8	8	9	9	9	9	9	9	9
15	Warrant	6	8	6	6	6	9	6	6	6	9	9	7	6	6	6	7	8	8	8	8
4+15	Warrant Ultra	7	9	7	7	7	9	7	7	7	9	9	8	7	7	7	8	9	9	9	9
15	Zidua	6	7	7	7	7	7	6	6	5	8	8	6	6	5	5	8	8	8	8	8

See footnotes on page 115.

†See pages 8-10 for more information on classification of herbicides by mode and site of action.

Soybean

Grass Weed Response To Soil-Applied Herbicides

Plant response may be altered by growing conditions, genetic variation in crops and weeds, soil type, pH, organic matter, temperature, growth stage, and application rates. Rating may vary from season to season and from area to area within the state. Ratings apply when herbicides are used as suggested in this publication. See pages 155-167 for additional problem weeds and their control.

Site of Action†	Response Ratings: Ratings are for light to moderate weed densities, favorable conditions and weed growth stage as specified on product label. High weed densities, adverse conditions, or large weeds will reduce control. 10 = 96-100% 6 = 70-79% 9 = 90-95% 5 = 60-69% 8 = 85-90% 4-2 = less than 60% 7 = 80-84% 1 = 0	Grasses											Crop Safety▯
		Barnyardgrass (0.3)§	Crabgrass (0.5)	Fall Panicum (0.4)	Giant Foxtail (2)	Green Foxtail (1)	Yellow Foxtail (1)	Sandbur (0.4)	Shattercane/Sorghum (3.5)	Shattercane, ALS-Resistant (3.5)	Volunteer Corn (6)	Woolly Cupgrass (2.5)	
14+2+2	Afforia	7	6	7	7	7	7	5	5	2	2	5	2
14+15	Anthem Maxx	9	9	9	9	9	9	7	6	6	3	3	1
14+2	Authority Assist	6	7	7	7	8	8	5	6	3	3	3	2
14+15	Authority Elite/Broadaxe XC	9	9	9	9	9	9	5	4	4	2	6	1
14+2	Authority First/Sonic	5	7	5	4	6	5	3	3	3	3	3	2
14+5	Authority MTZ	4	4	4	5	5	4	2	4	4	1	1	3
14+2	Authority XL	6	7	6	6	7	6	3	5	2	3	3	2
15+5	Boundary/Tailwind	9	9	9	9	9	9	4	4	4	1	6	3
2+5	Canopy	4	4	4	4	4	4	2	2	2	2	2	2
13	Command	9	9	9	9	9	9	6	6	6	5	6	1
15	Dual II Magnum/Parallel PCS	9	9	9	9	9	9	5	4	4	1	6	1
2+14	Envive/Enlite	6	6	5	6	6	6	3	3	3	3	5	2
14+15	Fierce	8	7	7	8	8	8	7	6	6	3	5	2
14+15+2	Fierce XLT	8	7	7	8	8	8	7	6	6	3	5	2
2	FirstRate	1	1	1	3	1	4	1	1	1	1	1	2
2+14	Surveil	6	5	7	6	6	6	3	3	3	3	3	2
14+2	Latir/Militia	7	6	8	7	7	7	5	7	2	3	3	2
5	Metribuzin (Dimetric/Glory)/TriCor	2	2	2	2	2	2	2	4	2	1	1	3
15	Outlook	9	9	9	9	9	9	4	4	4	4	6	1
14+2	OpTill	6	2	6	7	7	7	5	7	1	1	3	2
14+2+15	OpTill Pro	9	9	9	9	9	9	4	4	4	4	6	1
15+14	Prefix/Vise/Statement	9	9	9	9	9	9	4	4	4	3	6	2
3	Prowl H ₂ O	9	9	9	9	9	9	8	6	6	3	8	2
3+5	Prowl H ₂ O + Metribuzin	9	9	9	9	9	9	8	7	7	3	7	3
2+15	Pummel	7	9	7	9	9	9	6	7	3	3	5	2
2	Pursuit	6	2	6	7	7	7	5	7	1	3	3	2
2+15	Pursuit + Dual II Magnum	9	9	9	9	9	9	7	7	3	3	5	2
14+5	Ransom	6	6	5	7	7	7	3	4	3	3	5	3
2+15	Scepter + Dual II Magnum	9	9	9	9	9	9	4	4	4	2	5	2
2+14	Torment	6	5	6	7	7	7	6	6	3	3	3	2
3+5	Trifluralin + Metribuzin	9	9	9	9	9	9	8	7	7	2	6	3
2+5+14	Trivence	6	5	6	6	6	6	3	3	3	2	4	2
14	Valor/Outflank/Rowel	6	6	5	7	7	7	3	3	3	3	5	2
14+2	Valor XLT/Rowel FX	6	6	5	7	7	7	3	3	3	3	5	2
15	Warrant	9	9	7	7	7	7	5	5	5	5	5	1
14+15	Warrant Ultra	9	9	8	7	8	8	5	6	5	5	6	2
15	Zidua	8	7	7	8	8	8	7	6	6	3	5	2

[§]Weed Competitive Index — See page 11.

[¶]Varieties differ in their response to herbicides. Crop safety ratings less than 3 indicate that crop yield should not be affected by any direct injury. If stand is not lost to injury, most crops will compensate for early injury. Adding surfactants, COC, or liquid nitrogen may reduce crop safety for some herbicide combinations. Refer to product label for specific information.

[†]See pages 8-10 for more information on classification of herbicides by mode and site of action.

Soybean

Broadleaf Weed Response To Postemergence Herbicides

Plant response may be altered by growing conditions, genetic variation in crops and weeds, soil type, pH, organic matter, and application rates. Ratings may vary from season to season and among geographical areas within the state. Ratings apply when herbicides are used as suggested in this publication. See pages 155-167 for additional problem weeds and their control. For generic herbicides check label to confirm site.

Site of Action†	Response Ratings: Ratings are for light to moderate weed densities, favorable conditions and weed growth stage as specified on product label. High weed densities, adverse conditions, or large weeds will reduce control. 10 = 96-100% 9 = 90-95% 8 = 85-90% 7 = 80-84% 6 = 70-79% 5 = 60-69% 4-2 = less than 60% 1 = 0	Herbicide	Broadleaves																		
			Cocklebur (5.5)§	E. Black Nightshade (3.5)	Giant Ragweed (3)	Giant Ragweed, Glyphosate-Resistant (3)	Kochia Glyphosate-Resistant	Kochia, ALS-Resistant (2.5)	Kochia, Triazine-Resistant (2.5)	Lambsquarters (1.5)	Marestail (2)	Marestail, Glyphosate-Resistant (2)	Morningglories (5.5)	Pigweed (2.5)	Russian Thistle (2.3)	Smartweed (1.5)	Sunflower (10)	Velvetleaf (4.2)	Waterhemp (2.5)	Waterhemp, ALS-Resistant (2.5)	Waterhemp, Glyphosate-Resistant
1	Assure II/Targa	2	2	2	2	2	2	2	2	1	1	1	2	2	1	2	2	2	2	2	2
6	Basagran	9	2	7	6	7	7	7	7	4	4	3	2	7	9	8	9	2	2	2	2
14	Cadet	7	7	5	6	7	7	7	9	6	6	7	8	7	7	5	10	7	7	7	7
2	Classic	10	2	9	6	4	1	4	4	6	6	8	8	3	9	9	8	6	1	6	6
14	Cobra/ Phoenix	8	8	7	7	7	7	7	2	6	6	6	9	6	7	4	4	9	9	9	9
9+4	Enlist Duo*	9	9	9	7	7	8	8	8	8	6	8	9	8	9	9	9	9	9	7	9
2+9	Extreme	9	9	8	6	9	6	9	9	9	4	8	9	7	9	9	9	9	9	6	9
2	FirstRate	9	2	9	8	4	1	4	3	8	8	5	5	3	8	9	9	4	1	4	4
14+9	Flexstar GT	9	10	10	8	5	10	10	8	8	6	7	10	10	9	9	9	9	9	9	9
1	Fusilade DX	2	2	2	2	2	2	2	2	1	1	1	2	2	2	2	2	2	2	2	2
1	Fusion	2	2	2	2	2	2	2	2	1	1	1	2	2	2	2	2	2	2	2	2
9	Glyphosate♦	9	8	8	2	2	8	8	8	8	2	7	9	7	8	9	8	9	9	3	9
9+14	Glyphosate♦ + Phoenix	9	8	10	6	7	9	9	6	7	6	7	10	9	10	8	9	10	10	9	10
9+2	Glyphosate♦ + Raptor	10	10	8	6	8	8	10	10	7	6	7	10	10	8	10	10	10	10	6	10
9+14	Glyphosate♦ + Ultra Blazer	8	10	10	7	4	9	9	6	7	6	7	10	10	10	8	8	9	9	9	9
2	Harmony SG/Unity	6	2	4	7	4	1	4	8	7	7	5	8	3	8	6	8	6	1	6	6
2	Harmony SG/Unity + Classic	9	2	9	7	4	1	4	9	7	7	8	9	7	9	9	9	6	1	6	6
10	Libertyc	7	7	7	7	6	6	6	8	7	7	8	7	6	8	7	8	7	7	7	7
14	Marvel	7	8	8	6	6	6	6	9	7	7	7	9	7	8	7	10	9	9	9	9
1	Poast	2	2	2	2	2	2	2	2	1	1	1	2	2	2	2	2	2	2	2	2
2	Pursuit	9	8	7	6	8	1	8	4	5	5	5	9	5	8	7	8	6	1	6	6
2+14	Pursuit + Ultra Blazer or Phoenix or Reflex	9	8	9	7	8	4	5	4	4	4	5	9	5	9	7	7	9	8	9	9
2	Raptor	9	9	7	6	8	1	8	8	5	5	5	9	-	7	9	9	6	1	6	6
2+14	Raptor + Ultra Blazer	9	9	9	8	8	4	8	8	6	6	6	9	5	9	9	9	9	9	9	9
14	Reflex/Flexstar/Rhythm/Dawn/Rumble	7	8	9	6	4	4	4	5	7	7	5	9	5	8	7	7	9	9	9	9
14	Resource	7	4	7	6	3	3	3	7	5	5	5	5	3	4	4	10	4	4	4	4
1	Select Max	2	2	2	2	2	2	2	2	1	1	1	2	2	2	2	2	2	2	2	2
2	Synchrony XP	9	2	9	6	6	1	6	9	6	6	5	9	7	9	9	9	6	1	6	6
2+9	Tackle	9	9	8	6	9	9	9	9	9	4	8	9	7	9	9	9	9	9	9	9
2+14	Torment	9	8	9	7	6	4	8	5	7	7	5	9	5	8	7	9	9	9	9	9
14	Ultra Blazer	6	8	9	6	4	4	4	4	6	6	6	9	5	9	4	4	9	9	9	9

See footnotes on page 117.

[†]See pages 8-10 for more information on classification of herbicides by mode and site of action.

*Enlist Duo can be applied only on Enlist soybeans.

Soybean

Grass Weed Response To Postemergence Herbicides

Plant response may be altered by growing conditions, genetic variation in crops and weeds, soil type, pH, organic matter, and application rates. Ratings may vary from season to season and among geographical areas within the state. Ratings apply when herbicides are used as suggested in this publication. See pages 155-167 for additional problem weeds and their control. For generic herbicides check label to confirm site.

Site of Action†	Herbicide	Grasses															Crop Safety▣
		Barnyardgrass (0.3)§	Crabgrass (0.5)	Fall Panicum (0.4)	Giant Foxtail (2)	Green Foxtail (1)	Yellow Foxtail (1)	Sandbur (0.4)	Shattercane/Sorghum (3.5)	Shattercane, ALS-Resistant (3.5)	Volunteer Corn, Conventional (6)	Volunteer Corn, Roundup Ready (6) ^a	Volunteer Corn, Liberty Link (6) ^d	Volunteer Corn, Clearfield (6) ^b	Woolly Cupgrass (2.5)		
	Response Ratings: Ratings are for light to moderate weed densities, favorable conditions and weed growth stage as specified on product label. High weed densities, adverse conditions, or large weeds will reduce control. 10 = 96-100% 6 = 70-79% 9 = 90-95% 5 = 60-69% 8 = 85-90% 4-2 = less than 60% 7 = 80-84% 1 = 0																
	§Weed Competitive Index — See page 11.																
1	Assure II/Targa	9	9	9	8	8	6	9	10	10	10	10	10	10	9	1	
6	Basagran	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1	
14	Cadet	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	
2	Classic	2	2	2	2	2	1	2	2	2	3	3	3	3	2	3	
14	Cobra/Phoenix	2	4	4	1	1	1	4	4	4	2	2	2	2	2	3	
9+4	Enlist Duo*	10	9	10	9	10	9	10	9	10	10	1	10	10	9	2	
2+9	Extreme	10	9	10	8	10	9	10	10	10	10	6	10	10	9	1	
2	FirstRate	1	1	1	1	1	1	1	1	1	2	2	2	2	1	2	
14+9	Flexstar GT	10	9	10	9	10	9	10	10	10	10	1	10	10	9	3	
1	Fusilade DX	9	9	9	8	9	8	8	10	10	10	10	10	10	9	1	
1	Fusion	9	9	9	9	9	9	8	10	10	10	10	10	10	9	2	
9	Glyphosate◆	10	9	10	9	10	9	10	10	10	10	1 ^a	10	10	9	1	
9+14	Glyphosate◆ + Phoenix	10	9	10	9	10	9	10	10	10	10	2 ^a	10	10	9	3	
9+2	Glyphosate◆ + Raptor	10	9	10	9	10	9	10	10	10	10	3 ^a	10	10	9	1	
9+14	Glyphosate◆ + Ultra Blazer	10	9	10	9	10	9	10	10	10	10	3 ^a	10	10	9	3	
2	Harmony SG/Unity	1	1	1	1	1	1	1	1	1	2	2	2	2	2	3	
2	Harmony SG/Unity + Classic	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	
10	Liberty ^c	7	8	7	8	7	8	6	7	7	6	6	1 ^d	6	6	1	
14	Marvel	2	3	3	3	3	3	3	4	4	5	1	1	1	1	3	
1	Poast	9	9	9	9	9	9	9	10	10	10	10	10	10	9	1	
2	Pursuit	7	7	5	8	9	7	5	9	1	6	6	6	1 ^b	6	1	
2+14	Pursuit + Ultra Blazer or Phoenix or Reflex	7	7	4	8	8	7	4	6	9	6	6	6	1 ^b	4	3	
2	Raptor	8	7	9	9	9	8	7	9	1	8	8	8	1 ^b	5	1	
2+14	Raptor + Ultra Blazer	8	7	9	9	9	8	7	9	1	8	8	8	1 ^b	5	3	
14	Reflex/Flexstar/Rhythm/Dawn/Rumble	2	4	4	4	5	4	4	4	4	6	6	6	6	1	3	
14	Resource	1	1	1	1	1	1	1	1	1	1	1	1	1	1	3	
1	Select Max	9	9	9	9	9	9	9	10	10	10	10	10	10	9	1	
2	Synchrony XP	2	2	2	2	2	2	2	2	2	6	6	6	1 ^b	2	1	
2+9	Tackle	10	9	10	9	10	9	10	10	10	10	9	10	10	9	1	
2+14	Torment	7	7	5	7	9	7	5	8	4	6	6	6	6	1	3	
14	Ultra Blazer	2	4	4	2	2	2	4	4	4	3	3	3	3	2	3	

■ Varieties differ in their response to herbicides. Crop safety ratings less than 3 indicate that crop yield should not be affected by any direct injury. If stand is not lost to injury, soybeans will compensate for early injury. Adding surfactants, COC, or liquid nitrogen may reduce crop safety for some herbicide combinations. Refer to product label for specific information.

^aGlyphosate will not control Roundup Ready volunteer corn.

^bClearfield corn will not be controlled by imidazolinones and sulfonylurea herbicides.

^cFor use with Liberty-Link soybeans only.

^dLiberty will not control Liberty-Link volunteer corn hybrids.

[◆]Glyphosate rates are based on a 4.0 ai/gal or 3.0 lb ae/gal formulation. See pages 193-199 for information on common glyphosate formulations.

[†]See pages 8-10 for more information on classification of herbicides by mode and site of action.

*Enlist Duo can be applied only on Enlist soybeans.

Using 2,4-D or Dicamba Before Planting

The University of Nebraska recommends following the guidelines below when applying 2,4-D or dicamba before planting corn, soybean and sorghum. Please note that these recommendations are applicable to both the ester and amine formulations of 2,4-D.

<u>2,4-D Preplant Interval</u>	<u>Use Rate</u>	<u>Use Rate</u>	<u>Dicamba Preplant Interval</u>	<u>Use Rate</u>	<u>Use Rate</u>
<u>Crop</u>	<u>16 oz</u>	<u>>16 oz</u>	<u>Crop</u>	<u>4 oz</u>	<u>8 oz</u>
Corn	7 days	14 days	Corn	5 days	7 days
Soybean (use ester only)	7 days	30 days	Soybean	DO NOT USE	DO NOT USE
Sorghum	10 days	21 days	Sorghum	7 days	10 days

Soybean

Fall Burndown Treatments (See page 52 for spray additives)

See Weed Response Chart on page 105 before selecting herbicides)	Commercial Product per Acre			Remarks and Approximate Cost Per Acre Broadcast
	Sandy Loam < 1% OM	Silt Loam 1-2% OM	Silty-Clay Loam > 2% OM	
2,4-D ESTER	32.0 oz	32.0 oz	32.0 oz	Apply before ground freezes. Cost: \$3.50.
2,4-D	16.0 oz	16.0 oz	16.0 oz	Apply before ground freezes. Cost: \$6.50.
+ DICAMBA	8.0 oz	8.0 oz	8.0 oz	
AIM	0.75 oz	0.75 oz	0.75 oz	Apply before ground freezes. Cost: \$8.50.
+ 2,4-D	16.0 oz	16.0 oz	16.0 oz	
AUTHORITY MTZ	Do not use	12.0-14.0 oz	14.0-16.0 oz	Can be planted to corn 4 months after application. Apply before ground freezes. Labeled for use only south of Hwy 30 and east of Hwy 281. Cost: \$18.00-\$24.00; Authority XL + Aim + 2,4-D \$24.75-\$28.75.
+ 2,4-D	—	16.0 oz	16.0 oz	
AUTHORITY XL	4.0 oz	4.0-5.0 oz	4.0-5.0 oz	
+ AIM	0.75 oz	0.75 oz	0.75 oz	
+ 2,4-D	16.0 oz	16.0 oz	16.0 oz	
CANOPY EX	1.1-3.3 oz	1.1-3.3 oz	1.1-3.3 oz	Canopy EX is only labeled for use south of Hwy 30 and east of Hwy 281. Can be used 14 days before planting. DO NOT EXCEED 1.1 oz/A of Canopy EX on soil with pH greater than 7.0. Cost: \$11.00-\$30.00.
ENVIVE/ENLITE	2.5-2.8 oz	2.5-2.8 oz	2.5-2.8 oz	Do not apply Enlite on fields that received alachlor (Intrro), metolachlor (Dual), or dimethenamide (Outlook) in the same season as it may result in severe soybean injury during a prolonged period of cool, wet weather. Cost: \$16.00-\$20.00.
EXTREME	3.0 pt	3.0 pt	3.0 pt	Apply before ground freezes. Cost: \$12.00.
GLYPHOSATE♦	32.0 oz	32.0 oz	32.0 oz	Apply before ground freezes. Cost: \$3.50.
GLYPHOSATE♦	32.0 oz	32.0 oz	32.0 oz	Apply before ground freezes. Cost: \$6.25.
+ 2,4-D	16.0 oz	16.0 oz	16.0 oz	
GRAMOXONE SL	2.0-3.0 pt	2.0-3.0 pt	2.0-3.0 pt	Apply before ground freezes. Cost: \$9.50-\$14.25.
OPTILL	2.0 oz	2.0 oz	2.0 oz	Must add MSO at 1% v/v. Use only if the next crop will be soybean. Apply in fall to kill emerged winter annuals. Cost: \$16.00.
OPTILL PRO	2.0 oz dry + 10.0 oz liquid	2.0 oz dry + 10.0 oz liquid	2.0 oz dry + 10.0 oz liquid	It is a co-pack of dry and liquid components. Mixing order is critical for product activity, therefore place a dry component first until it dissolves in water and then add a liquid component. Cost: \$25.50.
SHARPEN	2.0 oz	2.0 oz	2.5 oz	Apply before ground freezes. Apply with MSO (1 qt/A) and 1-2% AMS. Cost: \$12.25-\$18.50.
+ GLYPHOSATE	32.0 oz	32.0 oz	32.0 oz	
or 2,4-D	1.0 pt	1.0 pt	1.0 pt	
VALOR or OUTFLANK	2.0 oz	2.0-3.0 oz	2.0-3.0 oz	Apply before ground freezes. Cost: \$19.75-\$26.00.
+ GLYPHOSATE♦	32.0 oz	32.0 oz	32.0 oz	
+ 2,4-D	16.0 oz	16.0 oz	16.0 oz	
VALOR XLT	3.0-5.0 oz	3.0-5.0 oz	3.0-5.0 oz	Do not apply on soils with pH greater than 6.8. In Nebraska, Valor XLT may only be applied south of Hwy 30 and east of Hwy 281. Applications must be made no earlier than October 15 or when soil temperature falls below 50°F at a 2-inch depth. Cost: \$21.00-\$31.00.
+ 2,4-D	32.0 oz	32.0 oz	32.0 oz	
+ GLYPHOSATE	32.0 oz	32.0 oz	32.0 oz	

♦Glyphosate rates are based on a 4.0 ai/gal or 3.0 lb ae/gal formulation. See pages 193-199 for information on common glyphosate formulations.

Soybean

Spring Burndown and No-till (See page 52 for spray additives)

Early preplant (EPP) treatments provide excellent early weed control; however, when the interval between herbicide application and planting is 28 days or more, split applications will generally give better control. If planting is delayed longer than planned after an EPP treatment, a PRE treatment may be needed. A non-selective herbicide such as glyphosate may be needed to control emerged weeds at time of application of residual herbicides. If only non-residual PRE or POST herbicides are used, apply appropriate PRE or POST herbicides as necessary. If Roundup Ready or Liberty Link varieties are planted, consider using a residual herbicide if a high weed density is expected. Also, glyphosate does not control volunteer Roundup Ready corn.

Herbicide (See <i>Weed Response Chart</i> on pages 106-107 before selecting herbicides)	Commercial Product per Acre			Application Time	Remarks and Approximate Cost Per Acre Broadcast
	Sandy Loam < 1% OM	Silt Loam 1-2% OM	Silty-Clay Loam > 2% OM		
NO-TILL IN ALFALFA OR CLOVER SOD					
2,4-D ESTER (4L) ¹ + DICAMBA [•]	32.0 oz	32.0 oz	32.0 oz	Apply in spring to alfalfa with 4” new spring growth	Generally it is not wise to follow alfalfa with soybean. Use appropriate residual herbicide at planting. 2,4-D + Banvel/Clarity used to kill alfalfa. Cost: \$9.50.
	8.0 oz	8.0 oz	8.0 oz		
SOYBEAN, NO-TILL IN COOL-SEASON GRASS SOD					
GLYPHOSATE [♦]	32.0 oz	32.0 oz	32.0 oz	Apply in fall to 6-12” of new growth	Plant RR soybean. Cost: \$3.50.
SOYBEAN, NO-TILL IN WARM-SEASON GRASS SOD					
GLYPHOSATE [♦]	32.0 oz	32.0 oz	32.0 oz	Apply in August to early September	Plant RR soybean. Cost: \$3.50.
SOYBEAN, NO-TILL IN RYE OR WINTER WHEAT					
AUTHORITY XL	3.0 oz	3.2-4.0 oz	4.0-5.0 oz		Cost: \$12.00-\$20.00.
GLYPHOSATE [♦]	32.0 oz	32.0 oz	32.0 oz	Apply when rye and wheat are 4-10” and before soybean emerges	Follow with appropriate EPP treatment. Cost: \$3.50.
SOYBEAN, NO-TILL IN CORN OR SOYBEAN RESIDUE					
AUTHORITY FIRST	5.0 oz	5.0-6.4 oz	6.4-8.0 oz	Apply EPP, PPI or PRE	Do not apply on soils with less than 1% OM. Cost: \$28.25-\$45.00.
AUTHORITY FIRST or SONIC + 2,4-D	5.0-8.0 oz	5.0-8.0 oz	5.0-8.0 oz		Cost: \$31.00-\$47.75.
	16.0 oz	16.0 oz	16.0 oz		
AUTHORITY MTZ + 2,4-D	Do not use	12.0-16.0 oz	16.0-18.0 oz	PRE, 0-14 DBP	Do not use if soybean emerged. Do not graze or harvest forage for hay. Cost: \$20.00-\$30.00.
		16.0 oz	16.0 oz		
AUTHORITY XL / AUTHORITY MAXX + AIM + 2,4-D	5.0 oz	6.0-7.0 oz	6.0-8.0 oz	PP, PRE and up to 3 days after planting in soybean	Do not use north of Hwy 30 or west of Hwy 281 in Nebraska. Do not use on soils with pH greater than 7.6. Do not feed soybean forage or hay to livestock. Cost: \$24.75-\$28.75.
	0.75 oz	0.75 oz	0.75 oz		
	16.0 oz	16.0 oz	16.0 oz		
CANOPY	2.25 oz	3.0 oz	4.0 oz	0-30 DBP	Do not exceed 2.25 oz rate on soils with pH over 7. Use only east of Hwy 281 and south of Hwy 30. Cost: \$6.50-11.50.
DIMETRIC OR GLORY + DUAL II MAGNUM or OUTLOOK or INTRRO	0.33 lb	0.67 lb	0.83 lb	0-14 DBP	Add 0.25% surfactant or 1 qt/A crop oil concentrate for better burndown of small weeds up to 1.5-2”. If emerged weeds are more than 2”, add Gramoxone or glyphosate as discussed in the preemergence section. Split application is not necessary except if planter causes excessive soil disturbance. Do not apply on soils with less than 0.5% OM. Reduce Sencor/Dimetric rate by 1/3 on calcareous soils. Cost: Sencor/Dimetric + Dual II Magnum \$23.25-\$38.00; Sencor/Dimetric + Outlook \$25.50-\$44.00; Intro \$21.25-\$23.50.
	1.0 pt	1.33 pt	1.33 pt		
	12.0 oz	16.0 oz	18.0 oz		
	2.5 qt	2.75 qt	2.5-2.75 qt		
EXTREME	3.0 pt	3.0 pt	3.0 pt	0-30 DBP	Add Sharpen 1 oz 0-21 DBP. Cost: \$12.00.

¹Preplant interval for 1 pt 2,4-D is 7 days. If more than 1 pt of 2,4-D is used, the preplant interval is 30 days or crop injury will result. Do not use Banvel, Clarity or Sterling Blue preplant.

²With colder days/nights (less than 60°F/50°F) glyphosate performance will be reduced.

[♦]Glyphosate rates are based on a 4.0 ai/gal or 3.0 lb ae/gal formulation. See pages 193-199 for information on common glyphosate formulations.

[•]Dicamba rates are based on a 4.0 ae/gal formulation, like those found in Clarity. See page 203 or the *Herbicide Dictionary* for other products containing dicamba.

Soybean

Spring Burndown and No-till *(continued)* (See page 52 for spray additives)

Herbicide (See <i>Weed Response Chart</i> on pages 106-107 before selecting herbicides)	Commercial Product per Acre			Application Time	Remarks and Approximate Cost Per Acre Broadcast
	Sandy Loam < 1% OM	Silt Loam 1-2% OM	Silty-Clay Loam > 2% OM		
GLYPHOSATE♦ ²	32.0 oz	32.0 oz	32.0 oz	0-30 DBP	Cost: \$3.50.
GLYPHOSATE♦ ² + 2,4-D LV ESTER (4L) ¹	32.0 oz 16.0-32.0 oz	32.0 oz 16.0-32.0 oz	32.0 oz 16.0-32.0 oz	7-30 DBP	Use appropriate herbicide at planting. 2,4-D at 1 pt, 7 days before planting; at 2 pt, 30 days before planting. Cost: \$6.25-\$9.25.
OPTILL	2.0 oz	2.0 oz	2.0 oz		Must add MSO at 1% v/v to get burndown activity on emerged broadleaf weeds (less than 6" tall). Cost: \$14.50.
OPTILL PRO	2.0 oz dry + 10.0 oz liquid	2.0 oz dry + 10.0 oz liquid	2.0 oz dry + 10.0 oz liquid		It is a co-pack of dry and liquid components. Mixing order is critical for product activity, therefore place a dry component first until it dissolves in water and then add a liquid component. Cost: \$25.50.
RANSOM + GLYPHOSATE + 2,4-D	Do not use	8.0 oz 32 oz 16 oz	10 oz 32 oz 16 oz	0-30 DBP	Use Adjuvants if weeds emerged
SCEPTER 70DG	2.0 oz	2.0 oz	2.0 oz	PRE	Cost: \$11.00.
SEQUENCE	2.5-3.0 pt	2.5-3.0 pt	2.5-3.0 pt	0-30 DBP	Cost: \$17.75-\$21.50.
TACKLE	32.0 oz	32.0 oz	32.0 oz	PRE, 0-21 DBP	Add 2,4-D ester to enhance control of weeds such as marestail and hemp dog-bane, but delay planting until 7 days after application. Preplant applications may be followed by a second application of Tackle 2-3 weeks after planting. Cost: \$11.00.
VALOR or OUTFLANK or ROWEL or VALOR XLT or ROWEL FX + GLYPHOSATE♦ or 2,4-D LV ESTER (4L) ¹	2.0 oz 3.0-5.0 oz 32.0 oz 16.0 oz	2.0-3.0 oz 3.0-5.0 oz 32.0 oz 16.0 oz	2.0-3.0 oz 3.0-5.0 oz 32.0 oz 16.0 oz	0-14 DBP 0-14 DBP 0-14 DBP 7-14 DBP	Cost: Valor + glyphosate \$17.00-\$23.25; Valor XLT + glyphosate \$18.25-\$28.25; Valor + 2,4-D \$16.25-\$23.00; Valor XLT + 2,4-D \$17.50-\$27.50.

Soil-Applied Herbicides

Herbicide (See <i>Weed Response Chart</i> on pages 108-109 before selecting herbicides)	Commercial Product per Acre			Remarks and Approximate Cost Per Acre Broadcast
	Sandy Loam < 1% OM	Silt Loam 1-2% OM	Silty-Clay Loam > 2% OM	
AFFORIA	2.5 oz	2.5 oz	2.5 oz	PP, PRE. Use 2.5-3.7 oz if 70 BP. Do not use on cracking soybeans.
ANTHEM MAXX	2.5-3.25 oz for sandy loam	3.25-4.75 oz	3.5-5.5 oz	PPSA, PPI, PRE, EPOST. Can be tank-mixed with Authority XL, Authority First, or Authority Assist for broader weed control. Do not apply more than 6.8 oz on coarse soils or 11.0 oz on medium and fine soils in soybean. Cost: \$11.30-\$29.50/A.
AUTHORITY ASSIST 4SC	6.0-8.0 oz	8.0-10.0 oz	10.0-12.0 oz	PPI, PRE. Apply up to 3 days after soybean planting. Use the 5.0-7.0 oz rate in Roundup Ready soybean. Do not use on soils with less than 1% OM. Use 8 oz if soil OM is greater than 3%. Do not harvest feed forage to hay for livestock. Cost: \$18.75-\$37.50.
AUTHORITY ELITE/ BROADAXE XC	22.0-24.0 oz	26.0-28.0 oz	28.0-32.0 oz	PP, PPSM, PPI, PRE. Apply up to 3 days after planting. Cost: \$22.50-\$36.00.
AUTHORITY FIRST/SONIC	Do not use	4.5-6.4 oz	5.0-6.4 oz	Cost: \$25.00-\$35.00.
AUTHORITY MTZ	12.0-16.0 oz	12.0-16.0 oz	16.0-18.0 oz	Do not use on soils with soil pH of 7.5 or greater, and on coarse soil with less than 1% OM. Cost: \$18.00-\$27.00.
AUTHORITY XL/ AUTHORITY MAXX	4.0 oz	6.0 oz	8.0 oz	PP, PRE and up to 3 days after planting in soybean. Do not use north of Hwy 30 or west of Hwy 281 in Nebraska. Do not use on soils with pH greater than 7.6. Do not feed soybean forage or hay to livestock. Cost: \$15.00-\$32.00.
BOUNDARY 6.5 OR TAILWIND	Do not use	1.5-2.0 pt	1.5-2.25 pt	PP, PRE. Cost: \$17.25-\$26.00.
CANOPY	2.25 oz	3.0 oz	4.0 oz	PRE or PREPLANT up to 14 days. Do not exceed 2.25 oz rate on soils with pH over 7. Use only east of Hwy 281 and south of Hwy 30. Cost: \$7.00-\$12.00.

¹Preplant interval for 1 pt 2,4-D is 7 days. If more than 1 pt of 2,4-D is used, the preplant interval is 30 days or crop injury will result. Do not use Banvel, Clarity or Sterling Blue preplant.

²With colder days/nights (less than 60°F/50°F) glyphosate performance will be reduced.

♦See pages 193-199 for information on common glyphosate formulations.

Soybean

Soil-Applied Herbicides (continued) (See page 52 for spray additives)

Herbicide (See <i>Weed Response Chart</i> on pages 108-109 before selecting herbicides)	Commercial Product per Acre			Remarks and Approximate Cost Per Acre Broadcast
	Sandy Loam < 1% OM	Silt Loam 1-2% OM	Silty-Clay Loam > 2% OM	
COMMAND 3ME	1.0 pt	1.6 pt	2.0 pt	Cost: \$21.25-\$42.50.
DIMETRIC or GLORY or TRICOR + DUAL II MAGNUM/CINCH	0.33 lb 1.0 pt	0.40 lb 1.0 pt	0.50 lb 1.33 pt	Cost: Sencor/Dimetric + Dual II Magnum \$23.25-\$32.00.
DUAL II MAGNUM/CINCH or DUAL IIG MAGNUM or PARALLEL PCS	1.33 pt 6.0-8.0 lb 1.6-2.0 pt	1.33 pt 8.0-10.0 lb 1.6-2.0 pt	1.33 pt 10.0-12.0 lb 1.6-2.0 pt	EPP, PRE, or SURFACE MIX. Cost: \$23.75.
ENLITE	2.8 oz	2.8 oz	2.8 oz	Do not tank-mix Enlite/Envive with acetochlor, alachlor, flufenacet, metolachlor (Dual), or dimethenamide (Outlook) within 14 days of planting soybean unless soybean is planted in no-till or minimum tillage on wheat stubble or no-till corn stubble. Cost: \$19.25.
ENVIVE	2.5 oz	3.0 oz	3.5 oz	In Nebraska, use Envive only on soils east of Hwy 281 and south of Hwy 30. On soils with pH greater than 7.0, do not apply more than 2.5 oz/A. Do not apply Envive on fields that received alachlor (Intro), metolachlor (Dual), dimethenamide (Outlook) in the same season as it may result in severe soybean injury during a prolonged period of cool, wet weather. Cost: \$14.50-\$20.25.
FIERCE	3.0 oz	3.0 oz	3.75 oz	PP, PRE. Cost \$20.00-\$25.00.
FIERCE XLT	3.75 oz	3.75-4.5 oz	4.5-5.25 oz	South of Hwy 30 and East Hwy 281
FIRSTRATE	0.60 oz	0.60 oz	0.60 oz	Season Max 1 oz. Cost: \$26.00.
SURVEIL (co-pack) or SURVEIL (pre-mix)	1.8-3.0 oz 0.6 oz	1.8-3.0 oz 0.6 oz	1.8-3.0 oz 0.6 oz	Do not use on sand less than 1% OM. Cost: Gangster V \$12.00-\$20.25. Surveil \$7.00-\$21.00
LATIR/MILITIA	3.2 oz	3.2 oz	4.25 oz	Apply before emergence.
OPTILL	2.0 oz	2.0 oz	2.0 oz	Must used 30 DBP on sandy soil. Must add MSO at 1% v/v to get burndown activity on emerged broadleaf weeds. Apply PP, PPI, Surface Mix or PRE. Cost: \$14.50.
OPTILL PRO	2.0 oz dry + 10.0 oz liquid	2.0 oz dry + 10.0 oz liquid	2.0 oz dry + 10.0 oz liquid	It is a co-pack of dry and liquid components. Mixing order is critical for product activity, therefore place a dry component first until it dissolves in water and then add a liquid component. Cost: \$25.50.
OUTLOOK	12.0-14.0 oz	14.0-18.0 oz	18.0-21.0 oz	Outlook can be applied EPOST up to V5 soybean to obtain residual activity for various weeds. (See <i>Weed Response</i> table for soil-applied herbicides.) Cost: \$13.25-\$23.00.
PREFIX/VEISE/STATEMENT	2.0 pt	2.0 pt	2.0 pt	PP, PRE. Cost: \$15.50.
PROWL H ₂ O	1.2-1.8 pt	1.8-3.0 pt	2.4-3.6 pt	PPI or SURFACE MIX. Cost: Prowl \$7.00-\$22.00.
PROWL H ₂ O + DIMETRIC or GLORY or TRICOR	1.2-1.8 pt 0.33 lb 4.0-5.0 oz	1.8-3.0 pt 0.4 lb 4.0-5.0 oz	2.4-3.6 pt 0.5 lb 4.0-5.0 oz	Cost: \$13.25-\$30.50.
PUMMEL	Do not use	1.6 pt	1.6-2.0 pt	PPI, PP, PRE. Cost: \$12.80-\$16.00.
PURSUIT	4.0 oz	4.0 oz	4.0 oz	Cost: \$14.50.
RANSOM	Do not use	8 oz	10 oz	Apply before emergence. (Follow with Torment EPOST.)
SONIC (see Authority First)	Do not use	3.0-6.4 oz	3.0-6.4 oz	Rates are for conventional soybeans. Use 3.0 oz rate in Roundup-Ready soybean. Do not use on sand with less than 1.0% organic matter. Cost: \$16.50-\$35.25.
TORMENT	1.0 pt	1.0 pt	1.0 pt	PRE. For use in counties east of Hwy. 281. Cost: \$16.90.
TRIVENCE	6.0-10.0 oz	6.0-10.0 oz	6.0-10.0 oz	PP, PRE. Do not exceed 6.0 oz for all soils with < 7.0 pH. Up to 10.0 oz on composite soils with > 7.0 pH. Cost: \$15.30-\$25.50.
VALOR/OUTFLANK/ROWEL	2.0 oz	2.0-3.0 oz	2.0-3.0 oz	PRE. Cost: \$13.50-\$20.25.
VALOR XLT/ROWEL FX	3.0-5.0 oz	3.0-5.0oz	3.0-5.0 oz	PP, PRE. Cost: \$14.75-\$24.75.
ZIDUA	1.5-2.1 oz	2.0-3.0 oz	2.0-3.5 oz	PPSA, PPI, PRE, and EPOST. Cost: \$12.75-\$29.75.

Soybean

Postemergence *(See page 52 for spray additives)*

Herbicide (See <i>Weed Response Chart</i> on pages 110-111 before selecting herbicides)	Rate Per Acre	Application Time	Remarks and Approximate Cost Per Acre Broadcast
ASSURE II or TARGA	7.0-8.0 oz	Grasses 4" Shattercane and corn 12-18"	Use COC (1% v/v) with Targa. If tank-mixed with Harmony SG or Synchrony XP, use NIS at 0.25% v/v. Cost: Assure II \$5.75-\$6.50; Targa \$7.00-\$8.25.
BASAGRAN alone or with ULTRA BLAZER or HARMONY SG or FLEXSTAR/REFLEX	1.0-2.0 pt 8.0-16.0 oz 0.12 oz 12.0-16.0 oz	Broadleaf weeds less than 4" tall	Split applications of Basagran at 1.0 pt/A may improve control of several weeds. See label for specific weed size. Cost: Basagran \$15.00-\$30.00; Basagran + Ultra Blazer \$20.50-\$41.00; Basagran + Harmony SG \$16.75- \$31.75; Basagra + Flexstar/Reflex \$25.25-\$43.75; Basagran + Scepter \$22.75-\$45.50.
BASAGRAN + POAST	1.5-2.0 pt 1.5-2.5 pt	Use Basagran and Poast Plus guidelines	See label for rates and weed size. Cost: \$37.50-\$55.00.
CADET	0.6-0.9 oz	If tank-mixed with glyphosate, use 0.4-0.9 oz	Apply up through full flower stage. Cost: \$8.00-\$12.00.
CLASSIC	0.33-0.75 oz	Apply when most broadleaf weeds are less than 4" tall	In Nebraska, use Classic only on soils east of Hwy 281 and south of Hwy 30. Do not use COC or grass-type herbicide containing high level of formulated oils under hot and humid conditions as crop injury may occur. Refer to Classic label for recrop intervals. Cost: Classic \$6.00-\$13.50; Classic + Harmony SG \$6.25.
CLASSIC + HARMONY SG	0.25 oz 0.12 oz		
COBRA	10.0-12.5 oz	Apply when most broadleaf weeds are 2-4" tall	Do not use during periods of stress or weed control will be poor. See label for specific weed size. Cost: \$13.50-\$21.00.
ENLIST DUO	3.5-4.7 pts/ acre	Apply up to Recrop of soybean (full flower)	Only on Enlist Duo soybeans
EXTREME (Roundup Ready varieties only)	3.0 pt	Weeds 6-8" tall	Add NIS at 1.0 pt/100.0 gal + spray grade AMS 17.0 lb/100.0 gal. Recrop interval of 18 months for oat, sunflower, popcorn, sweet corn, and sorghum. Cost: \$11.00.
FIRSTRATE	0.30 oz	Broadleaf weeds 1-6"	Tank-mix with Blazer or Cobra or Flexstar/Reflex for waterhemp control. Also labeled for second 0.3 oz application. Cost: \$11.00.
FLEXSTAR/REFLEX/DAWN/ RUMBLE/RHYTHM	12.0-16.0 oz	Apply when most broadleaf weeds are less than 4" tall	Do not plant sorghum the following year. Do not use west of Hwy 281. Do not apply Reflex, Flexstar or Rumble to any field more than once every two years. Cost: \$10.00-\$18.50.
FLEXSTAR GT	3.0 pt	When most broadleaf weeds are less than 4" tall	Do not plant sorghum the following year. Do not use west of Hwy 281. Do not apply more than once every two years. Cost: \$15.75.
FUSILADE DX	8.0-12.0 oz	Grasses 2-6"	Use 6.0 oz rate for volunteer corn less than 12" tall, otherwise use higher rate. See label. Cost: \$10.75-\$16.00.
FUSION	6.0-10.0 oz	Grasses 4" Shattercane and corn 12-18"	Use 6.0 oz rate for volunteer corn less than 12" tall, otherwise use higher rate. See label. Cost: \$10.75-\$18.00.
GLYPHOSATE ^{♦1} (Roundup Ready variety required)	32.0 oz	Weeds less than 12" tall	Check label for maximum application amount per growing season. Cost: \$3.50.
GLYPHOSATE ^{♦1} + FLEXSTAR	32.0 oz 8.0 oz	Weeds 2-4"	Control of taller morningglory, velvetleaf, and common waterhemp can be reduced by 60%. Cost: \$10.50.
GLYPHOSATE ^{♦1} + PHOENIX	32.0 oz 5.0 oz	Weeds 2-4"	Control of taller morningglory and velvetleaf can be reduced by 10-40%. Cost: \$12.00.
GLYPHOSATE ^{♦1} + RAPTOR	32.0 oz 3.0 oz	Weeds 2-4"	Control of taller morningglory can be reduced by 60%. Cost: \$17.00.

¹Warning: Repeated use of glyphosate can result in a shift in weed species and weed resistance (see pages 18-22).

[♦]Glyphosate rates are based on a 4.0 ai/gal or 3.0 lb ae/gal formulation. See pages 181-195 for information on common glyphosate formulations.

Soybean

Postemergence (continued) (See page 52 for spray additives)

Herbicide (See <i>Weed Response Chart</i> on pages 110-111 before selecting herbicides)	Rate Per Acre	Application Time	Remarks and Approximate Cost Per Acre Broadcast
GLYPHOSATE ^{♦1} + RAPTOR	32.0 oz 3.0 oz	Weeds 2-4"	Control of taller morningglory can be reduced by 60%. Cost: \$17.00.
GLYPHOSATE ^{♦1} + ULTRA BLAZER	32.0 oz 12.0 oz	Weeds 2-4"	Control of taller morningglory, velvetleaf, and waterhemp can be reduced by 20-60%. Cost: \$11.75.
GLYPHOSATE + WARRANT	32.0 oz 1.25-1.9 qt	Weeds 2-4"	Warrant has no POST activity on emerged weeds. It is added to glyphosate to provide soil residual activity for subsequent flushes of waterhemp and grassy species. Cost: \$12.00-\$18.00.
LIBERTY	29.0-36.0 oz	Soybeans up to 12" (prior to flowering) Weeds 1-4"	Apply only to Liberty Link soybean varieties. Liberty is a contact herbicide without soil residual. Apply 15-20 GPA at 35-40 PSI. Add AMS at 2% v/v. Use higher Liberty rates for taller weeds. Cost: \$22.00-\$26.00.
MARVEL	6.0-7.25 oz	Weeds 1-4"	Do not plant sorghum the following season. Do not use west of Hwy. 281. Do not apply to any field more than once every two years. Cost: \$9.75-\$11.85.
PHOENIX	8.0-12.5 oz	Apply when most broadleaf weeds are less than 4" tall	May be tank-mixed with Select (6.0-8.0 oz) + NIS. COC not required if weeds are less than 4 inches. Cost: \$13.50-\$21.25.
POAST	1.5-2.5 pt	Grasses 8" Shattercane and corn 12-18"	Use lower rate for most grasses and higher rates for volunteer corn control. COC needed for effective control. UAN or AMS will improve control of some species. Refer to label. Cost: \$15.00-\$25.00.
PURSUIT alone or with COBRA or ULTRA BLAZER or FLEXSTAR/REFLEX	4.0 oz 4.0 oz 8.0-16.0 oz 12.0-16.0 oz	Weeds less than 4" Shattercane up to 6"	Do not plant sorghum the following year. Do not use during periods of stress or weed control will be poor. Add Select to improve control of volunteer corn. Do not graze or feed treated soybean forage, hay, or straw to livestock. Cost: Pursuit \$14.50; Pursuit DG + Cobra \$22.50; Pursuit DG + Blazer \$21.50-\$27.00; Pursuit + Flexstar/Reflex \$24.75-\$28.25.
PUMMEL	2 pts	Weeds 2-4"	Do not use if Metolachlor applied
RAPTOR or RAPTOR + ULTRA BLAZER	5.0 oz 4.0 oz 10.0-16.0 oz	Weeds 2-4" Shattercane up to 8"	Apply only once per season. Do not graze or feed treated forage to livestock. Use 4 oz rate if a pre-emergence herbicide was used. Add Ultra Blazer for waterhemp and smartweed control. Cost: Raptor \$22.75; Raptor + Ultra Blazer \$25.25-\$29.25.
RESOURCE	4.0-12.0 oz	Velvetleaf 4-30"	Add COC + AMS. Cost: \$8.00-\$25.00.
SELECT MAX	6.0-16.0 oz	Corn 12-36" See label for specific weeds.	Cost: \$6.00-\$16.00.
STORM	1.5 pt	Broadleaf weeds less than 4" tall	Cost: \$17.75.
SYNCHRONY XP (STS variety required)	0.75 oz	Broadleaf weeds less than 6"	May be tank-mixed with 4.0-6.0 oz Cobra or labeled rates of Blazer or Reflex (where eastern black nightshade or waterhemp is present). Can be tank-mixed with POST grass herbicides under certain conditions. Synchrony STS may reduce POST grass herbicide activity. Cost: (STS variety) \$10.50; (any variety) \$5.25.
SYNCHRONY XP (any variety)	0.375 oz		
TACKLE (Roundup Ready varieties only)	32.0 oz	Weeds 6-8" tall	Add NIS at 1.0 pt/100.0 gal + AMS at 8.5-17.0 lb/100.0 gal. Recrop interval of 18 months for oats, popcorn, sweet corn, sorghum, and sunflower. Cost: \$11.00.
TORMENT	1 pt	Weeds 2-4"	Cost: \$15/acre.
WISE	2 pt	Weeds 2-4"	Do not use if Metolachlor applied. Cost: \$12/acre.

¹Warning: Repeated use of glyphosate can result in a shift in weed species and weed resistance (see page 18-22).

[♦]Glyphosate rates are based on a 4.0 ai/gal or 3.0 lb ae/gal formulation. See pages 181-195 for information on common glyphosate formulations.

Soybean

Postemergence (See page 52 for spray additives) (continued)

Herbicide (See <i>Weed Response Chart</i> on pages 110-111 before selecting herbicides)	Rate Per Acre	Application Time	Remarks and Approximate Cost Per Acre Broadcast
TORMENT	0.75 pt	4-6" tall	For use only in counties east of Hwy. 281. Cost: \$13.00.
ULTRA BLAZER	8.0-24.0 oz	Apply when most broadleaf weeds are less than 4" tall	See label for rates and specific weed size. Cost: \$5.50-\$16.50.
Harvest Aid			
AIM	1.0-1.5 oz	When 70% of pods are brown	Use 15 GPA of water carrier. Preharvest interval of 3 days. Velvetleaf, morningglory, nightshade, and waterhemp control. Cost: \$7.50-\$11.25
GRAMOXONE SL	1.0 pt	When 65% of pods are brown	Desiccant. Follow label directions on water volume and NIS additive. Do not graze for 15 days. Cost: \$6.00.
SHARPEN	1.0-2.0 oz	<i>Indeterminate varieties:</i> when 65% of pods are brown, there is more than 70% leaf drop, and seed moisture is less than 30% <i>Determinate varieties:</i> beans are fully developed and there is more than 50% leaf drop while remaining leaves are yellow	Do not use on soybean grown for seed production. Soybean can be harvested within 3 days after application. Check the label for more information. Cost: \$6.25-\$12.25. Add 1 pt MSO preharvest interval of 3 days.

Sugar beet

Weed Response to Selected Herbicides

Site of Action†	Response Ratings: Ratings are for light to moderate weed densities, favorable conditions and weed growth stage as specified on product label. High weed densities, adverse conditions, or large weeds will reduce control. 10 = 96-100% 6 = 70-79% 9 = 90-95% 5 = 60-69% 8 = 85-90% 4-2 = less than 60% 7 = 80-84% 1 = 0	Broadleaves																Grasses						Crop Safety▢	
		Annual Morningglory	Cocklebur	Jimsonweed	Kochia	Kochia, ALS-Resistant	Kochia, Glyphosate-Resistant	Kochia, Triazine-Resistant	Lambsquarters	Nightshade (Hairy)	Pigweed	Ragweed	Russian Thistle	Smartweed	Sunflower	Velvetleaf	Wild Buckwheat	Barnyardgrass	Crabgrass	Fall Panicum	Foxtail	Sandbur	Shattercane/Sorghum		
	Herbicide																								
		PPI & PRE																							
8	Nortron-PPI/PRE	1	5	1	6	6	6	6	6	6	8	1	6	7	4	5	7	5	7	7	8	6	1	2	
8	Ro-Neet-PPI	4	4	4	3	3	3	3	8	9	9	6	4	4	2	4	4	7	8	8	9	7	7	2	
		POST																							
1	Assure II/Targa	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	9	9	9	9	9	10	1		
5	Betamix	1	2	3	4	4	4	4	9	9	9	3	5	3	1	2	5	4	1	1	6	6	1	3	
5+8	Betamix Progress	1	2	3	5	5	5	5	6	8	8	3	5	3	2	2	5	4	1	1	7	7	1	3	
5+4	Betamix + Stinger	5	9	7	5	5	5	5	9	9	9	8	5	7	9	3	9	5	1	1	6	6	1	3	
5+2	Betamix + UpBeet	1	6	3	9	5	7	9	9	9	9	6	5	6	6	7	7	4	1	1	7	6	1	3	
5+2+4	Betamix + UpBeet + Stinger	5	9	7	9	5	7	9	9	9	9	8	8	8	9	7	9	5	4	2	5	5	2	2	
5+2+4	Betamix + UpBeet + Stinger (Micro-Rate)	5	9	7	9	5	6	9	7	7	7	7	8	8	9	6	8	6	5	3	6	5	2	1	
5+2+4	Betamix + UpBeet + Stinger (Half-Rate)	5	9	7	9	6	6	9	8	8	8	7	8	8	9	7	9	6	5	3	6	5	2	2	
9	Glyphosate◆	8	10	8	9	9	1	9	9	10	10	10	8	10	10	9	7	10	10	10	10	10	1		
1	Poast	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	6	7	7	9	7	7	1	
1	Select Max	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	8	9	9	9	9	9	1	
4	Stinger	1	9	5	3	3	3	3	4	4	1	7	4	5	5	3	7	1	1	1	1	1	1	2	
		POST — Sugarbeet Past 2-leaf Stage																							
15	Dual Magnum	1	2	1	2	2	2	2	6	7	7	5	3	3	1	2	2	8	8	8	9	7	6	1	
8	Eptam	5	5	5	8	8	8	8	7	7	7	6	4	5	3	5	6	6	9	9	9	9	9	1	
15	Outlook	1	2	1	2	2	2	2	7	6	7	5	3	3	2	2	1	8	8	8	9	6	3	1	
15	Warrant	1	2	1	3	3	3	3	7	7	8	5	3	3	1	2	2	8	8	8	9	7	6	1	

[□]Varieties differ in their response to herbicides. Crop safety ratings less than 3 indicate that crop yield should not be affected by any direct injury.

[♦]Glyphosate rates are based on a 4.0 ai/gal or 3.0 lb ae/gal formulation. See pages 193-199 for information on common glyphosate formulations.

[‡]See pages 8-10 for more information on classification of herbicides by mode and site of action.

Sugar beet

Herbicide	Commercial Product per Acre						Application Time, Remarks, and Approximate Cost Per Acre Broadcast
	Sandy Loam 1% OM			Silt Loam 1-2% OM			
	Broadcast	Product/7" Band		Broadcast	Product/7" Band		
		22" Row	30" Row		22" Row	30" Row	
No-till in Rye or Winter Wheat							
ROUNDUP WEATHERMAX	22.0-40.0 oz	—	—	22.0-40.0 oz	—	—	Apply in spring when rye or wheat are 6-10" tall and before sugarbeet have emerged. Cost: \$3.25-\$6.00.
PPI or PRE							
NORTRON SC	32.0 oz	11.0 oz	8.0 oz	59.0 oz	19.0 oz	14.0 oz	PPI or PRE—For furrow irrigation, apply preplant and incorporate 1 to 2"; for sprinkler irrigation apply PRE at planting or shortly after and immediately irrigate with 0.5" water. Cost broadcast: \$6.50-\$48.50.

Postemergence					
Herbicide	Rate Per Acre			Application Time	Remarks and Approximate Cost Per Acre Broadcast
	Broadcast	Product Per 7" Band			
		22" Row	30" Row		
ASSURE II/TARGA + COC	5.0-8.0 oz	1.6-2.5 oz	1.2-1.9 oz	Grass 1-3"	Susceptible grasses less than 4" tall. Good activity on volunteer cereals. Can be tank-mixed with glyphosate for volunteer corn control. Do not apply within 45 days of harvest. Do not mix with any herbicide or insecticide. Use the 8.0 oz rate for volunteer corn control. Cost broadcast: \$1.00-\$6.50.
BETAMIX	32.0 oz	10.0 oz	7.5 oz	Any stage of sugarbeet growth. Weeds cotyledon stage. Repeat in 5-7 days	Treat in late afternoon to reduce injury. Cost broadcast: Betamix \$20.00; Betamix + Stinger \$38.00.
BETAMIX with STINGER	32.0 oz 4.0 oz	10.0 oz 1.3 oz	7.5 oz 1.0 oz	Sugarbeet 2-leaf stage. Repeat in 5-7 days	
PROGRESS	20.0-36.0 oz	6.4-11.4 oz	4.7-8.4 oz	Sugarbeet cotyledon to 2-leaf stage	
GLYPHOSATE♦ (Roundup-tolerant variety required)	32-48 oz	10.0-15.0 oz	7.5-11.0 oz	1) Sugarbeet 2-leaf stage, weeds less than 2" 2) Repeat in 14 days before weeds exceed 4" in height 3) Make a third application to greater than 8-leaf sugarbeet	Always add ammonium sulfate at a rate of 17.0 lb/100.0 gal of spray solution. Tank mixtures of glyphosate with fungicides, insecticides, micronutrients, or foliar fertilizers are not recommended. Total in crop application must not exceed 128.0 oz. Do not apply 30 days prior to harvest. Cost \$0.75-\$5.00.
POAST + COC or SELECT MAX + NIS	16.0-32.0 oz	5.0-10.0 oz	3.0-7.0 oz	Grass 1-3"	Use higher rate for larger grass or grass under drought stress. Suggested rate for volunteer corn control: Poast at 24.0 oz and Select Max at 9.0 oz. Can be tank-mixed with glyphosate for volunteer corn control. All herbicides require the addition of an adjuvant. See label. Cost broadcast: Poast \$2.75-\$26.75; Select Max \$1.75-\$11.50.
	9.0-12.0 oz	2.8-5.0 oz	1.9-3.5 oz	Grass 1-3"	
BETAMIX with POAST or SELECT MAX	32.0 oz	10.0 oz	7.5 oz	Sugarbeet 2-leaf stage	Do not add crop oil or NIS to Betamix plus Poast or Betamix plus Select Max combinations. Grasses should be less than 2". Cost broadcast: Betamix plus Poast \$38.75; Betamix plus Select Max \$30.25.
	24.0 oz	7.5 oz	5.0 oz		
	12.0 oz	3.8 oz	2.8 oz		

♦Glyphosate rates are based on a 4.0 ai/gal or 3.0 lb ae/gal formulation. See pages 193-199 for information on common glyphosate formulations.

Sugar beet

Postemergence *(continued)*

Herbicide	Rate Per Acre			Application Time	Remarks and Approximate Cost Per Acre Broadcast
	Broadcast	Product Per 7" Band			
		22" Row	30" Row		
CONVENTIONAL RATE BETAMIX + UPBEET + STINGER	32.0 oz 0.5 oz 12.0 oz	10.0 oz 0.16 oz 1.3 oz	7.5 oz 0.12 oz 1.0 oz	Weeds, cotyledon to less than 1"	Use a minimum of two sequential applications. Cost broadcast: \$114.75.
MICRO-RATE BETAMIX + UPBEET + STINGER + MSO 1.5%	8.0 oz 0.125 oz 1.2 oz	2.5 oz 0.04 oz 0.4 oz	1.7 oz 0.03 oz 0.3 oz	Weeds, cotyledon to less than 1"	Micro-Rate/Half-Rate — Use a minimum of three sequential applications; repeat applications on a 5- to 7-day interval. Timing of applications is very important. Cost broadcast: Micro-Rate \$20.50; Half-Rate \$41.25.
HALF-RATE BETAMIX + UPBEET + STINGER + MSO 1.5%	16.0 oz 0.25 oz 2.4 oz	5.1 oz 0.07 oz 0.74 oz	3.7 oz 0.05 oz 0.55 oz		
STINGER	4.0-6.0 oz	4.0-10.0 oz	4.0-10.0 oz	Sugarbeet, 2-8 true leaves; Canada thistle rosette to pre-bud	Use lower rates for annual weeds and higher rates for Canada thistle. Do not plant or rotate for 1 year after treatment to any crop except small grains or corn. Cost broadcast: \$18.00-\$44.75.
UPBEET + MSO or UPBEET + BETAMIX	0.5 oz 0.5 oz 32.0 oz	0.17 oz 0.17 oz 10.0 oz	0.12 oz 0.12 oz 7.5 oz	Weeds less than 2" tall	For best weed control, use a minimum of two sequential applications. Should be tank-mixed with Betamix or Progress. ALS-resistant kochia will not be controlled by UpBeet. A split application of UpBeet plus MSO applied when velvetleaf is 1" to 2" tall provides excellent control. The addition of UpBeet to Roundup WeatherMAX can help with resistant weed management. Cost broadcast: UpBeet \$42.50; Betamix + UpBeet \$61.00; UpBeet + Roundup Weather-Max \$46.25.
UPBEET + ROUNDUP WEATHERMAX	0.5 oz 22.0 oz	0.17 oz 7.0 oz	0.12 oz 5.1 oz		

Postemergence — Sugarbeet Past the 2-leaf Stage

Herbicide	Commercial Product per Acre						Application Time, Remarks, and Approximate Cost Per Acre Broadcast
	Sandy Loam 1% OM			Silt Loam 1-2% OM			
	Broad- cast	Product/7" Band		Broad- cast	Product/7" Band		
		22" Row	30" Row		22" Row	30" Row	
EPTAM 7E or EPTAM 20G	36.0 oz 15.0 lb	11.5 oz 4.7 lb	8.0 oz 3.5 lb	56.0 oz 15.0 lb	18.0 oz 4.7 lb	13.0 oz 3.5 lb	Apply after thinning and clean cultivation; incorporate immediately 2" deep with a cultivator. Cost broadcast: \$14.00-\$22.00.
TREFLAN	16.0 oz	5.0 oz	3.5 oz	20.0 oz	6.0 oz	4.5 oz	Sugarbeet 2" to 6" tall. Cover exposed beet roots with soil before Treflan application to reduce root girdling. Cost broadcast: \$3.50-\$4.25.
OUTLOOK	12.0 oz	3.8 oz	2.8 oz	14.0 oz	4.4 oz	3.2 oz	Sugarbeet 4-leaf stage. Do not apply after the crop reaches the 8-leaf stage. Apply 0.5" of overhead irrigation water after application to incorporate herbicide. Cost broadcast: Outlook \$13.25-\$15.25; Dual Magnum \$16.75-\$26.80; Warrant \$11.88-\$19.00.
DUAL MAGNUM	1.0 pt	5.0 oz	3.0-7.0 oz	1.6 pt	8.0 oz	6.0 oz	
WARRANT	1.25 qt	12.7 oz	9.3 oz	2.0 qt	20.3 oz	14.9 oz	

Sunflower

Broadleaf and Grass Weed Response to Selected Herbicides

Site of Action†	Response Ratings: Ratings are for light to moderate weed densities, favorable conditions and weed growth stage as specified on product label. High weed densities, adverse conditions, or large weeds will reduce control. 10 = 96-100% 9 = 90-95% 8 = 85-90% 7 = 80-84% 6 = 70-79% 5 = 60-69% 4-2 = less than 60% 1 = 0	Broadleaves				Grasses				Crop Safety▣
		Kochia (6)§	Pigweed (4)	Puncturevine, Common (1)	Russian Thistle (6)	Foxtail, Green (2)	Stinkgrass (2)	Wheat, Volunteer (1)	Witchgrass (2)	
Herbicide										
	Soil-Applied									
14+15	BroadAxe XC/Spartan Elite	9	9	2	9	9	8	9	9	3
15	Dual Magnum	3	5	1	3	9	9	9	9	2
8+3	Eptam + Sonalan	9	9	-	5	9	9	9	9	1
8+3	Eptam + Treflan (trifluralin)	9	9	-	5	9	9	9	9	1
3	Prowl H ₂ O (pendimethalin) PPI	7	6	1	7	9	9	8	9	1
3	Prowl H ₂ O (pendimethalin)	6	5	1	6	8	8	8	8	1
3	Sonalan	7	6	1	7	9	9	9	9	1
14+3	Spartan Charge + Prowl H ₂ O (pendimethalin)	9	9	2	9	9	9	9	9	4
3	Treflan (trifluralin)	7	6	1	7	9	9	9	9	1
	Postemergence (Weed size influences performance — see label)									
1	Assure II (quizalofop)	2	2	1	2	8	8	9	8	1
2	Beyond (Clearfield hybrids only)	8	9	8	-	8	7	7	7	2
2	Express SG (ExpressSun hybrids only)	7	8	8	7	1	1	1	1	2
1	Poast	1	1	1	1	9	9	9	9	1

§Weed Competitive Index — See page 11.

‡Varieties differ in their response to herbicides. Crop safety ratings less than 3 indicate that crop yield should not be affected by any direct injury.

†See pages 9-10 for more information on classification of herbicides by mode and site of action.

Preemergence

(See *Ecofarming* for early prelant sunflower recommendations.)

Herbicide	Commercial Product per Acre			Remarks and Approximate Cost Per Acre Broadcast
	Sandy Loam	Silt Loam	Silty-Clay Loam	
BROADAXE XC/ SPARTAN ELITE	20.0 oz	22.0 oz	24.0-28.0 oz	Apply 30 DBP to 3 DAP. Risk of crop injury increases on high pH soil or applications close to planting, especially on light soils. Cost: \$22.00-\$31.00.
DUAL MAGNUM	1.0-1.33 pt	1.33 pt	1.67 pt	Apply PRE up to 30 days prior to planting. Provides excellent grass weed control, but should be combined with Spartan or followed with Beyond (Clearfield hybrids only) or Express SG (ExpressSun hybrids only) for broadleaf weed control. Cost: \$15.00-\$25.00.
EPTAM 7E + TREFLAN HFP or SONALAN HFP	2.5 pt 1.0 pt 1.5 pt	2.5 pt 1.25 pt 2.0 pt	2.5 pt 1.5 pt 2.5 pt	Apply and incorporate just before planting. Cost: Eptam + Treflan \$21.00-\$23.00; Eptam + Sonalan \$27.75-\$34.75.
PROWL (3.3 EC) PPI or PROWL H ₂ O PPI	1.2-2.4 pt 2.0 pt	1.8-3.0 pt 2.5 pt	2.4-3.6 pt 3.0 pt	PPI up to 30 days prior to planting. Prowl or Prowl H ₂ O PRE is most effective in controlling weeds when adequate rainfall or irrigation is received within 7 days of application. Cost: Prowl \$7.50-\$22.50; Prowl + glyphosate \$13.00-\$19.50.
PROWL (3.3 EC) or PROWL H ₂ O with or without GLYPHOSATE♦	3.0 pt 3.0 pt 2.0 pt	3.6 pt 3.0 pt 2.0 pt	3.6 pt 3.0 pt 2.0 pt	

Sunflower

Preemergence *(continued)*

Herbicide	Commercial Product per Acre			Remarks and Approximate Cost Per Acre Broadcast
	Sandy Loam	Silt Loam	Silty-Clay Loam	
SONALAN or TREFLAN	1.5-2.0 pt 1.0 pt	2.0-2.5 pt 1.25-1.5 pt	2.5-3.0 pt 1.5-2.0 pt	For best results immediately incorporate. Read label for carryover precautions. Cost: Sonalan \$10.50-\$21.00; Treflan \$3.75-\$7.50.
SPARTAN CHARGE + PROWL or PROWL H ₂ O or DUAL MAGNUM	3.5-4.5 oz 3.0 pt 3.0 pt 1.0-1.33 pt	4.5-5.5 oz 3.6 pt 3.0 pt 1.33 pt	4.5-7.0 oz 3.6 pt 3.0 pt 1.67 pt	Apply PRE up to 30 days prior to planting. Carfentrazone (Aim) in Spartan Charge will provide some burndown of small broadleaf weeds. Prowl or Prowl H ₂ O is most effective in controlling weeds when adequate rainfall or irrigation is received within 7 days of application. Risk of crop injury increases as soil pH increases and/or soil organic matter decreases. Cost: Spartan Charge + Prowl \$30.75-\$46.50; Spartan Charge + Dual Magnum \$27.00-\$49.00.

Postemergence

Herbicide	Rate Per Acre	Application Time	Remarks and Approximate Cost per Acre Broadcast
ASSURE II/TARGA	8.0 oz	Annual grass weeds 2-6"	Supplemental label. Do not apply within 60 days of harvest. Do not apply to sunflowers under stress. Add NIS at 1 qt/100 gal. Cost: Assure II \$6.50; Targa \$8.500.
BEYOND (Clearfield hybrids only)	4.0 oz	Sunflower 2-8 leaf, grasses 1-5 leaf, broadleaves 1-3"	Add NIS at 1.0 qt/100.0 gal and UAN at 2.5 gal/100.0 gal or AMS at 12.0-15.0 lb/100.0 gal. Cost: \$19.50.
EXPRESS SG (ExpressSun hybrids only)	0.5 oz	Sunflower 1-leaf to pre-bud	Supplemental label. Provides suppression of Canada thistle. Does not control grass weeds. May apply sequential treatments, not to exceed 1.0 oz/season. Add MSO at 1.0 gal/100.0 gal. Cost: \$10.75.
POAST	16.0-32.0 oz	Most grasses less than 8", corn 12-20"	Good coverage essential. Use 2.0 pt COC/A or 1.5 pt MSO/A. Add 2.5 lb AMS/A or 4.0-8.0 pt UAN/A. Cost: \$13.75-\$27.50.

Harvest Aid

Herbicide	Rate Per Acre	Application Time	Remarks and Approximate Cost per Acre Broadcast
GRAMOXONE SL	1.5-2.0 pt	Seeds mature, 35% moisture content or less; often corresponds to when back of head is yellow and bracts are turning brown.	Use nonionic surfactant at 1.0 qt/100.0 gal spray solution. Do not graze treated areas or feed treated forage to livestock. Use the higher rate when crop stands or weed infestations are heavy. Apply at least 7 days before harvest. Cost: \$7.25-\$9.50.
SHARPEN	2.0 oz	Seeds mature, 35% moisture content or less; often corresponds to when back of head is yellow and bracts are turning brown.	Use MSO at minimum of 1.0 pt/A. Use a minimum spray volume of 12.5 gal/A for ground application or 5.0 gal/A for aerial application. Apply at least 7 days before harvest. Cost: \$14.00.
VALOR SX	2.0-3.0 oz	Seeds mature, 35% moisture content or less; often corresponds to when back of head is yellow and bracts are turning brown.	Use MSO at 1.0 qt/A. Apply at least 5 days before harvest. Cost: \$15.25-\$23.00.

Wheat and Small Grains (Barley, Oat, Proso Millet, Rye, Triticale)

Broadleaf Weed Response to Postemergence Herbicides

Site of Action†	Response Ratings: Ratings are for light to moderate weed densities, favorable conditions and weed growth stage as specified on product label. High weed densities, adverse conditions, or large weeds will reduce control. 10 = 96-100% 6 = 70-79% 9 = 90-95% 5 = 60-69% 8 = 85-90% 4-2 = less than 60% 7 = 80-84% 1 = 0	Blue Mustard (10)§	Field Pennycress (10)	Horseweed (5)	Knotweed (3)	Kochia (5)	Kochia, ALS-Resistant (5)	Lambsquarters (5)	Penn. Smartweed (3)	Prickly Lettuce (10)	Redroot Pigweed (2)	Russian Thistle (5)	Shepherdspurse (10)	Sunflower (5)	Tansymustard (10)	Waterhemp (3)	Wild Buckwheat (4)	Wild Vetch (8)	Crop Safety‡
4	2,4-D	7	9	5	6	6	6	9	8	9	9	8	9	9	9	8	4	7	2
2+4	Affinity BroadSpec + 2,4-D	9	10	7	6	9	6	9	8	9	9	8	10	8	10	8	8	5	1
2+4	Agility SG	9	10	6	7	10	7	10	9	10	10	9	10	9	10	9	7	8	3
14+4	Aim + 2,4-D	8	9	-	7	9	9	8	-	9	8	8	9	8	9	8	8	1	2
2	Ally XP/Accurate	9	9	7	4	6	1	7	4	8	8	6	9	7	9	7	5	1	1
2+4	Ally XP + 2,4-D	10	10	6	7	9	6	10	6	10	10	8	10	10	10	9	6	6	2
2+4	Ally XP + Starane Ultra	9	10	7	4	10	8	7	4	8	8	6	9	7	9	7	5	1	1
2	Ally Extra SG/Accurate Extra	9	9	7	4	6	1	7	4	8	8	6	9	7	9	7	5	1	1
2+4	Ally Extra SG + 2,4-D	10	10	6	7	9	6	10	6	10	10	8	10	10	10	9	6	6	2
2	Amber	9	9	7	4	7	1	6	5	8	8	6	9	8	9	7	8	1	1
2+4	Amber + 2,4-D	10	10	6	6	9	6	10	6	10	10	8	10	9	10	9	8	6	2
2+4	Amber + Starane Ultra	9	9	7	4	10	8	6	5	8	8	6	9	8	9	9	8	1	1
2	Beyond (fall applied)***	1	9	1	1	1	1	1	1	1	1	1	9	1	9	1	7	9	2
4	Curtail	9	10	9	9	8	8	10	10	10	10	8	9	10	9	9	10	9	2
4	Curtail M	7	9	9	8	8	8	8	9	8	8	7	9	8	9	7	9	8	1
4	Dicamba• + 2,4-D	6	10	6	8	10	10	9	10	8	10	9	10	10	10	9	9	8	4
4	Finesse	9	9	7	4	5	1	8	5	8	8	5	9	6	9	7	6	1	1
2+4	Finesse Cereal and Fallow/Report Extra + 2,4-D	9	10	6	7	9	6	10	6	10	10	8	10	9	10	9	7	6	2
2+4	Harmony Extra SG + 2,4-D	9	10	7	6	9	6	9	8	9	9	8	10	8	10	8	8	5	1
27+6+4	Huskie + 2,4-D	10	9	-	-	9	9	8	-	8	8	10	10	9	10	8	8	-	2
27+6+4	Huskie + MCPA	10	9	-	-	8	8	8	-	8	8	9	10	8	10	8	8	-	1
2	Maverick (fall applied)	5	9	6	2	3	1	3	2	8	4	3	9	3	9	3	2	1	1
4	MCPA	4	7	4	4	5	5	7	6	6	6	6	8	6	8	5	4	5	1
2	Olympus (fall applied)	8	9	-	-	-	-	-	-	-	5	-	9	-	9	-	-	-	1
2	Peak	8	9	7	6	5	1	6	8	8	8	6	9	8	9	7	6	1	1
2+4	Peak + 2,4-D	10	10	7	7	9	6	10	8	10	10	8	10	10	10	9	6	6	2
2	PowerFlex (fall applied)/GR1	9	9	-	-	-	-	-	-	-	-	-	9	-	9	-	-	-	1
2+4	Rave	9	10	6	7	10	7	10	9	10	10	9	10	10	10	9	9	8	3
4	Starane NXT	10	10	6	9	10	10	9	10	8	9	9	10	10	9	9	9	6	1
4	WideMatch	6	6	9	6	10	10	-	-	9	-	6	-	9	6	-	8	-	1

§Weed Competitive Index — See page 11.

‡Crop ratings of 3 or less usually result in no yield loss; adding liquid nitrogen may considerably reduce crop safety for some herbicide combinations.

•See page 84 for dicamba formulations other than Clarity and Banvel.

***For use in Clearfield wheat varieties only.

‡See pages 9-10 for more information on classification of herbicides by mode and site of action.

Wheat and Small Grains (Barley, Oat, Proso Millet, Rye, Triticale)

Winter Annual Grass Response to Selected Herbicides

(See Downy Brome in *Troublesome Weeds* Section, pages 155-166, for more information.)

Site of Action†	Response Ratings: Ratings are for light to moderate weed densities, favorable conditions and weed growth stage as specified on product label. High weed densities, adverse conditions, or large weeds will reduce control.	Downy Brome	Feral Rye	Jointed Goatgrass	Crop Safety☐
	10 = 96-100% 6 = 70-79%				
	9 = 90-95% 5 = 60-69%				
	8 = 85-90% 4-2 = less than 60%				
	7 = 80-84% 1 = 0				
	Herbicide				
	Preemergence				
2	Amber	3*	1	1	1
2	Finesse Cereal and Fallow/Report Extra	4*	1	1	2
2	Maverick	4-8*	1	2	1
	Early Postemergence**				
2	Beyond***	8	7	9	2
2	Maverick	6-9*	1	3	1
2	Olympus	6-9	1	5	1
2	PowerFlex	6-9	-	-	1
	Late Postemergence**				
2	Beyond***	7	4	8	1
2	Maverick	3-5*	1	1	1
2	Olympus	5-8	1	3	1
2	PowerFlex/GR1	5-8	-	-	1

*Requires rainfall shortly after application for best results.

**Early postemergence is the period before weeds have tillered; late postemergence is the time after weeds have tillered.

***For use in Clearfield wheat varieties only.

‡Varieties differ in their response to herbicides. Crop safety ratings less than 3 usually indicate that crop yield should not be affected by any direct injury.

†See pages 9-10 for more information on classification of herbicides by mode and site of action.

Barley and Spring Wheat

Herbicide (See <i>Weed Response Tables</i> on page 124-129)	Rate Per Acre	Application Time	Remarks and Approximate Cost Per Acre Broadcast
2,4-D AMINE (4L) or 2,4-D ESTER (4L)	16.0-24.0 oz 8.0-12.0 oz	Spring 4-leaf to joint stage	Cost: 2,4-D amine \$1.75-\$2.75; 2,4-D ester \$1.25-\$1.75.
AFFINITY BROADSPEC/ EDITION BROADSPEC + 2,4-D ESTER (4L)	0.4-0.6 oz 4.0-8.0 oz	Spring 4-leaf to joint stage Weeds less than 4" tall	Add NIS at 1.0-2.0 qt/100.0 gal. Any crop may be planted 60 days after application. Cost: \$6.00-\$9.00.
AIM EC + 2,4-D AMINE (4L)	0.5 oz 16.0 oz	Wheat 4-leaf to joint stage	Add NIS at 1.0 qt/100.0 gal of spray solution. Cost: \$5.00.
ALLY XP/ACCURATE or ALLY EXTRA SG	0.1 oz 0.3-0.5 oz	Spring 4-leaf to joint stage	Check label for rotation restrictions. Add NIS at 1.0 qt/100.0 gal of spray solution. Use of lower rates requires good growing conditions and small weed size. Cost: Ally XP \$1.00; Ally Extra \$2.75-\$4.50; Ally Extra SG + 2,4-D \$2.25-\$4.75; Amber + 2,4-D \$4.25-\$5.75; Finesse + 2,4-D \$4.00-\$8.00; Peak + 2,4-D \$5.00-\$10.25.
ALLY EXTRA/ACCURATE EXTRA or AMBER	0.2-0.4 oz 0.28-0.35 oz	Spring 4-leaf to joint stage	
FINESSE CEREAL AND FALLOW/ REPORT EXTRA	0.2-0.4 oz		
or PEAK + 2,4-D ESTER (4L)	0.25-0.50 oz 4.0-8.0 oz		

Wheat and Small Grains

Barley and Spring Wheat *(continued)*

Herbicide (See <i>Weed Response Tables</i> on page 124-125)	Rate Per Acre	Application Time	Remarks and Approximate Cost Per Acre Broadcast
CURTAIL	2.0-2.67 pt	Spring 4-leaf to joint stage	Provides good control of Canada thistle. Cost: \$16.25-\$21.75.
HUSKIE + MCPA ESTER (4L)	11.0-13.5 oz 12.0 oz	Wheat 3-leaf to flag emergence	Add NIS at 1.0-2.0 qt/100.0 gal plus AMS at 0.5 lb/A or UAN at 1-2 qt/A. Cost: \$12.75-\$15.25.
STARANE ULTRA + 2,4-D ESTER	0.3-0.4 pt 4.0-8.0 oz	Spring 4-leaf to joint Weeds less than 8"	Provides excellent control of kochia. Cost: \$11.75-\$16.00.
WIDEMATCH	1.0-1.33 pt	Wheat 3-leaf to flag leaf emergence Weeds less than 8"	Provides good control of Canada thistle. Cost: \$10.25-\$13.75.

Harvest Aid

2,4-D ESTER (4L)	32.0 oz	Hard dough, 7 or more days before harvest	Helps desiccate large broadleaf weeds. Only certain brands labeled for this use. Cost: \$4.50. Add this herbicide to the harvest aid section:
AIM EC	1.5-2.0 oz	Apply after hard dough stage	Can be tank mixed with 2,4-D. Requires the use of either MSO, COC, or NIS and must be applied using a carrier rate of 10 GPA or greater. Coverage is essential to herbicide performance. PHI is 3 days. Cost: \$9.50-\$12.50.
ALLY XP/ACCURATE + 2,4-D ESTER (4L)	0.1 oz 4.0-8.0 oz	Hard dough, 10 or more days before harvest	Add NIS at 1.0-2.0 qt/100.0 gal of spray solution. Cost: \$1.50-\$2.00.

Oat

Herbicide	Rate Per Acre	Application Time	Remarks and Approximate Cost per Acre Broadcast
2,4-D AMINE (4L)	8.0-16.0 oz	3-leaf to joint	Some injury from 2,4-D may be expected at any stage. Cost: \$1.00-\$2.00.
AFFINITY BROADSPEC/ EDITION BROADSPEC or GLEAN XP or PEAK + MCPA ESTER (4L)	0.4 oz 0.25 oz 0.25-0.5 oz 8.0-12.0 oz	3-leaf to prior to jointing	Check label for rotation restrictions. Do not use Affinity BroadSpec on 'Ogle', 'Porter', or 'Premier' varieties as crop injury can occur. Add NIS at 1.0-2.0 qt/100.0 gal of spray solution. Cost: Affinity BroadSpec + MCPA \$7.25-\$8.00; Glean XP + MCPA \$7.75-\$8.50; Peak + MCPA \$6.25-\$11.50.
AIM EC + 2,4-D AMINE (4L)	0.5 oz 16.0 oz	3-leaf to joint stage	Add NIS at 1.0 qt/100.0 gal of spray solution. Cost: \$5.00.
CURTAIL M	1.75-2.3 pt	3-leaf to joint Weeds less than 3"	Cost: \$14.25-\$18.75.
MCPA ESTER (4L)	8.0-16.0 oz	Fully tillered to boot	Cost: \$1.75-\$3.50.
WIDEMATCH	1.0-1.33 pt	Wheat 3-leaf to flag leaf emergence Weeds less than 8"	Provides good control of Canada thistle. Cost: \$10.25-\$13.75.

Wheat and Small Grains

Harvest Aid

AIM EC	1.5-2.0 oz	Apply after hard dough stage	Can be tank mixed with 2,4-D. Requires the use of either MSO, COC, or NIS and must be applied using a carrier rate of 10 GPA or greater. Coverage is essential to herbicide performance. PHI is 3 days. Cost: \$9.50-\$12.50.
2,4-D ESTER (4L)	32.0 oz	Hard dough; 7 or more days before harvest	Helps desiccate large broadleaf weeds. Only certain brands labeled for use. Cost: \$4.50.

Rye

Herbicide (See <i>Weed Response Table on page 124-125</i>)	Rate Per Acre	Application Time	Remarks and Approximate Cost Per Acre Broadcast
2,4-D ESTER (4L)	8.0-12.0 oz	Spring, 4 tillers to joint stage	Do not spray until crop is well tillered. Spray broadleaf weeds as soon as good growing conditions occur. Cost: \$1.25-\$1.75.
AIM EC + 2,4-D ESTER (4L)	0.5-1.0 oz 4.0-8.0 oz	Spring, 4 tillers to joint stage	Add NIS at 1.0 qt/100.0 gal of spray solution. Cost: \$3.75-\$7.25.
DICAMBA [•] + 2,4-D ESTER (4L)	2.0-3.0 oz 4.0-8.0 oz	Spring, 4 tillers to joint stage	Controls most troublesome broadleaf weeds. Do not apply with fertilizer solutions. Cost: \$1.25-\$2.25.
PEAK + 2,4-D ESTER (4L)	0.25-0.50 oz 4.0-8.0 oz	Spring, 4 tillers to joint stage	Check label for rotation restrictions. Add NIS at 1.0-2.0 qt/100.0 gal. If spray solution contains liquid fertilizer, do not add surfactant. Cost: \$5.00-\$10.00.

Triticale

Herbicide (See <i>Weed Response Table on page 124-125</i>)	Rate Per Acre	Application Time	Remarks and Approximate Cost Per Acre Broadcast
AGILITY SG	1.6-3.2 oz	Spring, tillered to before jointing or 2-6 leaf for spring-seeded	Add NIS at 1.0 to 2.0 qt/100.0 gal of spray solution. Cost: \$4.25-\$8.75.
AFFINITY BROADSPEC/ EDITION BROADSPEC or ALLY XP/ACCURATE or GLEAN XP + 2,4-D ESTER (4L)	0.4-0.6 oz 0.1 oz 0.25 oz 4.0-8.0 oz	Spring, 4-leaf to joint stage	Check label for rotation restrictions. Add NIS at 1.0 qt/100.0 gal of spray solution. Cost: Affinity BroadSpec + 2,4-D \$6.00-\$9.00; Ally XP + 2,4-D \$1.50-\$2.00; Glean XP + 2,4-D \$6.50-\$7.00.

[•]Dicamba rates are based on a 4.0 ae/gal formulation, like those found in Clarity. See page 203 or the *Herbicide Dictionary* for other products containing dicamba.

Wheat and Small Grains

Winter Wheat

Winter Annual Grass Control

Herbicide (See <i>Weed Response Tables</i> on page 125)	Rate Per Acre	Application Time	Remarks and Approximate Cost Per Acre Broadcast
BEYOND (Clearfield varieties only)	4-5 oz	Wheat 3-leaf to joint Grass weeds 1-5 leaves	For feral rye control use 5.0 oz/A rate and apply in fall before rye tillers. Add NIS at 1.0 qt/100.0 gal and nitrogen-based fertilizer at 2.5 gal/100.0 gal or AMS at 12.0-15.0 lb/100.0 gal. For wheat varieties with 2-gene tolerance, MSO or COC at 1.0-2.0 gal/100.0 gal spray may be substituted for NIS. Cost: \$19.50-\$24.50.
MAVERICK or OLYMPUS or POWERFLEX/GR1	0.67 oz 0.9 oz 3.5 oz	In fall when weeds are actively growing or prior to jointing in spring; at least 3-leaf stage for Powerflex	For downy brome control, best applied early postemergence in the fall. Use NIS at 2.0 qt/100 gal of spray solution. Cost: Maverick \$11.50; Olympus \$13.50; PowerFlex \$26.25.

Broadleaf Control

Herbicide (See <i>Weed Response Tables</i> on page 124)	Rate Per Acre	Application Time	Remarks and Approximate Cost Per Acre Broadcast
2,4-D AMINE (4L) or 2,4-D ESTER (4L)	16.0-24.0 oz 8.0-12.0 oz	Spring, 4 tillers to joint stage	Do not spray winter wheat until well tillered. Spray broadleaf weeds as soon as good growing conditions occur. Cost: \$1.25-\$2.75.
AFFINITY BROADSPEC/ EDITION BROADSPEC or HARMONY EXTRA SG + 2,4-D ESTER (4L)	0.4-0.6 oz 0.45-0.90 oz 4.0-8.0 oz	Spring, 4 tillers to joint stage Weeds less than 4" tall	Soybeans may be planted 7-14 days and corn or grain sorghum 14-21 days after application of Affinity BroadSpec; any crop may be planted 60 days after application. Corn may be planted anytime and soybeans 7 days after application of Harmony Extra SG + 2,4-D; any crop may be planted 45 days after application. Add NIS at 1.0 qt/100.0 gal. If the spray solution contains liquid fertilizer, do not add surfactant. Cost: Affinity BroadSpec + 2,4-D \$6.00-\$9.00; Harmony Extra SG + 2,4-D \$7.25-\$14.50.
AGILITY SG	1.6-3.2 oz	Spring, 4 tillers to joint stage	Add NIS at 1.0-2.0 qt/100.0 gal of spray solution. Cost: \$4.25-\$8.75.
AIM EC + 2,4-D ESTER (4L)	0.5-1.0 oz 4.0-8.0 oz	Spring, 4 tillers to joint stage	Add NIS at 1.0 qt/100.0 gal of spray solution. Cost: \$3.75-\$7.25.
ALLY XP/ACCURATE or ALLY EXTRA SG or AMBER or FINESSE CEREAL AND FALLOW/ REPORT EXTRA or PEAK	0.1 oz 0.3-0.4 oz 0.28-0.35 oz 0.2-0.3 oz 0.38-0.50 oz	In fall after 2-leaf stage	Check label for rotation restrictions. Effective control on mustards and pennycress. Some wheat varieties are more sensitive than others to fall application. Add surfactant. Cost: Ally XP \$1.00; Ally Extra SG \$2.75-\$3.50; Amber \$3.75-\$4.50; Finesse \$3.50-\$5.00; Peak \$6.75-\$9.00.
ALLY XP/ACCURATE or ALLY EXTRA SG or AMBER or FINESSE CEREAL AND FALLOW/ REPORT EXTRA or PEAK + 2,4-D ESTER (4L)	0.1 oz 0.3-0.5 oz 0.28-0.35 oz 0.2-0.4 oz 0.38-0.50 oz 4.0-8.0 oz	Spring, 4 tillers to joint stage	Check label for rotation restrictions. Add surfactant at 1.0-2.0 qt/100.0 gal. If the spray solution contains liquid fertilizer, do not add surfactant. Use of lower rates requires good growing conditions and small weed size. Cost: Ally XP + 2,4-D \$1.50-\$2.00; Ally Extra SG + 2,4-D \$3.25-\$5.50; Amber + 2,4-D \$4.25-\$5.50; Finesse + 2,4-D \$4.00-\$7.75; Peak + 2,4-D \$7.25-\$10.00.
ALLY XP/ACCURATE or AMBER + STARANE ULTRA	0.1 oz 0.28-0.35 oz 0.3 pt	Spring, prior to flag leaf emergence Weeds less than 4" tall	Check label for rotation restrictions. Provides excellent control of kochia, including ALS- and glyphosate-resistant kochia, with excellent crop safety. Add surfactant at 1.0-2.0 qt/100.0 gal. Cost: Ally XP + Starane Ultra \$12.25; Amber + Starane Ultra \$15.00-\$15.75.

Wheat and Small Grains

Winter Wheat Broadleaf Control *(continued)*

Herbicide (See <i>Weed Response Tables</i> on page 124)	Rate Per Acre	Application Time	Remarks and Approximate Cost Per Acre Broadcast
CURTAIL	2.0-2.67 pt	Spring, 4-leaf to joint stage	Provides good control of Canada thistle. Cost: \$16.25-\$21.75.
DICAMBA [•] + 2,4-D AMINE (4L)	2.0-3.0 oz 8.0-12.0 oz	Spring, 4 tillers to joint stage	Controls most troublesome broadleaf weeds. Do not apply with fertilizer solutions. Cost: \$1.75-\$2.50.
HUSKIE + 2,4-D ESTER	11.0-13.5 oz 4.0-8.0 oz	Spring, 4 tillers to joint	Add NIS at 1.0-2.0 qt/100.0 gal plus AMS at 0.5 lb/A or UAN at 1.0-2.0 qt/A. Cost: \$10.75-\$13.75.
RAVE	2.0-4.0 oz	Spring, 4 tillers to joint stage	Check label for rotation restrictions. Add surfactant at 1.0-2.0 pt/100.0 gal. Cost: \$4.50-\$9.25.
STARANE NXT	14.0-21.0 oz	3-leaf to prior to flag leaf emergence Weeds up to 4"	Excellent control of kochia. Apply in at least 10.0 gal of carrier per acre for good plant coverage. Cost: \$10.00-\$15.00.
STARANE ULTRA + 2,4-D ESTER (4L)	0.3-0.4 pt 4.0-8.0 oz	Spring, 4 tillers to joint Weeds less than 8"	Provides excellent control of kochia. Cost: \$11.75-\$16.00.
WIDEMATCH	1.0-1.33 pt	Wheat 3-leaf to flag leaf emergence Weeds less than 8"	Provides good control of Canada thistle. Cost: \$10.25-\$13.75.

Harvest Aid

AIM EC	1.5-2.0 oz	Apply after hard dough stage	Can be tank mixed with 2,4-D. Requires the use of either MSO, COC, or NIS and must be applied using a carrier rate of 10 GPA or greater. Coverage is essential to herbicide performance. PHI is 3 days. Cost: \$9.50-\$12.50.
ALLY XP/ACCURATE + 2,4-D AMINE (4L)	0.1 oz 4.0-8.0 oz	After dough stage	Preharvest interval of 10 days. Add surfactant at 1.0 qt/100.0 gal of spray solution. Cost: \$1.50-\$2.00.
2,4-D ESTER (4L) or GLYPHOSATE [♦]	32.0 oz 32.0 oz	Hard dough 7 or more days before harvest	Rescue treatment for control of late broadleaf weeds. To reduce breakage with 2,4-D, all green color should be gone from joints. Only certain brands of 2,4-D labeled for this use. Cost: 2,4-D \$4.50; glyphosate \$3.25.
VALOR SX + GLYPHOSATE [♦]	2.0 oz 32.0 oz	Hard dough 7 or more days before harvest	Add MSO at 1.0 pt/A. Cost: \$18.75.

Proso and Forage Millet

Burndown and Preplant

GLYPHOSATE + SHARPEN	32.0 oz 2.0 oz	0-10 DBP	Supplemental label. Use with proso and pearl millets only or severe crop injury may occur. Early season crop injury may occur, but seldom results in yield loss. Do not apply on soils of pH 7.8 or greater. Ensure the seed row is covered after planting. Provides burndown plus early season residual control of broadleaf weeds such as pigweeds. Cost: \$17.25.
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Postemergence

2,4-D AMINE (4L)*	16.0 oz	3-leaf to before boot	Coverage is essential for good control with Aim. Weeds should be less than 4 inches. Add NIS with Aim at 1.0 qt/100.0 gal of spray solution. 2,4-D may cause significant crop injury in foxtail millet. Cost: 2,4-D \$1.75; 2,4-D + Aim EC \$4.50-\$7.50.
2,4-D AMINE (4L)* + AIM EC	12.0 oz 0.5-1.0 oz	3- to 6-leaf	
2,4-D AMINE (4L)* + CLARITY or PEAK	12.0 oz 4.0 oz 0.38-0.50 oz	3- to 5-leaf 3-leaf to joint	These treatments labeled in proso only. Observe all Clarity precautions when susceptible crops are within 1/2 mile of application site. Add NIS with Peak at 1.0 qt/100.0 gal of spray solution. Cost: 2,4-D + Clarity \$4.50; 2,4-D + Peak \$8.00-\$10.25.
AIM EC (without 2,4-D)	1.0 oz	Preplant to 6 leaves	Coverage is essential for good control with Aim. Weeds should be less than 4". Add NIS at 1.0 qt/100.0 gal of spray solution. Cost: \$6.25.

*Only a few brands of 2,4-D are labeled for millet.

♦Glyphosate rates are based on a 4.0 ai/gal or 3.0 lb ae/gal formulation. See pages 193-199 for information on common glyphosate formulations.

•Dicamba rates are based on a 4.0 ae/gal formulation, like those found in Clarity. See page 203 or the *Herbicide Dictionary* for other products containing dicamba.

Aquatic Weed Control

Slow Moving and Still Water

Important: Before treating any body of water containing fish, contact the Nebraska Game and Parks Commission local representative. When possible, treat before aquatic weed growth becomes dense to avoid fish suffocation due to oxygen depletion from decaying vegetation. When dense weed growth is present in fish-containing waters, treat no more than half of the area. After vegetation in the treated area disappears, treat the remaining water.

Herbicide	Rate Per AF (Acre Foot) or SA (Surface Acre)	Weeds Controlled	Application Time	Remarks and Approximate Cost
2,4-D AMINE or ESTER (4L) or 2,4-D 20G	48.0-128.0 oz/SA 7.5-20.0 lb/SA	Water Hyacinth Water Lily Water Primrose Duckweed Arrowhead Pondweed Milfoil	Use sprays on emerged weeds when in full leaf stage. Apply granules when first growth appears	Do not use water for 14 days for livestock or irrigation. Cost: \$6.25-\$22.50.
AQUATHOL G or AQUATHOL K or CASCADE	13.0-135.0 lb/AF 0.3-3.2 gal/AF	Burreed Coontail Milfoil Pondweed Naiad	Water has warmed and growth is visible	Handle with caution, extremely irritating. Overdose can be harmful to fish. Do not use water within 14 days for irrigation or domestic uses. Cost: \$24.00-\$256.00.
AQUATIC GLYPHOSATE ¹	128.0 oz/SA	Most annual and perennial weeds	Apply to well emerged vegetation	NIS can be applied to most water situations. No restrictions on use of water for irrigation, recreation, or domestic purposes. Cost/SA: \$13.25.
AVAST SRP	2.5-5.0 lb/AF	Coontail Milfoil Pondweed Duckweed Naiad	Before active growth	Do not use water for human consumption or irrigation. Cost: Consult dealer.
COPPER SULFATE CRYSTALS	0.7-5.3 lb/AF	Algae (Moss) Chara	When growth first becomes visible	No restrictions on water usage at recommended rates except for use with sheep . Copper compounds can be corrosive to equipment. Use chelated copper in high pH water. Cost/SA: copper sulfate \$1.75-\$13.25.
GARLON 3A	0.25-3.0 gal/SA	Woody plants, broadleaf weeds, and vines in and around aquatic sites	When vegetation is fully emerged and actively growing	Cost: \$22.50-\$270.00.
HABITAT	1.0-6.0 pt	Emerged and shoreline aquatic weeds	Actively growing	Follow irrigation water restrictions. Not effective on submerged weeds. See <i>Noxious</i> and <i>Trouble- some Weeds</i> sections for appropriate rates. Cost: \$15.75-\$93.75.
REWARD	1.0-2.0 gal/SA	Arrowhead Cattail Bulrush Elodea Pondweed	Post on foliage or on surface for submerged species	Do not allow livestock/domestic animal consumption for 1 day. Do not use for irrigation water for 5 days after application. Not effective in water with suspended silt. Cost: \$109.00- \$218.00.

¹Before using a glyphosate formulation, confirm that it is approved for aquatic use. Glyphosate formulations labeled for aquatic use in Nebraska include: Rodeo and Accord Concentrate (Dow AgroSciences), AquaMaster (Monsanto), Aquaneat (NuFarm), Cinco (Loveland), and Glyfos Aquatic (Cheminova).

CRP Acres

Preplant or Preemergence

Herbicide	Commercial Product per Acre	Application Time	Remarks and Approximate Cost Per Acre
2,4-D AMINE (4L) or ESTER (4L) or LANDMASTER BW	16.0-32.0 oz 54.0-72.0 oz	At least 30 days before grass seeding	Controls most broadleaf annual weeds. Both treatments may injure grass seedlings if applied less than 30 days before planting. Cost: 2,4-D \$2.00-\$5.75; Landmaster BW \$8.00-\$10.75.
ATRAZINE DF (NEB. STATE LABEL) (Confirm your atrazine product is labeled.)	2.2 lb	PPI or PRE	Use only on loam or finer textured soils containing 1% or more organic matter. For use on big bluestem, eastern gamagrass, and switchgrass. Cost: \$7.25.
GLYPHOSATE [♦]	32.0 oz	Before or at grass seeding	Will control most emerged seedling grass and broadleaf weeds. Apply glyphosate at 10 GPA carrier or less and include surfactant at 0.5% v/v if needed. Ammonium sulfate can be added at 17.0 lb per 100.0 gal solution to improve glyphosate performance. Cost: \$3.50.
PLATEAU or JOURNEY	2.0-4.0 oz 5.3-10.7 oz	At grass/ wildflower seeding PRE	Plateau is currently marketed and sold by approved government agencies. For use in big bluestem, little bluestem, indiangrass, buffalo grass, sideoats grama, blue grama, selected wildflowers, and legumes. Cost: Plateau \$3.00-\$6.00; Journey \$5.50-\$11.00.
PROWL (3.3 EC)/PROWL H ₂ O or TREFLAN/TRIFLURALIN	1.2-2.4 pt 1.0-1.5 pt	PPI or PRE PPI	For use on legumes only. Incorporate immediately for best results. Cost: Prowl \$7.25-\$14.50; Treflan/Trifluralin \$3.50-\$5.00.

Postemergence

For established grass, see *Pasture and Range*, pages 144-146.
For specific weeds, see *Troublesome Weeds and Woody Plants*, pages 155-167.

2,4-D AMINE (4L) or 2,4-D ESTER (4L)	16.0 oz 8.0 oz	After 5-leaf stage of grass	Controls most broadleaf weeds. Reduce rate 25% if used on warm-season grasses. Will injure or kill legumes. Cost: 2,4-D amine \$2.00; 2,4-D ester \$1.50.
AMBER	0.28-0.56 oz	After 3-4 leaf stage of grass	Controls most broadleaf weeds. Use Escort on selected perennial grasses. Do not use on soils with pH greater than 8.0. Do not use on grass/legume mixtures. Add surfactant at 0.25% v/v. Cost: Amber \$3.25-\$6.75; Cimarron XTRA \$8.50-\$17.00; Cimmaron Plus \$1.75-\$3.50; Escort \$1.25-\$12.00.
CIMARRON XTRA or CIMARRON PLUS	0.5-1.0 oz 0.125-0.25 oz		
ESCORT XP ¹	0.1-1.0 oz		
BUCTRIL	1.5-2.0 pt	After 3-leaf stage of grass	Controls many broadleaf weeds. Apply in minimum 10.0 gal/A by air. May be used on grass/legume mixtures after third trifoliolate leaf stage of alfalfa. May be tank-mixed with 2,4-D or MCPA for improved control. Tank mix may injure or kill legumes. Cost: \$15.00-\$20.00.
CHAPPARAL	1.5-3.3 oz	Established grasses on label	For control of broadleaf weeds and certain woody plants, including invasive and noxious weeds. Cost: \$9.00-\$19.75.
CIMARRON MAX	Rate I: Part A = 0.25 oz/A Part B = 1.0 pt/A Rate II: Part A = 0.50 oz/A Part B = 2.0 pt/A	Grasses on label	Cost: Rate I \$6.25; Rate II \$12.50.
CURTAIL	2.0-4.0 pt	Established grasses	Use only on grasses established one season or longer. Controls most broadleaf weeds including thistles. Do not use on grass/legume mixtures. Cost: \$14.75-\$29.50.
DICAMBA [•] + 2,4-D ESTER (4L)	4.0-8.0 oz 8.0-16.0 oz	After 5-leaf stage of grass	Controls most broadleaf weeds. Use lower rates on warm-season grasses. Do not use on grass/legume mixtures. Established grasses may be treated with 0.5-1.0 pt Banvel/Clarity/Sterling Blue + 0.5-2.0 pt 2,4-D for perennial weed control. Cost: \$3.50-\$6.50.

¹Escort can be applied to established crested wheatgrass and smooth brome at 0.25 to 1.0 oz/A and to fescue and bluegrass at 0.25 to 0.5 oz/A.

[♦]Glyphosate rates are based on a 4.0 ai/gal or 3.0 lb ae/gal formulation. See pages 193-199 for information on common glyphosate formulations.

[•]Dicamba rates are based on a 4.0 ae/gal formulation, like those found in Clarity. See page 203 or the *Herbicide Dictionary* for other products containing dicamba.

CRP Acres

Postemergence (continued)

Herbicide	Commercial Product per Acre	Application Time	Remarks and Approximate Cost Per Acre
FOREFRONT or MILESTONE	1.5-2.6 pt 3.0-7.0 oz		For control of broadleaf weeds and certain woody plants, including invasive and noxious weeds. It is permissible to treat up to the water's edge, but do not apply directly to water. Milestone can be used to treat non-irrigation ditch banks, seasonably dry wetlands (e.g., flood plains, deltas, marshes), and transitional areas between upland and lowland sites. Cost: Forefront \$10.75-\$18.50; Milestone \$8.25-\$19.25.
GLYPHOSATE [♦]	12.0-16.0 oz	Late fall or late winter	Apply when perennial grasses are dormant. Do not use ammonium sulfate. Cost: \$1.25-\$1.75.
PLATEAU	4.0 oz	Spring	Plateau is currently marketed and sold by approved government agencies. Apply when annual broadleaf and grass weeds are less than 6 inches tall. Cost: \$6.00.
PURSUIT	3.0-6.0 oz	Legumes 3-trifoliate Grasses 4-leaf	Use on alfalfa, clover, crown vetch, birdsfoot trefoil, lespedeza, smooth brome, reed canarygrass, orchardgrass, big bluestem, little bluestem, switchgrass, Russian wildrye, and wheatgrasses (intermediate, crested, tall). Cost: \$10.75-\$21.50.
TELAR XP	1.33 oz		Controls noxious perennials and troublesome annual weeds. Cost: \$30.50.

[♦]Glyphosate rates are based on a 4.0 ai/gal or 3.0 lb ae/gal formulation. See pages 193-199 for information on common glyphosate formulations.

•Dicamba rates are based on a 4.0 ae/gal formulation, like those found in Clarity. See page 203 or the *Herbicide Dictionary* for other products containing dicamba.

Ditches and Roadsides

Area or Use	Herbicide	Commercial Product per Acre	Application Time	Remarks and Approximate Cost Per Acre Broadcast
ROADSIDES (Broadleaf weed control)	2,4-D (4L)	32.0 oz	Broadleaf weeds 2-6"	Repeat treatments may be necessary. Do not use near susceptible plants/trees. Cost: 2,4-D \$5.75; 2,4-D + dicamba \$13.25.
	2,4-D (4L) + DICAMBA [•]	32.0 oz 16.0 oz		
	GARLON 4	1.0-8.0 qt		
	GARLON 4 ULTRA/ REMEDY ULTRA + MILESTONE	2.0-3.0 qt 7.0 fl oz	Broadleaf weeds 2-12"	Cost: \$25.00-\$200.00. Broadcast on plants regrowing after mowing/shredding. For spot spraying, use same rates, except per 100 gal of water. Cost: \$69.25-\$94.25.
	MILESTONE	3-7 fl oz		
	MILESTONE VM PLUS	4.0-9.0 pt		
	OPENSIGHT	1.0-3.0 oz	Broadleaf weeds 2-6"	For broadcast and spot treatment. Cost: \$8.25-\$19.25. For control of broadleaf weeds and certain woody plants, including invasive and noxious weeds. Cost: \$22.50-\$50.75. Spring, early summer, and fall. For control of broadleaf weeds and certain woody plants. Cost: \$7.00-\$20.75.
	OVERDRIVE	4.0-8.0 oz		
	PLATEAU (tall fescue, smooth brome, Kentucky bluegrass)	4.0-12.0 oz		
	PERSPECTIVE	4.75 oz	Actively growing broadleaf weeds	Cost: \$27.00.
	REDEEM R&P	1.5-4.0 pt	Broadleaf weeds 2-6"	Cost: \$24.00-\$64.00.
	STREAMLINE	4.75 oz	Actively growing broadleaf weeds	Cost: \$28.50.

¹Before using a generic glyphosate, confirm that it is approved for aquatic use. Glyphosate formulations labeled for aquatic use in Nebraska include: Rodeo and Accord Concentrate (Dow AgroSciences), AquaMaster (Monsanto), Aquaneat (NuFarm), Cinco (Loveland), and Glyfos Aquatic (Cheminova).

•Dicamba rates are based on a 4.0 ae/gal formulation, like those found in Clarity. See page 203 or the *Herbicide Dictionary* for other products containing dicamba.

Ditches and Roadsides *(continued)*

Area or Use	Herbicide	Commercial Product per Acre	Application Time	Remarks and Approximate Cost Per Acre Broadcast
ROADSIDES (Broadleaf weed control)	TELAR	0.25-0.5 oz	Weeds 0-2"	Use with surfactant 1.0 qt/100.0 gal. Cost: \$6.00-\$12.00.
	TORDON 101 MIXTURE	0.5-2.0 gal	Broadleaf weeds 2-6"	Cost: \$33.50-\$134.00.
	TRANSLINE	0.25-1.33 pt	Broadleaf weeds 2-6"	Cost: \$6.25-\$33.25.
	VISTA	0.67-1.3 pt	Broadleaf weeds 2-6"	Cost: \$18.50-\$35.75.
GRASS SUPPRESSION	JOURNEY	5.3-16.0 oz	Spring — early in growing season	Do not apply to bare soil. May move if soil moves. Suppresses height and heading of brome grass and other cool season grasses. Do not use year after year in order to avoid development of resistant weeds. Trace amounts can harm crops and gardens. Imperative that label directions are followed. Cost: Journey \$5.50-\$16.50; Oust \$7.25.
	OUST	1.0 oz	Grass 6-12"	
	PLATEAU (tall fescue, smooth brome, Kentucky bluegrass)	4.0-8.0 oz	Dormant (fall) or growing season (spring-early summer)	Plateau is currently marketed and sold only to approved government agencies. Applications made in growing season may cause yellowing, especially at higher rates. Cost: \$6.00-\$12.00.
IRRIGATION DITCHBANKS	KARMEX 80W	5.0-10.0 lb	Soon after ditches are open. Treat before weeds appear or soon after	Use enough water to ensure good coverage. Use 50 mesh or coarser screens. May injure nearby trees and shrubs. Cost: Karmex \$40.00-\$80.00; 2,4-D \$5.75.
	2,4-D LV ESTER (4L)	32.0 oz	Broadleaf weeds 2-6"	
	AQUATIC GLYPHOSATE ¹	128.0 oz in 10.0 gal or less water	POST when good growth is present	Nonselective. No residual control. Use the lower rate on annual weeds and perennial grasses, the higher rates on perennial broadleaf weeds. Add an approved non-ionic surfactant at 1/2% v/v. Cost: \$13.25.
PERENNIAL GRASSES (including smooth brome and quackgrass)	GLYPHOSATE [♦]	64.0 oz in 10.0 gal or less water	Full foliage or fall	Perennial grasses should have good top growth. Retreatment may be required. Cost: \$6.75.
PERENNIAL BROADLEAF WEEDS	MILESTONE	4.0-7.0 oz	Broadleaf weeds 2-12"	For broadcast and spot treatments. Cost: \$11.00-\$19.25.
	MILESTONE VM PLUS	4.0-9.0 pt		For control of broadleaf weeds and certain woody plants, including invasive and noxious weeds. Cost: \$22.50-\$50.75.
	OPENSIGHT	1.0-3.0 oz	Spring, early summer and fall	For control of broadleaf weeds and certain woody plants. Cost: \$6.00-\$17.75.
	OVERDRIVE	4.0-8.0 oz	Full foliage	Cost: \$13.00-\$26.00.
	OVERDRIVE + TORDON	4.0 oz 8.0 oz	Full foliage	Cost: \$17.75.
	REDEEM R&P	1.5-4.0 pt	2 to full foliage	Cost: \$24.00-\$64.00.
	TORDON 101 MIXTURE	0.5-2.0 gal	2 to full foliage	Cost: \$33.50-\$134.00.
	TORDON 22K	0.5-4.0 pt	2 to full foliage	Cost: \$4.75-\$37.00.
	TRANSLINE	0.3-0.6 pt	Full foliage	For non-cropland, can be used in wildlife openings, including grazed areas. Provides control of knapweeds, Canada thistle, and musk thistle. Cost: \$7.50-\$15.00.

[♦]Glyphosate rates are based on a 4.0 ai/gal or 3.0 lb ae/gal formulation. See pages 193-199 for information on common glyphosate formulations.

Weed Response to Selected Pasture and Range Herbicides

Response Ratings: Ratings are for light to moderate weed densities, favorable conditions and weed growth stage as specified on product label. High weed densities, adverse conditions, or large weeds will reduce control. 10 = 96-100% 6 = 70-79% 9 = 90-95% 5 = 60-69% 8 = 85-90% 4-2 = less than 60% 7 = 80-84% 1 = 0															
Weeds	2,4-D ester	Amber	Chaparral	Cimarron MAX	Curtail	Dicamba [•]	Forefront	Glyphosate [♦]	Grazon P&D	Milestone	Overdrive/Distinct	Plateau/Imazapic E 2 SL	Spike 20P	Tordon 22K	Transline/Stinger
Arkansas Rose	6	-	7	7	6	6	-	-	7	-	6	4	6	7	5
Broom Snakeweed	5	5	8	8	5	5	-	-	9	-	5	-	-	9	5
Buckbrush/Snowberry	8	-	8	8	8	6	8	-	7	-	6	3	7	6	2
Canada Thistle	6	6	9	7	7	7	9	6	9	9	7	6	6	9	9
Common Mullein	-	-	8	7	3	6	9	7	7	8	6	-	7	9	4
Cottonwood	9	-	-	-	7	9	8	-	8	-	9	3	9	9	4
Curled/Pale Dock	6	6	9	8	7	9	9	7	9	9	9	7	9	9	9
Dogwood	7	-	-	9	6	9	-	-	6	-	9	-	9	7	-
Downy Brome/Cheat Grass	-	6	-	2	-	4	2	9	-	-	4	8	7	-	-
Field Bindweed	7	-	-	7	5	8	7	8	9	-	8	6	-	9	-
Flodman Thistle	8	6	9	8	8	8	9	8	9	9	8	5	-	9	9
Fringed Sagebrush	6	-	6	6	5	3	6	-	8	-	3	-	4	9	-
Gumweed	9	-	8	8	6	9	9	-	9	-	9	-	-	8	4
Hemp	9	-	-	9	7	8	9	5	8	-	8	-	-	9	4
Hemp Dogbane	7	-	-	-	6	8	-	7	7	-	8	-	-	8	4
Hoary Cress	6	-	9	-	5	7	-	5	6	-	7	7	-	6	-
Honey/Black Locust	6	-	9	6	5	8	8	-	9	8	8	-	9	9	4
Honeyvine Milkweed	7	-	-	7	6	6	7	7	7	-	6	-	-	7	4
Horseweed/Marestail	6	8	9	8	7	8	9	7	6	9	8	-	7	7	7
Houndstongue	3	6	8	8	3	-	4	5	6	4	-	4	-	7	-
Kochia	6	8	-	8	5	8	6	9	5	-	8	8	6	5	-
Leafy Spurge	6	-	-	3	5	6	6	7	9	-	6	9	-	9	-
Lespedeza Sericea	3	-	8	7	4	6	-	7	4	-	6	-	-	-	-
Locoweed	7	-	8	-	7	7	-	5	8	-	7	-	-	8	8
Lupine Species	7	-	-	-	4	8	-	5	9	-	8	-	-	9	-
Marshelder	7	8	8	8	7	-	9	5	7	9	-	-	-	8	8
Multiflora Rose	4	-	8	8	3	6	-	-	7	-	6	3	9	9	4
Musk/Plumeless Thistle	7	6	9	8	8	9	9	7	9	9	9	7	7	9	9
Osage Orange	6	-	-	-	5	4	-	-	5	-	4	-	6	7	4
Oaks	6	-	-	-	5	8	-	-	7	-	8	-	9	6	4
Perennial Sowthistle	7	-	9	5	6	7	9	5	7	9	7	-	7	7	7
Plains Larkspur	7	-	-	-	5	5	-	5	9	-	5	-	-	8	4
Prickly Pear	6	-	-	6	4	6	-	-	8	-	6	-	-	9	4
Rabbit Brush	6	-	-	5	4	7	-	-	5	-	7	-	-	9	-
Red Cedar	4	-	-	-	3	4	-	-	4	-	4	7	7	9	-
Russian Knapweed	4	-	9	5	6	6	9	7	7	9	6	7	-	7	7
Russian Olive	6	-	-	-	3	7	6	-	7	5	7	-	9	9	-
Sand Sagebrush	9	-	-	8	6	4	9	-	7	-	4	-	6	4	-
Scotch Thistle	7	6	9	9	8	8	9	7	8	9	8	-	-	8	9
Siberian Elm	7	-	-	-	5	9	-	-	8	-	9	-	9	9	4
Smooth Sumac	9	-	8	8	5	7	-	4	8	-	7	-	7	9	4
Soapweed/Yucca	4	-	-	8	4	4	-	-	6	-	4	-	4	6	-
Sweetclover	9	-	9	9	7	9	9	5	6	-	9	-	9	9	8
Tall Larkspur	4	-	-	-	3	7	-	5	9	-	7	-	-	9	4
Western Ironweed	6	-	8	-	5	8	8	5	8	9	8	-	6	9	4
Western Ragweed	7	6	8	8	6	7	9	5	8	9	7	8	7	9	4
Wild Licorice	3	-	-	-	4	6	3	3	7	-	6	-	-	7	-
Wild Plum	8	-	8	-	6	8	-	-	5	-	8	-	9	9	-
Willows	9	-	-	8	6	7	9	-	5	2	7	-	9	5	-
Woollyleaf Bursage	7	-	-	7	7	8	7	6	8	-	8	-	-	9	9
Yarrow	4	-	8	7	4	7	9	4	8	9	7	-	-	-	-
Yellow Toadflax	3	-	-	-	3	-	3	4	5	-	-	7	-	8	-

♦ See pages 193-199 for information on common glyphosate formulations.

• See page 84 for dicamba formulations other than Clarity and Banvel.

Pasture and Range

(See *Troublesome Weeds*, pages 155-167 for more information)

Area or Use	Herbicide	Commercial Product per Acre	Application Time	Remarks and Approximate Cost Per Acre Broadcast
NEW AND ESTABLISHED GRASSES	PLATEAU/ IMAZAPIC E2	New: 2.0-4.0 oz Established: 4.0-8.0 oz	Apply preemergence or early postemergence to grass plantings. For established grasses apply early postemergence when weeds are less than 4".	Postemergence applications of Imazapic E2 require a spray adjuvant. Use on big bluestem, indiagrass, switchgrass (mixes only), sideoats and blue grama, buffalograss and eastern gamagrass. Postemergence to established smooth brome grass, common bluegrass, and wheatgrasses. Cost: Plateau \$3.00-\$12.00.
GRASS SEEDLINGS (Cool- and warm-season grasses)	2,4-D AMINE (4L) 2,4-D ESTER (4L)	16.0-32.0 oz 16.0 oz	Grass 5-leaf stage or beyond	Can be applied to new seedlings once grass is established. For broadleaf weeds. After grasses are well established, increase rate to 1.0 qt. Cost: 2,4-D amine \$2.00-\$4.25; 2,4-D Ester \$2.75.
SOD SEEDING (Legumes into grass)	GRAMOXONE SL	2.0 pt	Before or immediately after legume seeding	Add NIS (0.25% v/v) per 100 gal spray solution. Suppresses established sod. Seed legumes with a sod seeder. If grass is less than 3 inches, use lower rate. During year of establishment, graze intensively for short periods only. Add X-77 surfactant. Cost: \$9.50.
SOD SEEDING (Native grass planted no-till)	GLYPHOSATE♦	16.0-32.0 oz	Spring on cool-season grasses	Suppresses established sod. Seed grasses with a sod seeder. Do not graze seeded area until dormancy after second growing season. Apply in no more than 10.0 gal water per acre and add 2 qt X-77 and 17 lb ammonium sulfate per 100 gallons. Cost: \$1.75-\$3.50.
ANNUAL OR BIENNIAL BROADLEAF WEEDS IN PASTURES AND RANGES	2,4-D ESTER (4L)	32.0 oz	Rosette stage in fall or when weeds are small in spring	Consult the <i>Table on Grazing Restrictions for Pasture and Range Herbicides</i> on page 178. Combination controls greater variety of weed species. Do not use Banvel/Clarity within 1/2 mile of sensitive crops. Cost: 2,4-D \$3.25-\$5.75; 2,4-D + dicamba \$9.50; Amber \$5.75; Chaparral \$9.00-\$19.75; Cimarron Plus \$1.75-\$17.50; Cimarron Max \$51.00/gal; Cimarron Xtra \$8.50-\$34.00; Curtail \$13.75-\$27.50; Escort XP \$2.50-\$4.75; Grazon P+D \$9.00-\$18.00; Overdrive \$13.00-\$26.00; Rave \$4.25-\$10.50; Redeem R&P \$24.00-\$32.00; Surmount \$12.00-\$16.00; Tordon 22K \$4.75-\$18.50.
	2,4-D ESTER (4L) + DICAMBA•	32.0 oz 8.0 oz		
	AMBER	0.28-0.56 oz		
	CHAPARRAL	1.5-3.3 oz		
	CIMARRON PLUS	0.125-1.25 oz		
	CIMARRON MAX	see label for rates		
	CIMARRON XTRA	0.5-2.0 oz		
	CURTAIL	2.0-4.0 pt		
	ESCORT XP	0.2-0.4 oz		
	GRAZON P+D	2.0-4.0 pt		
	OVERDRIVE	4.0-8.0 oz		
	RAVE	2.0-5.0 oz		
	REDEEM R+P	1.5-2.0 pt		
	SURMOUNT	1.5-2.0 pt		
	TORDON 22K	0.5-2.0 pt		

♦Glyphosate rates are based on a 4.0 ai/gal or 3.0 lb ae/gal formulation. See pages 193-199 for information on common glyphosate formulations.

•Dicamba rates are based on a 4.0 ae/gal formulation, like those found in Clarity. See page 203 or the *Herbicide Dictionary* for other products containing dicamba.

Pasture and Range *(continued)*

(See Troublesome Weeds, pages 155-167 for more information)

Area or Use	Herbicide	Commercial Product per Acre	Application Time	Remarks and Approximate Cost Per Acre Broadcast
ANNUAL OR BIENNIAL BROADLEAF WEEDS IN PASTURES AND RANGE <i>(continued)</i>	CHAPARRAL	1.5-3.3 oz		For control of broadleaf weeds in noncropland areas, rights-of-way and wildlife openings, including grazed areas, and rangeland and grass pastures. Milestone: It is permissible to treat non-irrigation ditch banks, seasonally dry wetlands (such as flood plains, deltas, marshes, swamps, or bogs) and transitional areas between upland and lowland sites. Cost: Chaparral \$9.00-\$19.75; ForeFront \$10.75-\$18.50; Milestone \$8.25-\$19.25; Transline \$6.25-\$13.50.
	FOREFRONT	1.5-2.6 pt		
	MILESTONE	3.0-7.0 oz		
	TRANSLINE	0.25-1.3 pt		
PERENNIAL BROADLEAF WEEDS IN PASTURE AND RANGE Includes: vervains, broom snakeweed, western ironweed, woolly loco, flodman thistle and wavy leaf thistle. (For other weeds see pages 146-158.)	2,4-D LV ESTER (4L)	48.0 oz	At bud stage of predominant weed. Oct. or April for dandelion and musk thistle	Annual treatment for 2-3 years may be necessary. Consult the <i>Table on Grazing Restrictions for Pasture and Range Herbicides</i> on page 178. Overdrive used alone or in tank-mix combination with Tordon or Transline. Cost: 2,4-D \$9.00-\$19.75; 2,4-D + dicamba \$13.25; Chaparral \$9.00-\$19.75; Curtail \$27.50-\$41.25; Forefront \$10.75-\$18.50; Grazon \$13.50-\$27.00; Milestone \$8.25-\$19.25; Overdrive/Distinct \$13.00-\$26.00; Redeem R&P \$32.00-\$64.00; Surmount \$16.00-\$32.00; Tordon 22K \$18.50-\$37.00.
	2,4-D LV ESTER (4L) + DICAMBA [•]	32.0 oz 16.0 oz		
	CHAPARRAL	1.5-3.3 oz		
	CURTAIL	4.0-6.0 pt		
	FOREFRONT	1.5-2.6 pt		
	GRAZON P+D	3.0-6.0 pt		
	MILESTONE	3.0-7.0 oz		
	OVERDRIVE/DISTINCT	4.0-8.0 oz		
	REDEEM R+P	2.0-4.0 pt		
	SURMOUNT	2.0-4.0 pt		
	TORDON 22K	2.0-4.0 pt		
WINTER ANNUAL GRASS CONTROL Includes downybrome	GLYPHOSATE [♦]	16.0 oz	Late fall and late winter prior to forage grass green-up	Controls downy brome. Do not use on grasses for seed production. Do not harvest or graze for 8 weeks. Cost: \$1.75.
	PLATEAU/ IMAZAPIC (E2)	4.0-6.0 oz	Fall PRE or early POST before grass is 2" tall	Currently marketed and sold only to approved government agencies. Add 1.0 qt MSO. Wait 7 days before hay harvest. Cost: \$6.00-\$9.00.
WOODY PLANT CONTROL	REMEDY ULTRA/ GARLON 4	1.5 qt		For woody plant control, can be used for individual plant or small stands. Treat when woody plants are actively growing. Use lower rate of Spike in areas receiving 20" or less average rainfall. Cost: Remedy Ultra/Garlon 4 \$26.25; Spike \$0.25-\$0.50/100.0 sq ft.
	SPIKE (20P) per 100 sq ft	0.20-0.41 oz		
	SURMOUNT	3.0-6.0 pt		Apply when plants are actively growing and after leaves are fully expanded. Add a nonionic surfactant. No grazing restrictions for non-lactating dairy animals or other livestock. Cost: \$24.00-\$48.00.

[♦]Glyphosate rates are based on a 4.0 ai/gal or 3.0 lb ae/gal formulation. See pages 193-199 for information on common glyphosate formulations.

[•]Dicamba rates are based on a 4.0 ae/gal formulation, like those found in Clarity. See page 203 or the *Herbicide Dictionary* for other products containing dicamba.

Total Vegetation Control (TVC)

If you have areas around a building or parking lot where you always battle weeds, it can be frustrating, time consuming, and costly to constantly mow or trim these areas. Nonselective herbicides are available to prevent vegetation from growing on a particular site. This type of weed management is referred to as total vegetation control or “bareground” since it leaves the ground without vegetative cover. Total vegetation control herbicides allow for control of undesirable vegetation in many commercial and agricultural settings (see examples).

Agricultural

Buildings	Equipment parking areas
Fence lines	Waste lagoons
Driveways	Grain storage bins

Commercial

Driveways and parking areas	Fuel storage
Cemeteries	Outbuildings
Fence lines	Vacant lots

Herbicides used in total vegetation control can be broken down into two groups, long-term control and short-term control. Long-term control herbicides will have a strong residual, allowing for control of vegetation for many months if not years, depending on use rate. Do not use long-term control herbicides near root zones and other desirable plants as the herbicides may come in contact with those plants and trees and cause injury or loss of the entire plant or tree.

Herbicides with short-term vegetation control are useful for controlling all the vegetation in an area but not limiting future use of the site with residual. The residual for these herbicides may be as short as 7 days. It is also important to be aware of herbicide-resistant weeds such as ALS-resistant kochia. Consult labels for specific instructions on controlling problem weeds and conditions. You also may refer to the *Troublesome Weeds* section (pages 151-163) for other suggestions for control of these weeds. Finally, do not use total vegetation control on land subject to erosion unless there is a plan to control erosion.

Area or Use	Herbicide	Commercial Product	Application Time	Remarks and Approximate Cost Per Acre Broadcast
LONG-TERM TOTAL VEGETATION CONTROL	ARSENAL	1.0 oz/1000 ft ²	Treat before weeds appear or soon after	Cost: \$1.25/1000 ft ² .
	HYVAR X-L	0.75 pt/1000 ft ²	Treat before weeds appear	Cost: \$9.75/1000 ft ² .
	KARMEX DF / KARMEX IWC	5.0-15.0 lb/A depending on weed	Treat before weeds appear	Cost: \$40.00-\$120.00.
	KROVAR I DF	10.0 oz/1000 ft ² 6.0-16.0 lb/A depending on weed	Treat before weeds appear	Do not use around homes, walks, driveways, or recreational areas or allow cattle to graze. Cost: \$10.00/1000 ft ² .
	PIPER	10.0 oz/A	Spring	Spray bare ground with minimal or no vegetation. Cost: TBA.
	PRAMITOL 25E	5.0-10.0 gal/A	Treat before weeds appear or soon after	Be aware of the root zone of desirable species. Do not use on land to be cropped. Do not apply in greenhouses. Cost: \$195.00-\$390.00.
	SAHARA	0.2 – 0.4 lb/1000 ft ² 7.0-19.0 lb/A	Actively growing weeds are preferred but it can be applied before weeds emerge	Use 1.0% v/v methylated seed oil (MSO) for postemergence applications. Do not use near irrigation water. Can be used under pavement only on industrial sites. Do not use around homes, walks, driveways, or recreational areas where desirable vegetation may come in contact with the herbicide. Cost: \$3.50-\$7.25/1000 ft ² .
	SPIKE 20P	2.5-20.0 lb/A	Treat before weeds appear or soon after	Not for residential use. Primarily for control of woody plants. Do not apply in areas with a water table less than 10 ft. Cost: \$40.00-\$320.00.
	SPIKE 80 DF	1.25-5.0 lb/A	Treat before weeds appear or soon after	Not for residential use. Primarily for control of woody plants. Do not apply in areas with a water table less than 10 ft. Cost: \$31.25-\$125.00.
	TELAR XP	1.0-2.6 oz/A	Treat before or soon after annual weeds appear. Perennial weeds are best controlled at the bud to bloom or fall rosette stage.	Do not apply more than 2.6 oz/A per year. For use in non-crop areas such as farmyards, fuel storage areas, and barrier strips. Cost: \$23.00-\$59.75.
	THROTTLE XP	12.5 oz/A	Treat preemergence to early postemergence	Cost: \$101.50.
	VIEWPOINT	13.0-20.0 oz/A	Treat preemergence or postemergence to actively growing broadleaf weeds.	For use in non-crop areas. Do not apply more than 20 oz/A per year. Cost: \$61.00-\$93.75.
SHORT-TERM TOTAL VEGETATION CONTROL	GLYPHOSATE◆	32.0-64.0 oz/A 1-3% spot treatment	Broadleaves less than 10"; grasses less than 24"	Add 2% v/v spray grade ammonium sulfate (AMS). Has no soil residual. Do not use around water. Cost: \$3.50-\$6.75.
	GRAMOXONE SL	2.5-4.0 pt	Treat after weeds have emerged	Add 0.25% v/v NIS or 1% Crop Oil Concentrate (COC). Do not use around home gardens, schools, recreational parks, or playgrounds. Cost: \$12.00-\$19.00.
	REGLONE/ REWARD L&A	1.0-2.0 pt/A 1.0-2.0 qt/100 gal spot treatment	Treat after weeds have emerged	Use 0.25% v/v NIS. Ensure good coverage. Cost: \$12.00-\$23.75.

◆Glyphosate rates are based on a 4.0 ai/gal or 3.0 lb ae/gal formulation. See pages 193-199 for information on common glyphosate formulations.

Trees and Shrubs

Including Shelterbelts, Christmas and Fruit Trees*

Herbicide	Rate Per Acre	Application Time	Remarks and Approximate Cost Per Acre Broadcast
2,4-D AMINE (4L)	32.0 oz	POST to weeds	Keep off new bark and foliage. Controls broadleaf weeds. Cost: \$4.25.
CASORON 4G*	100.0 lb	PRE on trees at least 2 years old	Apply a 20-inch band on each side of tree row after trees are planted. Some injury to trees may result on low organic matter soil. Cost: \$310.00.
CHATEAU*	6.0-12.0 oz	PRE to weeds	For use on established grapes and non-bearing fruit and nut trees. A burndown tank-mix partner should be used if weeds are emerged. Avoid contact with foliage and green bark. Do not exceed 6.0 oz/A if soil is sandy or gravel. Do not apply within 60 days of harvest. Cost: \$45.00-\$90.00.
GLYPHOSATE♦	32.0-128.0 oz in 10.0 gal water	Directed POST	Do not spray green bark or foliage. Spray may contact brown bark. Use lower rate on annuals. Cost: \$3.50-\$13.50.
GOAL	2.0-4.0 qt	PRE or POST to weeds	Conifers and cottonwoods. Grasses should be treated before they are beyond 2-leaf stage. Use before bud break or after new growth hardens. Cost: \$47.00-\$94.00.
GRAMOXONE SL*	2.0-3.0 pt	Directed POST	Nonselective contact herbicide. Keep spray off tree foliage. Add surfactant. Cost: \$9.50-\$14.25.
KARMEX 80W*	2.5-5.0 lb	PRE on trees at least 2 years old	Karmex use limited to conifers, honey locust, green ash, apples, and pears. Cost: \$20.00-\$40.00.
POAST*	32.0 oz	POST before grasses tiller	Use on fruit trees limited to nonbearing trees. Add 1.0 qt crop oil concentrate per acre. Thorough coverage required. Cost: \$26.25.
PRINCEP CALIBER 90/ SIMAZINE 90*	2.2-4.4 lb	PRE on trees at least 2 years old	Fruit trees and many conifers. Cost: \$11.00-\$22.00.
SOLICAM 80 WP*	2.5-5.0 lb	PRE, late fall or early spring	Fruit trees only. May be combined with Karmex and Princep for improved broadleaf control.
SURFLAN A.S.*	2.0-4.0 qt	PRE	Fruit trees only. May be combined with Karmex and Princep for improved broadleaf control. Cost: \$21.00-\$42.00.
TREEVIX*	1.0 oz	PRE or POST to weeds	For use in established bearing and non-bearing apple, pear, and walnut. Avoid contact with foliage and green bark.

♦Glyphosate rates are based on a 4.0 ai/gal or 3.0 lb ae/gal formulation. See pages 193-199 for information on common glyphosate formulations.

*Denotes products registered for use in fruit trees.

Commercial Turfgrass

Weeds are usually the most visible of turfgrass pests and are a major problem for turf managers and homeowners. Weeds are a concern principally because they compete with desirable turfgrass plants for space, light, water, and nutrients. In addition, weeds detract from the appearance and function of turfs.

Any plant can be considered a weed if it's growing where it's not wanted. For example, although tall fescue is a major turfgrass species, it is considered a weed if it infests Kentucky bluegrass.

Management and control measures will vary depending on which weeds are present. Proper identification of the weed problem is the first step in developing a management strategy.

Weeds often are grouped by life span (annuals, biennials, or perennials). Determining a weed's life span is important when developing a management strategy.

The best defense against weeds is a thick, well-managed turf. A vigorous turf will successfully compete with weeds for light, nutrients, and water. Weeds become established most readily in thin, weak stands of turf. Herbicides alone do not usually produce satisfactory long-term control. Although herbicides can be used in an integrated weed control system, proper turfgrass management to encourage a dense, vigorous turf and discourage weeds.

Chemical Weed Control

Herbicides are available to control most turf weeds. Care should be used when applying any pesticide. Always read and follow label directions. Improper use can

result in poor weed control, turf injury, or injury to sensitive ornamental, garden, or even agricultural plants.

Preemergence Herbicides

Preemergence herbicides should be applied to the turf before weeds germinate. To control most summer annual grasses such as crabgrass, apply preemergence herbicides when soil temperature exceeds 55°F. A second application is usually needed eight to 10 weeks after the first to provide the most consistent season-long control. Preemergence herbicides should be watered in immediately after application with at least 0.5 inch of water.

Postemergence Herbicides

Postemergence herbicides are applied once weeds emerge and are absorbed by foliage and/or roots of actively growing weeds. The majority of postemergence herbicides used in turfgrass management are for broadleaf weed control, but herbicides are also available for the control of some grasses and grass-like plants.

Several factors influence the effectiveness of postemergence herbicide applications. Control is easiest to achieve when weeds are small, healthy, and actively growing. As weeds age, changes in the leaf surface, growth habit, and physiological function result in reduced herbicide uptake and translocation.

If possible avoid mowing for several days before and after postemergence herbicide application. Mowing before application reduces the amount of weed foliage available to intercept the chemical and causes stress, which reduces herbicide uptake. Mowing after application may

remove the treated portion and prevent translocation to the roots.

It's best to avoid applying postemergence herbicides to turfgrass and weeds under heat or drought stress. Injury may occur to the turfgrass and weed control can be less effective. If conditions have been persistently dry, irrigating before application may ensure that weeds are actively growing, and improve control. Unlike with preemergence herbicides, it's best not to water for several days after application. Watering can wash the herbicide off the plant. Also, avoid spraying if rain is expected within 24 hours.

Many postemergence herbicides for the control of broadleaf weeds are volatile and may injure sensitive plants in the area. Care should be taken only to spray when the wind is 5 mph or less and the air temperature is less than 80°F. Postemergence broadleaf herbicides can be applied early in the spring (April-May) but are best applied from September through October. However, summer annual weeds may require May or June applications.

Integrated Weed Management

Herbicides are a useful tool for reducing weed populations, but the best approach is to use herbicides as part of an integrated system with proper mowing, fertilizer, and irrigation management to establish a vigorous turf.

Homeowners and professionals can get more information on turfgrass weed problems from their local University of Nebraska–Lincoln Extension office or at the University of Nebraska–Lincoln's turf web page at <http://turf.unl.edu>.

Commercial Turfgrass

Weed Response to Selected Turfgrass Herbicides

Plant response may be altered by growing conditions, genetic variation in turf and weeds, soil type, organic matter, temperature, growth stage and application rates. Ratings will vary from season to season and from area to area within the state. Ratings apply when herbicides are used as suggested in this guide. See pages 155-167 for additional problem weeds and their control.

Annual Weeds

	Herbicide	Crabgrass*	Foxtail**	Goosegrass**	Sandbur***	Prostrate Spurge**	Henbit**	Oxalis*
Site of Action	Preemergence							
3	Barricade/Prodiamine	9	9	8	—	9	9	9
8	Bensumec	7-8	6-7	8	—	—	—	—
2	Defendor	9	8	7	—	7	9	—
3	Dimension/Dithiopyr	9	8	7	—	6	8	—
14+3	Echelon	9	9	8	—	8	9	9
3	Pendimethalin	9	9	9	8	9	9	8
14	Ronstar G	8	8	9	8	7	7	8
27	Tenacity	8	8	—	—	—	—	—
	Postemergence +							
1	Acclaim Extra	9	9	8	6	0	0	0
6	Buctril	0	0	0	0	8	9	8
4	Confront	0	0	0	0	9	9	9
4	Cool Power	0	0	0	0	7	9	9
3	Dimension/Dithiopyr***	9	7	0	—	—	—	—
14	Dismiss	5	—	6	—	7	7	5
4	Drive/Drive XLR8	9	7	0	7	—	9	9
4	Millenium Ultra	0	0	0	0	8	9	9
4	OneTime	9	8	—	7	9	9	9
4+14	Q4 Plus	8	7	6	8	9	9	9
14	QuickSilver	0	0	0	0	9	9	9
4+14	SpeedZone	0	0	8	0	7	9	9
4+14	Solitaire	9	7	6	7	—	9	9
14+4	SquareOne	9	7	0	7	7	9	9
14+4	Surge	0	0	0	0	7	9	9
27	Tenacity	8	8	—	—	—	—	—
4	Trimec Classic	0	0	0	0	7	9	9
4+17	Trimec Plus	7	6	5	6	7	9	9
4	Tripower	0	0	0	0	7	9	9
4	Triplet	0	0	0	0	7	9	9

Perennial Weeds

	Herbicide	Dandelion	Clover	Ground Ivy	Violet	Plantain	Nutsedge
Site of Action	Preemergence						
2	Defendor	9	9	—	—	—	—
14+3	Echelon	—	—	—	—	—	8
21	Gallery/Isoxaben	9	9	9	9	9	0
	Postemergence						
4	2,4-D amine	9	5	5	5	7	—
6	Buctril	8	8	6	6	7	—
4	Cool Power	9	7	8	7	9	—
4	Confront	9	9	8	8	8	—
14	Dismiss	7	6	7	7	7	8
4	Drive/Drive XLR8	9	9	6	7	—	—
4	Horsepower	9	7	8	8	9	—
4	Lontrel	8	9	0	—	7	—
4	Millenium Ultra	9	8	8	7	9	—
4	OneTime	9	9	8	8	9	—
14+4	PowerZone	8	9	7	7	8	—
4+14	Q4 Plus	9	8	7	—	9	7
14	QuickSilver****	9	9	9	—	—	0
2	Sedgehammer	—	—	—	—	—	9
4+14	Solitaire	9	9	6	7	—	7
14+4	SpeedZone	9	9	7	7	8	—
4+14	SquareOne	9	9	8	—	—	0
14+4	Surge	9	9	6	6	8	7
27	Tenacity	9	4	7	8	—	6
4	Trimec Classic	9	9	6	6	8	—
4+17	Trimec Plus	9	9	6	6	8	6
4	Tripower	9	9	6	6	8	—
4	Triplet	9	9	6	6	8	—
4	Turflon Ester	8	9	8	8	7	—

*Apply PRE when soil temperatures in the spring are sustained at 55°F.

**Apply PRE when soil temperatures in the spring are sustained at 60°F.

***Apply PRE when soil temperatures in the spring are sustained at 65°F.

+POST application at early growth stage for annual weeds and fall treatments for perennial weeds will result in better control.

++Apply PRE in the fall.

+++POST activity is limited to 1-3 leaf annual grasses.

****QuickSilver is a contact herbicide only providing quick burn down of most broadleaf weeds; only short-term control is likely.

— Efficacy data not available.

Response Ratings: Ratings are for light to moderate weed densities, favorable conditions and weed growth stage as specified on product label. High weed densities, adverse conditions, mature weeds or thin turf will reduce control.

9 = 90-100%

8 = 80-90%

7 = 70-80%

6 = 60-70%

5 = 51-59%

4 = 40-50%

3 = 30-40%

2 = < 30%

0 = 0

Commercial Turfgrass Herbicide Rates and Prices

Dry Products	Rate oz/1000 sq ft	Costs		
		\$/pound	\$/1000 sq ft	\$/acre
Barricade 65 WDG	0.42	21.00	0.55	24.01
Drive 75 DF	0.38	51.00	1.21	52.76
Gallery	0.37	145.00	3.35	146.06
Sedgehammer	0.03	1083.00	2.03	88.45
SquareOne	0.28	118.00	2.07	89.95
Tupersan	4.4	27.00	7.43	323.43
Liquid Products	Rate oz/1000 sq ft	Costs		
		\$/gallon	\$/1000 sq ft	\$/acre
2,4-D amine	1.1	14.00	0.12	5.24
Acclaim Extra	0.46	521.00	1.87	81.56
Bensumec	6.5	94.00	4.77	207.93
Buctril	0.37	69.00	0.20	8.69
Confront	0.56	137.00	0.60	26.11
Cool Power	1.0	61.00	0.48	20.76
Dimension 2EW	0.36	236.00	0.66	28.91
Dismiss	0.14	1493.00	1.63	71.13
Drive XLR8	0.74	118.00	0.68	29.72
Echelon	0.41	265.00	0.85	36.97
Finale	2.2	59.00	1.01	44.17
Horsepower	1.1	55.00	0.47	20.59
Lontrel	0.18	673.00	0.95	41.23
Millenium Ultra	1.1	63.00	0.54	23.58
OneTime	0.37	129.00	0.37	16.24
Pendulum 3.3EC	1.5	32.00	0.38	16.34
PowerZone	1.8	80.00	1.13	49.01
Prograss SC	1.0	127.00	1.00	44.00
Q4 Plus	2.9	97.00	2.20	95.73
Razor PRO	1.5	17.00	0.20	8.68
Reward	5.9	105.00	4.84	210.82
Roundup PRO	1.5	36.00	0.42	18.38
SpeedZone	1.5	68.00	0.80	34.71
Surge	1.3	53.00	0.54	23.45
Surflan	2.25	53.00	0.93	40.58
Tenacity	0.11	747.00	0.64	27.96
Trimec Classic	1.25	37.00	0.36	15.74
Trimec Plus	3.0	57.00	1.34	58.19
Triplet	1.1	36.00	0.31	13.48
Turflon Ester Ultra	0.55	141.00	0.61	26.39

Noxious Weeds

Statement from the Nebraska Department of Agriculture

Noxious weeds compete with crops, rangeland, and pastures, reducing yields substantially. Some noxious weeds are directly poisonous or injurious to man, livestock, and wildlife. Losses from noxious weed infestations can be staggering, costing millions of dollars due to lost production. The business of noxious weed control is everyone's concern, and their control is to everyone's benefit. The support of all individuals within the state is needed and vital for the control of noxious weeds within Nebraska.

It is the duty of each person who owns or controls land in Nebraska to effectively control noxious weeds on such land. County boards or control authorities are responsible for administering noxious weed control laws at the county level. This system provides Nebraskans with local control. Each county is required to implement a noxious weed program. When landowners fail to control noxious weeds on their property, the county can serve an individual notice on the landowner. This notice shall give specific instructions and methods on when and how certain noxious weeds are to be controlled.

University of Nebraska–Lincoln Extension in cooperation with the Nebraska Department of Agriculture has developed a series of publications on the biology, identification, distribution and control of the state's noxious weeds. See *Canada Thistle* (EC157); *Plumeless Thistle* (EC163); *Spotted and Diffuse Knapweed* (EC161); *Leafy Spurge* (EC152); *Musk Thistle* (EC162); *Saltcedar* (EC165) and *Common Reed* (*Phragmites*) (EC155).

For a description of individual plant treatment techniques, go to page 67.

Weed	Herbicide	Product Per Acre	Application Time	Remarks and Approximate Cost Per Acre Broadcast
CANADA THISTLE	Grazon NXT	1.5-2.1 pt	Fall when actively growing or spring early flower bud	
	Chaparral/Opensight	2.0-3.3 oz	Fall when actively growing or spring early flower bud	Cost: Chaparral \$11.50-\$18.75; Opensight \$12.00-\$19.75.
	Tordon 22K or Picloram 22K	1.0 qt	Fall when actively growing or spring early flower bud	For noncrop areas and spot treatment in pasture and range. Tordon may remain in the soil for three or more years. Cost: \$18.50.
	Tordon 22K + 2,4-D ester (4L)	1.0 pt 32.0 oz	Fall; spring during flower bud	Cost: \$15.00.
	Glyphosate [♦]	56.0-80.0 oz	Flower bud stage or in fall when growing actively	Idle ground or spot treatment in cropland before head or pod fill of crop. Avoid tillage for three days. Cost: \$6.00-\$8.50.
	Wide Match	1.33-2.66 pt	Rosette to bud stage	Use 1.33 pt/A rate in wheat and corn and 2.66 pt/A rate in non-crop uses. Cost: \$12.47-\$24.94.
	Curtail or Cody or Stinger or Transline	2.0-4.0 pt 0.67-1.3 pt	Rosette to pre-bud or in fall when actively growing	Curtail needs lower rate in wheat and barley, higher rate in fallow, pasture or CRP. Stinger used in sugarbeet and corn. Transline is labeled for rangeland and permanent grass pastures. Cost: Curtail \$16.25-\$32.50; Stinger \$47.00-\$91.00; Transline \$16.75-\$32.50.
	Telar	1.0-3.0 oz	4-6" or rosette stage	Escort or Telar for use in ag noncropland only. One application suppresses Canada thistle. For Telar, do not graze treated area if rate is more than 1.33 oz/A. Add NIS at 0.5% v/v. Cost: Escort \$12.00; Cimarron Plus \$14.00; Cimarron Xtra \$17.00; Telar \$23.00-\$69.00.
	Escort or Cimarron Plus or Cimarron Xtra	1.0 oz 1.0 oz 1.0 oz	Prebloom to bloom or in the fall when actively growing	
	Grazon P+D ²	4.0-6.0 pt		
	Milestone	5.0-7.0 oz	Fall; spring during flower bud	It is permissible to treat non-irrigation ditchbanks, seasonably dry wetlands (such as flood plains, deltas, marshes, swamps or bogs) and transitional areas between upland and lowland sites. Cost: \$13.75-\$19.25.
	Perspective	4.75-8.0 oz	Fall when actively growing or spring until flower bud	For non-crop areas, roadsides, industrial sites, airports. Cost: \$27.00-\$45.52.
	Streamline	4.75-9.5 oz	Fall when actively growing or spring until flower bud	For non-crop areas, roadsides, industrial sites. Streamline may temporarily cause yellowing or stunting of perennial grasses. Cost: \$30.20-\$60.56.
	Additional Control Strategies: Spring and summer — Prevent seed production by mowing once in June and again in July or apply inexpensive herbicides (2,4-D at 2qrts/A). Fall after first frost — After first frost, but before ground freezes, apply one of the above herbicides for excellent control.			

[♦]Glyphosate rates are based on a 4.0 ai/gal or 3.0 lb ae/gal formulation. See pages 193-199 for information on common glyphosate formulations.

²Dicamba rates are based on a 4.0 ae/gal formulation, like those found in Clarity. See page 203 or the *Herbicide Dictionary* for other products containing dicamba.

Noxious Weeds *(continued)*

Weed	Herbicide	Product Per Acre	Application Time	Remarks and Approximate Cost Per Acre Broadcast
DIFFUSE AND SPOTTED KNAPWEED	2,4-D ester (4L)	32.0 oz	Rosette stage	Cost: \$5.75.
	Chaparral/ Opensight	2.5-3.3 oz		Cost: Chaparral \$14.25-\$18.75; Opensight \$15.00-\$19.75.
	Curtail	2.0-3.0 qt	Last bud to early rosette	Cost: \$14.75-\$22.25.
	Grazon P+D [♦]	3.0-4.0 pt		Cost: \$13.50-\$18.00.
	Telar	1.0-2.0 oz	Mid-bolt to last bud stage	Cost: \$22.00-\$44.00.
	Redeem R&P Tordon 22K	1.5 qt 1.0-2.0 pt	Rosette to bud stage	Cost: Redeem \$24.00; Tordon 22K \$9.25-\$18.50.
	Milestone	5.0-7.0 oz	Rosette to bolting stage	For broadcast and spot treatment on noncropland, rangeland, pastures and CRP. Cost: \$13.75-\$19.25.
	Perspective	4.75-8.0 oz	Fall when rosettes are actively growing	For non-crop areas, roadsides, industrial sites, airports. Cost: \$27.00-\$45.52.
	Streamline	4.75-9.5 oz	Fall when rosettes are actively growing	For non-crop areas, roadsides, industrial sites. Streamline may temporarily cause yellowing or stunting of perennial grasses. Cost: \$30.20-\$60.56.
KNOTWEED (Japanese and Giant)	Glyphosate (Roundup, Accord, Glypro, Rodeo) or tryclopir (Garlon, Crossbow)	Foliar application: 2%-3% v/v (spot spray)	Foliar application: Spring or fall (2 weeks before killing frost)	Cut Stump Application: Cut stem 2" above soil surface then apply 25% v/v solution of water and Roundup or Garlon. Cost: glyphosate \$13.50/gal.
LEAFY SPURGE	2,4-D ester (4L)	64.0 oz	Bud stage in spring	Retreatment necessary. Annual applications gradually reduce infestation. Cost: 2,4-D \$11.25; Grazon P+D \$9.00.
	Grazon P+D	2.0 qt		
	Curtail or Cody or Stinger	2.0-4.0 pt 0.67-1.3 pt	Flowering stage in spring	Cost: Curtail \$16.25-\$32.50; Stinger \$47.00-\$91.00.
	Plateau or Panoramic or Cadre or Imazapic 2E)	8.0-12.0 oz	In fall 2 weeks before first frost	Do not apply herbicide in spring over area treated the previous fall with 8.0-12.0 oz/A. Use with MSO 1.0 qt/A. Cost: \$12.00-\$17.75.
	Perspective	4.75-8.0 oz	Flowering stage in spring	Cost: \$27.00-\$45.50.
	Sharpen + Plateau	1.0-2.0 oz 4.0-6.0 oz	Flowering stage in spring only	Use with COC or MSO 1.0 qt/A. Cost: \$12.25-\$21.25.
	Streamline	4.75-9.5 oz	Flowering stage in spring	Cost: \$28.75-\$60.50.
	Tordon 22K or Picloram 22K	2.0-4.0 pt	Fall or spring Sept. to early Oct.	Tordon for noncrop areas and spot treatment in pasture and range. Cost: Tordon \$18.50-\$37.00; Overdrive + Tordon \$22.25.
	Overdrive + Tordon	4.0 oz 16.0 oz	Flowering stage	
	Streamline	4.75-9.5 oz	Fall when rosettes are actively growing	For non-crop areas, roadsides, industrial sites. Streamline may temporarily cause yellowing or stunting of perennial grasses. Cost: \$30.25-\$60.50.

[♦]See manufacturer's label for application time.

•Dicamba rates are based on a 4.0 ae/gal formulation, like those found in Clarity. See page 203 or the *Herbicide Dictionary* for other products containing dicamba.

¹Before using a glyphosate formulation, confirm that it is approved for aquatic use. Glyphosate formulations labeled for aquatic use in Nebraska include: Rodeo and Accord Concentrate (Dow AgroSciences), AquaMaster (Monsanto), Aquaneat (NuFarm), Cinco (Loveland), and Glyfos Aquatic (Cheminova).

Noxious Weeds *(continued)*

Weed	Herbicide	Product Per Acre	Application Time	Remarks and Approximate Cost Per Acre Broadcast
MUSK AND PLUMELESS THISTLE	Chaparral/Opensight	1.0-1.25 oz	Late fall or spring before bolting	Cost: Chaparral \$6.00-\$7.50; Opensight \$6.00-\$7.25.
	Cimarron Max	0.25 oz part A + 1.0 pt part B		Use in pastures, grasses for seed, fallow and CRP. Curtail may be used in wheat. Cost: Cimarron Max \$9.25; Cimarron Plus \$3.50; Curtail \$14.75.
	Cimarron Plus	0.25 oz		
	Curtail	2.0 pt		
	Telar	1.0 oz	Bolted plants in spring prior to flowering	Use in noncropland and roadsides. Add surfactant at 1.0 pt/100 gal. Cost: \$23.00.
	Milestone	3.0-5.0 oz	Rosette through bolting or in the fall	For broadcast and spot treatment on noncropland, rangeland, pasture and CRP. Cost: \$8.25-\$13.75.
	2,4-D ester (4L)	48.0-64.0 oz	Late fall treatment of rosettes or in spring before flowering stalks lengthen	Annual treatments necessary for control of new seedlings. Fall applications after trees drop leaves and before leafing out in the spring reduces damage. Do not apply after soil freeze-up in the fall. For use on ranges and permanent pastures only. Cost: 2,4-D \$8.50-\$11.25; 2,4-D + dicamba \$9.50; Tordon 22K \$4.75-\$7.00; Grazon P+D \$9.00-\$18.00; Transline \$8.25-\$25.00; Redeem R&P \$24.00-\$32.00.
	2,4-D ester (4L) + Dicamba [♦]	32.0 oz 8.0 oz		
	Tordon 22K	8.0-12.0 oz		
	Grazon P+D	2.0-4.0 pt	Rosette to early bolt growth stage	
	Transline	0.33-1.0 pt		
	Redeem R&P	1.5-2.0 pt		
	Perspective	3.0-4.5 oz	Fall or spring to actively growing rosettes until flower bud	For non-crop areas, roadsides, industrial sites, airports. Cost: \$17.00-\$25.61.
PHRAGMITES (common reed)	Aquatic glyphosate ¹ or Habitat	96.0-128.0 oz 2.0-4.0 pt	Apply in spring before flower or fall	Do not use glyphosates not labeled for aquatic use. Cost: Aquatic glyphosate \$10.00-\$13.25; Habitat \$31.25-\$62.50.
PURPLE LOOSESTRIFE (Lythrum)	2,4-D amine	80.0 oz/20.0 gal	Plants with active growth in bloom or later	Confirm that your brand of 2,4-D is labeled for aquatic uses. Do not use Roundup or other non-aquatic glyphosate products in aquatic habitat. Cost: 2,4-D amine \$10.25; 2,4-D LV 4 ester \$5.75-\$7.00; Aquatic glyphosate \$6.50-\$10.00.
Aquatic habitat (12 months under water)	2,4-D LV 4 ester	32.0-40.0 oz/ 5.0-15.0 gal		
	Aquatic glyphosate ¹	64.0-96.0 oz		
PURPLE LOOSESTRIFE (Lythrum)	Habitat	1.0-3.0 pt		Cost: \$15.75-\$47.00.
	Garlon 3A	3.0-5.0 pt	Plants with active growth in bloom or later	Watch for desirable species. Garlon, 2,4-D, and Escort have some safety on many grassy species and cattails at the listed rates; however, they will injure or kill many broadleaf species. Cost: Garlon 3A \$33.75-\$56.25; Garlon 3A + 2,4-D amine \$39.00; Escort \$24.00-\$48.00; Escort + 2,4-D amine \$17.25.
	Garlon 3A + 2,4-D amine	3.0 pt 40.0 oz		
	Escort	2.0-4.0 oz		
	Escort + 2,4-D amine	1.0 oz 40.0 oz		
	Habitat (spot treat)	1.0-2.0 qt/ 100.0 gal		Add 1 qt NIS/100 gal. Spray foliage to wet, but not to runoff. Cost \$31.25-\$62.50/gal.
	Habitat (broadcast)	1.0-3.0 pts		Higher rates of Habitat are nonselective and will result in total vegetation control. Do not apply more than 6 pt/year. Cost: \$15.75-\$47.00.
SALT CEDAR	Garlon 4 Ultra + Milestone	3.0 qt 7.0 oz	Late summer or early fall	Do not apply near irrigation ditches or water for domestic use. Do not disturb areas after they have been sprayed with Habitat. Cost: Garlon 4 Ultra + Milestone \$94.25; Habitat \$62.50; Habitat (spot spray) \$125.00/gal; Habitat + glyphosate \$34.75; Garlon 4 \$100.00/gal; Remedy \$70.00/gal.
	Habitat	4.0 pt (broadcast)		
	Habitat	1% (spot spray)		
	Habitat + glyphosate [♦]	2.0 pt 32.0 oz		
	Garlon 4/Remedy	33% (spot treat)	Basal treatment. Apply directly to 18" length of lower trunk or fresh cut stump (page 57).	
SERICEA LESPEDEZA	Cimarron Plus	0.625 oz	Spray at flower bud to full bloom	Cost: \$8.75.
	Escort	1.0-2.0 oz	Spray at flower bud to full bloom	Cost: \$14.00-\$28.00.
	PastureGard	1.5-2.0 pt	Spray at flower bud to full bloom	Cost: \$11.25-\$15.00.
	Remedy	1.0-1.5 pt	Spray before bloom	Cost: Remedy \$17.50-\$26.25; Surmount \$15.50-19.50.
	Surmount	2.0-2.5 pt	Spray before bloom	

[♦]Glyphosate rates are based on a 4.0 ai/gal or 3.0 lb ae/gal formulation. See pages 193-199 for information on common glyphosate formulations.

¹Before using a glyphosate formulation, confirm that it is approved for aquatic use. Glyphosate formulations labeled for aquatic use in Nebraska include: Rodeo and Accord Concentrate (Dow AgroSciences), AquaMaster (Monsanto), Aquaneat (NuFarm), Cinco (Loveland), and Glyfos Aquatic (Cheminova).

Troublesome Weeds and Woody Plants

(See pages 52-55 for spray additives)

Best control will be obtained if treatments are made when plants are actively growing. Treatment in following years may be required. An application just before flowering and a second application on fall regrowth will give best results on most perennials. Dust on leaves may interfere with herbicide activity. When the crop is not indicated, the treatment is for a weed growing in noncropland, pastures or rangeland. Always consult the label for the latest information and directions.

Weeds on the Watch List of the Nebraska Department of Agriculture are denoted by ✕. These weeds appear to be increasing and are being monitored by the NDA.

For a description of individual plant treatment techniques, go to page 67.

Weed	Herbicide	Product Per Acre	Application Time	Remarks and Approximate Cost per Acre Broadcast
ALFALFA (for control before planting wheat, soybean, dry edible bean, and potato)	2,4-D ester (4L)	48.0 oz	Alfalfa with 4-6" new growth; fall application best	Delay planting for 30 days after application. Ester formulations are less persistent than amine formulations. Cost: \$8.50.
ALFALFA (for control before planting corn, wheat, or sorghum)	2,4-D ester 4L + Dicamba [•]	32.0 oz + 8.0 oz	Alfalfa with 4-6" new growth in fall or spring; fall application best; in spring at least 2 weeks before corn planting	Delay planting corn for 10 days and delay sorghum 15 days. Best time to kill alfalfa is in the fall. Cost: 2,4-D ester 4L + dicamba \$9.50; Distinct \$7.25-\$9.75.
	Distinct	3.0-4.0 oz		
ALFALFA (in corn or sorghum)	2,4-D amine (4L) + Dicamba [•] (corn only)	4.0 oz 8.0 oz	Alfalfa with 4-6" growth	Use drop tips on crop taller than 8". See No-till Burndown section of corn, sorghum, or soybean for control prior to planting. Apply in sorghum at the 3-5 leaf stage. Cost: 2,4-D + dicamba \$4.75; dicamba \$3.75; Distinct \$9.75; Hornet WDG \$15.00.
	Dicamba [•]	8.0 oz		
	Diflexx Duo	24-40 oz		
	Distinct	4.0 oz	Use drop nozzles if corn is above 24"	
	Hornet WDG	3.0 oz		
ARTICHOKE, JERUSALEM	2,4-D amine (4L) + Dicamba [•]	8.0 oz 8.0 oz	12-18" tall	For use in corn. Use drop tips on corn taller than 8 inches. Cost: \$4.75.
	2,4-D ester (4L)	32.0 oz	18-24" tall	For use where no crop is present. Cost: \$5.75.
	Classic	0.75 oz	2-8" tall	For use in soybean. Cost: \$13.50.
	Curtail	2.0 pt	12-18" tall	Cost: \$14.75.
BEDSTRAW (annual) (in corn)	Aim or with Atrazine	0.5 oz 0.75-1.0 lb	POST on corn less than 12"	Apply at 10.0 gal/A or more. Cost: Aim \$3.75; Aim + atrazine \$6.25-\$7.00.
	Dicamba [•]	0.50-1.0 pt	POST on corn less than 9"	Use lower rate on coarse textured soils. Cost: \$3.75-\$7.50.
BLUE MUSTARD	2,4-D ester (4L) 2,4-D amine (4L)	8.0 oz 16.0 oz	Nov. 15-Mar. 15 before blue mustard stem elongation	Use only on fully tillered wheat. Cost: \$1.50-\$2.00.
	Amber or Cimarron Extra, or Cimarron Plus or Finesse or Peak + 2,4-D ester (4L)	0.28 oz 0.28 oz 0.2 oz 0.38-0.5 oz 4.0 oz	Mar. 1-15 before blue mustard stem elongation; in spring, broadleaf weeds 2-4"	Add surfactant. Use only on wheat with four or more tillers. Use only on continuous wheat or wheat-fallow. Do not use on soils with pH of 7.9 or higher. Cost: Amber + 2,4-D \$4.00; Cimarron + 2,4-D \$4.75; Finesse + 2,4-D \$4.25; Peak + 2,4-D \$6.75-\$8.75.
	Cimarron Max	0.25 oz part A + 1.0 pt part B		

[•]Dicamba rates are based on a 4.0 ae/gal formulation, like those found in Clarity. See page 203 or the *Herbicide Dictionary* for other products containing dicamba.

Troublesome Weeds and Woody Plants *(continued)*

Weed	Herbicide	Product Per Acre	Application Time	Remarks and Approximate Cost per Acre Broadcast
BUCKBRUSH (snowberry)	2,4-D ester (4L)	64.0-96.0 oz	Full foliage (May 10-25)	Use sufficient water to ensure good coverage. May have to retreat. Cost: \$11.25-\$17.00.
	Chaparral	1.25 oz	Full foliage in spring	Cost: \$7.50.
	Cimarron Plus	0.5 oz	6-12" of new foliage	Cost: \$7.00.
	Cimarron Plus + Rangestar	0.25 oz 1.0 pt	6-12" of new foliage	Cost: \$7.50.
	Grazon P+D [◆]	4.0 pt	Full foliage (May 10-25)	Cost: \$18.00.
✕BUCKTHORN (European)	Garlon 3A	3.0-5.0 pt	In fall 2-4 weeks before first frost	Cost: \$33.75-\$56.25.
BUFFALOBUR	2,4-D ester (4L) + Dicamba [●]	8.0 oz 8.0 oz	POST on corn	Plants must be small. Cost: \$5.00.
	Atrazine 4L [■]	2.0 qt	Preplant or PRE on corn	Reduced rates less effective. Cost: \$7.00.
	Buctril	1.5 pt	In corn or sorghum weeds 3-5 leaf stage	Plants taller than 4 inches not controlled. Cost: \$15.00.
	Callisto	3.0 oz	Weeds 3-4 leaf in corn	Add 0.25 ai atrazine plus COC. Cost: \$18.00.
	Cobra	12.5 oz	POST on soybean	Weeds need to have 4 true leaves. Cost: \$21.00.
	Grazon P+D [◆]	2.0-4.0 pt	Actively growing in spring pre-bloom	Cost: \$9.00-\$18.00.
	Ultra Blazer	1.5 pt	Weeds 3-4 leaf stage in soybean	Weeds must be small. Follow-up treatments necessary. Cost: \$14.00.
✕BULL THISTLE	Cimarron Plus or Cimarron Xtra	1.25 oz 1.0 oz	Spring application	Cost: Cimarron Plus \$17.50; Cimarron Xtra \$17.00.
	Clarity	1.0-2.0 qt	Spring application	Cost: \$29.50-\$59.00.
	Escort	0.2-0.4 oz	Spring application	Cost: \$2.50-\$4.75.
	Garlon 3A	3.0 pt	Spring application	Cost \$33.75.
	Grazon P+D	2.0-3.0 pt	Rosette stage	Cost: \$9.00-\$13.50.
	Milestone	3.0-5.0 oz	Rosette through bolting or in fall	Cost: \$8.25-\$13.75.
	Overdrive	4.0 oz	Rosette stage	Cost: \$13.00.
	Telar XP	1.0 oz	Spring application	Cost: \$23.00.
	Tordon 22K	8.0-12.0 oz	Fall	Cost: \$4.50-\$7.00.
BURCUCUMBER and WILD CUCUMBER	Transline	0.5-1.0 pt	Spring application	Cost \$12.50-\$25.00.
	Atrazine 4L [■]	2.0 qt	PRE in corn Weeds 3-5 leaf stage in corn or sorghum	Atrazine can also be used POST. Cost: atrazine \$7.00.
	Buctril 2 EC	1.5 pt		Thorough coverage required. Cost: Buctril 2EC \$15.00.
	Classic	0.3-0.75 oz	Apply POST in soybean when crop is up to 4" Weeds 1-8" tall	Cost: \$5.50-\$13.50.
	Princep 4L	3.0 qt	PRE in trees	Cost: Princep \$19.50.

✕Nebraska Department of Agriculture "Watch List" weed.

●Dicamba rates are based on a 4.0 ae/gal formulation, like those found in Clarity. See page 203 or the *Herbicide Dictionary* for other products containing dicamba.

■The total amount of atrazine applied cannot exceed 2.5 lb ai/A per calendar year. Use no more than 1.6 lb ai/A on highly erodible land with less than 30% crop residue. Using atrazine on soils with less than 1% organic matter increases carryover injury risk to susceptible crops, especially high pH soils. Do not use on sandy soils if water table is shallower than 30 ft.

◆See manufacturer's label for application time.

Troublesome Weeds and Woody Plants *(continued)*

Weed	Herbicide	Product Per Acre	Application Time	Remarks and Approximate Cost per Acre Broadcast	
BURSAGE (skeletonleaf and woollyleaf)	2,4-D ester (4L) + Dicamba [•]	32.0 oz 32.0 oz	June or when growing actively	See remarks for field bindweed. If soil moisture conditions are poor, use oil-water emulsions as a carrier. Cost: 2,4-D ester + dicamba \$20.75.	
	Grazon P+D	3.0-4.0 pt	When growing actively to flower bud stage	Noncrop areas. Grazon P+D and Tordon may remain in soil for three or more years. Cost: Grazon P+D \$13.50-\$18.00; Tordon 22K \$18.50.	
	Tordon 22K	2.0 pt			
CACTUS — See <i>Pricklypear</i> for <i>Plains Pricklypear</i> , and <i>Brittle</i> or <i>Fragile Cactus</i>					
CANADA THISTLE — See <i>Noxious Weed Section</i>					
CATTAILS	2,4-D ester (4L)	1.5 gal + 5% diesel oil + 0.5% emulsifier	Boot to early flowering	Use the equivalent of 150 gal of water per acre. Retreat regrowth as necessary. Cost: 2,4-D \$22.50/gal.	
	Aquatic Glyphosate ¹	3.0 qt	At flowering	Use aquatic glyphosate product in or near water. Cost: \$40.50.	
	Habitat	1.0-3.0 pts	Boot to flowering	Cost: \$15.75-\$47.00.	
	Lineage Clearstand	25.0 oz	Boot to flowering	Cost: \$93.75.	
CEDAR — See <i>Red Cedar</i>					
CHEAT GRASS — See <i>Downy Brome</i>					
COTTONWOOD, WILLOWS, SIBERIAN ELM, CHINESE ELM	2,4-D ester (4L)	64.0-96.0 oz	Full foliage (June-July); basal treatment anytime	2,4-D with aerial equipment at least 5 gal carrier. Annual treatment for 2 to 3 years may be necessary. Basal or stump treatment: 2.0 qt of herbicide/10.0 gal of diesel; apply to point of runoff. Cost: 2,4-D \$11.25-\$17.00; Escort \$24.00; Grazon P+D \$36.00/gal; Remedy \$70.00/gal.	
	Escort	2.0 oz			
	Grazon P+D	4.0 pt			
	Cimmaron Max	Part A = 1 oz Part B = 4 pt	June or actively growing		
	Picloram	3 pt	June		
	Grazon P+D or Remedy ²	3.0 qt 2.0 qt	For trees greater than 10 feet tall, rate per 100 gal water		
	Grazon P+D or Remedy ²	1.5 pt 1.0 pt	For trees less than 10 feet tall, rate per 100 gal water		
	Krenite S	2.0-3.0 gal in 100.0 gal water + surfactant	Late July, Aug., and Sept.		Has little effect on grasses. Results show the following spring. Cost: \$98.00/gal.
	Spike 20P	0.25 oz/1" dia	Spring or fall		Apply under drip line. Cost: \$0.25/inch diameter.
	Velpar L	4.0 ml/1" dia	Spring with spot gun to tree base		Cost: \$0.08/inch diameter.
CUPGRASS, PRAIRIE (in corn)	Balance Flexx ³ + Harness Xtra 5.6 [■]	3.0-6.0 oz 1.8-2.7 qt	0-8 DBP	POST treatments may be needed. Cost: Balance Flexx + Harness Xtra \$42.50-\$72.25.	
✕DALMATION TOADFLAX	Cimarron Plus	0.5-1.0 oz	Before flowering in spring or fall	Cost: Cimarron Plus \$7.00-\$14.00; Plateau \$12.00-\$17.75; Telar \$46.00-\$69.00; Tordon 22K \$18.50-\$37.00.	
	Plateau	8.0-12.0 oz			
	Telar	2.0-3.0 oz	Fall		
	Tordon 22K	2.0-4.0 pts			
DANDELION — See <i>No-till Burndown Tables for Corn and Soybean</i>					

✕Nebraska Department of Agriculture "Watch List" weed.

¹Before using a glyphosate formulation, confirm that it is approved for aquatic use. Glyphosate formulations labeled for aquatic use in Nebraska include: Rodeo and Accord Concentrate (Dow AgroSciences), AquaMaster (Monsanto), Aquaneat (NuFarm), Cinco (Loveland), and Glyfos Aquatic (Cheminova).

²See manufacturer's label for application time.

³Do not use Balance Flexx on coarse textured soils of less than 2% organic matter if the water table is less than 25 feet. Do not use on fields prone to runoff or flooding. Crop response to Balance is most likely to occur where soils are coarse, organic matter content is less than 1.5%, and the pH is greater than 7.4. Corn seed must be covered with 1.5 to 2.0 inches of soil. Avoid planting when the surface soil is wet.

[■]The total amount of atrazine applied cannot exceed 2.5 lb ai/A per calendar year. Use no more than 1.6 lb ai/A on highly erodible land with less than 30% crop residue. Using atrazine on soils with less than 1% organic matter increases carryover injury risk to susceptible crops, especially high pH soils. Do not use on sandy soils if water table is shallower than 30 ft.

[•]Dicamba rates are based on a 4.0 ae/gal formulation, like those found in Clarity. See page 203 or the *Herbicide Dictionary* for other products containing dicamba.

Troublesome Weeds and Woody Plants *(continued)*

Weed	Herbicide	Product Per Acre	Application Time	Remarks and Approximate Cost per Acre Broadcast	
DEVILSCLAW (in corn and sorghum) (also controls cocklebur and common sunflower)	Aim EC + Atrazine DF [■]	0.5 oz 0.25-0.5 lb	2-4'' 2-4''	Use COC with atrazine and Laddok. Cost: Aim + atrazine \$5.00-\$5.75; atrazine \$4.50; only Basagran \$15.00-\$30.00; Laddok \$15.00-\$22.50; Bucril + atrazine \$12.00-\$19.00.	
	Atrazine DF [■]	1.4 lb	2-4''		
	Basagran + 28% N	1-2 pt 1.0 gal	Devilsclaw less than 4''		
	Bucril 2EC + Atrazine DF [■]	1.0-1.5 pt 0.6-1.2 lb			
	2,4-D ester (4L)	8.0-16.0 oz	Devilsclaw less than 6''	Cost: 2,4-D \$1.50-\$2.75.	
	Callisto	3.0 oz	POST in corn less than 5''	Use 1% COC + AMS. Cost: \$18.00.	
	Hornet (Corn only)	2.4 oz	Devilsclaw less than or equal to 6''	Apply to corn up to V6 stage. Include 1.0 gal COC + 2.5 gal of UAN/100.0 gal of water. Cost: \$12.00.	
	Corn Dicamba [●] + atrazine [■]	9.0-16.0 oz 0.57-1.0 lb	Emergence to 5-leaf 2-5 leaf stage	Cost: \$5.50-\$10.75.	
	Sorghum Dicamba [●] + atrazine [■]	6.5-9.0 oz 0.4-0.57 lb			
	Peak (Sorghum only)	0.75-1.0 oz	Devilsclaw 1-6''	Cost: \$12.00-\$16.00.	
	Permit	0.66-1.33 oz	Devilsclaw 1-6''	Cost: \$14.50-\$29.25.	
	Treatments (in soybean)	Resource (Corn only)	4.0-8.0 oz	Devilsclaw 4-12''	Use 1.0 qt/ A COC. Cost: \$8.75-\$17.50.
Classic + Harmony SG		0.25 oz 0.125 oz	POST	Add 28% UAN 1.0 gal/ A + 0.125% v/v NIS. Cost: \$6.50.	
Command 3ME		1.5-2.0 pt	PPI/PRE to soybean planting	Command drift may damage green vegetation. Command residue may damage wheat planted the same fall. Cost: \$32.00-\$42.00.	
Pursuit DG		1.44 oz	Devilsclaw less than 3''	Use with 1.0-2.0 qt of 28% UAN + NIS at 2.0 pt/ 100.0 gal. Cost: \$5.25.	
Resource		12.0 oz	Devilsclaw 30''	Use 1.0 qt/ A COC. Cost: Resource \$26.25.	
(Requires RR soybean)		Glyphosate [◆]	32.0 oz	Devilsclaw 4-12''	Cost: \$3.50.
DOCK (curled and pale)	2,4-D ester (4L) + Dicamba [●]	32.0 oz 8.0 oz	Before flowering in spring or fall	For use on idle ground or grassland. For corn in VE stage use 1.3 pt of 2,4-D + 0.5 pt of dicamba. Cost: \$8.00.	
	Grazon P+D [◆]	2.0-3.0 pt	Before flowering in spring or fall	Cost: \$8.50-\$12.75.	
	Glyphosate [◆]	16.0 oz	Preplant	Apply 1 week before planting soybean or corn. Plant Roundup Ready soybean or Roundup Ready corn and use labeled glyphosate POST. Cost: glyphosate \$1.75; glyphosate + 2,4-D \$5.00; Overdrive \$19.50; Telar \$23.00-\$69.00.	
	Glyphosate [◆] + 2,4-D ester (4L)	32.0 oz 8.0 oz			
	Overdrive	6.0 oz			
	Telar	1.0-3.0 oz			

■The total amount of atrazine applied cannot exceed 2.5 lb ai/ A per calendar year. Use no more than 1.6 lb ai/ A on highly erodible land with less than 30% crop residue. Using atrazine on soils with less than 1% organic matter increases carryover injury risk to susceptible crops, especially high pH soils. Do not use on sandy soils if water table is shallower than 30 ft.

◆Glyphosate rates are based on a 4.0 ai/ gal or 3.0 lb ae/ gal formulation. See pages 193-199 for information on common glyphosate formulations.

◆See manufacturer's label for application time.

●Dicamba rates are based on a 4.0 ae/ gal formulation, like those found in Clarity. See page 203 or the *Herbicide Dictionary* for other products containing dicamba.

Troublesome Weeds and Woody Plants *(continued)*

Weed	Herbicide	Product Per Acre	Application Time	Remarks and Approximate Cost per Acre Broadcast
DODDER (in alfalfa)	Pursuit	1.0-2.0 oz	Apply after dodder has emerged but prior to or soon after attachment	Cost: Pursuit \$3.50-\$7.25; Raptor \$18.25-\$27.25.
	Raptor	4.0-6.0 oz		
	Glyphosate♦ in Roundup Ready alfalfa	32.0-64.0 oz		Cost: \$3.50-6.75.
DOGWOOD (<i>Cornus</i> spp.)	Cimarron Plus	1.0 oz	Spring or fall Full foliage during June	Ground application only. Observe all drift precautions when using within 1/2 mile of sensitive crops. Cost: Cimarron Plus \$14.00; dicamba \$15.00-\$30.00; Crossbow \$70.00-\$105.00.
	Crossbow	1.0-1.5 gal		
	Dicamba●	1.0-2.0 qt		
	Grazon P+D	3.0 pt	Spring or fall	Cost: \$13.50.
	Grazon P+D	1% v/v High volume foliar	Spring or fall	See page 57 for <i>Individual Plant Treatment Techniques</i> . Cost: \$36.00/gal.
	Escort	2 oz	Spring or fall	Cost: \$20.00
	Spike 20P	0.25 oz/1" dia	Spring or fall	Apply under drip line. Cost: \$9.75.
DOWNY BROME	Glyphosate♦	12.0-16.0 oz	Fall or early spring when desirable grasses are dormant Early spring	Use glyphosate before planting corn, sorghum, soybean and in fallow. Cost: glyphosate \$1.25-\$1.75; Oust \$7.25-\$14.50.
	Oust (noncropland)	1.0-2.0 oz		
	Plateau /Cadre/ Imazapic 2E (noncropland, range, pasture CRP)	4.0-12.0 oz	Full PRE or early POST	Add MSO 1.0 qt/A. Cost: \$6.00-\$17.75.
	Alternate system			Crop rotation — include a late spring-seeded crop in the rotation. See NebGuide G422, <i>Downy Brome Control</i> .
ELM — See <i>Cottonwood</i>				
FIELD BINDWEED Retreatment is necessary. (When treating crops, adjust rates.) Glyphosate used only in Roundup Ready crops.	2,4-D ester (4L)	32.0 oz	Vigorous fall growth or flower bud stage in spring	Avoid tillage 5 weeks before and 1 week after application. Do not plant small grains for 15 days after 2,4-D and 45 days after dicamba. Plan to treat for several consecutive years. Cost: 2,4-D \$5.75; 2,4-D + dicamba \$9.50-\$13.25.
	2,4-D ester (4L) + Dicamba●	8.0-16.0 oz		
	Dicamba●	16.0-32.0 oz	Late summer or late fall actively growing	Apply glyphosate in 10 gal or less water/A. Avoid tillage for 5 days. Do not plant small grains for 15 days with 2,4-D and 45 days per pint of dicamba. Broadleaf crops may be injured 2 years after high rates of dicamba in western Nebraska. Cost: dicamba \$7.50-\$15.00; Landmaster BW \$8.00; glyphosate + 2,4-D \$4.50; glyphosate + dicamba \$7.25.
	Glyphosate♦ + 2,4-D amine (4L) or Dicamba●	32.0 oz 8.0 oz 8.0 oz		
	Landmaster BW	54.0 oz		
	Extreme	48.0 oz	2-6" runners	Control of larger plants reduced by 30%. Cost: \$19.25.
	Glyphosate♦ + Classic	32.0 oz 0.3 oz	2-6" runners	Control of larger plants reduced by 30%. Cost: \$9.00.
	Glyphosate♦ + Phoenix	32.0 oz 5.0 oz	2-6" runners	Control of larger plants reduced by 20%. Cost: \$12.00.
	Glyphosate♦ + Raptor	32.0 oz 3.0 oz	2-6" runners	Control of larger plants reduced by 20%. Cost: \$17.00.
	Paramount	5.3 oz	Fall	Preplant to wheat. Cost: \$20.50.
	Tordon 22K + 2,4-D ester (4L)	0.5-1.0 pt 16.0-32.0 oz	Fall after wheat harvest	Use in a wheat-fallow rotation. Retreat with 2,4-D or Landmaster BW in spring. Cost: \$7.50-\$15.00.
FOXTAIL (Pasture or CRP)	Prowl Plateau	2-3 pt 6-12 oz	2-3 pt 6-12 oz	

♦Glyphosate rates are based on a 4.0 ai/gal or 3.0 lb ae/gal formulation. See pages 193-199 for information on common glyphosate formulations.

●Dicamba rates are based on a 4.0 ae/gal formulation, like those found in Clarity. See page 203 or the *Herbicide Dictionary* for other products containing dicamba.

Troublesome Weeds and Woody Plants *(continued)*

Weed	Herbicide	Product Per Acre	Application Time	Remarks and Approximate Cost per Acre Broadcast
✕GARLIC MUSTARD	2,4-D + Dicamba [•]	16.0 oz 8.0 oz	Vegetation is dormant; young small plants	Do not use 2,4-D ester or dicamba when air temperature exceeds 85°F. Cost: \$5.75.
	Escort	1.0 oz	Spring application of 2-3" tall plants	Cost: \$12.00.
	Glyphosate [♦]	32.0 oz or 2% spot spray	Full or early spray when desirable	Use glyphosate broadcast in spring and fall when other vegetation is dormant. Spot spray during growing season. Cost: \$3.50-\$4.50.
GUMWEED (curlycup)	2,4-D ester (4L)	48.0 oz	Pre-bud	Cost: 2,4-D \$8.50; Grazon P+D \$9.00.
	Grazon P+D	1.0 qt		
	Lineage Clearstand	6.0-13.0 oz	Pre-bud	Cost: \$48.75.
HEMP (marijuana)	2,4-D ester (4L)	32.0 oz	2-12" tall	Cost: 2,4-D ester (4L) \$5.25; Grazon P+D \$8.50.
	Grazon P+D	2.0 pt		
HEMP DOGBANE	2,4-D ester (4L)	16.0-32.0 oz	Flower bud stage, spring	Use lower rates in crops. Cost: \$2.75-\$5.25.
	2,4-D ester (4L)	32.0 oz	Apply after corn is in the dough stage, but before the dogbane leaves start to turn yellow	Dogbane roots should have pink swollen buds. Cost: 2,4-D \$5.75.
	Glyphosate [♦]	128.0 oz	Late summer or fall	Idle ground or spot treatment in cropland before head or pod fill of crop. Avoid tillage for at least 7 days after treatment. Cost: \$13.50.
	Surmount	2.0 pt	Summer	Rangeland, pasture and CRP. Cost: \$16.00.
HOARY CRESS	2,4-D ester (4L)	64.0 oz	Rosette stage in the fall or early bud in spring	Suppression only. Growth starts in early spring. Treat twice a year for 2 to 3 years. Cost: \$11.25.
	Chaparral	3.3 oz	Early spring before bud stage	Cost: \$19.75.
	Cimarron Plus or Cimarron Xtra or Escort	1.0 oz 2.0 oz 1.0 oz	Rosette stage in spring	Cost: Cimarron Plus \$14.00; Cimarron Xtra \$34.00; Escort \$12.00.
	Perspective	4.75-8.0 oz	Rosette stage in spring	Cost: \$27.00-\$45.50.
	Plateau/Cadre (pasture, range, noncropland, CRP)	6.0-12.0 oz	Late spring/summer at flowering	Cost: \$9.00-\$17.75.
	Streamline	4.75-9.5 oz	Rosette stage in spring	Cost: \$28.75-\$60.50.
	Curtail	2.0-3.0 pt	Apply in early summer (up to 6" tall weed)	Cost: Grazon P+D \$9.00-\$13.50; Curtail \$14.75-\$22.25; Tordon 22K \$9.25; Salvo \$3.75-\$4.75; Weedmaster \$7.50.
HOARY VERVAIN	Grazon P+D	2.0-3.0 pt		
	Salvo	12.0-15.0 oz		
	Tordon 22K	1.0 pt		
	Weedmaster	32.0 oz		
✕HOUNDSTONGUE	Cimarron Plus	1.0 oz	Apply in spring (rosette stage)	Cost: Cimarron Plus \$14.00; Escort \$12.00-\$24.00; Plateau \$12.00-17.75; Telar DF \$23.00; Tordon \$15.00.
	Escort	1.0-2.0 oz		
	Plateau	8.0-12.0 oz		
	Telar XP	1.0 oz		
	Tordon	1.5 pt		

✕Nebraska Department of Agriculture "Watch List" weed.

♦Glyphosate rates are based on a 4.0 ai/gal or 3.0 lb ae/gal formulation. See pages 193-199 for information on common glyphosate formulations.

•Dicamba rates are based on a 4.0 ae/gal formulation, like those found in Clarity. See page 203 or the *Herbicide Dictionary* for other products containing dicamba.

Troublesome Weeds and Woody Plants *(continued)*

Weed	Herbicide	Product Per Acre	Application Time	Remarks and Approximate Cost per Acre Broadcast
HORSETAIL	Garlon 3A	5.0 pt	Spring treatment in pasture	Cost \$56.25.
IRONWEED	2,4-D ester (4L)	48.0 oz	Flower to bud stage	Cost: \$8.50.
	Grazon P+D [◆]	2.0-3.0 pt	Prior to bud stage	Rangeland. Cost: \$9.00-\$13.50.
✕JOHNSONGRASS — (See <i>Shattercane</i> in <i>Crops Table</i> for seedling Johnsongrass control.)				
KNAPWEED — See <i>Noxious Weed Section</i>				
KOCHIA — (See <i>Crop Tables</i>)				
KUDZU	Chaparral	3.3 oz	Apply at or after flowering	Cost: \$19.75.
	Cimarron Plus	1.0-2.0 oz	Apply to spring foliage or in fall	Cost: Cimarron Plus \$14.00-\$28.00; Escort \$12.00-\$24.00; Garlon 3A \$33.75-\$56.25; Lineage Clearstand \$71.25; Milestone \$19.25.
	Escort	1.0-2.0 oz		
	Garlon 3A	3.0-5.0 pt		
	Lineage Clearstand	19.0 oz		
	Milestone	7.0 fl oz		
LARKSPUR PRAIRIE	Grazon P+D	3.0-5.0 pt	Apply in spring	Cost: Grazon P+D \$13.50-\$22.50; Cimarron Plus \$6.50-\$13.00.
LEAFY SPURGE — See <i>Noxious Weed Section</i>				
✕LESPEDeza SERICEA	Cimarron Plus	0.625 oz	Spray at flower bud to full bloom	Cost: \$8.75.
	Escort	1.0-2.0 oz		Cost: \$12.00-\$24.00.
	PastureGard	1.5-2.0 pt		Cost: \$11.25-\$15.00.
	Remedy	1.0-1.5 pt	Before bloom	Cost: Remedy \$17.50-\$26.25; Surmount \$16.00-\$20.00.
	Surmount	2.0-2.5 pt		
LOCUST (honey and black)	Chaparral	3.3 oz	Full foliage	Cost: \$19.75.
	Curtail	2.0-3.0 pt	Full foliage during June; cut stump or basal treatment anytime	Ground application only. Observe all drift precautions. See <i>Cottonwood</i> for basal and cut stump treatment. Cost: Curtail \$13.00-\$19.00; dicamba \$30.00; Escort \$12.00-\$24.00; Grazon P+D \$17.00-\$34.00; Remedy \$27.00-\$54.00.
	Dicamba [●]	64.0 oz		
	Escort	1.0-2.0 oz		
	Grazon P+D	2.0-4.0 qt		
	Remedy [*]	2.0-4.0 pt		
	Spike 20P	0.25 oz/1" dia	Spring or fall	Apply under drip line. Cost: \$0.25/in diameter.
	Surmount	2.0-3.0 pt	Full foliage during June	Cost: Surmount \$16.00-\$24.00; Transline \$12.50-\$25.00.
	Transline	0.5-1.0 pt		
In no-till corn:	Hornet	3.0-5.0 oz		Cost: \$14.25-\$23.75.
MARESTAIL (horseweed) (for control in crops see individual <i>Crop Tables</i>)	2,4-D ester (4L) or Redeem R&P	32.0 oz or 1.0-2.0 pt	Prior to bolt	Cost: 2,4-D \$5.75; Redeem R&P \$16.00-\$32.00.
	Cimarron Plus	0.125 oz	2-6" weeds	Use in pastures. Cost: \$1.75.
	Grazon P+D	2.0-3.0 pt	Prior to bolt	Cost: \$9.00-\$13.50.
	Overdrive	4.0-8.0 oz	2-6" tall in pasture	Cost: \$13.00-\$16.25.
	Telar	1.0 oz	2-6" in pasture	Cost: \$23.00.
MILKWEED, COMMON	2,4-D ester (4L) + Dicamba [●]	32.0 oz + 8.0 oz	Flower bud to bloom stage	Do not plant small grains for 15 days after 2,4-D + dicamba treatment. 2,4-D + dicamba suppresses growth for 1 year. Cost: \$9.50.
	Glyphosate [◆]	96.0 oz	Flowering through maturity; ropewick application in soybean	Idle ground or spot treatment on cropland before head or pod fill of crop. Avoid tillage for 7 days. Cost: \$10.25.
	Lineage Clearstand	25.0 oz	At flowering time	Cost: \$93.75.
	Overdrive	4.0-8.0 oz	2-6" tall in pasture	Cost: \$13.00-\$26.00.

[◆]See manufacturer's label for application time.

✕Nebraska Department of Agriculture "Watch List" weed.

[◆]Glyphosate rates are based on a 4.0 ai/gal or 3.0 lb ae/gal formulation. See pages 193-199 for information on common glyphosate formulations.

[●]Dicamba rates are based on a 4.0 ae/gal formulation, like those found in Clarity. See page 203 or the *Herbicide Dictionary* for other products containing dicamba.

Troublesome Weeds and Woody Plants *(continued)*

Weed	Herbicide	Product Per Acre	Application Time	Remarks and Approximate Cost per Acre Broadcast
MILKWEED, HONEYVINE (climbing)	2,4-D amine (4L)	1.0-2.0 pt	Before vines reach 3 ft in length	For use in corn or sorghum. Use lower rates in sorghum. Gives suppression only. Cost: \$1.00-\$2.75.
	2,4-D ester (4L)	0.5-1.0 pt		
MULLEIN, COMMON	Cimarron Plus or Escort	0.5 oz 0.5 oz	Rosette stage in fall or spring	Add crop oil (COC) 2 qt/A. Cost: Cimarron Plus \$7.00; Escort \$6.00.
	Grazon P+D	4.0 pt	Late fall on rosettes or spring before flowering stalks lengthen	Essential to apply in rosette stage. Add surfactant 2.0 pt/100.0 gal solution. Cost: \$18.00.
	Overdrive	6.0 oz	Fall or spring prior to bolting	Cost: \$19.50.
✕MULTIFLORA ROSE	Chaparral	3.3 oz	Full foliage to bloom	Cost: \$19.75.
	Cimarron Max	0.5 oz Part A + 2.0 pt Part B	Full foliage bud to bloom	Cost: \$12.50.
	Cimarron Plus	0.375 oz or 1.0 oz/100.0 gal water	Full foliage bud to bloom	Add 0.25% (v/v) nonionic surfactant (NIS). Cost: \$14.00/oz.
	Cimarron Xtra	2.0 oz	Full foliage	Cost: \$34.00.
	Dicamba [•]	32.0-64.0 oz or 32.0 oz/25.0 gal water	Full foliage	Cost: \$15.00-\$30.00.
	Spike 20P	0.25 oz/bush or 0.25 oz/22.0 sq ft	Anytime soil is not frozen	Cost: \$16.00/lb.
	Streamline	4.75-9.5 oz	Full foliage bud to bloom stage in spring	Cost: \$28.75-\$60.50.
	Tordon 22K + 2,4-D (4L)	1.0 qt 64.0 oz	When plants are actively growing	Cost: \$39.00.
	Tordon RTU	Apply undiluted to cut stumps		Cost: \$13.00/qt.
MUSK THISTLE — See <i>Noxious Weed Section</i>				
NUTSEDGE — See <i>Yellow Nutsedge</i>				
OAK	Crossbow	1.5 gal	Full foliage June to July; cut stump or basal treatment anytime	Noncropland only for Spike and Crossbow. Be careful of desirable tree roots. Cost: dicamba \$30.00; Crossbow \$76.50; Remedy +2,4-D ester \$23.25-\$28.75; glyphosate \$13.50/gal; Spike 20P \$0.25/inch diameter; Pasturegard \$22.50-\$30.00.
	Dicamba [•]	64.0 oz		
	Remedy + 2,4-D ester (4L)	1.0 qt 32.0-64.0 oz		
	Glyphosate [♦]	50% to 100% solution	June cut stump	
	Spike 20P	0.25 oz/1" dia	Spring or fall to soil around tree base	
	Pasturegard	3.0-4.0 pt	In summer when leaves are fully emerged	
	Spike 20P	5.0-20.0 lbs	Anytime except when soil is frozen	Cost: \$80.00-\$320.00.
	Spike 80 DF	3.75-5.0 lb	Anytime except when soil is frozen	Cost: \$93.75-\$125.00.
	Surmount	3.0-4.0 pt	In summer when leaves are fully emerged	Cost: \$24.00-\$32.00.
	Velpar L	4.0 ml/1" dia	Spot gun in spring to tree base	Cost: \$0.08/inch diameter.

♦See manufacturer's label for application time.

✕Nebraska Department of Agriculture "Watch List" weed.

♦Glyphosate rates are based on a 4.0 ai/gal or 3.0 lb ae/gal formulation. See pages 193-199 for information on common glyphosate formulations.

•Dicamba rates are based on a 4.0 ae/gal formulation, like those found in Clarity. See page 203 or the *Herbicide Dictionary* for other products containing dicamba.

Troublesome Weeds and Woody Plants *(continued)*

Weed	Herbicide	Product Per Acre	Application Time	Remarks and Approximate Cost per Acre Broadcast
OSAGE ORANGE	Crossbow	1.0-1.5 gal	Full foliage June to July; basal treatment anytime	Noncrop areas only. See remarks for cottonwood. Cost: Crossbow \$51.00-\$76.50; Remedy + 2,4-D ester \$23.25-\$40.75.
	Remedy + 2,4-D ester (4L)	1.0-2.0 pt 32.0 oz		
	Spike 20P	0.5 oz/1" dia	Spring or fall to soil around tree base	Cost: Spike 20P \$0.50/inch diameter.
	Velpar L	4.0 ml/1" dia	Spot gun in spring to tree base	Cost: Velpar L \$0.08/inch diameter.
PHRAGMITES (Common reed): See <i>Noxious Weed Section</i>				
PLUMELESS THISTLE — See <i>Noxious Weed Section</i>				
POISON HEMLOCK	2,4-D ester (4L) + Dicamba [•]	32.0 oz 8.0 oz	Rosettes — fall or early spring	Do not allow livestock access to dry matter. Cost: \$8.00.
	Grazon P+D [◆]	2.0-4.0 pt		Cost: \$8.50-\$17.00.
	Perspective	4.75-8.0 oz	Flowering stage in spring	Cost: \$27.00-\$45.50.
	Streamline	4.75-9.5 oz	Flowering stage in spring	Cost: \$28.75-\$60.50.
POISON IVY	Crossbow	1.0-1.5 gal	Full foliage in spring	Thoroughly wet all vegetation. Do not apply to cropland. Cost: Crossbow \$51.00-\$76.50 gal; glyphosate \$10.25-\$17.00; Remedy + 2,4-D \$23.25-\$40.75.
	Glyphosate [◆]	96.0-160.0 oz		
	Remedy + 2,4-D ester	1.0-2.0 pt 32.0 oz		
	Streamline	4.75-9.5 oz	Full foliage stage in spring in noncrop areas	Cost: \$28.75-\$60.50.
PRICKLY PEAR	Tordon 22K	1% v/v	As spot treatments to new growth	Cost: \$74.00/gal.
	Tordon 22K	1.0-2.0 pt	New growth to flowering	May take 1-2 years before death. Spot treat in pasture and grazing land. Include NIS in spray mixture. Cost: Tordon 22K \$9.25-\$18.50; Remedy + Tordon 22K \$18.00-\$26.75; Grazon P+D \$18.00.
	Remedy + Tordon 22K	0.5-1.0 pt 1.0 pt		
	Grazon P+D [◆]	4.0 qt		
PUNCTURE VINE	2,4-D ester (4L)	16.0 oz	Pre-bloom stage most effective	Mature burs not affected by 2,4-D. Retreatment necessary on new plants. Cost: \$2.75.
	Callisto + atrazine (corn)	3.0 oz 1/4 lb	POST in corn	Cost: \$18.75.
	Dicamba [•]	16.0 oz	EPOST on corn or sorghum	Cost: \$7.50.
	Hornet WDG (corn)	3.0 oz	POST before V6 corn	Add 1% v/v COC or 0.25% v/v NIS. Cost: \$15.00.
	Journey	32.0 oz	POST in noncropland	Cost: \$33.00.
	Overdrive (Pasture and Range)	4.0-8.0 oz	4-8" in pasture	Cost: \$13.00-\$26.00.
	Peak	0.75-1.0 oz	POST on sorghum or proso millet	Cost: \$12.00-\$16.00.
	Plateau* (range, pasture CRP)	8.0-12.0 oz	Early POST	Add MSO 1.0 qt/A for use in warm-season grasses. Cost: \$12.00-\$17.75.
PURPLE LOOSESTRIFE (lythrum) — See <i>Noxious Weed Section</i>				

✕Nebraska Department of Agriculture "Watch List" weed.

◆Glyphosate rates are based on a 4.0 ai/gal or 3.0 lb ae/gal formulation. See pages 109-195 for information on common glyphosate formulations.

•Dicamba rates are based on a 4.0 ae/gal formulation, like those found in Clarity. See page 203 or the *Herbicide Dictionary* for other products containing dicamba.

◆See manufacturer's label for application time.

Troublesome Weeds and Woody Plants *(continued)*

Weed	Herbicide	Product Per Acre	Application Time	Remarks and Approximate Cost per Acre Broadcast
PURSLANE, COMMON (in fallow to be planted to winter wheat)	2,4-D ester (4L)	32.0 oz	When growing actively	Till 5-7 days after treatment. Do not plant small grains for 15 days. Cost: 2,4-D \$5.75.
	Amber or Finesse + 2,4-D ester (4L)	0.2-0.3 oz 0.4 oz 4.0 oz	Early POST	Add surfactant when used POST. Surfactant 1.0-2.0 qt/100.0 gal solution. Do not use on soils with pH of 7.9 or higher. Allow 12 days before planting wheat. Cost: Amber + 2,4-D \$3.25-\$4.75; Finesse + 2,4-D \$8.00.
	Rave	4.0 oz	Less than 6"	Cost: \$8.50.
RAGWEED, WESTERN (perennial)	2,4-D ester (4L)	32.0 oz	Early summer	Follow-up treatments may be necessary. Cost: \$5.75.
	Curtail	2.0-3.0 pts	Early summer	Cost: \$14.75-\$22.25.
	Grazon P+D	2.0-3.0 pt	Early summer	Lower rate when weeds are small. Cost: \$9.00-\$13.50.
	Overdrive	4.0-6.0 oz	Early summer	Cost: \$13.00-\$19.50.
	Salvo	12.0-15.0 oz	Early summer	Cost: \$3.75-\$4.75.
	Surmount	1.5-2.0 pt	Early summer	Cost: \$12.00-\$16.00.
	Transline	0.5-1.0 pt	Early summer	Cost: \$12.50-\$25.00.
	Weedmaster	32.0 oz	Early summer	Cost: \$7.50.
RED CEDAR, EASTERN	Spike 20P	0.5 oz/1" dia	Spring or fall	Spike for use in noncrop areas only. Tordon and Velpar LP can be used on grazing land. Cost: Spike 20P \$0.30/inch; Tordon \$0.14/inch; Velpar \$0.08/inch.
	Tordon 22K	4.0 ml/3 ft of tree height	Spring or fall	
	Velpar L	4.0 ml/1" dia	Spot gun in spring to tree base	Cost: Grazon P+D \$27.00-\$36.00; Tordon 22K \$14.00-\$18.50; Surmount \$40.00.
	Grazon P+D	6.0-8.0 pt	Apply broadcast up to 2 ft tall trees	
	Tordon 22K	1.5-2.0 pt		
	Surmount	5.0 pt/A		
	Grazon P+D	2% v/v	Individual tree treatments (up to 10 ft tall trees)	
	Tordon 22K	1% v/v		
	Surmount	1.5% v/v		
	Alternative treatment — prescribed burn.			See <i>Grassland Management with Prescribed Fire</i> , EC148, which is available online at http://www.ianrpubs.unl.edu/sendIt/ec148.pdf
	REED CANARYGRASS	Habitat	1.0-2.0 pt	Apply in spring, 2-3 ft of growth
Rodeo ²		64.0-96.0 oz		
Habitat + Rodeo ²		1.0 pt 32.0 oz		
Lineage Clearstand		19.0 oz	2-3 ft growth	Cost: \$71.25.
RUSSIAN KNAPOWEED	Curtail	3.0-4.0 qt	Apply at bud stage early flower	Idle ground or grassland. Avoid tillage for 7 days. Injury to forage grasses may occur. Broadleaf crops may be injured for 2 years after treatment. Cost: Curtail \$22.25-\$29.50; dicamba \$15.00-\$30.00; Grazon P+D \$11.25-\$18.00; Milestone \$13.75-\$19.25; Redeem R&P \$40.00-\$64.00; Tordon 22K \$9.25-\$18.50.
	Dicamba [•]	32.0-64.0 oz		
	Grazon P+D [◆]	2.5-4.0 pt		
	Lineage Clearstand	8.0-13.0 oz		
	Milestone	5.0-7.0 oz		
	Redeem R&P	2.5-4.0 pt		
	Tordon 22K	1.0-2.0 qt	Apply late in fall after killing frost	Pasture, range or noncropland. Add MSO 1 qt/A. Cost: \$17.75.
	Plateau ¹	12.0 oz		
	Transline	1.0-1.3 pt		

[•]Dicamba rates are based on a 4.0 ae/gal formulation, like those found in Clarity. See page 203 or the *Herbicide Dictionary* for other products containing dicamba.

¹The active ingredient in Plateau is imazapic. See *Herbicide Dictionary* for other formulations of imazapic.

²Before using a glyphosate formulation, confirm that it is approved for aquatic use. Glyphosate formulations labeled for aquatic use in Nebraska include: Rodeo and Accord Concentrate (Dow AgroSciences), AquaMaster (Monsanto), Aquaneat (NuFarm), Cinco (Loveland), and Glyfos Aquatic (Cheminova).

Troublesome Weeds and Woody Plants *(continued)*

Weed	Herbicide	Product Per Acre	Application Time	Remarks and Approximate Cost per Acre Broadcast
RUSSIAN OLIVE	2,4-D ester (4L) + Dicamba●	64.0 oz 32.0 oz	Full foliage (early June)	See remarks for cottonwood. Cost: \$26.25.
	Remedy	1.0 qt/3.0 qt diesel or crop oil as basal treatment		Cost: \$17.50/qt.
	Spike 20P	0.5 oz/1" dia	Spring or fall	Use on noncropland only. Cost: \$0.50/in diameter.
	Arsenal or Habitat	1.0-2.0 qt (broadcast)		Noncrop sites only. Add NIS at 0.25% v/v (broadcast or 1.0% v/v (spot spraying). Cost \$7.75-\$15.75.
	Pathfinder II	Apply undiluted as low volume basal treatment		
RUSSIAN THISTLE — See <i>Kochia</i> for controls				
SAGEBRUSH (sand, fringed and green sagewort)	2,4-D ester (4L)	48.0-64.0 oz	4"-8" new growth (June)	1.5 qt/A 2,4-D adequate on sand sagebrush. Cost: 2,4-D \$8.50-\$11.25; Grazon P+D \$13.50-\$18.00.
	Grazon P+D	3.0-4.0 pt		
	Garlon 3A	50% (spot spray)	Apply directly to fresh cut stump (See page 57)	50% spot spray is 1.0 qt Garlon 3A plus 1.0 qt water. Cost: \$90.00/gal.
SALT CEDAR — See <i>Noxious Weed Section</i>				
SANDBUR (pasture, range and noncropland)	Plateau	4.0-10.0 oz	Spring PRE to early POST Sandbur less than 4"	Add 1.0 qt MSO/A. For use in warm-season grasses. Cost: \$6.00-\$14.75.
✕SCOTCH THISTLE	2,4-D (4L) + Dicamba●	32.0 oz 16.0 oz	Spring or fall rosette	Cost: \$13.25.
	Chaparral	1.5-2.5 oz	Spring rosette stage	Cost: \$9.00-\$15.00.
	Cimarron Plus	0.25 oz	Spot treatment to rosette	Cost: \$3.50.
	Milestone	4.0-6.0 oz	Spring and fall rosette	Cost: \$11.00-\$16.50.
	Perspective	4.75-8.0 oz	Rosette stage in spring	Cost: \$27.00-\$45.50.
	Overdrive	4.0-6.0 oz	Spring or fall	Cost: \$13.00-\$19.50.
	Streamline	4.75-9.5 oz	Rosette stage in spring	Cost: \$28.75-\$60.50.
	Tordon 22K	1.0-2.0 pt	Fall rosette	Cost: \$9.25-\$18.50.
SCOURINGRUSH	Arsenal	2.0 pt	Late summer or early fall	Suppresses scouringrush. Apply in a minimum of 20.0 gal/A. Use 1.0% v/v MSO. Cost: \$36.25.
	Casoron	105.0 lb	Late summer or early fall	Requires tillage to incorporate. For best results, tillage should destroy all scouringrush shoots. Cost: \$325.50.
	Escort	1.0-2.0 oz	Late summer or early fall	Suppresses scouringrush. Apply in a minimum of 20.0 gal/A. Use 0.5% v/v NIS and 2% v/v AMS. Cost: \$12.00-\$24.00.
	Garlon 3A	5.0 pt	Late summer or early fall	Suppresses scouringrush. Apply in a minimum of 20.0 gal/A. Use 0.5% v/v NIS. Cost: \$56.25.
	MCPA amine	96.0 oz	Late summer or early fall	Suppresses scouringrush. Apply in a minimum of 20.0 gal/A. Use 0.5% v/v NIS and 2% v/v AMS. Cost: \$17.25.
	Oust XP	4.0 oz	Late summer or early fall	Suppresses scouringrush. Apply in a minimum of 20.0 gal/A. Use 1.0% v/v COC. Cost: \$28.75.
	Telar XP	1.0-3.0 oz	Late summer or early fall	Will control scouringrush. May require second treatment in following year at 1.5 oz/A. Apply in a minimum of 20.0 gal/A. Use 0.5% v/v NIS and 2% v/v AMS. Cost: \$23.00-\$69.00.
✕SERICEA, LESPEDEZA — See <i>Lespedeza Sericea</i>				
SOAPWEED — See <i>Yucca</i>				

✕Nebraska Department of Agriculture "Watch List" weed.

♦See manufacturer's label for application time.

•Dicamba rates are based on a 4.0 ae/gal formulation, like those found in Clarity. See page 203 or the *Herbicide Dictionary* for other products containing dicamba.

¹The active ingredient in Plateau is imazapic. See *Herbicide Dictionary* for other formulations of imazapic.

²Before using a glyphosate formulation, confirm that it is approved for aquatic use. Glyphosate formulations labeled for aquatic use in Nebraska include: Rodeo and Accord Concentrate (Dow AgroSciences), AquaMaster (Monsanto), Aquaneat (NuFarm), Cinco (Loveland), and Glyfos Aquatic (Cheminova).

Troublesome Weeds and Woody Plants *(continued)*

Weed	Herbicide	Product Per Acre	Application Time	Remarks and Approximate Cost per Acre Broadcast
SOW THISTLE (perennial)	2,4-D ester (4L)	48.0 oz	Fall rosette or spring bud stage	See remarks for field bindweed. Cost: \$8.50.
	Overdrive	4.0-6.0 oz	Spring bud stage	Cost: \$13.00-\$19.50.
SUMAC	2,4-D ester (4L)	32.0-64.0 oz	Full foliage	Use sufficient water for good coverage. Cost: \$5.75-\$11.25.
	Cimarron Plus + Weedmaster	0.5 oz 4.0 pt	Full foliage in June	Cost: Cimarron Plus + Weedmaster \$22.00.
	Grazon P+D [◆]	2.0-4.0 pt		Cost: \$9.00-\$18.00.
SWAMP SMARTWEED (tanweed, shoestring)	2,4-D ester (4L) + Dicamba [●]	32.0 oz 16.0 oz	When growing vigorously	On crops use lower rates and amine formulations. Cost: \$13.25.
	Glyphosate [◆]	3.0-4.0 qt in 10.0 gal or less water/A	Full foliage mid to late summer	Idle ground or spot treatment in cropland before head or pod fill of crop. Avoid tillage for 7 days. Cost: \$7.75-\$11.00.
	Tordon 22K [◆]	1.0-2.0 pt		Cost: \$9.25-\$18.50.
SWEET CLOVER	2,4-D ester	32.0 oz	12-20" tall	In pasture. Cost: \$5.75.
	Chaparral	2.5-3.0 oz	4-6"	Cost: \$15.00-\$18.00.
	Cimarron Plus	0.375-0.625 oz	4" in pasture	Cost: \$5.00-\$8.25.
	Glyphosate [◆] + Classic	32.0 oz 0.3 oz	4-6"	In Roundup Ready soybean (POST). Control of taller plants reduced by 60%. Cost: \$9.00.
	Glyphosate [◆] + Flexstar	32.0 oz 8.0 oz	4-6"	In Roundup Ready soybean (POST). Control of taller plants reduced by 50%. Cost: \$10.50.
TEASEL (Common)	2,4-D	32.0 oz	Apply at rosette stage in fall or spring	Cost: 2,4-D \$5.75; Garlon 3A \$33.75-\$45.00; Overdrive \$13.00-\$26.00.
	Garlon 3A	3.0-4.0 pt		
	Overdrive	4.0-8.0 oz		
TOOTHED SPURGE	Plateau	4.0-6.0 oz	Apply in spring (4-6" tall plants)	Cost: \$6.00-\$9.00.
VENICE MALLOW (in Roundup Ready soybean POST)	Extreme	48.0 oz	4-6"	Cost: \$11.00.
	Glyphosate [◆] + Classic	32.0 oz 0.3 oz	4-6"	Cost: \$9.00.
	Glyphosate [◆] + Phoenix	32.0 oz 8.0 oz	4-6"	Cost: \$17.00.
VERVAIN (HOARY) — See <i>Hoary Vervain</i>				
WESTERN RAGWEED — See <i>Ragweed, Western</i>				
WILD BUCKWHEAT (in Roundup Ready soybean POST)	Extreme	48.0 oz	1-4"	Cost: \$11.00.
	Glyphosate [◆] + Flexstar	32.0 oz 8.0 oz	1-4"	Cost: \$10.50.
	Glyphosate [◆] + Phoenix	32.0 oz 5.0 oz	1-4"	Cost: \$12.00.
	Glyphosate [◆] + Scepter	32.0 oz 1.44 oz	1-4"	Cost: \$11.50.
	Glyphosate [◆] + Ultra Blazer	32.0 oz 12.0 oz	1-4"	Cost: \$11.75.
	Distinct	4.0-6.0 oz	1-4"	Cost: \$9.75-\$14.75.
	Hornet	3.0 oz	1-4"	Cost: \$15.00.
	Affinity BroadSpec	0.8 oz	1-3 leaves	Add NIS. Cost: \$10.50.
	Curtail	2.0 pt	1-4"	Cost: \$14.75.
	Stinger	4.0-6.0 oz	1-4"	Cost: \$18.00-\$26.75.
(in corn)				
(in wheat)				
(in sugarbeet)				

✕Nebraska Department of Agriculture "Watch List" weed.

¹Before using a glyphosate formulation, confirm that it is approved for aquatic use. Glyphosate formulations labeled for aquatic use in Nebraska include: Rodeo and Accord Concentrate (Dow AgroSciences), AquaMaster (Monsanto), Aquaneat (NuFarm), Cinco (Loveland), and Glyfos Aquatic (Cheminova).

[◆]Glyphosate rates are based on a 4.0 ai/gal or 3.0 lb ae/gal formulation. See pages 193-195 for information on common glyphosate formulations.

[●]Dicamba rates are based on a 4.0 ae/gal formulation, like those found in Clarity. See page 203 or the *Herbicide Dictionary* for other products containing dicamba.

[◆]See manufacturer's label for application time.

Troublesome Weeds and Woody Plants *(continued)*

Weed	Herbicide	Product Per Acre	Application Time	Remarks and Approximate Cost per Acre Broadcast
WILD CUCUMBER — See <i>Burcucumber</i>				
WILD LICORICE	Tordon 22K	2.0 pt	Bloom stage	Cost: \$18.50.
WILD OAT — In Nebraska, most likely weedy annual brome. See <i>Downy Brome</i>				
YARROW	2,4-D LV ester (4L) + Dicamba [♦]	32.0 oz 8.0 oz	Spring pre-bloom	Cost: 2,4-D + dicamba \$8.00.
	Grazon P+D	2.0 pt	Fall or spring pre-bloom	Cost: Grazon P+D \$9.00.
	Overdrive	4.0-6.0 oz	Spring pre-bloom	Cost: \$13.00-\$19.50.
	Streamline	1.75-4.5 oz	Pre-flowering stage in spring	Cost: \$11.25-\$28.75.
YELLOW NUTSEDGE (in corn) (in soybean)	Beacon	0.76 oz	1-4"	For best results apply before June 21. Cost: Beacon \$29.00; Permit \$29.25.
	Permit	1.33 oz		
	Authority Assist	9.0 oz		Cost: \$28.25.
	Authority MTZ	20.0 oz		Cost: \$30.00.
	Authority First or XL	6.4 oz		Cost: \$36.00.
✕YELLOW STAR THISTLE	Curtail	1.5-2.5 pt	Apply in rosette stage	Cost: Curtail \$11.00-\$18.50; dicamba \$15.00-\$30.00; Overdrive \$13.00; Tordon \$4.75-\$14.00; Transline \$12.50-\$25.00.
	Dicamba [♦]	1.0-2.0 qt		
	Overdrive	4.0 oz		
	Transline	0.5-1.0 pt		
	Tordon 22K	0.5-1.5 pt		
✕YELLOW TOADFLAX	Telar	1.0-2.0 oz	Fall application at rosette stage	Cost: \$23.00-\$46.00.
	Tordon 22K	2.0 pt	Early bloom	Cost: Tordon \$18.50; Clarity \$6.00.
	Clarity (in corn)	8.0 oz		
YUCCA (soapweed)	Cimarron Plus	0.65-1.25 oz		Cost: \$9.00-\$17.50.
	Tordon 22K	1.0 ml/plant		Apply with spot gun in whorl or base of plant. Cost: Tordon \$0.02/plant; Velpar \$0.08/plant.
	Velpar L	4.0 ml/plant		
	Remedy	13.0 oz/5.0 gal of diesel or fuel oil		Spot application. Thoroughly wet the center of the plant to the soil surface. Cost: Remedy \$70.00/gal.

✕Nebraska Department of Agriculture "Watch List" weed.

♦Glyphosate rates are based on a 4.0 ai/gal or 3.0 lb ae/gal formulation. See pages 193-195 for information on common glyphosate formulations.

•Dicamba rates are based on a 4.0 ae/gal formulation, like those found in Clarity. See page 203 or the *Herbicide Dictionary* for other products containing dicamba.

Time until Herbicides are Rainfast

Herbicide	Hours Until Rainfast
2,4-D	1
Accent Q	4
Affinity Broadspec	4
Agility	6
Aim	1
Ally XP	4
Amber	4
Anthem/Anthem ATZ	4
Armezon/Armezon Pro/Impact	1
Arrow	1
Arsenal	1
Assure II	1
Assert	3
Atrazine	4
Avalanche Ultra	4
Banvel	4
Basagran/Broadloom	4
Basis Blend	4
Beacon	4
Betamix	6
Beyond	1
Bicep II	4
Blazer	6
Bronate	1
Buctril	1
Butyrac 200	6
Cadet	4
Callisto	1
Callisto GT	1
Callisto Xtra	4
Capreno	1
Cimarron Plus; Xtra	4
Clarity	4
Cleanwave	1
Crossbow	6
Curtail	8
Curtail M	6
Classic	1
Cobra	0.5
Diflexx	4
Distinct	4
Enlite	1
Envive	1
Exceed	4
Expert	1
Express	4
Extreme	1
Finesse	4
FirstRate	2
Flexstar	1
Flexstar GT	1
Fusilade DX	1
Fusion	1
Fallow Master	6
Galaxy	4
Gramoxone SL	0.5
Grazon P+D	4
Glean	4
Glyphosate	1-4 ^a
Habitat	1
Halex GT	1
Harrow	4
Harmony Extra	4
Harmony GT	1

Herbicide	Herbicide
Hornet WDG	2
Huskie	1
Landmaster BW	6
Laudis	1
Liberty	4
Lightning	1
Lineage Clearstand	1
Marvel	1
MCPA	1
Milestone	2
Northstar	4
Olympus Flex	4
Optill/Optill PRO	1
Orion	4
Overdrive	4
Paramount	6
Peak	4
Permit	4
Perspective	4
Phoenix	2
Pinnacle	1
Poast	1
PowerFlex	4
Rave	4
Pulsar	4
Pursuit	1
Raptor	1
Realm Q	4
Reflex	1
Resolve Q	4
Resource	1
Revulin Q	4
Roundup PowerMAX	0.5
Roundup WeatherMAX	0.5
Rowel/Rowel FX	4
Sandea	4
Scepter	2
Select Max	1
Sencor/Dimetric	6
Sharpen	1
Solstice	4
Spirit	4
Starane	1
Starane NXT	1
Status	4
Steadfast Q	4
Stinger	6
Stout	4
Streamline	4
Synchrony XP	1
Targa	1
Touchdown HiTech	1
Touchdown Total	1
Tordon	2
UpBeet	6
Verdict	1
WideMatch	6
Yukon	4

^aCheck product label.

Preemergence Herbicides Applied After Crop Emergence

When weather does not permit the normal application of pre-emergence herbicides, there are options. Several preemergence herbicides are labeled for broadcast application after emergence without injury to the crop. The following table lists those herbicides along with crop stage and weed height restrictions. **If the herbicide you are using is not listed, consult the label to see if it can be applied broadcast after emergence. All the herbicides below are labeled for use after emergence.**

If there is concern that weed size may exceed the range of most preemergence herbicides by the time they are applied, note that many of these products contain atrazine and have

burndown properties. Expect to control 4-inch broadleaf weeds at 1.5 lb and 2- to 3-inch broadleaf weeds at 0.75 – 1.0 lb of atrazine. The postemergence activity of atrazine can be increased by including an oil additive or applying with a UAN as the carrier, but do not use oil and UAN if the crop has emerged or crop injury will result. If you have planted Roundup Ready corn, you can add glyphosate to the mixture as well. Keep in mind glyphosate activity may suffer when mixed with other herbicides or UAN so the 1 qt rate should be used. If you add 2,4-D to the mixture, it is best if the entire field is in at least the spike stage to avoid injury to the corn.

Corn

Herbicide	Crop Stage	Maximum Weed Stage
Aatrex/Atrazine	0-12"	1.5"
Acuron	0-12"	3"
Anthem MAXX/Anthem ATZ	V4	2"
Balance Flexx ¹	V2	1.5"
Bicep II Magnum/ Cinch ATZ	0-12"	2-leaf
Bicep II Lite Magnum/Cinch ATZ Lite	0-12"	2-leaf
Bicep II Magnum FC	0-12"	2-leaf
Breakfree	0-11"	unemerged
Breakfree ATZ	0-11"	unemerged
Breakfree ATZ Lite	0-11"	unemerged
Callisto ²	0-30"	5"
Corvus	V2	1.5"
Degree	0-11"	unemerged
Degree Xtra	0-11"	2-leaf
Dual Magnum	0-5"	unemerged
Dual II Magnum/ Cinch	0-40"	unemerged
Dual + Aatrex	0-12"	2-leaf
Expert ³	0-12"	6"
FulTime NXT	0-11"	unemerged
G-MAX Lite	0-12"	1.5"
Guardzman Max	0-12"	1.5"
Harness/Confidence	0-11"	unemerged
Harness Xtra/Confidence Xtra	0-11"	2-leaf
Hornet WDG	0-20"	8"
Instigate	V2	3"
Keystone	0-11"	unemerged
Keystone LA NXT	0-11"	unemerged
Lightning (IMI corn)	corn < 8-leaf	weeds < 3"
Lumax EZ/Lexar EZ ³	0-12"	3"
Me-Too-Lachlor II	0-40"	2-leaf
Outlook	0-30"	unemerged
Prowl H ₂ O	0-30"	1"
Python	0-20"	6"
Resolve	0-12"	3"

Corn (continued)

Herbicide	Crop Stage	Maximum Weed Stage
Surpass NXT	0-11"	unemerged
Stalwart C	0-40"	2-leaf
Stalwart Xtra	0-5"	2-leaf
SureStart/TripleFLEX	0-11"	2" broadleaves
Topnotch	0-11"	unemerged
Trizmet II	0-5"	2-leaf
Volley/Volley ATZ/ Valley ATZ Lite	0-11"	unemerged
Warrant	0-30"	unemerged
Zemax	30" or V8	5"
Zidua	V4	unemerged

Sorghum

Herbicide	Crop Stage	Maximum Weed Stage
Aatrex/Atrazine	0-12"	1.5"
Bicep II Magnum	0-5"	2-leaf
Degree Xtra	0-11"	unemerged
Dual Magnum	0-5"	unemerged
Dual II Magnum	0-5"	unemerged
G-MAX Lite	0-12"	1.5"
Guardzman Max	0-12"	1.5"
Outlook	0-12"	unemerged
Warrant	0-11"	unemerged

Soybeans

Herbicide	Crop Stage	Maximum Weed Stage
Anthem MAXX	V3	2"
Dual II Magnum	3rd trifoliolate	unemerged
FirstRate	up to 1/2 flower	see label
Outlook	1st to 5th trifoliolate	2"
Prefix/Statement	cracking to 3rd trifoliolate	see label
Pursuit	up to 1/2 flower	3"
Warrant	prior to R2	unemerged
Warrant Ultra	R2	see label
Zidua	V1-V3	unemerged

¹If Balance Flexx is applied after the corn has emerged, do not add crop oil concentrate.

²Severe injury may occur if Callisto is applied postemergence to corn that has been treated with Counter. Do not tank mix with any organophosphate or carbamate insecticide. Do not cultivate within seven days of application

³Do not mix this product with complex fertilizer mixtures such as 10-34-0 or flowables. Use only water or liquid nitrogen carrier.

Crop Growth Stage Limits or Preharvest Intervals For Herbicide Application

POST Herbicides in Field Corn

Herbicide	Crop Height Limit or Preharvest Interval
2,4-D	8" broadcast, pre-tassel directed
Accent Q	20" broadcast, 36" directed
Acuron	12"
Aim	8"
Armezon	V8
Armezon Pro	V8 or 30"
Atrazine	12"
Banvel/Sterling	1 pt 8", 0.5 pt 36", coarse textured soils 0.5 pt
Basagran/Broadloom	None
Basis Blend	2 collar
Beacon/Exceed	20" broadcast to 36" directed
Buctril/Moxy	Pre-tassel
Buctril-Atrazine	12"
Cadet	48" or 70 days PHI
Callisto/Callisto GT	30" or 8-leaf
Callisto Xtra	12"
Capreno	V1-V6 broadcast, V6-V8 directed
Clarity	8", coarse-textured soils 0.5 pt
Diflexx Duo	V7 or 36"
Equip	70 days PHI
Glyphosate	Consult label, broadcast to 24", directed to 30" (RR) or 48" (RR2), harvest aid (7 days)
Halex GT	30" (or V8)
Hornet	20", 85 days PHI
Impact	45 days PHI

Herbicide	Crop Height Limit or Preharvest Interval
Laudis	V7
Liberty	24", V7, or 70 days PHI
Lightning	20" or V6
Lumax EZ/Lexar EZ	12"
North Star	4-20" broadcast, 20-36" directed
Permit	Lay-by
Pursuit (Clearfield Corn)	45 days
Realm Q	20" or 7 leaf collars
Resolve	12"
Resolve Q	20" or V7
Resource	V10
Revulin Q	V8 or 30"
Roundup PowerMAX	Consult label, broadcast to 24", directed to 30" (RR) or 48" (RR2), harvest aid (7 days)
Roundup WeatherMAX	Consult label, broadcast to 24", directed to 30" (RR) or 48" (RR2), harvest aid (7 days)
Sencor/Dimetric + Basagran	60 days PHI
Solstice	48" or 70 days PHI
Spirit	20" broadcast, 24" directed
Starane Ultra	V5, 90 days PHI
Status	36"
Steadfast Q	20" or V6
Stinger	24"
Stout	16" or V5
Touchdown	Consult label, broadcast to 24", directed to 30" (RR) or 48" (RR2), harvest aid (7 days)
Touchdown Total	Consult label, broadcast to 24", directed to 30" (RR) or 48" (RR2), harvest aid (7 days)
Yukon	36"

Crop Growth Stage Limits or Preharvest Intervals For Herbicide Application *(continued)*

POST Herbicides in Sorghum

Herbicide	Crop Height Limit or Preharvest Interval
2,4-D	8" broadcast, boot directed
Aim	6 leaf
Atrazine	12"
Banvel/Clarity	8", 15" with drops
Basagran	Boot
Buctril	Pre-boot
Buctril-Atrazine	12"
Huskie	V3 to 12"
Paramount	12"
Paramount + ATZ	12"
Peak	5-30"
Permit	Pre-boot
Starane	V7, 70 days
Yukon	15"

POST Herbicides in Soybean

Herbicide	Crop Height Limit or Preharvest Interval
Arrow	60 days, PHI
Assure II	Not after pod set, 80 days PHI
Basagran	30 days for forage or hay
Cadet	Full flower or 60 days PHI
Classic	60 days PHI
Cobra	45 days PHI
FirstRate	Bloom to 50% flowering, 65 days PHI
Enlist Duo	Up to full bloom (R2)
Extreme	Prior to flowering
Flexstar GT	Bloom
Fusilade	Bloom
Fusion	Bloom

Herbicide	Crop Height Limit or Preharvest Interval
Glyphosate	Consult specific label, generally through R2
Harmony SG	60 days PHI
Liberty	Bloom
Marvel	Up to R3 or 60 days PHI
Phoenix	45 days PHI
Pursuit	Prior to flowering
Raptor	Prior to flowering
Reflex/Flexstar	Bloom
Resource	60 days PHI
Roundup PowerMAX	Consult label, in crop, generally full bloom (R2); harvest aid, 7 days PHI.
Roundup WeatherMAX	Consult label, in crop, generally full bloom (R2); harvest aid, 7 days PHI.
Rowel/Rowel FX	Within 3 days after planting, prior to soybean emergence
Scepter	90 days PHI
Select MAX	60 days PHI
Sequence	90 days PHI
Synchrony XP	60 days PHI
Targa	Podset, 80 days PHI
Touchdown	Consult label, in crop, generally full bloom (R2); harvest aid, 7 days PHI.
Touchdown Total	Consult label, in crop, generally full bloom (R2); harvest aid, 14 days PHI.
Ultra Blazer	50 days PHI
Warrant	R2

Replant Options and Rotation Restrictions¹

Cereal and Broadleaf Crops

Herbicide	Common Name	Field Corn	Seed Corn	Popcorn	Sweet Corn	Winter Wheat	Spring Wheat	Oat	Winter Barley
2,4-D ester	2,4-D	7/14 D ^{dj}	NCS	NCS	NCS	3	NCS	NCS	NCS
2,4-D amine	2,4-D	7/14 D ^{dj}	NCS	NCS	NCS	3	NCS	NCS	3
2,4-DB	2,4-DB	Not specified on the label. NCS (Next Cropping Season) for all crops							
Aatrex	atrazine	AT	AT	AT	AT	NCS ^{bi}	2CS	2CS	NCS ^{bi}
Accent Q	nicosulfuron + isoxadifen	AT	AT	10	10	4	8	8	4
Achieve	tralkoxydim	106 D	106 D	106 D	106 D	1	1	1	1
Acuron	S-metolachlor + atrazine + mesotrione + bicylopyrone	AT ^{ds}	AT ^{ds}	AT ^{ds}	AT ^{ds}	4	4	4	4
Affinity Broadspec	thifensulfuron + tribenuron	1.5	1.5	1.5	1.5	AT	AT	1.5	AT
Afforia	flumioxazin + thifensulfuron methyl + tribenuron-methyl	14/30D ^{cy}	NI	4-12 ^{cz}	3/4 ^{da}	30D/2 ^{db}	30D/2	4-10 ^{dc}	3/4 ^{da}
Agility SG ^{bi}	sodium salt of dicamba + metsulfuron methyl + tribenuron methyl + thifensulfuron methyl	4/12	22-34	22-34	22-34	1	1	10	10
Aim	carfentrazone-ethyl	AT	AT	AT	AT	AT	AT	AT	AT
Ally XP	metsulfuron	12 ^w	34 ^x	34 ^x	34 ^x	1	1	10	10
Ally Extra ^{ae}	thifensulfuron + tribenuron + metsulfuron	12 ^y	22/FBA	22/FBA	22/FBA	1	1	10	10
Amber	triasulfuron	4/14 ^z	4/FBA	4/FBA	4/FBA	AT	AT	6 ^y	6 ^y
Anthem MAXX	pyroxasulfone + fluthiacet-methyl	AT	AT	AT	AT	4	4	11	11
Anthem ATZ	pyroxasulfone + fluthiacet + atrazine	AT	AT	AT	AT	2CS	2CS	2CS	2CS
Armezon	topramezone	AT	AT	AT	AT	3	3	3	3
Armezon Pro	topronezone + dimethenamid-P	0	0	0	4	4	4	4	4
Assert	imazamethabenz	NCS	15	15	15	NCS	NCS	15	NCS
Assure II/Targa	quizalofop-P	4	4	4	4	4	4	4	4
Authority Assist	sulfentrazone + imazethapyr	4/10 ^{ad}	10/FBA	18	18	4	4	18	9.5
Authority First	sulfentrazone + cloransulam methyl	10/18 ^{ce}	10/18 ^{ce}	10/18 ^{ce}	18	4	4	12	12
Authority Maxx ^{dl}	Sulfentrazone + chlorimuron-ethyl	10/18	10/18	10/18	18	4	4	12/18	4
Authority MTZ	sulfentrazone + metribuzin	4/10 ^{cf}	4/10 ^{cf}	4/10 ^{cf}	18	4	4	18	4
Authority XL ^{cm}	sulfentrazone + chlorimuron	10	10	18	18	4	4	12	4
Autumn Super	idosulfuron-methyl + thiencazone-methyl	1	1	9	9	3	3	18	4
Axial XL	pinoxaden	90 D	90 D	90 D	90 D	AT	AT	90 D	AT
Balan	benefin	10	10	10	10	10	10	10	10
Balance Flexx	isoxaflutole + cyprosulfamide	AT	18 ^f	6	6	4	4	18 ^f	6
Banvel	Dimethylamine salt of dicamba	NCS ^g	NCS ^g	NCS ^g	NCS ^g	NCS ^g	NCS ^g	NCS ^g	NCS ^g
Basagran/Broadloom	bentazon	AT	AT	AT	AT	AT	AT	AT	AT
Basin Blend/Harrow	rimsulfuron + thifensulfuron	AT	18/10	10	10	4/3	8/9 ^{ab}	8/9 ^{ab}	4/3
Beacon	primisulfuron	14 D ^h	8	8	8	3	8	8	3
Beyond	imazamox	8.5	8.5	8.5	8.5	0/3 ^{bv}	0/3 ^{bv}	9	4/9/18 ^{bx}
Bicep II Magnum	S-metolachlor + atrazine + benoxacor	AT	AT	AT	AT	2CS	2CS	2CS	2CS
Bicep Lite II Magnum	S-metolachlor + atrazine + benoxacor	AT	AT	AT	AT	2CS	2CS	2CS	2CS
Boundary/Tailwind	S-metolachlor + metribuzin	8	8	8	8	4.5	8	12	4.5
Breakfree	acetochlor	AT	AT	AT	DNR	4	4	DNR	DNR
Breakfree ATZ	acetochlor + atrazine	AT	AT	AT	DNR	15	15	DNR	DNR
Breakfree ATZ Lite	acetochlor + atrazine	AT	AT	AT	DNR	15	15	DNR	DNR
Bronate Advanced	bromoxynil (octanoic & heptanoic acid) + MCPA	1	1	1	1	1	1	1	1
Buctril	bromoxynil	AT	AT	AT	AT	1	1	1	1
Buctril + atrazine	bromoxynil + atrazine	AT	AT	AT	AT	2CS	2CS	2CS	2CS
Bullet	alachlor + atrazine	NCS	NCS	NCS	NCS	2CS	2CS	2CS	2CS
Cadet	fluthiacet-methyl	AT	NCS	NCS	NCS	NCS	NCS	NCS	NCS
Callisto	mesotrione	AT	AT	AT	AT	120 D	120 D	120 D	120 D

¹Months unless otherwise noted. D = Days, AT = Any time, NCS = Next Cropping Season; 2CS = Second Cropping Season, 3CS = Third Cropping Season, NTE = No Tolerance Established, NI = No information, FBA = Field Bioassay, DNR = Do not rotate.

See pages 184-187 for additional footnotes.

Replant Options and Rotation Restrictions¹ — Cereal and Broadleaf Crops

Spring Barley	Rye	Grain Sorghum	Pearl & Proso Millet	Soybean	Canola	Buckwheat	Sunflower	Sugarbeet	Dry Bean	Pea & Snap Bean	Potato	Alfalfa	Red Clover
NCS	3	7/14 D ^{ci}	NCS	7/30 D ^{ci}	NCS	NCS	NCS	NCS	NCS	NCS	NCS	NCS	NCS
NCS	3	7/14 D ^{ci}	NCS	15/30 D ^{ci}	NCS	NCS	NCS	NCS	NCS	NCS	NCS	NCS	NCS
2CS	NCS ^{bi}	AT	2CS	NCS ^d	2CS	2CS	2CS	2CS	2CS	2CS	2CS	2CS	2CS
8	4	10/18 ^b	10/18 ^b	0.5	10/18 ^b	10/18 ^b	11/18 ^b	10/18 ^b	10	10	10/18 ^b	12	12
1	1	106 D	106 D	106 D	106 D	106 D	106 D	106 D	106 D	106 D	106 D	106 D	106 D
4	4	10 ^{du}	18	10 ^{dt,du}	18	4	18	18	10 ^{du,dv}	18	10 ^{du}	18	18
AT	1.5	1.5	1.5	1.5	2	1.5	1.5	2	1.5	1.5	1.5	1.5	1.5
3/4 ^{da}	3/4 ^{da}	30D ^{dd}	4-12 ^{cz}	AT/7D ^{cx}	4-12 ^{cz}	4-12 ^{cz}	45d/2 ^{de}	4-10 ^{dc}	3/4 ^{da}	3/4 ^{da}	4-12 ^{cz}	4-10 ^{dc}	4-10 ^{dc}
10	22-34	4	4	4-34	22-34	22-34	10-22	22-34	10-22	10-22	22-34	10-22	22-34
AT	AT	AT	AT	AT	12	AT	AT	AT	AT	AT	AT	AT	AT
10	34 ^x	10	10	22/34	34 ^x	34 ^x	22	34 ^x	34 ^x	34 ^x	34 ^x	34 ^x	34 ^x
10	10	4 ^y	4 ^y	4/22 ^{au}	34	34	10 ^y /22	34	10/22 ^{ak,al}	10/22 ^{ak,al}	34	10/22 ^{ak,al}	34
6 ^y	6 ^y	14 ^y	4	11/36 ^{aa}	4/FBA	4/FBA	24/FBA	24/FBA	4/FBA	4/FBA	4/FBA	4/FBA	4/FBA
11	11	6	18	AT	12	18	4	12	11	6	4	10	18
2CS	2CS	NCS	2CS	2CS	2CS	2CS	2CS	2CS	2CS	2CS	2CS	2CS	2CS
3	3	9	18	9	9	18	9	18	9	18 ^{cb}	9	9	18
4	4	9	18	9	9/18 ^{cv}	18	9	18	9/18 ^{cw}	9/18 ^{cw}	9	9	18
NCS	15	15	15	NCS ^d	15	15	NCS	20	NCS	15	15	15	15
4	4	4	4	AT	AT	4	4	AT	AT	AT	4	4	4
9.5	4	18	40	AT	40/FBA	40	18	40/FBA	10	10	26	12	40
12	12	12	NI	AT	24	NI	30/FBA	30/FBA	12	12	18	12	NI
4	4	10/18 ^{dm}	36	AT ^{dn}	36	36	18	36	12/18	36	36	12/18	18
4	18	12/18 ^{cg}	18	AT	24	18	12	36	12	NI	12	12	18
4	4	10	36	AT	18	36	18	36	12	36	36	12	18
9	18	18	18	2	18	18	18	18	18	18	18	18	18
AT	90 D	90 D	90 D	90 D	90 D	90 D	90 D	90 D	90 D	90 D	30 D	90 D	90 D
10	10	10	10	AT	AT	AT	AT	10	AT	AT	10	AT	AT
6	18 ^f	6	18 ^f	6	18 ^f	18 ^f	6	18 ^f	18 ^f	18 ^f	6	10	18 ^f
NCS ^g	NCS ^g	NCS ^g	NCS ^g	NCS ^g	NCS ^g	1	NCS ^g	NCS ^g	NCS ^g	NCS ^g	NCS ^g	NCS ^g	NCS ^g
AT	AT	AT	AT	AT	AT	AT	AT	AT	AT	AT	AT	AT	AT
8/9 ^{ab}	4	10	18	15 D/10 ^{ab}	18	18	10	10	8/10 ^{ab}	8/10 ^{ab}	AT/1	10	18/10
8	3	8	8	8	18*	18*	8	18*	8	8	8 ⁱ	8	18*
4/9/18 ^{bx}	3	9	9	AT	0/26 ^{bv}	18	0/9 ^{bv}	26/18 ^{bw}	18	18	18/9 ^{bw}	3	18
2CS	2CS	AT ^j	2CS	NCS ^{e,k}	2CS	2CS	2CS	2CS	2CS	2CS	2CS	2CS	2CS
2CS	2CS	AT ^j	2CS	NCS ^{e,k}	2CS	2CS	2CS	2CS	2CS	2CS	2CS	2CS	2CS
8	12	12	12	AT ^s	12	12	12	18	12	8	8	4.5	12
DNR	NCS	NCS	NCS	NCS	2CS	2CS	NCS	NCS	NCS	NCS	NCS	NCS	2CS
DNR	15	NCS	15	NCS	2CS	2CS	15	15	15	15	15	15	2CS
DNR	15	NCS	15	NCS	2CS	2CS	15	15	15	15	15	15	2CS
1	1	1	1	1	1	1	1	1	1	1	1	1	1
1	1	1	1	1	1	1	1	1	1	1	1	1	1
2CS	2CS	NCS	2CS	NCS**	2CS	2CS	2CS	2CS	2CS	2CS	2CS	2CS	2CS
2CS	2CS	NCS	NI	NCS ^l	2CS	2CS	2CS	2CS	2CS	2CS	2CS	2CS	2CS
NCS	NCS	NCS	NCS	AT	NCS	NCS	NCS	NCS	NCS	NCS	NCS	NCS	NCS
120 D	120 D	AT	18	10	NCS	18	10	18	18	18	10	10	18

Replant Options and Rotation Restrictions¹

Cereal and Broadleaf Crops (*continued*)

Herbicide	Common Name	Field Corn	Seed Corn	Popcorn	Sweet Corn	Winter Wheat	Spring Wheat	Oat	Winter Barley
Callisto GT	mesotrione + glyphosate	AT	AT	AT	AT	4	4	18	4
Callisto Xtra	mesotrione + atrazine	AT	AT	AT	AT	NCS	NCS	18	NCS
Canopy	metribuzin + chlorimuron	10	10 ^s	10	18	4	4	30	4
Canopy EX ^{br}	chlorimuron + tribenuron	10	10	10	18	4	4	30	4
Capreno	thiencarbazone-methyl + nicosulfuron	AT	AT	10 ^{cn,co,cp}	10 ^{cn,co,cp}	4 ^{cn}	4 ^{cn}	18 ^{co,cq}	10 ^{cn,cp}
Celebrity Plus	dicamba + diflufenzopyr + nicosulfuron	7 D	7 D	10	10/15 ^a	4	8	8	4
Cinch	see Dual II Magnum								
Cinch ATZ	see Bicep II Magnum								
Cinch ATZ Lite	see Bicep Lite II Magnum								
Clarity	dicamba-glycolamine	AT ^m	AT ^m	AT ^m	DNR	AT ^m	AT ^m	120D ^m	120D ^m
Classic	chlorimuron	8/9 ^{ad}	8/9 ^{ad}	15/9 ^v	9	3	3	3	3
Clearmax	imazamox + MCPA	8.5	8.5	8.5	8.5	0/3	0/3	9	4-18
Cobra	lactofen	AT	AT	AT	AT	AT	AT	AT	AT
Command 3ME	clomazone	9	9/12 ^{ae}	9	9/12 ^{ae}	12	12	16	16
Confidence	see Harness								
Confidence Xtra	see Harness Xtra								
Confidence Xtra 5.6L	see Harness Xtra 5.6L								
Corvus ^{bi}	isoxaflutole + thiencarbazone-methyl + cyprosulfamide	AT	17	9	9	4	4	17	9
Curbit EC	ethalfluralin	NCS	NCS	NCS	NCS	NCS	NCS	NCS	NCS
Curtail	clopyralid + 2,4-D	1	10.5	10.5	10.5	1	1	1	1
Curtail M	clopyralid + MCPA	1	10.5	10.5	10.5	1	1	1	1
Degree	acetochlor + safener	AT	AT	AT	AT	NCS	NCS	2CS	2CS
Degree Xtra	acetochlor + atrazine + safener	AT	AT	AT	AT	2CS	2CS	2CS	2CS
Distinct	diflufenzopyr + dicamba	7D	30D ^d	7D	4	30D ^d	30D ^d	30D ^d	30D ^d
Diflexx	dicamba-glycolamine	AT/ 120D ^{dy}	AT/ 120D ^{dy}	120D/ 180D ^{dw}	120D/ 180D ^{dw}	60 ^{dx}	60 ^{dx}	60 ^{dx}	60 ^{dx}
Diflexx DUO ^{eh}	dicamba - glycolamine + tembotrione	AT	AT	AT	4	4	4	4	4
Dual II Magnum	S-metachlor + benoxacor	AT	AT	AT	AT	4.5	4.5	4.5	4.5
Enlist Duo	Glyphosate + 2,4-D	7D/14D	NCS	NCS	NCS	3	NCS	NCS	3
Enlite	chlorimuron ethyl + flumioxazin + thifensulfuron methyl	9	9	9	9/18 ^{aw}	3	3	10	4
Envive	chlorimuron ethyl + flumioxazin + thifensulfuron methyl	10	10 ^s	10	18	4	4	10	4
Eptam	EPTC	NCS	NCS	NCS	NCS	NCS	NCS	NCS	NCS
Eradicane	EPTC + safener	AT	AT	AT	AT	NCS	NCS	NCS	NCS
Everest	flucarbazone-sodium	11	NI	NI	NI	AT	AT	NI	9
Expert	S-metachlor + benoxacor + atrazine + glyphosate	AT	AT	AT	AT	NCS	2CS	2CS	2CS
Express	tribenuron	1.5	1.5	1.5	1.5	AT	AT	1.5	AT
Extreme	imazethapyr + glyphosate	AT/8.5 ^{ad}	AT/8.5 ^{ad}	18	18	4	4	18	9.5
Far-GO	traiallate	12	12	12	12	AT	AT	2CS	AT
Fierce	Flumioxazin + pyroxasulfone	7D/1 ^{do}	7D/1 ^{do}	18	18	1/2 ^{dp}	1/2 ^{dp}	11/12 ^{dp}	11/12 ^{dp}
Fierce XLT ^{dr}	Flumioxazin + pyroxasulfone + chlorimuron	10	10	10	18	10	10	30	18
Finesse	chlorsulfuron + metsulfuron	11/36 ^v	FBA	FBA	FBA	0/4 ^{ae}	0/4 ^{ae}	10	10/16 ^{ae}

¹Months unless otherwise noted. D = Days, AT = Any time, NCS = Next Cropping Season; 2CS = Second Cropping Season, 3CS = Third Cropping Season, NTE = No Tolerance Established, NI = No information, FBA = Field Bioassay, DNR = Do not rotate.

See pages 193-199 for additional footnotes. *See page 195 for glyphosate formulation brand names.

Replant Options and Rotation Restrictions¹ — Cereal and Broadleaf Crops

Spring Barley	Rye	Grain Sorghum	Pearl & Proso Millet	Soybean	Canola	Buckwheat	Sunflower	Sugarbeet	Dry Bean	Pea & Snap Bean	Potato	Alfalfa	Red Clover
4	4	AT	18	10	10	18	10	18	18	18	10	10	18
NCS	18	AT	18	NCS	NCS	18	NCS	18	18	18	NCS	NCS	18
4	4	12	30	AT	18	30	18	30	12	12	30	10	12
4	4	12	30	AT	18	30	18	30	12	12	30	10	12
10 ^{cn,cp}	18 ^{co,cq}	10 ^{cn,co,cp}	18 ^{co,cq}	10 ^{cn,cp}	18 ^{co,cq}	18 ^{co,cq}	18 ^{co,cq}	18 ^{co,cq}	18 ^{co,cq}	18 ^{co,cq}	18 ^{co,cq}	18 ^{co,cq}	18 ^{co,cq}
8	4	10/18 ^b	10/18 ^c	4	10/18 ^c	10/18 ^c	11/18 ^c	10/18 ^c	10	10	10/18 ^c	12	12
120D ^m	120D ^m	120D ^m	120D ^m	120D ^m	120D ^m	120D ^m	180D ^m	180D ^m	180D ^m	180D ^m	180D ^m	120D ^m	120D ^m
3	3	15/9 ^v	30	AT	18	30	9/12 ^v	30	9	9	30	9/12 ^v	9/12 ^v
4-18	4	9	9	AT	0-26	18	9	26	AT	AT	9/18	3	18
AT	AT	AT	AT	AT	AT	AT	AT	AT	AT	AT	AT	AT	AT
16	16	9	16	AT	16	16	16	9	9	9	9	16	16
9	17	17	17	9	17	17	17	17	17	17	17	17	17
NCS	NCS	NCS	NCS	AT	NCS	NCS	AT	8/13 ^{ae,u}	AT	NCS	NCS	NCS	NCS
1	1	10.5	18	10.5/18 ^{ah}	5	18	10.5/18 ^{ah}	NCS	10.5/18 ^{ah}	18	18	10.5	18
1	1	10.5	19	10.5/18 ^{ah}	5	18	10.5/18 ^{ah}	5	10.5/18 ^{ah}	18	18	10.6	18
2CS	2CS	NCS	2CS	NCS	2CS	2CS	2CS	2CS	2CS	2CS	2CS	2CS	2CS
2CS	2CS	AT	2CS	NCS**	2CS	2CS	2CS	2CS	2CS	2CS	2CS	2CS	2CS
30 D ^{ci}	30 D ^{ci}	30 D ^{ci}	30 D ^{ci}	30 D ^{ci}	4	4	4	4	4	4	4	30 D ^{ci}	4
60 ^{dx}	120 ^{dx}	60D/120D ^{dy}	120D/180D ^{dw}	60D/120D/180D ^{dw}	120 ^{dx}	120D/180D ^{dw}	120D/180D ^{dw}	120D/180D ^{dw}	120D/180D ^{dw}	120D/180D ^{dw}	120D/180D ^{dw}	120D/180D ^{dw}	120D/180D ^{dw}
4	4	10	18	8	10	18	10	10	10 ^{ei}	10	10	10	18
4.5	4.5	AT	NCS	AT	NCS	NCS	NCS	NCS	AT	AT	AT	4	9
NCS	3	7D/14D ^{cs}	NCS	15D/30D ^{cs}	NCS	NCS	NCS	NCS	NCS	NCS	NCS	NCS	NCS
4	4	15	30	AT	18	30	9/18 ^{ch}	30	9	9	30	10	10
4	4	12	30	AT	30	30	18	30	12	12	30	10	12
NCS	NCS	NCS	NCS	NCS	NCS	NCS	AT	AT	NCS	NCS	AT	AT	AT
NCS	NCS	NCS	NCS	NCS	NCS	NCS	NCS	NCS	NCS	NCS	NCS	NCS	NCS
9	NI	NI	NI	6 ^{av,-9}	9	NI	9	9	9	NI	9	NI	NI
2CS	2CS	AT	2CS	NCS	2CS	2CS	NI	2CS	2CS	2CS	2CS	2CS	2CS
AT	1.5	1.5	1.5	1.5	2	1.5	1.5	2	1.5	1.5	1.5	1.5	1.5
9.5	4	18	40/FBA	AT	40/FBA	40/FBA	18	40/FBA	4	4	26	4	4
AT	12	12	12	12	12	12	12	AT	12	AT	12	12	12
11/12 ^{dp}	11/12 ^{dp}	18	18	AT	18	11/12 ^{dp}	4	15	11	6/11 ^{dq}	4	10	18
18	18	18	30	AT	30	30	18	30	18	18	30	18	18
10/16 ^{ae}	0/4 ^{ae}	14/24/36 ^v	11/36 ^v	14/24/36 ^v	FBA	FBA	FBA	FBA	FBA	FBA	FBA	FBA	FBA

Replant Options and Rotation Restrictions¹

Cereal and Broadleaf Crops *(continued)*

Herbicide	Common Name	Field Corn	Seed Corn	Popcorn	Sweet Corn	Winter Wheat	Spring Wheat	Oat	Winter Barley
FirstRate	cloransulam methyl	9	9 ^s	9	18	3	3	9	30/FBA
Flexstar/Rhythm/Rumble	fomesafen	10	10	10	10	4	4	4	4
Flexstar GT	fomesafen + glyphosate	10	10	10	10	4	4	4	4
FulTime NXT	encapsulated acetochlor + atrazine + safener	AT	AT	AT	AT	2CS	2CS	2CS	2CS
Fusilade DX	fluzifop-P	2	2	2	2	2	2	2	2
Fusion	fluzifop-P + fenoxaprop	2	2	2	2	2	2	2	2
G-Max Lite	dimethenamid + atrazine	AT	AT	AT	AT	2CS	2CS	2CS	2CS
Glean XP	chlorsulfuron	24/36 ^{bn}	FBA	FBA	FBA	0/4 ^{bm}	0/4 ^{bm}	10	10/16 ^{bm}
Glory	metribuzin	4	4	4	4	8 ^{ax}	8 ^{ax}	18	8 ^{ax}
Glyphosate*	glyphosate	AT	AT	AT	AT	AT	AT	AT	AT
Goal	oxyfluorfen	10	10	10	10	10	10	10	10
Gramoxone SL	paraquat	AT	AT	AT	AT	AT	AT	AT	AT
Guardsman Max	dimethenamid-P + atrazine	AT	AT	AT	AT	2CS	2CS	2CS	2CS
Halex GT	S-metachlor + mesotrione + glyphosate	AT	AT	AT	AT	120 D	120 D	18**	120 D
Harmony Extra SG/ TNT Broadleaf	thifensulfuron + tribenuron	45 D	45 D	45 D	45 D	AT	AT	AT	AT
Harmony SG/Unity	thifensulfuron	AT	45 D	45 D	45 D	AT	AT	AT	AT
Harness	acetochlor + MON 4660 safener	AT	AT	AT	NCS	NCS	NCS	2CS	2CS
Harness Xtra	acetochlor + MON 4660 + atrazine	AT	AT	AT	NCS	NCS	NCS	2CS	2CS
Harness Xtra 5.6L	acetochlor + MON 4660 + atrazine	AT	AT	AT	NCS	2CS	2CS	2CS	2CS
Hornet WDG	flumetsulam + clopyralid	AT	AT	10.5	10.5/18 ^q	4	4	4	4
Huskie	pryasulfotole + bromoxynil octanoate + bromoxynil heptanoate	9	9	9	9	7 D	7 D	7 D	7 D
Impact	topramezone	AT	AT	AT	AT	3	3	3	3
Instigate	rimsulfuron + mesotrione	AT	10	10	10	4	9	9	4
Journey	imazapic + glyphosate	9	26	26	18	4	4	18	18
Karmex DF	diuron	12/24 ^{ae}	12/24 ^{ae}	12/24 ^{ae}	12/24 ^{ae}	12/24 ^{ae}	12/24 ^{ae}	12/24 ^{ae}	12/24 ^{ae}
Keystone NXT	acetochlor + dichlormid safener + atrazine	AT	AT	AT	NCS	NCS	NCS	2CS	2CS
Keystone LA NXT	acetochlor + dichlormid safener + atrazine	AT	AT	AT	NCS	2CS	2CS	2CS	2CS
Landmaster BW	glyphosate + 2,4-D amine	AT	AT	AT	AT	AT	AT	AT	AT
Lariat	alachlor + atrazine	AT	AT	AT	AT	2CS	2CS	2CS	2CS
Latir	flumioxazin + imazethapyr	8.5	8.5	18	18	4	4	18	9.5
Laudis	tembotrione	AT	AT	AT	AT	4	4	4	4
Liberty	glufosinate-ammonium	AT	AT	AT	AT	70 D	70 D	70 D	70 D
Lexar EZ	S-metachlor + atrazine + mesotrione	AT	AT	AT	AT	NCS	4.5	NCS	NCS
Lightning	imazethapyr + imazapyr	8.5 ^h	8.5 ^h	18	18	4	4	18	9.5
Linex	linuron	AT	12	12	12	4	4	4	4
Lorox	linuron	AT	12	12	12	4	4	4	4
Lumax EZ	S-metachlor + atrazine + mesotrione	AT	AT	AT	AT	4.5	4.5	NCS	4.5
Matrix	rimsulfuron	AT ^{bc}	AT ^{bc}	10 ^{bc}	10 ^{bc}	4 ^{bc}	9 ^{bc}	9 ^{bc}	18
Marvel	fluthicat-methyl + fomesafen	10	10	10	10	4	4	4	4
Maverick PRO	sulfosulfuron	22/FBA	12/FBA	12/FBA	12/FBA	AT	AT	12/FBA	12/FBA
MCPA	MCPA	0/3 ^{ae}	0/3 ^{ae}	0/3 ^{ae}	0/3 ^{ae}	0/3 ^{ae}	0/3 ^{ae}	0/3 ^{ae}	0/3 ^{ae}
Me-Too-Lachlor II	metolachlor + safener	AT	12	AT	AT	4.5	4.5	4.5	4.5
Metribuzin 75 DF/Tricor	metribuzin	4	4	4	4	8 ^{ax}	8 ^{ax}	18	8 ^{ax}
Moxy	bromoxynil	AT	AT	AT	AT	AT	AT	AT	AT

¹Months unless otherwise noted. D = Days, AT = Any time, NCS = Next Cropping Season; 2CS = Second Cropping Season, 3CS = Third Cropping Season, NTE = No Tolerance Established, NI = No information, FBA = Field Bioassay, DNR = Do not rotate.

See pages 184-187 for additional footnotes.

Replant Options and Rotation Restrictions¹ — Cereal and Broadleaf Crops

Spring Barley	Rye	Grain Sorghum	Pearl & Proso Millet	Soybean	Canola	Buckwheat	Sunflower	Sugarbeet	Dry Bean	Pea & Snap Bean	Potato	Alfalfa	Red Clover
30/FBA	30/FBA	9	30/FBA	AT	30/FBA	30/FBA	30/FBA	30/FBA	9	9	18	9	30/FBA
4	4	18	18	AT	18	18	18	18	0	0	18	18	18
4	4	18	18	AT	18	18	18	18	0	10	18	18	18
2CS	2CS	AT	2CS	NCS**	2CS	2CS	2CS	2CS	2CS	2CS	2CS	2CS	2CS
2	2	2	AT	AT	AT	AT	AT	AT	AT	AT	AT	AT	AT
2	2	2	AT	AT	AT	AT	AT	AT	AT	AT	AT	AT	AT
2CS	2CS	AT	2CS	NCS ^e	2CS	2CS	2CS	2CS	2CS	2CS	2CS	2CS	2CS
10/16 ^{bm}	0/4 ^{bm}	14/24/36 ^{bn}	24/36 ^{bn}	14/26/36 ^{bn}	FBA	FBA	FBA	FBA	FBA	FBA	FBA	FBA	FBA
8 ^{ax}	18	18	18	4	18	18	18	18	18	8	12	4	18
AT	AT	AT	AT	AT	AT	AT	AT	AT	AT	AT	AT	AT	AT
10	10	10	10	1	NI	10	NI	3	2	2	2	2	2
AT	AT	AT	AT	AT	AT	AT	AT	AT	AT	AT	AT	AT	AT
2CS	2CS	AT	2CS	NCS ^e	2CS	2CS	2CS	2CS	2CS	2CS	2CS	2CS	2CS
120 D	120 D	AT ^j	18**	10	10	18**	10	18	18	18	10	10	18
AT	45 D	45 D	45 D	AT	60 D	45 D	45 D	60 D	45 D	45 D	45 D	45 D	45 D
AT	45 D	45 D	45 D	AT	45 D	45 D	45 D	45 D	45 D	45 D	45 D	45 D	45 D
2CS	2CS	NCS	2CS	NCS	2CS	2CS	2CS	2CS	2CS	2CS	2CS	2CS	2CS
2CS	2CS	NCS	2CS	NCS ^{l**}	2CS	2CS	2CS	2CS	2CS	2CS	2CS	2CS	2CS
2CS	2CS	NCS	2CS	NCS ^{l**}	2CS	2CS	2CS	2CS	2CS	2CS	2CS	2CS	2CS
4	4	12	NI	10.5/18 ^p	26/FBA	26/FBA	18	26/FBA	10.5/18 ^p	10.5/18 ^p	18	10.5/18 ^p	10.5/18 ^p
7 D	7 D	4	4	4	9	FBA	9	9	9	9	9	9	FBA
3	3	9	18	9	9	18	9	18	9	9/18 ^{cb}	9	9	18
9	9 ^{cs}	10	18	10 ^{cs}	10	18	10	18	18	18	10	10 ^{cs}	18
18	4	18	26	9	40	26	26	40	26	9	40	26	26
12/24 ^{ae}	12/24 ^{ae}	12/24 ^{ae}	12/24 ^{ae}	12/24 ^{ae}	12/24 ^{ae}	12/24 ^{ae}	12/24 ^{ae}	12/24 ^{ae}	12/24 ^{ae}	12/24 ^{ae}	12/24 ^{ae}	12/24 ^{ae}	12/24 ^{ae}
2CS	2CS	NCS	2CS	NCS ^{1**}	2CS	2CS	2CS	2CS	2CS	2CS	2CS	2CS	2CS
2CS	2CS	NCS	2CS	NCS ^{1**}	2CS	2CS	2CS	2CS	2CS	2CS	2CS	2CS	2CS
AT	AT	AT	3	3	3	3	3	3	3	3	3	3	3
2CS	2CS	AT ^j	2CS	NCS ^{l**}	2CS	2CS	2CS	2CS	2CS	2CS	2CS	2CS	2CS
9.5	4	18	40	AT	40	40	18	40	4/8 ^{ct}	4/8 ^{ct}	26	4/8 ^{ct}	4/8 ^{ct}
4	4	10	18	8	10	18	18	18	18	10	10	10	18
70 D	70 D	180 D	180 D	AT	AT	70 D	180 D	AT	180 D	180 D	70 D	180 D	180 D
NCS	NCS	AT	18	NCS ^{d,ca}	18	18	18	18	18	18	18	18	18
9.5	4	18	NI	9	40/FBA	40/FBA	18	40/FBA	40/FBA	9.5	26	9.5	NI
4	4	AT	12	AT	12	12	12	12	12	12	AT	12	12
4	4	AT	12	AT	12	12	12	12	12	12	AT	12	12
4.5	4.5	AT	18	NCS ^d	18	18	18	18	18	18	18	18	18
9 ^{bc}	18	18	18	4 ^{bc}	18	18	10 ^{bc}	18	10 ^{bc}	10 ^{bc}	AT	18	18
4	4	18	18	AT	18	18	18	18	AT	AT	AT	18	18
12/FBA	12/FBA	22/FBA	12/FBA	12/FBA	12/FBA	12/FBA	22/FBA	12/FBA	12/FBA	12/FBA	12/FBA	12/FBA	12/FBA
0/3 ^{ae}	0/3 ^{ae}	0/3 ^{ae}	0/3 ^{ae}	0/3 ^{ae}	0/3 ^{ae}	0/3 ^{ae}	0/3 ^{ae}	0/3 ^{ae}	0/3 ^{ae}	0/3 ^{ae}	0/3 ^{ae}	0/3 ^{ae}	0/3 ^{ae}
4.5	4.5	NCS	NCS	NCS	12	NCS	12	12	12	12	12	4	9
8 ^{ax}	18	18	18	4	18	18	18	18	18	8	12	4	18
AT	AT	AT	AT	NCS	NCS	NCS	NCS	NCS	NCS	NCS	NCS	NCS	NCS

Replant Options and Rotation Restrictions¹

Cereal and Broadleaf Crops (continued)

Herbicide	Common Name	Field Corn	Seed Corn	Popcorn	Sweet Corn	Winter Wheat	Spring Wheat	Oat	Winter Barley
North Star	primisulfuron + dicamba	14 D ^h	8 ^s	8	8	3**	8	8	3**
Nortron	ethofumesate	6/12 ^{bb}	6/12 ^{bb}	6/12 ^{bb}	6/12 ^{bb}	6/12 ^{bb}	6/12 ^{bb}	6/12 ^{bb}	6/12 ^{bb}
Olympus	propoxycarbazone-sodium	18	FBA	FBA	FBA	0	0	24	FBA
Olympus FLEX	propoxycarbazone + mesosulfuron	18	FBA	FBA	FBA	0	0	FBA	FBA
OpTill	saflufenacil + imazethapyr	8.5 ^{ck}	8.5	18	18	4 ^{ck}	4 ^{ck}	18	9.5
Orion	florasulam + MCPA	3	3	3	3	0.5	0.5	0.5	0.5
Osprey	mesosulfuron-methyl	12	12	12	12	7 D	7 D	10	1
Outlook	dimethenamid-P	AT	AT	AT	AT	4	NCS	NCS	4
Paramount	quinclorac	10	10	10	10	AT	AT	10	10
Peak	prosulfuron	1	10	10	10	AT	AT	AT	AT
Permit/Sandea	halosulfuron	1	2	3	3	2	2	2	2
Phoenix	lactofen	1	1	1	1	1	1	1	1
Plateau	ammonium salt of imazapic	9 ^{bo}	26 ^{bo}	26 ^{bo}	18 ^{bo}	4 ^{bo}	4 ^{bo}	18 ^{bo}	18 ^{bo}
Poast	sethoxydim	4 ^{bf}	4	4	4	4	4	4	4
Poast Plus	sethoxydim	1	1	1	1	1	1	1	1
PowerFlex	pyroxsulam	9	9	9	9	1	1	9	9
Prefar	bensulide	4 ^{be}	4 ^{be}	4 ^{be}	4 ^{be}	4 ^{be}	4 ^{be}	4 ^{be}	4 ^{be}
Prefix/Statement/Vise	metolachlor + fomesafen	10	10	10	10	4.5	4.5	4.5	4.5
Prequel	rimsulfuron + isoxaflutole	AT	AT	10	10	4	9	9	4
Princep	simazine	NCS	2CS	2CS	2CS	2CS	2CS	2CS	2CS
Priority	carfentrazone-ethyl + halosulfuron-methyl	1	2	3	3	2	2	2	2
Prowl (H ₂ O)	pendimethalin	NCS	NCS	NCS	NCS	4**	NCS	NCS	4**
Pulsar	dicamba + fluroxypyr	AT	9	9	4	22 D	22 D	22 D	22 D
Pursuit	imazethapyr	8.5 ^h	8.5	18	18	4	4	18	9.5
Python	flumetsulam	AT	AT	9	10.5/18 ^s	4	4	4	4
Raptor	imazamox	8.5	8.5	8.5	8.5	0/3 ^{bv}	0/3 ^{bv}	9	4 ^{ca}
Rave	triasulfuron + sodium salt of dicamba	4/36 ^{at}	4/36 ^{at}	4/36 ^{at}	4/36 ^{at}	12 D	12 D	6 ^y	6 ^y
Realm Q	rimsulfuron + mesotrione + isoxadifen	AT	10	10	10	4	9	9	4
Reflex	fomesafen	10	10	10	4	4	4	4	4
Resicore ^{ej}	acetochlor + mesotrione, clopyralid	AT	AT	AT	18	4	4	10.5	10.5
Resolve SG/Solida	rimsulfuron	AT	18	10	10	4	9	9	18
Resolve Q ^{bi}	rimsulfuron + thifensulfuron + safener	AT	18	10	10	3	9	9	18
Resource	flumiclorac	AT	1	1	1	1	1	1	1
Revolin Q	nicosulfuron + mesotrione	AT	AT	10	10 ^{dh}	4	8	4	8
Ro-Neet	cycloate	NCS	NCS	NCS	NCS	NCS	NCS	NCS	NCS
Roundup PowerMAX	glyphosate	AT	AT	AT	AT	AT	AT	AT	AT
Roundup WeatherMAX	glyphosate	AT	AT	AT	AT	AT	AT	AT	AT
Rowel	flumioxazin	14D-9 ^{ea}	14D-9	4-18 ^{ec}	3-18 ^{ef}	30D-9 ^{ed}	30D-9 ^{ed}	4-18 ^{ee}	3-18 ^{ef}
Rowel FX ^{dz}	flumioxazin + chlorimuron ethyl	10	10	10	18	4	4	30	4
Scepter	imazaquin	9.5/18 ^{v,ad}	18	18	18	4/18 ^v	4/18 ^v	11/18 ^v	11/18 ^v
Scoparia	Isoxaflutole	4		6	6	4	4	6	6
Select MAX/Arrow	clethodim	6 D	1	1	1	1	1	1	1
Sequence	S-metachlor + glyphosate	AT	AT	AT	AT	4.5	4.5	4.5	4.5
Surveil	flumioxazin + cloransulam-methyl	9	9	9	18	3	3	9	FBA
Sharpen	saflufenacil	AT	AT	AT	0.5	0-3 ^{cl}	0-3 ^{cl}	0-3 ^{cl}	0-3 ^{cl}
Sinbar	terbacil	24	24	24	24	24	24	24	24
Sonalan HFP	ethalfuralin	NCS	NCS	NCS	NCS	NCS	NCS	NCS	NCS
Solstice	fluthiacet methyl + mesotrione	AT	AT	AT	AT	4	4	AT	4

¹Months unless otherwise noted. D = Days, AT = Any time, NCS = Next Cropping Season; 2CS = Second Cropping Season, 3CS = Third Cropping Season, NTE = No Tolerance Established, NI = No information, FBA = Field Bioassay, DNR = Do not rotate.

See pages 184-187 for additional footnotes.

Replant Options and Rotation Restrictions¹ — Cereal and Broadleaf Crops

Spring Barley	Rye	Grain Sorghum	Pearl & Proso Millet	Soybean	Canola	Buckwheat	Sunflower	Sugarbeet	Dry Bean	Pea & Snap Bean	Potato	Alfalfa	Red Clover
8	3**	8**	18**	8	18**	18**	8**	18**	8	8	8	8**	18**
6/12 ^{bb}	6/12 ^{bb}	6/12 ^{bb}	6/12 ^{bb}	6/12 ^{bb}	6/12 ^{bb}	6/12 ^{bb}	6/12 ^{bb}	AT	6/12 ^{bb}	6/12 ^{bb}	6/12 ^{bb}	6/12 ^{bb}	6/12 ^{bb}
FBA	FBA	12	4	4/12	FBA	24	12	24	FBA	FBA	FBA	FBA	FBA
FBA	FBA	12	4	12	FBA	FBA	FBA	FBA	FBA	FBA	FBA	FBA	FBA
9.5	4-18	18	40	0-1	9.5 ^{ck}	40	9.5-18 ^{ck}	40	4	4	26	4	4
0.5	0.5	3	0.5	9	9	12	9	9	9	9	9	9	12
1	10	10	10	3	10	10	1	10	3	3	10	10	10
NCS	4	AT	NCS	AT	NCS	NCS	NCS	NCS	AT	NCS	NCS	NCS	NCS
10	10	AT	10	10	10	10	10	24/FBA	10	24/FBA	24/FBA	24/FBA	24/FBA
AT	AT	1	22	22	22	22	22	22	22	10	22	22	22
2	2	2	2	9	15	NTE/36	18	36	9	9	9	9	9
1	1	1	1	AT	1	1	1	1	1	1	1	1	1
18 ^{bo}	4 ^{bo}	18 ^{bo}	26 ^{bo}	9 ^{bo}	40 ^{bo}	26 ^{bo}	26 ^{bo}	40 ^{bo}	26 ^{bo}	26 ^{bo}	40 ^{bo}	26 ^{bo}	26 ^{bo}
4	4	4	4	AT	4	4	AT	AT	AT	AT	AT	AT	AT
1	1	1	1	AT	1	1	1	1	1	1	1	AT	AT
9	12	9	9	5	9	12	9	9	9	9	12	9	12
4 ^{be}	4 ^{be}	4 ^{be}	4 ^{be}	4 ^{be}	4 ^{be}	4 ^{be}	4 ^{be}	4 ^{be}	4 ^{be}	4 ^{be}	4 ^{be}	4 ^{be}	4 ^{be}
4.5	4.5	18	18	AT	18	18	18	10	AT	10 & 0	18	18	18
9	9	10	18	10	18	18	10	10 ^{CP}	10 ^{CP}	18 ^{CP}	6	10	18 ^{CP}
2CS	2CS	2CS	2CS	2CS	2CS	2CS	2CS	2CS	2CS	2CS	2CS	2CS	2CS
2	12	2	12	9	15	NI	18	24	12	12	12	12	12
NCS	NCS	NCS	NCS	NCS	NCS	NCS	NCS	12-14	NCS	NCS	NCS	NCS	NCS
22 D	22 D	4	22 D	9	9	12	9	9	9	9	9	9	12
9.5	4	18	40/FBA	AT	40/FBA	40/FBA	18	40/FBA	40/FBA	4	26	4	40/FBA
4	4	12	26/FBA	AT	26/FBA	26/FBA	18	26/FBA	4	4	12	4	26/FBA
4 ^{ca}	3	9	9	AT	18-26	18	9	18-26 ^{as,bv}	AT	AT	18	3	18
6 ^y	6 ^y	14 ^y	4	11/26/36 ^{au}	4/FBA	4/FBA	24/FBA	24/FBA	4/FBA	4/FBA	4/FBA	24/FBA	24/FBA
9	18	10/18 ^{bu}	18	10	10/18 ^{bu}	18	10	18	18	18	10	10/18 ^{bu}	18
4	4	10/18	18	AT	18	18	18	18	10	10	18	18	18
10.5	10.5	10.5	10.5	10.5	10.5 ^{ek}	18	10.5	18	18	18	18	10.5	18
9	18	10/18	18	10	18	18	10	10	10	10	AT	18	10/18
9	18	10/18 ^{ae}	18	4 ^{av} /10	10/18 ^{ae}	18	10	10/18 ^{ae}	10	10	1.5	10/18 ^{ae}	10/18 ^{ae}
1	1	1	1	AT	1	1	1	1	1	1	1	1	1
8	4/8 ^{dg}	10 ^{di}	18	10	10 ^{df}	18	10	18	18	18	10 ^{df}	10 ^{df}	18
NCS	NCS	NCS	NCS	NCS	NCS	NCS	NCS	NCS	NCS	NCS	NCS	NCS	NCS
AT	AT	AT	AT	AT	AT	AT	AT	AT	AT	AT	AT	AT	AT
AT	AT	AT	AT	AT	AT	AT	AT	AT	AT	AT	AT	AT	AT
3-18 ^{ef}	3-18 ^{ef}	30D-9 ^{eg}	4-18 ^{ec}	AT-9 ^{eb}	4-18 ^{ec}	4-18 ^{ec}	30D-9 ^{ed}	4-18 ^{ee}	3-18 ^{ef}	3-18 ^{ef}	4-18 ^{ec}	4-18 ^{ee}	4-18 ^{ee}
4	4	10	30	AT	30	30	18	30	12	12	30	12	18
11/18 ^v	18	11	18	AT	18-26 ^v	18	18	40	18	18	18/26 ^v	18	18
6	6	6	18	6	18	18	6	18	18	18	6	10	18
1	1	1	1	AT	1	1	1	AT	AT	1	1	AT	1
4.5	4.5	AT	NCS	AT	NCS	NCS	NCS	NCS	AT	AT	AT	4	9
FBA	FBA	9	FBA	AT	FBA	FBA	30	30	9	9	18	FBA	FBA
0-3 ^{cl}	0-3 ^{cl}	0-1 ^{cl}	0-3 ^{cl}	0-6 ^{cl}	4-9 ^{cl}	4-9 ^{cl}	4-9 ^{cl}	4-9 ^{cl}	4-9 ^{cl}	0-6 ^{cl}	4-9 ^{cl}	4-9 ^{cl}	4-9 ^{cl}
24	24	24	24	24	24	24	24	24	24	24	24	24	24
NCS	NCS	NCS	NCS	AT	NCS	NCS	AT	8/13 ^{ae,u}	AT	NCS	NCS	NCS	NCS
4	4	18	AT	10	10	18	10	18	18	18	10	18	18

Replant Options and Rotation Restrictions¹

Cereal and Broadleaf Crops (*continued*)

Herbicide	Common Name	Field Corn	Seed Corn	Popcorn	Sweet Corn	Winter Wheat	Spring Wheat	Oat	Winter Barley
Sonic	cloransulam methyl + sulfentrazone	10	10	10	18	4	4	12	12
Spartan	sulfentrazone	10	12	18	18	4	4	12/FBA	4
Spartan Charge	sulfentrazone + carfentrazone	4	12	12	12	4	4	12	4
Spirit	prosulfuron + primisulfuron	1	8	8	8	3	3	3	3
Stalwart C	metolachlor	AT	12	AT	12	4.5	4.5	4.5	4.5
Stalwart Xtra	metolachlor + atrazine	AT	NCS	AT	NCS	18	2CS	2CS	2CS
Starane Flex	fluroxypyr + florasulam	3	3	3	3	AT	AT	AT	AT
Starane NXT	fluroxypyr + bromoxini	4	4	4	4	1	1	1	1
Starane Ultra	fluroxypyr	AT	4	4	AT	AT	AT	AT	AT
Status	diflufenzopyr + dicamba	7 D	7 D	7 D	120 D	30 D ^{ci}	30 D ^{ci}	30 D ^{ci}	30 D ^{ci}
Steadfast Q	nicosulfuron + rimsulfuron + isoxadifen	AT	10	10	10	4	8	8	4
Stinger	clopyralid	AT	AT	AT	AT	AT	AT	AT	AT
Storm	bentazon + acifluorfen	NCS	NCS	NCS	NCS	NCS	NCS	NCS	NCS
Stout	nicosulfuron + thifensulfuron-methyl	AT	AT	10	10 ^a	4	8	8	4
SureStart II/TripleFLEX II	acetochlor + clopyralid + flumetsulam	AT	AT	2CS	2CS	4	4	2CS	2CS
Surpass NXT	acetochlor + dichlormid safener	AT	AT	AT	NCS	NCS	NCS	2CS	2CS
Surveil ^{dj}	chloransulam methyl + flumioxazin	9	9 ^{dk}	9	18	3	3	9	30
Synchrony XP	chlorimuron + thifensulfuron	8/9 ^{v,ad}	9	9	18	3	3	3	3
Telar	chlorsulfuron	FBA	FBA	FBA	FBA	FBA	FBA	FBA	FBA
TopNotch	acetochlor + safener	AT	AT	AT	AT	4	4	NCS	NCS
Tordon 22K	picloram	FBA	FBA	FBA	FBA	NCS	NCS	NCS	NCS
Torment	fomesafen + imazethapyr	10	10	40	18	4	4	4	9.5
Touchdown Total	glyphosate	AT	AT	AT	AT	AT	AT	AT	AT
Treflan HFP	trifluralin	NCS	NCS	NCS	NCS	NCS	NCS	12/18 ^{ba}	NCS
Trifluralin	trifluralin	NCS	NCS	NCS	NCS	NCS	NCS	12/18 ^{ba}	NCS
Trizmet II	metolachlor + atrazine + safener	AT	NCS	NCS	NCS	18	2CS	2CS	2CS
Trivence	chlorimuron + metribuzin	10	10	10	18	4	4	18	4
Ultra Blazer	acifluorfen	AT	AT	AT	AT	AT	AT	AT	AT
UpBeet	triflurosulfuron methyl	21 D	21 D	21 D	21 D	14 D	14 D	14 D	14 D
Valor ^{bl,ae} /Outflank	flumioxazin	0.5-1	12/FBA	12/FBA	4/FBA	2	2	5-10	4
Valor XLT	flumioxazin + chlorimuron ethyl	10	10	10	18	4	4	30	4
Velpar	hexazinone	12	24	24	24	24	24	24	24
Verdict	saflufenacil + dimethenamid-P	AT	AT	NCS	NCS	4	NCS	NCS	4
Volley	acetochlor + dichlormid safener	AT	AT	AT	2CS	4	4	2CS	2CS
Volley ATZ	acetochlor + dichlormid safener + atrazine	AT	AT	AT	2CS	15	15	2CS	2CS
Volley ATZ Lite	acetochlor + dichlormid safener + atrazine	AT	AT	AT	2CS	15	15	2CS	2CS
Warrant	acetochlor	NCS	NCS	NCS	NCS	4	4	NCS	NCS
Warrant Ultra	acetochlor + formasafen	10	10	12	12	4	4	4	4
Widematch	clopyralid + fluroxypyr	AT	AT	4	AT	AT	AT	AT	AT
Yukon	halosulfuron-methyl + dicamba	0/1 ^{bs}	2	3	3	2	2	2	2
Zemax	S-metolachlor + mesotrione	AT	AT	AT	AT	4.5	NCS	NCS	4.5
Zidua	pyroxasulfone	AT	AT	AT	AT	4/6 ^{cr}	4/6 ^{cr}	11/18 ^{cr}	11/18 ^{cr}

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See pages 184-187 for additional footnotes.

Replant Options and Rotation Restrictions¹ — Cereal and Broadleaf Crops

	Spring Barley	Rye	Grain Sorghum	Pearl & Proso Millet	Soybean	Canola	Buckwheat	Sunflower	Sugarbeet	Dry Bean	Pea & Snap Bean	Potato	Alfalfa	Red Clover
	12	12	12	2CS	AT	24	2CS	30	30	12	2CS	18	12	2CS
	4	4	10/18 ^{by}	12	AT	24	12/FBA	AT	36	12	AT/12	12/FBA	12	12
	4	4	10/18 ^{by}	12	AT	24	12	AT	36	12	AT/12	12	12	12
	3	3	10	10	10/18 ^v	10/18 ^v	18	18	18	10/18 ^v	10	10/18 ^v	18	18
	4.5	4.5	NCS	NCS	NCS	12	12	12	12	12	NCS	12	4	9
	2CS	2CS	NCS	2CS	NCS	2CS	2CS	2CS	2CS	2CS	2CS	2CS	2CS	2CS
	AT	AT	3	AT	9	9	12	9	9	9	9	9	9	12
	1	1	4	4	4	4	4	4	4	4	4	4	4	4
	AT	AT	AT	4	4	4	4	4	4	4	4	4	4	4
	30 D ^{ci}	30 D ^{ci}	30 D ^{ci}	30 D ^{ci}	30 D ^{ci}	120 D	120 D	120 D	120 D	120 D	120 D	120 D	30 D ^{ci}	120 D
	8	4	10/18 ^b	10/18 ^{bh}	0.5	10/18 ^{bh}	10/18 ^{bh}	10/18 ^b	10/18 ^{bh}	10	10	10/18 ^{bh}	10/18 ^{bh}	10/18 ^{bh}
	AT	AT	10.5	18/FBA	10.5 ^{ay}	AT	18	10.5 ^{ay}	AT	10.5 ^{ay}	18	18	10.5	18/FBA
	NCS	NCS	NCS	NCS	AT	NCS	NCS	NCS	18	NCS	NCS	18	NCS	NCS
	8	4	10/18 ^b	18	0.5	18	18	10/12 ^{cc}	10/18 ^{bh}	10	10	10/12 ^{cc}	10/12 ^{cc}	10/12 ^{cc}
	2CS	2CS	NCS	2CS	NCS	2CS	2CS	2CS	2CS	NCS	2CS	2CS	2CS	2CS
	2CS	2CS	NCS	2CS	NCS	2CS	2CS	2CS	2CS	2CS	2CS	2CS	2CS	2CS
	30	30	9	30	AT	30	30	30	30	9	9	18	10	30
	3	3	9	30	AT	18	30	9/18 ^{v,ae}	30	9	9	30	9/12 ^{v,ae}	9/12 ^{v,ae}
	FBA	FBA	FBA	FBA	FBA	FBA	FBA	FBA	FBA	FBA	FBA	FBA	FBA	FBA
	NCS	NCS	NCS	NCS	NCS	2CS	2CS	2CS	2CS	2CS	2CS	2CS	2CS	2CS
	NCS	FBA	8	FBA	36/FBA	36/FBA	36/FBA	36/FBA	36/FBA	36/FBA	36/FBA	36/FBA	36/FBA	36/FBA
	9.5	4	18	4	AT	40	40	18	40	AT	10 & AT	26	18	40
	AT	AT	AT	AT	AT	AT	AT	AT	AT	AT	AT	AT	AT	AT
	NCS	NCS	12/18 ^{ba}	NCS	AT	NCS	NCS	AT	12/14 ^{az}	AT	AT	AT	NCS	NCS
	NCS	NCS	12/18 ^{ba}	NCS	AT	NCS	NCS	AT	NCS ^u	AT	AT	AT	NCS	NCS
	2CS	2CS	2CS	AT	2CS	NCS	2CS	2CS	2CS	2CS	2CS	2CS	2CS	2CS
	4	30	18	30	AT	30	30	18	30	30	12	30	10	30
	AT	AT	AT	AT	AT	AT	AT	AT	18	AT	AT	18	AT	AT
	14 D	14 D	14 D	14 D	14 D	14 D	14 D	14 D	AT	14 D	14 D	14 D	14 D	14 D
	4	4	1	6-12/FBA	AT	12/FBA	12/FBA	2	6-12/FBA	4	4	6-12/FBA	5-10/FBA	5-10/FBA
	4	4	10	30	AT	30	30	18	30	12	12	30	12	18
	24	24	24	24	24	24	24	24	12 ^{bg}	24	24	12 ^{bg}	24	24
	NCS	NCS	AT	NCS	0-1	NCS	NCS	NCS	NCS	NCS	NCS	NCS	NCS	NCS
	2CS	2CS	NCS	2CS	NCS	2CS	2CS	2CS	2CS	2CS	2CS	2CS	2CS	2CS
	2CS	2CS	NCS	2CS	2CS	2CS	2CS	2CS	2CS	2CS	2CS	2CS	2CS	2CS
	2CS	2CS	NCS	2CS	2CS	2CS	2CS	2CS	2CS	2CS	2CS	2CS	2CS	2CS
	NCS	NCS	NCS	NCS	AT	NCS	NCS	NCS	NCS	NCS	NCS	NCS	9	9
	4	4	18	NI	AT	NI	NI	18	18	NCS	10	NI	18	NI
	AT	NI	10.5	NI	10.5/18 ^{bz}	4	NI	10.5/18 ^{bz}	4	10.5/18 ^{bz}	18	18	10.5	NI
	2	2	2	2	9	15	NI	18	24	9	9	9	9	9
	4.5	4.5	NCS	18	NCS	18	18	18	18	18	18	NCS	18	18
	11/18 ^{cr}	11/18 ^{cr}	18	18	AT/4 ^{cr}	18	18	4	15	11	6	4	10	18

Replant Options and Rotation Restrictions *(continued)*

*All other crops.

**Injury may occur.

^a15 months for sweet corn varieties Merit, Carnival and Sweet Success.

^bpH < or = 7.5, interval is 10-11 months; pH > 7.5, interval is 18 months.

^cpH < or = 6.5, interval is 10 months; if pH > 6.5 and cumulative precipitation is < 25 inches, interval is 18 months.

^dIn eastern Nebraska, do not rotate to soybean if the rate applied was more than 2.0 lb/A ai or if the soil has a calcareous surface layer.

^eInjury may occur if surface soils are calcareous.

^f15 inches of cumulative precipitation from application to planting. (No more than 7 inches from overhead irrigation. Furrow or flood not to be included in total.)

^gRotation interval is 45 days per pint of Banvel applied and 23 days per pint of Banvel SGF, excluding days when the ground is frozen.

^hClearfield, IR or IMR field corn hybrids may be planted "anytime."

ⁱOnly following 0.38 oz/A rate.

^jSafened seed only (Concep).

^k18 months if more than 2.0 lb/A ai atrazine or equivalent band application was made to corn or sorghum.

^lDo not plant soybean in areas where furrow irrigation is practiced.

^mApplications of 24 oz/A or less = 22 days for each 8 fluid oz; 24 oz/A or more = 45 day interval for each 16 fluid oz/A applied.

ⁿIf applied after June 10, do not plant soybean the next season.

^p18 months when annual rainfall and/or irrigation is less than 15 inches on soils with less than 2% organic matter.

^qCertain sweet corn varieties may be planted 10.5 months following a soil or postemergence application of up to 3.2 oz/A of Hornet or 4.0 oz/A of Hornet WDG.

^rIf applied after June 10, do not rotate with crops other than corn or sorghum the next year or crop injury may occur. In high plains or intermountain regions where rainfall is sparse and erratic or where irrigation is required, rotate only in the second cropping season.

^sVerify with the seed company (supplier) the safety of the herbicide on inbred lines, hybrids or varieties.

^tRotation interval varies by location north/south of I-80, soil pH levels, and application rates and dates.

^uMoldboard plow to a depth of 12 inches prior to planting.

^vRotation interval varies by location in Nebraska, soil pH, application rate, and cumulative precipitation.

^wGenerally west of Hwy 77 and east of the Panhandle and 15 inches of cumulative precipitation. Soybeans with soil pH < 7.5 or 7.6-7.9 and 22/33 inches of cumulative precipitation.

^xAt least 28 inches of cumulative precipitation during the period.

^yWhere soil pH is 7.9 or less and one application at a standard rate was made.

^zFour months for IR corn, 14 months for "normal" corn and when soil pH is 6.9 or lower.

^{aa}11 months for STS varieties, 36 months or earlier with a bioassay; 14 or 26 months if pH < 7.9 and rainfall limits are followed.

^{ab}Cropping intervals are according to rate of Basis used: 1/3 oz / 1/3-1 oz per acre rates.

^{ac}Should not be planted for 18 months after application if combined rainfall and irrigation during the previous growing season was less than 20 inches.

^{ad}IR, IMR/non-IR field corn.

^{ae}Rotation interval varies with application rates.

^{af}Areas receiving 20 inches or greater cumulative rainfall and irrigation or those receiving less than 20 inches.

^{ag}Areas receiving 20 inches or greater cumulative rainfall and irrigation moldboard 12 inches deep or those with less than 20 inches.

^{ah}10.5 months or 18 months if soils contain less than 2% organic matter and natural precipitation is less than 15 inches during the 10.5 months following treatment.

^{ai}Minimum of 15 inches of cumulative precipitation.

^{aj}pH 7.5 or lower and 22 inches of cumulative precipitation or soil pH of 7.6-7.9 and cumulative precipitation of 33 inches.

^{ak}Application rate of one Soluble Pack per 10 acres on wheat, barley, or fallow on non-irrigated land.

^{al}Soil pH 6.8 or lower or those with a soil pH 6.9-7.9.

^{ao}Soil pH of 7.9 or lower and 25 inches of cumulative precipitation.

^{ap}Soil should be reworked before planting.

^{aq}Soybean should not be planted in the same year as the application in areas receiving less than 25 inches of cumulative precipitation. Other areas can be planted after 1 inch of rain or irrigation.

^{ar}IR corn can be replanted, but do not rework the soil. Corn must be planted at least 2 inches deep or below the treated zone.

^{as}18 months in eastern Nebraska if soil pH is 6.2 or greater and 26 months if the soil pH is less than 6.2; 26 months for western Nebraska.

^{at}Four months for IR corn at any soil pH or 14 months for non-IR corn at a soil pH 6.9 or lower or 22 months with a soil pH 7.9 or lower, or 36 months if the soil pH is above 7.9.

^{au}STS soybeans — Non-STS soybeans with a soil pH below 7.9 in an area receiving 46 inches of cumulative precipitation — all pH levels and field bioassay.

^{av}STS soybean varieties only.

^{aw}Processing sweet corn varieties only/other sweet corn varieties.

^{ax}Four months following peas, lentils or soybean.

- ^{ay}Use longer interval if soils contain less than 2% organic matter and natural precipitation is less than 15 inches during the 12 months following treatment.
- ^{az}Spring application/fall application.
- ^{ba}All areas receiving more than 20 inches of rainfall and irrigation — those areas receiving less than 20 inches of rainfall and irrigation to produce a crop.
- ^{bb}Six months following split postemergence applications totaling 12 fl oz/A or less — all types of applications totaling more than 12 fl oz/A.
- ^{bc}Rotation intervals may need to be extended to 18 months if drought conditions prevail after application and before the rotational crop is planted, unless supplemental sprinkler irrigation has been applied and total is greater than 15 inches during the potato growing season.
- ^{bd}In areas where irrigation is necessary, do not rotate to winter wheat or winter barley if the crop was lost or destroyed and the land was fallowed that summer.
- ^{be}The soil must be tilled to a minimum depth of 4 inches prior to replanting.
- ^{bf}Poast Protected field corn hybrids may be planted anytime.
- ^{bg}Rate of Velpar did not exceed 1 lb/A for corn and 2/3 lb/A for sugarbeet and potato, except in areas of low rainfall (20 inches or less).
- ^{bh}10 months for a pH of 6.5/18 months when pH is higher than 6.5, except on irrigated soil where precipitation following application must exceed 25 inches prior to planting beets where the interval is 10 months on soils with pH is less than 7.5.
- ^{bi}Consult label for rainfall, location, rate, pH, and organic matter restrictions.
- ^{bj}2.0 oz/A or less/up to 3.0 oz/A.
- ^{bl}Up to 3.0 oz/A rate of Valor and a minimum of 1 inch of rainfall/irrigation has occurred between Valor application and replanting for field corn, cotton, sorghum, sunflower, tobacco and wheat. Rotation interval based on use rate and tillage practices; see label for other rates and rotation intervals.
- ^{bm}Soil pH of 7.9 or lower and Glean rate of 1/6 to 1/3 oz per acre/1/2 oz per acre rate.
- ^{bn}Refer to Glean label for pH, rate and cumulative precipitation restrictions in specified Nebraska counties.
- ^{bo}Following the 4.0 oz per acre rate to Federal CRP (Conservation Reserve Program) land.
- ^{bs}IR, IMR field corn/ IT, Normal field corn.
- ^{bt}IR, IMR, IT field corn may be planted the next cropping season.
- ^{bu}Rotation intervals should be extended to 18 months if drought conditions prevail after application and before the rotation crop is planted, unless sprinkler irrigation has been applied and totals greater than 15 inches during the growing season.
- ^{bv}Clearfield/normal (non-Clearfield).
- ^{bw}West/east of Highway 83.
- ^{bx}Rotation interval is based on soil pH, rainfall, tillage, and location west/east of Highway 83. See label.
- ^{by}18-month rotation for rates above 0.25 lb ai/A sulfentrazone.
- ^{bz}18 months for soils less than 2% organic matter AND rainfall less than 15 inches during 12 months following application.
- ^{ca}Applied prior to June 1 in previous year.
- ^{cb}Pea 9 months; snap bean 18 months.
- ^{cc}Extend to 12 months if drought conditions exist after application unless sprinkler irrigation totals greater than 15 inches during the growing season.
- ^{cd}Restrictions based on east or west of Highway 83 in Nebraska. See label for other soil and rainfall restrictions.
- ^{ce}If rate is 6.4 oz or higher on soils with 1.5% OM or less and pH is 7.0 and above.
- ^{cf}4-month use rate of 14 oz or less, 10-month rate above 14 oz.
- ^{cg}12 months up to 20 oz, 18 months over 20 oz.
- ^{ch}18 months if in sequence with 0.5 oz/A Classic or Synchrony XP for use season.
- ^{ci}At least 1 inch of rainfall or overhead irrigation must be received after last application. Rotation interval starts after rainfall/irrigation event.
- ^{cj}Interval for use rate of 1 pt or less / interval for use rate greater than 1 pt.
- ^{ck}Check the label for specific rotations for Clearfield® crops (corn, wheat, canola and sunflower).
- ^{cl}Rotation interval depends upon the rate applied and soil texture. See the label for detailed instructions.
- ^{cm}If soil pH is above 7.2, consult the label and use the longer rotation interval.
- ^{cn}Avoid planting back crops with known susceptibility to ALS/SU herbicides.
- ^{co}When soil pH is 7.5 or above, use longer rotation intervals. Consult the label.
- ^{cp}Additionally, 15 inches of cumulative precipitation must occur between application and planting of rotational crop.
- ^{cq}Additionally, 30 inches of cumulative precipitation must occur between application and planting of rotational crop.
- ^{cr}Use higher rotation interval if the use rate is 4 oz/A.
- ^{cs}Rotation interval should be extended to 18 months if drought conditions prevail after application unless at least 15 inches of sprinkler irrigation has been applied.
- ^{ct}For rates up to 3.2 oz; 4 months if soil is tilled prior to planting; 8 months if no tillage is performed. For rates of 3.21-4.25 oz use 6 and 12 months.

Replant Options and Rotation Restrictions *(continued)*

- ^{cu}Do not include time when soil is frozen and days before receiving any required rainfall or overhead irrigation
- ^{cv}9 months up to 20 fl oz/A, 18 months over 20 fl oz/A.
- ^{cw}West of highway 83, 9 months up to 16 fl oz/A, 18 months over 16 fl oz/A. East of highway 83, 18 months over 20 fl oz/A.
- ^{cx}Apply until 3 days after planting for rates up to 2.5 fl. oz/A, 7 days over 2.5 fl. oz/A; on light textured soils such as sands and loamy sands extend time by 7 additional days. on High pH soils (>7.9), extend time to planting by 7 additional days.
- ^{cy}For minimum and no-till, 14 days and on light textured soils such as sands and loamy sands extend time by 7 additional days. On high pH soils (>7.9), extend time to planting by 7 additional days. For conventional tillage, 30 days and at least one inch of rainfall/irrigation must occur between application and planting or crop injury may occur.
- ^{cz}If soil is tilled prior to planting, 4 months up to 2.5 oz/A, 6 months over 2.5 oz/A. If no tillage is performed, 8 months up to 2.5 oz/A, 12 months over 2.5 oz/A. Successful soil bioassay must be performed prior to planting crops.
- ^{da}3 months up to 2.5 oz/A, 4 months over 2.5 oz/A.
- ^{db}30 days up to 2.5oz/A, 2 months over 2.5oz/A. At least one inch of rainfall/irrigation must occur between application and planting or crop injury may occur.
- ^{dc}If soil is tilled prior to planting, 4 months up to 2.5 oz/A, 5 months over 2.5 oz/A. If no tillage is performed, 8 months up to 2.5 oz/A, 10 months over 2.5 oz/A.
- ^{dd}30 days and at least one inch of rainfall/irrigation must occur between application and planting or crop injury may occur.
- ^{de}45 days up to 2.5oz/A. 2 months over 2.5oz/A and at least one inch of rainfall/irrigation must occur between application and planting or crop injury may occur.
- ^{df}The rotation intervals should be extended to 18 months if drought conditions prevail after application and before the rotational crop is planted, unless sprinkler irrigation has been applied and totals greater than 15 inches during the growing season.
- ^{dg}4 months if winter cereal, 8 months is spring cereal.
- ^{dh}Except the sweet corn variety 'Merit', 'Carnival', and 'Sweet Success' for which the minimum interval is 15 months.
- ^{di}With composite soil pH >7.5, extend rotation interval to 18 months.
- ^{dj}Successful soil bioassay must be performed prior to planting canola, sugar beets and other crops not listed.
- ^{dk}At least one inch of rainfall/irrigation must occur between application and planting or crop injury may occur. Hybrid Seed Production: Corn inbred lines grown for hybrid seed production may be injured during the growing season following an application of Surveil. Inbred lines should be thoroughly tested for crop tolerance before rotating to large acreage. While growers are not prohibited from rotating to seed corn in the growing season following an application of Surveil, to the extent consistent with applicable law, Dow AgroSciences will not accept responsibility for any crop injury on field corn grown for seed following an application of Surveil.
- ^{dl}For use in Nebraska east of Hwy 281 and south of Hwy 30. Where soil pH is <6.8 and rates are <5 oz/A use shorter restriction interval. Where soil pH is between 6.8 and 7.2 and rates are >5 oz/A use longer restriction interval.
- ^{dm}Sorghum may be planted after 10 months where Authority Maxx was applied at rates 6.4 oz/A or less.
- ^{dn}Do not feed treated soybean forage or soybean hay to livestock.
- ^{do}7 days for no-till and up to 3 oz/A. 1 month for conventional-till fields.
- ^{dp}Up to 3.75 oz/A use shorter restriction interval. Over 3.75 oz/A use longer restriction interval.
- ^{dq}6 months for field peas, 11 months for edible peas.
- ^{dr}In Nebraska, Fierce XLT can be used south of Hwy 30 and east of Hwy 281.
- ^{ds}Do not reapply Acuron.
- ^{dt}Injury may occur to soybeans planted the year following application on soils having a calcareous layer if additional atrazine or atrazine-containing products are used. In western Nebraska, do not rotate soybeans for 18 months following application if the combined atrazine rate applied was more than 2 lbs ai/A, or equivalent band application rate, or soybean injury may occur
- ^{du}If applied after June 1, rotating to crops other than corn may result in crop injury.
- ^{dv}This rotational interval applies only to areas west of US Hwy 83 in the states of Colorado and Nebraska: If Acuron was applied to ground that was under center pivot irrigation and the soil pH is greater than 6.5, dry beans can be planted 10 months following application.
- ^{dw}120 days and over 24 fl oz/A and over 30" rainfall annually. 180 days and over 24 fl oz/A and under 30" rainfall annually.
- ^{dx}60 days up to 16 fl oz/A. 90 days 17-32 fl oz/A. 135 days 33-48 fl oz/A. 180 days 49-64 fl oz/A.
- ^{dy}120 days over 24 fl oz/A
- ^{dz}For Nebraska, only fields south of Hwy 30 and east of Hwy 281.
- ^{ea}14 days with minimum or no-till or 30 days (and at least one inch of rainfall/irrigation) with conventional tillage and up to 3 oz/A. 4 months up to 4 oz/A. 9 months over 6 oz/A.
- ^{eb}Anytime up to 3 oz/A. 4 months up to 4 oz/A. 9 months over 6 oz/A.
- ^{ec}4 months if soil is tilled prior to planting, 8 months if no tillage is performed and up to 2 oz/A. 6months if soil is tilled prior to planting, 12 months if no tillage is performed and up to 4 oz/A. 12months if soil is tilled prior to planting, 18 months if no tillage is performed and over 6 oz/A.

- ^{ed}30 days and at least one inch of rainfall/irrigation up to 2 oz/A. 2 months and at least one inch of rainfall/irrigation up to 3 oz/A. 4 months up to 4 oz/A. 9 months over 6 oz/A.
- ^{ee}4 months if soil is tilled prior to planting, 8 months if no tillage is performed and up to 2 oz/A. 5 months if soil is tilled prior to planting, 10 months if no tillage is performed and up to 3 oz/A. 6 months if soil is tilled prior to planting, 12 months if no tillage is performed and up to 4 oz/A. 12 months if soil is tilled prior to planting, 18 months if no tillage is performed and over 6 oz/A.
- ^{ef}3 months up to 2 oz/A. 4 months up to 3 oz/A. 6 months if soil is tilled prior to planting, 12 months if no tillage is performed and up to 4 oz/A. 12 months if soil is tilled prior to planting, 18 months if no tillage is performed and over 6 oz/A.
- ^{eg}30 days (and at least one inch of rainfall/irrigation) with conventional tillage and up to 3 oz/A. 4 months up to 4 oz/A. 9 months over 6 oz/A.
- ^{eh}Cover crops that are not grazed or harvested for food and terminated prior to seeding the next crop can be planted 90-120D after application of DiFlexx DUO. Prior to seeding a cover crop, a successful field/small scale bioassay should be completed.
- ^{ei}18 month restriction if red kidney or cranberry bean.
- ^{ej}Non-food or non-feed winter cover crops following harvest of corn may be planted. Do not graze or feed cover crops for 18 months following last application. This does not apply to winter wheat, which may be planted 4 months following last application or to nongrass animal feeds, which may be planted 9 months after last application.
- ^{ek}Injury may occur to soybeans planted the year following application on soils having a calcareous subsurface layer, if products containing atrazine were used at rates above 0.75 lbs ai per acre in tank mixtures or sequentially with Resicore.

Forage, Feed, and Grazing Restrictions for Row Crop Herbicides*

The following information is provided as a reference to the restrictions and limitations for the grazing and feeding of row crops to livestock. This information serves as a guide only and does not replace or supersede the label. Always read and follow label directions.

Herbicide	Restrictions
2,4-D	Do not forage or feed corn fodder for 7 days following application. Do not permit dairy animals or meat animals being finished for slaughter to forage treated grain fields within 2 weeks after treatment. Do not feed treated straw to livestock if a preharvest or emergency treatment is used. See label for further information.
Accent Q	Do not graze or feed forage or grain from the treated areas to livestock within 30 days after application.
Achieve	Mature straw and grain may be fed to livestock 45 days after treatment. Immature crops (forage) may be grazed or cut for hay 30 days after treatment.
Acuron	Do not graze or feed forage from treated areas for 45 days following application.
Afforia	Do not graze treated soybean fields or harvest for forage or hay.
Aim	Do not feed soybean forage or hay to livestock. Do not feed small grain forage for 7 days.
Anthem MAXX	Do not feed soybean hay or forage to livestock. Do not feed corn forage for 30 days after application. Do not harvest or feed corn grain or fodder for 70 days after last application.
Anthem ATZ	Do not harvest for forage for 60 days or for grain and stover for 70 days after the last application. Do not harvest sweet corn or feed forage for 45 days after application.
Armezon/Armezon Pro	Do not graze or feed treated corn forage, silage, fodder, or grain for at least 45 days after application.
Arrow	Do not graze treated fields or feed treated forage or hay to livestock.
Assure II	Do not graze treated fields or harvest for forage or hay.
Atrazine	Do not graze or feed forage from treated areas for 21 days following application, or illegal residues may result.
Authority Assist	Do not feed treated soybean forage, soybean hay, or soybean straw to livestock.
Authority Elite	Do not feed soybean forage or hay to livestock.
Authority First	Do not feed treated soybean forage or hay to livestock.
Authority MTZ	Do not graze treated soybeans or harvest for forage or hay.
Authority XL/Authority Maxx	Do not feed treated soybean forage or hay to livestock.
Balance Flexx	Corn may be harvested for forage 45 days after a postemergence application.
Banvel	Do not graze or harvest for livestock feed prior to crop maturity.
Basagran	Do not graze treated fields for at least 30 days after application.
Beacon	Do not graze or feed forage from treated corn to livestock within 60 days after application.
Beyond	No restrictions.
Bicep II/Bicep II Magnum, Bicep Lite II/Bicep Lite II Magnum	Do not graze or feed forage from treated areas for 60 days following application.
Blazer	Do not use treated plants for feed or forage.
Boundary	Soybean plants or hay may be grazed or fed to livestock 40 days after application.
Breakfree ATZ	Do not apply within 60 days of harvest for forage use.
Breakfree ATZ Lite	Do not apply within 60 days of harvest for forage use.
Broadaxe	Do not feed soybean forage or hay to livestock.
Bronate	Do not graze treated fields for 30 days following application.
Buctril	Do not cut for feed or graze within 45 days after application.
Buctril + atrazine	Do not cut crop for feed or graze within 45 days after application.
Bullet	Do not graze treated area or feed treated forage to livestock for 60 days following application.
Butyrac/Butoxone (2,4-DB)	Do not graze or feed soybean hay within 60 days after application of a 2,4-DB tank-mix application.
Cadet	Do not feed treated soybean forage to livestock. Do not harvest or feed corn grain or stover for 90 days following application. Do not harvest or feed field corn forage for 30 days after application.
Callisto	Do not harvest forage, grain, or stover within 45 days after application.
Callisto GT	Do not graze or feed forage from treated areas for 45 days following application.
Callisto Xtra	Do not harvest field corn within 60 days after application and sweet corn with 45 days after application.
Canopy EX	Allow 14 days after application before grazing or feeding forage or hay.
Capreno	Do not apply within 45 days of grazing livestock or harvesting corn forage.

*This table is produced in cooperation with the University of Missouri.

Herbicide	Restrictions
Cinch	Do not feed or graze forage from treated areas for 30 days following application (all corn).
Cinch ATZ	Do not graze or feed forage from the treated area following application to sweet corn (45 days) and field corn and sorghum (60 days).
Cinch ATZ Lite	Do not graze or feed forage from treated area following application to field corn (30 days).
Clarity	For lactating dairy animals, do not harvest forage within 37, 51 or 70 days for 1, 2, and 4 pt/A use rates, and do not graze within 7, 21, and 40 days for 1, 2, and 4 pt/A applications. No restrictions for other animals.
Classic	Do not graze treated fields or harvest for forage or hay.
Cobra	Do not graze animals on green forage or stubble. Do not use hay or straw for animal feed or bedding.
Command	Do not allow livestock to graze on treated fields or crop residue, or feed treated forage to livestock.
Conclude/Conclude Ultra/Conclude Xact/Conclude Xtra	Do not use treated plants for feed or forage.
Corvus	Corn may be harvested for forage 45 days after a postemergence application.
Degree	No information on label. Consult product manufacturer.
Degree Xtra	No information on label. Consult product manufacturer.
Diflex	Do not harvest forage for 45 days after application. Corn grain and stover may be harvested once the crop has reached the ensilage (milk) stage.
Distinct	Do not apply within 32 days of forage harvest. Do not apply within 72 days of corn grain and stover harvest.
DSMA	Do not feed treated foliage to livestock or graze treated areas.
Dual II/Dual II Magnum	Do not graze or feed forage from treated areas for 30 days following application.
Enlist Duo	Do not graze treated soybean. Do not harvest for forage or hay.
Enlite	Do not graze treated areas or harvest for forage or hay.
Envive	Do not graze treated areas or harvest for forage or hay.
Eradicane	No information on label. Consult product manufacturer.
ET	Do not allow livestock to graze treated areas.
Expert	Do not graze or feed forage from treated areas for 60 days.
Extreme	Do not graze or feed treated soybean forage, hay, or straw to livestock.
Fierce/Fierce XLT	Do not graze treated fields or feed treated forage or hay to livestock.
FirstRate	Do not harvest soybeans for forage or hay for 14 days after application.
Flexstar	Do not graze treated areas or harvest for forage or hay. Do not graze rotated small grain crops or harvest for livestock forage or straw.
Flexstar GT	Do not graze treated areas or harvest for forage or hay.
Frontrow	Do not graze or feed treated soybean forage, hay or staw to livestock.
Fultime NXT	No information on label. Consult product manufacturer.
Fusilade DX	Do not graze or harvest for forage or hay.
Fusilade 2000	Do not graze or harvest for forage or hay.
Fusion	Do not graze or harvest for forage or hay.
Glyphosate♦	Refer to product label for specific information.
G-MAX Lite	<i>Corn</i> : Do not graze or feed treated forage within 60 days of application. <i>Sorghum</i> : Do not graze or feed forage within 80 days of application.
Goal	Do not use treated plants for feed or forage or allow animals to graze treated areas.
Gramoxone SL	<i>Soybean POST directed</i> : Do not graze treated areas or feed treated forage to livestock. <i>Corn harvest aid</i> : Do not use on corn grown for fodder or forage. Do not pasture livestock in treated fields. <i>Soybean harvest aid</i> : Do not pasture livestock within 15 days of treatment and remove 30 days before animal harvest.
Guardsman Max	<i>Corn</i> : Do not graze or feed treated forage within 60 days of application. <i>Sorghum</i> : Do not graze or feed forage within 80 days of application.
Halex GT	Do not graze or feed forage from treated areas for 45 days after application.
Harmony Extra	Do not graze or feed forage or hay from treated areas to livestock (dry-harvested straw may be used for bedding and/or feed).
Harmony GT XP	Do not graze or feed forage, hay, or straw from treated areas to livestock for 30 days after application.
Harness	No information on label. Consult product manufacturer.
Harness Xtra	No information on label. Consult product manufacturer.
Hoelon	Do not allow livestock to graze treated fields. Do not harvest forage, hay, or straw from treated fields.
Hornet WDG	Allow 45 days before harvesting for forage or silage.

♦See pages 193-199 for information on common glyphosate formulations.

Herbicide	Restrictions
Huskie	Do not graze or harvest forage within 25 days or grain and straw within 60 days after application.
Impact	Do not graze or feed treated corn forage, silage, or grain for at least 45 days after application.
Intrro	<i>Grain sorghum</i> : Do not graze harvest forage for 70 days following application. <i>Soybeans</i> : Do not feed forage, hay, or straw. Do not ensile treated soybeans.
Keystone NXT	Allow 45 days before harvesting for forage or silage.
Lariat	Do not graze treated area or feed treated forage to livestock for 60 days following application.
Laudis	Do not graze livestock or harvest corn forage within 45 days of application.
Liberty	Do not harvest corn forage within 60 days of application.
Lightning	Do not graze or feed treated corn forage, silage, fodder or grain for at least 45 days after application.
Linex	Do not graze treated fields or feed forage from treated areas to livestock. Do not feed gin trash to livestock.
Lumax EZ/Lexar EZ	Do not graze or feed forage for 45 days. Do not harvest forage, grain, or stover within 45 days after application.
Marvel	Do not feed soybean forage or hay to livestock.
MCPA	Do not forage or graze meat or dairy animals on treated areas within 7 days of slaughter.
Me-Too-Lachlor II	Do not graze or feed forage from treatment areas for 30 days following application.
Moxy	Do not cut crop for feed fodder or graze within 45 days of application.
MSMA	Do not feed treated foliage to livestock or graze treated areas.
NorthStar	Do not graze or feed forage from NorthStar-treated corn to livestock within 30 days following application. Do not harvest silage within 45 days after application.
Optill/Optill PRO	Do not graze or feed treated soybean forage, hay, or straw to livestock.
Orion	Do not allow livestock to graze treated areas or harvest forage within 7 days of application. Do not apply closer than 14 days before cutting of hay or 40 days before harvest of grain or straw.
Outlook	<i>Corn</i> : Do not graze or feed forage within 40 days of application. <i>Sorghum (forage)</i> : Do not graze or feed forage within 60 days of application. <i>Sorghum (grain)</i> : Do not graze or feed forage within 80 days of application. <i>Soybean</i> : Do not graze or feed forage, hay, or straw to livestock
Paramount	Do not graze treated areas. Do not harvest hay from treated areas for 309 days. Do not feed forage or fodder from treated areas.
Peak	Do not graze or feed forage from treated crops until 30 days following application. Do not harvest for silage until 40 days following application.
Permit	Allow 30 days before grazing and harvest of forage or silage.
Phoenix	Do not graze animals on green forage or stubble. Do not feed treated soybean silage (ensiled soybeans) to cattle. Do not utilize hay or straw for animal feed or bedding.
Poast/Poast Plus	Do not graze treated fields and do not feed treated soybean forage (green succulent) or ensilage to livestock. Treated soybean hay may be fed. Do not apply within 75 days of harvest for fodder or forage/silage.
Prequel	Do not graze or feed forage, grain, or stover from treated areas to livestock for 30 days after application.
Princep	Do not graze treated areas, or illegal residues may occur.
Priority	Following application to foliage, allow 30 days before grazing livestock, harvesting forage, or harvesting silage.
Prowl H ₂ O	<i>Sorghum</i> : Do not graze or feed forage within 21 days of application. <i>Corn</i> : Do not graze within 21 days of application. <i>Soybean</i> : Livestock can graze or be fed forage from treated soybean field.
Pulsar	Do not allow livestock to graze treated area or harvest forage within 7 days of application. Do not apply closer than 14 days before cutting of hay or 40 days before harvesting of grain or straw.
Pursuit Plus	Do not graze or feed treated soybean forage, hay or straw to livestock.
Pursuit	Do not graze or feed treated soybean forage, hay or straw to livestock.
Python	Do not graze or feed treated soybean forage, hay or straw to livestock. No corn information on label.
Raptor	No restrictions.
Realm Q	Do not graze or feed forage, grain, or fodder (stover) from treated areas to livestock within 45 days of application.
Reflex	Do not graze treated areas or harvest for forage or hay. Do not graze rotated small grain crops or harvest for livestock forage or straw.
Reglone	Do not graze or feed treated forage to livestock. Do not use seed from treated plants for food, feed or oil purposes.
Resicore	Do not apply within 45 days of harvest for ears and forage or within 60 days of harvest for stover.
Resolve	Do not graze, feed forage, grain or fodder (stover) from treated areas to livestock within 30 days of Resolve SG application.
Resource	Do not graze animals on green forage or use as feed prior to 28 days after application.
Revulin Q	Do not graze, feed forage, grain, or fodder (stover) from treated areas to livestock within 45 days of application. Do not harvest grain within 70 days or harvest forage or stover within 45 days of application.

Herbicide	Restrictions
Roundup PowerMAX	Allow a minimum of 7 days for corn and 14 days for soybeans between application and feeding of treated vegetation. <i>General:</i> Do not harvest or feed treated vegetation for 8 weeks after application unless otherwise specified.
Roundup WeatherMAX	<i>Roundup Ready corn:</i> Do not harvest or feed treated crops within 7 days of application. <i>Roundup Ready soybeans:</i> Do not harvest or feed treated crops within 14 days of application. <i>Forage legumes:</i> If application is greater than 44 oz, wait 8 weeks before grazing or feeding to livestock. <i>Pastures:</i> Do not harvest or feed treated crops within 8 weeks of application. <i>Corn, sorghum, and wheat harvest aid:</i> Allow 7 days between application and harvest of treated vegetation. <i>Soybean harvest aid:</i> Do not graze or harvest treated hay or fodder for livestock feed within 25 days of application.
Rowel	Except for field corn, do not graze treated fields or feed treated forage or hay to livestock.
Rowel FX	Do not graze treated fields or feed treated forage or hay to livestock.
Scepter	Do not graze or feed treated soybean forage, hay, or straw to livestock.
Select MAX	Except for alfalfa (15 days), do not graze treated fields or feed treated forage or hay to livestock.
Sencor/Dimetric	Treated vines may be grazed or fed to livestock 40 days after application.
Sequence	Do not graze or feed treated forage or hay to livestock following a POST application to soybeans.
Sharpen	<i>Corn:</i> Forage or silage may be harvested, fed, or grazed 80 or more days after application. <i>Sorghum:</i> Forage can be harvested, fed, or grazed 70 or more days after application. <i>Soybeans:</i> Forage may be fed or grazed 65 or more days after application.
Solistice	Do not harvest or feed forage for 45 days after application. Do not feed stover for 70 days after application. Do not harvest sweet corn ears or forage for 40 days after application.
Sonalan	Do not graze or forage crop grown in treated soil or cut for hay or silage.
Sonic	Do not feed treated soybean forage or soybean hay to livestock.
Spartan	No information on label. Consult product manufacturer.
Spirit	Do not graze or feed forage from treated crops to livestock for 30 days after application.
Stalwart C	Do not feed or graze forage from treated areas for 30 days following application.
Stalwart Xtra	Do not graze or feed forage from treated areas for 60 days following application to field corn or popcorn.
Starane Ultra	<i>Corn:</i> Do not allow livestock to graze or harvest forage from treated areas within 47 days of application. <i>Sorghum:</i> Do not allow livestock to graze or harvest forage from treated areas within 40 days of application. <i>Small Grain:</i> Do not graze or harvest forage for 7 days following treatment.
Steadfast Q	Do not graze or feed forage, hay, or straw from treated areas to livestock within 30 days of application.
Storm	Do not use treated plants for feed or forage.
Stout	Do not graze or feed treated forage or hay to livestock for 30 days following application.
SureStart/TripleFLEX	No restrictions on the label.
Surpass NXT	No restrictions.
Synchrony XP	Do not graze treated fields for forage or hay.
Targa	Do not graze treated fields or harvest for forage or hay.
TopNotch	No restrictions.
Touchdown	Do not graze or harvest treated cover crops for feed.
Touchdown Total	<i>Roundup Ready corn:</i> Allow a minimum of 50 days between POST application and harvest of forage. <i>Roundup Ready soybeans:</i> Do not graze or harvest for forage or hay.
Treflan	<i>Alfalfa:</i> Wait 21 days after application before grazing alfalfa. No other information on label. Consult product manufacturer.
Trivence	Do not graze treated fields or harvest for forage or hay.
Trizmet II	Do not feed or graze forage from treated areas for 30 days following application.
Ultra Blazer	Do not use treated plants for feed or forage.
Valor SX	Except for field corn, do not graze treated areas or harvest for forage or hay.
Valor XLT	Do not graze treated areas or harvest for forage or hay.
Velpar DF/L/AlfaMax/AlfaMax Gold	Do not apply within 30 days of cutting, feeding for forage, or grazing.
Verdict	<i>Corn or popcorn silage</i> can be harvested, fed, or grazed 80 or more days after application. <i>Sorghum:</i> Forage and silage can be harvested, fed or grazed 70 or more days after application. <i>Soybean:</i> Do not graze or feed forage, hay, or straw to livestock.
Warrant	Do not graze or feed treated soybeans for feed. Do not graze or feed treated corn for 40 days after application.
Warrant Ultra	Do not graze treated areas of feed treated forage to livestock following application of this product.
Yukon	<i>Corn:</i> Following application to foliage, corn may be grazed or harvested for feed after the crop reaches ensilage (milk) stage at least 30 days after application
Zemax	Do not graze or feed forage from treated areas for 45 days following application.
Zidua	(BASF) Grazing restrictions not addressed on the label.

Grazing Restrictions for Pasture and Range Herbicides

Herbicide	Product per Acre	Lactating Dairy Animals		Beef and Non-Lactating Animals (Includes equines and nonlactating dairy)		
		Before Grazing	Before Hay Harvest	Before Grazing	Before Hay Harvest	Removal Before Slaughter
2,4-D/MCPA ^c	0.5 pt-1.0 qt	7-14 days	30 days	0-7 days	0-30 days	0
AMBER	0.28-0.56 oz	0	0	0	0	0
BRASH/ CLARITY/BANVEL/ STERLING BLUE/ DICAMBA [•]	Up to 1 pt Up to 2 pt Up to 4 pt Up to 16 pt	7 days 21 days 40 days 60 days	37 days 51 days 70 days 90 days	0 0 0 0	0 0 0 0	30 days 30 days 30 days 30 days
CHAPARRAL/OPENSIGHT	1.0-3.3 oz	0	0	0	0	0
CIMARRON MAX	See label	7 days	37 days	0	0	30 days
CIMARRON PLUS	0.125-1.25 oz	0	0	0	0	0
CIMARRON X-TRA	0.05-2.0 oz	0	0	0	0	0
CROSSBOW 3S	1.0 to 6.0 qt	1 year	14 days	0	14 days	3 days
CURTAIL	2.0 to 4.0 pt	14 days	30 days	0	30 days	7 days ^e
DISTINCT	4.0 to 8.0 oz	0	0	0	0	0
ESCORT XP	0.33-1.66 oz 1.67-3.33 oz	0 3 days	0 3 days	0 3 days	0 3 days	0 3 days
FOREFRONT	1.5 to 2.6 pt	0	7 days	0	7 days	0
GARLON 3A	0.5-1.5 gal/100.0 gal	1 year	1 year	14 days	14 days	3 days
GLYPHOSATE [♦]	(Check label. Restrictions vary by product and type of application.)					
GRAMOXONE SL ^a	1.5 to 2.0 pt	1 month	1 month	1 month	1 month	0
GRAZON P+D ^b	3.0-4.0 pt	7 days	30 days	0	30 days	3 days
MILESTONE	3.0-7.0 oz	0	0	0	0	0
OVERDRIVE	4.0-8.0 oz	0	0	0	0	3 days
PASTUREGARD	1.5-2.0 pt	1 year	1 year	0	14 days	3 days
PLATEAU	4.0-12.0 oz	0	7 days	0	7 days	0
RAVE	2.0-5.0 oz	7 days	—	0	—	30 days
REDEEM R&P	1.5-4.0 pt	14 days	1 year	0	7 days	3 days
REMEDY	1.0-2.0 qt	14 days	1 year	0	7 days	3 days
SHARPEN	1-2 OZ	0	0	0	0	0
SPIKE 20P	1/2 oz per 45 sq ft	0 days ^e	1 year ^d	0	1 year ^d	0 days ^d
STINGER 3E	0.66 to 1.31 pt	0	0	0	0	0
SURMOUNT	1.5-4.0 pt	14 days	7 days	0	7 days	3 days
TELAR XP	Up to 1.33 oz	0	0	0	0	0
TORDON 22K ^b	0.5 to 2.0 pt	14 days	14 days	0	14 days (if greater than 1 qt/A)	3 days
TRANSLINE	0.25-1.3 pt	0	0	0	0	0
WEEDMASTER	1.0-4.0 pts	7 days	37 days	0	37 days	30 days

^aRestrictions based on the degree of new seedling establishment before grazing. Suggested at least 6 inches of grass or legume seedling growth which is approximately one month. Late fall seeding may require 3 to 5 months before the suggested 6-inch height is reached.

^bMove livestock to untreated grass pasture for 7 days before transferring livestock to broadleaf crop or pasture areas. Removal before slaughter statement only applies to animals grazing treated forage for 2 weeks immediately after application. If greater than 1 qt/A, only spot treatments are allowed; total acres cannot exceed 25% of landowner's areas in any particular watershed.

^cBe sure to check individual product labels for restrictions and use rates due to the large number of formulations available.

^dIf no more than 20 lb per acre used.

^eWithdrawal not needed if 2 weeks or more time elapsed since application.

[•]Dicamba is the active ingredient in Banvel, Clarity, Sterling Blue and several other herbicides. The rates and information provided here are based on the same 4 lb/gal acid equivalent formulation found in Banvel, Clarity and Sterling Blue.

[♦]See the glyphosate product comparison table on pages 193-199 for more information on the different glyphosate products available.

Growth Regulator Herbicides

Growth regulator herbicides include 2,4-D, Clarity, Stinger, MCPP, MCPA, Tordon and others. (See pages 9-10 for herbicides classified as growth regulators.) These herbicides are valuable in controlling broadleaf weeds in crops, range, turf, and landscape situations. However, these products can also damage nearby vegetable or ornamental crops, ornamentals, trees or shrubs. Damage is usually the result of chemical drift. There are two kinds of chemical drift: vapor drift and particle drift.

Vapor Drift: The vaporization of a herbicide followed by movement off target. Vaporization and vapor drift increase as temperature increases. Vaporized herbicides can travel long distances before contacting and damaging non-target plants.

Particle Drift: The movement of droplets (particles) from the sprayer nozzle. Spraying when the wind speed is too high is the leading cause of particle drift. Typically, if the windspeed is over 10 mph, it is too windy to spray.

All herbicide products are subject to particle drift, but product susceptibility to vapor drift varies. See page 30 for pointers on reducing drift. Regardless of the specific growth regulator you use, be sure to spray in the right conditions. Below is information on some of the more common growth regulators.

2,4-D

2,4-D is an active ingredient in many herbicides. It is used to control broadleaf weeds in selected crop, range, turf, and landscape areas; however, inappropriate use of 2,4-D often results in injury to non-target plants.

2,4-D is available in 4 lb and 6 lb formulations. The 4 lb is most common. Make sure you understand what rate of what formulation you are going to spray since it only takes 2/3 pint of 6 lb 2,4-D to have the same activity as 1 pint of 4 lb 2,4-D.

2,4-D is available in ester and amine formulations. Esters vaporize readily and result in vapor drift which can travel long distances. The low volatility (LV) esters reduce the amount of volatilization but some will still likely volatilize at temperatures above 85°F. The amine salt formulation is nonvolatile. During warm weather (temperatures above 85°F), only amine formulations of 2,4-D should be used. The ester formulation is more effective at penetrating the leaf cuticle, so amine use rates are usually higher than ester rates to compensate for reduced absorption. All 2,4-D formulations are subject to particle drift. A selection of products that contain 2,4-D include:

2,4-D Amine 4	Cornbelt Amine
2,4-D LV4	Credit Master
2,4-D LV6	Crossbow
Amine 4 2,4-D	Curtail
Banvel + 2,4-D	D-638
Barrage HF	DMA4 IVM
Brash	Esteron 99
Brush Rhap	Five Star
Brushmaster	Formula 40
Campaign	Grazon P+D
Chaser 2 Amine	HardBall
Chaser Turf Herbicide	Hi-DEP
Cimmaron Max	Kamba Master
Cornbelt 6 lb LoVol	Landmaster BW
Cornbelt 4 lb LoVol	Latigo

Low Vol 4 Ester Weed Killer	Strike 3
Low Vol 6 Ester Weed Killer	Strike 3 Ultra
Maestro D	Three-way
MEC Amine-D	Triamine
Oasis	Trimec Broadleaf Herbicide
Opti-Amine	Trimec Classic
Outlaw	Trimec Plus
PastureMaster	Trimec
Pasture MD	Triplet
Pathway	Turf Weed
Phenoxy 088	Turret
Range Star	Unison
Recoil	Veteran 10G
Saber	Weedar 64
Salvo	Weedone LV4
Savage	Weedone LV6 EC
Shotgun	Weedone 638
Speed Zone	Weedmaster Herbicide

Aminocyclopyrachlor

Aminocyclopyrachlor is the newest growth regulator herbicide active ingredient. It will be used in rangeland, pasture, natural areas, and turf. Aminocyclopyrachlor is not typically subject to vapor drift, but is subject to particle drift. It has soil residual activity and may carry over into the next season. Products that contain aminocyclopyrachlor include:

Perspective	Viewpoint
Streamline	

Aminopyralid

Aminopyralid is the active ingredient in Milestone. Aminopyralid is not typically subject to vapor drift, but is subject to particle drift. It has soil residual activity and may carry over into the next growing season. Products that contain aminopyralid include:

Chaparral	Milestone VM
CleanWave	Milestone VM Plus
Forefront R&P	Opensight
Milestone	PasturAll

Clopyralid

Clopyralid is the active ingredient in Stinger. Clopyralid is not typically subject to vapor drift, but is subject to particle drift. It has soil residual activity and may carry over into the next growing season. Products that contain clopyralid include:

Brazen	Millennium Ultra 2
Clean Slate	Redeem R&P
Clopyr AG	Refute
Colt AS	Solix 3
Commando	Spur
Confront	Stinger
Curtail	Strike 3
Curtail M	Strike 3 Ultra 2
Cutback	Sure Start
Cutback M	Transline
Garrison	TripleFLEX
Hat Trick Three Way	TruPower 2
Hornet WDG	Truslate
Lontrel	WideMatch

Dicamba

Dicamba is the active ingredient in Banvel and Clarity. It is prone to both particle drift and vapor drift. Vapor drift is less common with dicamba than with 2,4-D ester. Each year products containing dicamba damage trees, soybeans, alfalfa and other broadleaf plants in Nebraska, primarily due to particle drift. Use safe practices and spray when weather conditions minimize the risk of drift. Products that contain dicamba include:

Agility SG	NorthStar
Banvel	Onetime
Banvel + 2,4-D	Outlaw
Banvel SGF	Overdrive
Banvel-K + Atrazine	Pasture Master
Brash	Pasture MD
Brash GFC	Power Zone
Brush-Rhap	Pulsar
Brushmaster	Quincept
Celebrity	Range Star
Celebrity Plus	Rave
Cimmaron Max	Redzone 2
Clarifier	Require Q
Clarity	Rifle
Clash	Rifle Plus
Cool Power	Speed Zone
Co Starr	Status
Detonate	Sterling Blue
DiCamba K	Strike 3
Dicambazine	Strut
Dicamba DMA Salt	Surge
Dicamba SG	Three-way
Dicamba XP	Tie-down
Diflexx	Trimec
Distinct	Trimec Broadleaf
Eliminate	Trimec Classic
Endrun	Trimec Plus
Escalade 2	Trimec DMB
Fallow Master Broadspectrum	Trimec Encore
Fallow Star	Triplet
Fuego	Trooper Extra
GlyKamba	TruPower 2
Horsepower	T Zone
Kamba Master	Vanquish
Latigo	Veteran 720
Lightning	Vision
Lock up Extra 2	Weedmaster
Marksman	Yukon
Mec Amine-D	
Momentum Q	

Fluroxypyr

Fluroxypyr is the active ingredient in Starane. It is labeled for use in selected crops, range, perennial grass pasture and non-crop areas. It is not typically subject to vapor drift, but is subject to particle drift. It has soil residual activity. Products that contain fluroxypyr include:

Battleship III	Starane
Chaser Ultra 2	Starane NXT
Cleansweep D	Starane Ultra
Colt AS	Starane + Sword
Comet	Strike 3 Ultra
Confront	Surmount
Escalade 2	Tailspin
Fluroxypyr	Trooper Pro
Hat Trick Three Way	Trumpcard
Momentum FX2	Vista
PastureGard	Vista XRT
Pulsar	WideMatch
Spotlight	

Picloram

Picloram is the active ingredient in Tordon. It is labeled for control of woody plants and annual and perennial broadleaf weeds in rangeland, perennial grass pastures and non-crop areas. It is not typically subject to vapor drift, but is subject to particle drift. It has a long soil residual activity, resulting in carryover to subsequent growing seasons. Products that contain picloram include:

Grazon P+D	Tordon 22K
Gunslinger	Tordon 101 Mixture
HiredHand P+D	Tordon RTU
Pathway	Triumph K
OutPost 22K	Triumph 22K
Picloram 22K	Trooper Extra
Picloram K	Trooper Pro
Surmount	Trooper P + D
Terva 22K	Trooper 101
Tordon K	Trooper 22 K

Triclopyr

Triclopyr is the active ingredient in Remedy and Garlon. It is labeled for use in turf, rangeland, grass pasture, CRP and non-crop areas. Triclopyr is not typically subject to vapor drift, but is vulnerable to particle drift. Triclopyr has soil residual activity. Products that contain triclopyr include:

Candor	Progeny
Chaser 2 Amine	Redeem R&P
Chaser Turf Herbicide	Refute
Confront	Remedy
Cool Power	Remedy Ultra
Crossbow	Tahoe 3A
Crossroad	Tahoe 4E
Element 3A	Tailspin
Element 4	Triclopyr 3A
Garlon 3A	Triclopyr 3SL
Garlon 4	Triclopyr 4E
Garlon 4 Ultra	Triclopyr R&P
Garlon XRT	Trycera
Horsepower	Turflon Ester
Milestone VM Plus	Turflon Ester Ultra
PastureGard	Turflon II Amine
Pathfinder II	

Glyphosate Herbicide Comparison

Glyphosate products differ in active ingredient salt, concentration and surfactant requirements, and labelling for use in Roundup Ready crops. Below is a list of the more common products labeled for use in Roundup Ready corn and soybean. Other registered glyphosate products are listed at <http://www.cdms.net> or <http://www.kellysolutions.com/ne/pesticideindex.htm>. Before applying any glyphosate product, consult the label to verify legal use of that product in Roundup Ready crops.

Brand Name	Distributor	Glyphosate Salt ¹	Glyphosate Concentration ²		Equivalent Rates to Roundup Original ³		Additional Surfactant
			Salt ²	Acid Equivalent ³	1 pint	1 quart	
			—— lb/gal ——				
Abundit Extra	DuPont	IPA	4.0	3.0	16.0 fl oz	32.0 fl oz	Not required
Alecto 41HL	Ritter Chemical	1PA	4.0	3.0	16.0 fl oz	32.0 fl oz	May be added
Alecto 41UL	Ritter Chemical	IPA	4.0	3.0	16.0 fl oz	32.0 fl oz	Required
Alecto 41S	Ritter Chemical	IPA	4.0	3.0	16.0 fl oz	32.0 fl oz	Not required
Buccaneer	Tenkoz	IPA	4.0	3.0	16.0 fl oz	32.0 fl oz	May be added
Buccaneer 5	Tenkoz	IPA	5.0	3.75	12.8 fl oz	25.6 fl oz	May be added
Buccaneer Plus	Tenkoz	IPA	4.0	3.0	16.0 fl oz	32.0 fl oz	May be added
Cornerstone	WinField Solutions	IPA	4.0	3.0	16.0 fl oz	32.0 fl oz	May be added
Cornerstone Plus	WinField Solutions	IPA	4.0	3.0	16.0 fl oz	32.0 fl oz	Not required
Cornerstone 5 Plus	WinField Solutions	IPA	5.4	4.0	12.0 fl oz	24.0 fl oz	May be added
Credit Extra	NuFarm	DA + K	1.8 + 1.6	1.65 + 1.35	16.0 fl oz	32.0 fl oz	May be added
Credit Extreme	NuFarm	IPA + K	2.5 + 2.0	4.5	11.0 fl oz	22.0 fl oz	Not required
Credit 41	NuFarm	IPA	4.0	3.0	16.0 fl oz	32.0 fl oz	May be added
Credit 41 Extra	Nufarm	IPA	4.0	3.0	16.0 fl oz	32.0 fl oz	May be added
Duramax	Dow AgroSciences	DMA	5.4	4.0	12.0 fl oz	24.0 fl oz	Not required
Durango DMA	Dow AgroSciences	DMA	5.4	4.0	12.0 fl oz	24.0 fl oz	Not required
Extra Credit 5	Nufarm	IPA	5.0	4.0	12.0 fl oz	24.0 fl oz	May be added
Gly-4	UCPA	IPA	4.0	3.0	16.0 fl oz	32.0 fl oz	May be added
Gly-4 Plus	UCPA	IPA	4.0	3.0	16.0 fl oz	32.0 fl oz	Not required
Glyphos X-tra	Cheminova	IPA	4.0	3.0	16.0 fl oz	32.0 fl oz	Not required
Glyphogan TM	MANA	IPA	4.0	3.0	16.0 fl oz	32.0 fl oz	May be added
Glyphomax Plus	Dow AgroSciences	IPA	4.0	3.0	16.0 fl oz	32.0 fl oz	Not required
Glyphomax XRT	Dow AgroSciences	IPA	5.4	4.0	12.0 fl oz	24.0 fl oz	Not required
Gly Star Original	Albaugh	IPA	4.0	3.0	16.0 fl oz	32.0 fl oz	May be added
Gly Star Plus	Albaugh	IPA	4.0	3.0	16.0 fl oz	32.0 fl oz	Not required
Gly Star 5 Extra	Albaugh	IPA	5.4	4.0	12.0 fl oz	24.0 fl oz	Not required
Honcho	Monsanto	IPA	4.0	3.0	16.0 fl oz	32.0 fl oz	May be added
Honcho Plus	Monsanto	IPA	4.0	3.0	16.0 fl oz	32.0 fl oz	May be added
Makaze	Loveland	IPA	4.0	3.0	16.0 fl oz	32.0 fl oz	Not required
Makaze Yield Pro	Loveland	IPA	4.0	3.0	16.0 fl oz	32.0 fl oz	Not required
Rascal	WinField Solutions	IPA	4.0	3.0	16.0 fl oz	32.0 fl oz	May be added
Rascal Plus	WinField Solutions	IPA	4.0	3.0	16.0 fl oz	32.0 fl oz	Not required
Rattler	Helena	IPA	4.0	3.0	16.0 fl oz	32.0 fl oz	May be added
Rattler Plus	Helena	IPA	4.0	3.0	16.0 fl oz	32.0 fl oz	May be added
Roundup Original	Monsanto	IPA	4.0	3.0	16.0 fl oz	32.0 fl oz	May be added
Roundup Original Max	Monsanto	K	5.5	4.5	11.0 fl oz	22.0 fl oz	May be added
Roundup PowerMAX	Monsanto	K	5.5	4.5	11.0 fl oz	22.0 fl oz	May be added
Roundup WeatherMAX	Monsanto	K	5.5	4.5	11.0 fl oz	22.0 fl oz	Not required
Touchdown CT	Syngenta	K	5.0	4.17	12.0 fl oz	24.0 fl oz	May be added
Touchdown HiTech	Syngenta	K	5.5	5.0	9.6 fl oz	19.2 fl oz	Required
Touchdown Total	Syngenta	K	5.0	4.17	12.0 fl oz	24.0 fl oz	Not required
Traxion	Syngenta	K	5.0	4.17	12.0 fl oz	24.0 fl oz	May be added

¹Glyphosate may be formulated as one of several different salts, including: IPA= Isopropylamine, MA = Monoammonium, DA = Diammonium, K = Potassium, and DMA = dimethylammonium. It also can be delivered as a dry product, formulated either as a salt or as an acid.

²The concentration of glyphosate can be expressed two ways: salt and acid equivalent. The glyphosate salt is considered the active ingredient of the herbicide. Because the glyphosate salts differ in weight, the use of the acid equivalent (glyphosate as an acid, no salt) expresses how much glyphosate is actually in the formulation. For example, in the Roundup Original formulation the active ingredient concentration is 4 lb/gal (the IPA salt of glyphosate), but the amount of glyphosate (the acid equivalent) is 3 lb/gal.

³Rates are equivalent to the normal use rates of Roundup Original in Roundup Ready corn and soybeans. 1 pint = 16 oz; 1 quart = 32 oz.

Guidelines for the Use of Glyphosate♦ on Roundup Ready Soybean

The labeled limit for in-crop application of glyphosate to Roundup Ready Soybeans is 96 fl oz/A♦. Glyphosate should not be applied to soybeans after pods begin to form (R3).

Guidelines for the Use of Glyphosate♦ on Roundup Ready Corn

There are currently two different Roundup Ready events available in corn hybrids. The older event (Roundup Ready) is labeled to allow up to 64 oz/A♦ in crop in two applications, with a maximum corn height of 30 inches (V8). The newer event, Roundup Ready 2, was introduced in 2004 and allows up to 96 oz/A♦ in crop, with a maximum corn height of 48 inches (V12). Directed spray using drop nozzles is recommended for both events when corn height exceeds 24 inches. When using drop nozzles, do not allow the spray to concentrate in the whorl. Check with your seed company about the status of your hybrid. In addition, not all glyphosate brands are labeled for application to corn over 30 inches. Please check the specific label or label supplement for compliance.

Applying Glyphosate in Hard Water

The University of Nebraska–Lincoln Extension recommends that AMS always be added when a glyphosate product is applied. AMS will generally increase the activity of glyphosate, regardless of the hardness of the water used as the carrier. In fact, research has shown that AMS can increase glyphosate activity on some species even when glyphosate is applied in distilled water. AMS should be added at a 1% to 2% weight per volume rate. This is equivalent to 8.5 to 17 lb AMS per 100 gallons of spray. There are many liquid water conditioner products marketed as AMS substitutes for use with glyphosate. These products often contain some AMS in addition to proprietary surfactants and other ingredients. When a liquid AMS product is used as a substitute for spray grade AMS, it is important that an equivalent amount of AMS be added to maximize the activity of glyphosate. Many liquid AMS replacements contain approximately 3.5 lb AMS/gal. To obtain 8.5-17 lb AMS/100 gal will require approximately 2.5-5.0% v/v of the liquid product.

♦Glyphosate rates are based on a 4.0 ai, 3 lb ae formulation.

Combination Herbicides

Trade name Manufacturer	Equivalent amount (active ingredient) contained in 1 gal or 1 lb of product	If you apply (per acre) ...	Then the equivalent product rates are: ^{1,2}
Accurate Extra Chemnova	0.375 lb thifensulfuron 0.1875 lb tribenuron 0.15 lb metsulfuron	0.2 oz	0.15 oz Harmony 0.075 oz Express 0.05 oz Ally
Acuron Syngenta	2.14 lb S-metolachlor 1.0 lb atrazine 0.24 lb mesotrione 0.06 lb bicyclopyrone	2.5 qt	1.4 pt Dual II Magnum 0.63 qt AAtrex 4L 4.8 fl oz Callisto 0.608 oz bicyclopyrone
Affinity Broadspec DuPont	0.25 lb thifensulfuron 0.25 lb tribenuron	0.6 oz	0.3 oz Harmony SG 0.3 oz Express SG
Afforia DuPont	0.48 lb flumioxazin 0.05 lb thifensulfuron 0.05 lb tribenuron	2.5 oz	2 oz Valor 0.25 oz Harmony SG 0.25 oz Express SG
Alluvex DuPont	0.167 lb rimsulfuron 0.167 lb thifensulfuron	1.5 oz	1.0 oz Resolve 0.5 oz Harmony
Anthem FMC	2.087 lb pyroxasulfone 0.014 lb fluthiacet	8.0 oz	2.5 oz Zidua 0.56 oz Cadet
Anthem ATZ FMC	4.006 lb atrazine 0.485 lb pyroxasulfone 0.014 lb fluthiacet	2.0 pt	1.0 qt atrazine 4L 2.3 oz Zidua 0.5 oz Cadet
Anthem Maxx FMC	4.17 lb pyroxasulfone 0.126 lb fluthiacet	4 oz	2.5 oz Zidua 0.56 oz Cadet
Armezon Pro BASF	0.1 lb topramezone 5.25 lb dimethenamid-P	20 oz	0.75 oz Armezon 17 oz Outlook
Authority Assist FMC	3.33 lb sulfentrazone 0.67 lb imazethapyr	10.0 fl oz	8.3 fl oz Spartan 4F 3.3 fl oz Pursuit
Authority Elite FMC	6.3 lb S-metolachlor 0.7 lb sulfentrazone	24.0 oz	4.2 oz Spartan 4F 1.25 pt Dual Magnum
Authority First FMC	0.62 lb sulfentrazone 0.08 lb chloransulam	6.45 oz	8 fl oz Spartan 4L 0.6 oz FirstRate
Authority Maxx FMC	0.621 lbs sulfentrazone 0.0388 lbs chlorimuron	6 oz	7.4 oz Spartan 4L 0.93 oz Classic
Authority MTZ FMC	0.18 lb sulfentrazone 0.27 lb metribuzin	16.0 oz	5.8 fl oz Spartan 4L 8.6 fl oz Sencor 4L
Authority XL FMC	0.622 lb sulfentrazone 0.078 lb chlorimuron	5.0 oz	6.2 fl oz Spartan 4L 1.56 oz Classic
Basis Blend DuPont	0.20 lb rimsulfuron 0.10 lb thifensulfuron	0.825 oz	0.66 oz Resolve SG 0.17 oz Harmony SG
Betamix 1.3 EC Bayer	0.65 lb phenmedipham 0.65 lb desmedipham	2.0 pt	0.16 lb ai phenmedipham 1.0 pt Betanex 1.3E
Betamix Progress 1.8 EC Bayer	0.60 lb phenmedipham 0.60 lb desmedipham 0.60 lb ethofumesate	2.0 pt	0.15 lb ai phenmedipham 0.9 pt Betanex 1.3E 0.3 pt Nortron SC
Chisum FMC	0.48 lb metsulfuron 0.15 lb chlorsulfuron	0.25 oz	0.2 oz Ally 0.05 oz Glean
Crusher FMC	0.25 lb rimsulfuron 0.25 lb thifensulfuron	1 oz	1 oz Resolve 0.5 oz Harmony
Edition Broadspec FMC	0.25 lb thifensulfuron 0.25 lb tribenuron	0.6 oz	0.3 oz Harmony 0.3 oz Express
Edition Tank-mix FMC	0.4 lb thifensulfuron 0.1 lb tribenuron	0.75 oz	0.6 oz Harmony 0.15 oz Express
Harrow FMC	0.5 lb rimsulfuron 0.25 lb thifensulfuron	0.5 oz	1 oz Resolve 0.25 oz Harmony
Nimble FMC	0.5 lb thifensulfuron 0.25 lb tribenuron	0.4 oz	0.4 oz Harmony 0.2 oz Express
Report Extra FMC	0.125 lb metsulfuron 0.625 lb chlorsulfuron	0.3	0.0625 oz Ally 0.25 oz Glean
Statement FMC	4.33 lb metolachlor 0.91 lb fomesafen	2 pt	1.11 pt Parallel 0.91 pt Dawn
Tackle FMC	4 lb glyphosate-IPA 0.128 lb imazethapyr	1 qt	qt Glyfos 2.0 oz Pursuit

¹ai = active ingredient

ae = acid equivalent

²Active ingredients will match, but formulations may differ in the single ingredient products.

Combination Herbicides *(continued)*

Trade name Manufacturer	Equivalent amount (active ingredient) contained in 1 gal or 1 lb of product	If you apply (per acre) ...	Then the equivalent product rates are: ^{1,2}
Bicep II Magnum 5.5L Syngenta	2.4 lb S-metolachlor 3.1 lb atrazine	2.1 qt	1.3 pt Dual II Magnum 7.64 EC 1.8 lb atrazine 90 DF
Bicep Lite II Magnum 6L Syngenta	3.33 lb S-metolachlor 2.67 lb atrazine	1.5 qt	1.3 pt Dual II Magnum 7.64 EC 1.1 lb atrazine 90 DF
Boundary 6.5 EC Syngenta	5.25 lb S-metolachlor 1.25 lb metribuzin	1.5 pt	1.2 pt Dual II Magnum 7.64 EC 0.30 lb Sencor 75 DF
Brash Winfield Solutions	1.0 lb dicamba 2.87 lb 2,4-D	2.0 pt	8.0 oz Clarity / Sterling 1.5 pt 2,4-D (4L)
Breakfree ATZ DuPont	3.0 lb acetochlor 2.25 lb atrazine	2.6 qt	2.44 pt Breakfree 1.62 lb atrazine 90 DF
Breakfree ATZ Lite DuPont	4 lb acetochlor 1.5 lb atrazine	2.0 qt	2.5 pt Breakfree 0.83 lb atrazine 90 DF
Bronate Advanced Bayer	2.5 lb bromoxynil 2.5 lb MCPA	12.8 fl oz	1.0 pt Buctril 2 EC 1.0 pt MCPA 2 EC
Bullet Monsanto	2.5 lb alachlor 1.5 lb atrazine	4.0 qt	2.5 qt Micro-Tech 4ME 1.7 lb atrazine 90 DF
Callisto GT Syngenta	3.8 lb ae glyphosate 0.38 lb mesotrione	2.0 pt	3.0 oz Callisto 29 oz Touchdown Total
Callisto Xtra Syngenta	0.5 lb mesotrione 3.2 lb atrazine	20 fl oz	2.5 oz Callisto 1.0 pt Aatrex 4L
Campaign Monsanto	0.9 lb ae glyphosate-IPA 1.5 lb ae 2,4-D	3.0 pt	14.4 oz Roundup Original 19.0 fl oz 2,4-D 4 lb
Canopy 75 DF DuPont	0.64 lb metribuzin 0.11 lb chlorimuron	6.0 oz	5.1 oz Sencor 75 DF 2.6 oz Classic 25 DF
Canopy EX DuPont	0.227 lb chlorimuron 0.068 lb tribenuron	1.5 oz	1.36 oz Classic 0.2 oz Express
Capreno Bayer	2.88 lb tembotrione 0.57 lb thienicarbazone	3.0 oz	2.5 oz Laudis 0.2 oz thienicarbazone
Celebrity Plus 70 DF BASF	0.42 lb ae dicamba 0.17 lb diflufenzopyr 0.106 lb nicosulfuron	4.7 oz	4.0 oz Distinct 0.66 oz Accent 75 DF
Chaparral Dow	0.525 lb ae aminopyralid 0.0945 lb metsulfuron	2.5 oz	5.25 fl oz Milestone 0.39 oz Escort
Chisum FMC	0.48 lb metsulfuron 0.15 lb chlorsulfuron	0.25 oz	0.2 oz Ally 0.05 oz Glean
Cimarron Plus DuPont	0.48 lb metsulfuron methyl 0.15 lb chlorsulfuron	0.25 oz	0.2 oz Escort XP 0.05 oz Telar FC
Cimarron X-tra DuPont	0.3 lb metsulfuron methyl 0.38 lb chlorsulfuron	1.0 oz	0.5 oz Escort XP 0.5 oz Telar FC
Cinch ATZ DuPont	2.4 lb S-metolachlor 3.1 lb atrazine	2.1 qt	1.3 pt Cinch 1.8 lb atrazine 90 DF
Confidence Xtra Winfield Solutions	4.3 lb acetochlor 1.7 lb atrazine	2.3 qt	2.8 pt Confidence 1.1 lb atrazine 90 DF
Corvus Bayer	0.75 lb thienicarbazone 1.88 lb isoxaflutole	4.5 fl oz	0.42 oz thienicarbazone 4.2 fl oz Balance Flexx
Crossbow 3E Dow AgroSciences	1.0 lb ae triclopyr 2.0 lb ae 2,4-D ester	1.0 gal	1.0 qt Garlon 4 2.9 qt 2,4-D 4E
Crusher FMC	0.25 lb rimsulfuron 0.25 lb thifensulfuron	1 oz	1.0 oz Resolve 0.5 oz Harmony
Curtail 2.38E Dow AgroSciences	2.0 lb ae 2,4-D amine 0.38 lb ae clopyralid	2.0 pt	1.0 pt 2,4-D amine 4SC 0.25 pt Stinger 3C
Degree Xtra 4.04L Monsanto	2.7 lb acetochlor ME 1.34 lb atrazine	3.5 qt	2.5 qt Degree 1.3 lb atrazine 90 DF
Diflexx DUO Bayer	1.26 dicamba -diglycolamine 0.27 lb tembotrione	40 fl oz	12.5 fl oz DiFlexx 3.0 fl oz Laudis
Distinct 70 WDG BASF	0.2 lb diflufenzopyr 0.5 lb dicamba	4.0 oz	0.8 oz ai diflufenzopyr 4.0 fl oz Clarity 4S
Edition Broadspec FMC	0.25 lb thifensulfuron 0.25 lb tribenuron	0.6 oz	0.3 oz Harmony 0.3 oz Express
Edition Tank Mix FMC	0.4 lb thifensulfuron 0.1 lb tribenuron	0.75 oz	0.6 oz Harmony 0.15 oz Express

¹ai = active ingredient

ae = acid equivalent

²Active ingredients will match, but formulations may differ in the single ingredient products.

Combination Herbicides *(continued)*

Trade name Manufacturer	Equivalent amount (active ingredient) contained in 1 gal or 1 lb of product	If you apply (per acre) ...	Then the equivalent product rates are: ^{1,2}
Enlist Duo Dow Agrosciences	1.7 lb glyphosate 1.6 lb 2,4-D	4.75 pt	32.28 oz Roundup Pro -2,4-D choline
Enlite DuPont	0.029 lb chlorimuron 0.362 lb flumioxazin 0.088 lb thifensulfuron	2.8 oz	0.32 oz Classic 2.0 oz Valor 0.5 oz Harmony SG
Envive DuPont	0.092 lb chlorimuron 0.292 lb flumioxazin 0.029 lb thifensulfuron	3.0 oz	1.1 oz Classic 1.7 oz Valor 0.17 oz Harmony SG
Expert 4.88L Syngenta	1 lb glyphosate IPA 1.74 lb S-metolachlor 2.14 lb atrazine	3.0 qt	24.0 oz glyphosate 4 lb ai 1.33 pt Dual II Magnum 1.8 lb atrazine 90 DF
Extreme 1.67L BASF	0.17 lb imazethapyr 1.5 lb ae glyphosate IPA	3.0 pt	1.44 oz Pursuit 70DG 24.0 oz Roundup Original
Fierce Valent	0.335 lb flumioxazin 0.425 lb pyroxasulfone	3.0 oz	2.0 oz Valor 1.5 oz Zidua
Fierce XLT Valent	0.0667 lb chlorimuron 0.2457 lb flumioxazin 0.3117 lb pyroxasulfone	3.75 oz	1 oz Classic 1.8 oz Valor 1.375 oz Zidua
Finesse DuPont	0.625 lb chlorsulfuron 0.125 lb metsulfuron	0.3 oz	0.25 oz Glean 75 DF 0.063 oz Ally 60 DF
Flexstar GT Syngenta	0.66 lb fomesafen 2.63 lb ae glyphosate	3.0 pt	1.0 pt Flexstar 30 oz Touchdown Total
Forefront R&P Dow AgroSciences	0.33 lb ae aminopyralid 2.67 lb ae 2,4-D	32.0 fl oz	5.3 fl oz Milestone 1.4 pt 2,4-D amine
Frontrow (co-pack) Dow AgroSciences	0.84 lb chloransulam 0.80 lb flumetsulam	0.30 oz 0.12 oz	0.30 oz First Rate 0.12 oz Python
FulTime NXT Dow AgroSciences	2.4 lb acetochlor 1.6 lb atrazine	3.0 qt	2.2 qt TopNotch 3.2CS 1.33 lb atrazine 90 DF
Fusion 2.66E Syngenta	2.0 lb fluazifop-P 0.66 lb fenoxaprop	6.0 fl oz	6.0 oz Fusilade DX 2.0E 0.5 oz fenoxaprop
G-Max Lite BASF	2.25 lb dimethamid-p 2.75 lb atrazine	3.0 pt	18.0 fl oz Outlook 1.03 lb atrazine 90 DF
Grazon P+D Dow AgroSciences	0.54 lb ae picloram 2.0 lb 2,4-D	2.0 pt	0.50 pt Tordon 22K 1.0 pt 2,4-D amine 4SC
Guardsman Max BASF	1.7 lb dimethenamid-p 3.3 lb atrazine	3.4 pt	15.4 oz Outlook 1.4 lb atrazine 90 DF
Halex GT Syngenta	0.21 lb mesotrione 2.1 lb S-metolachlor 2.1 lb ae glyphosate	3.6 pt	3.0 oz Callisto 1.0 pt Dual II Magnum 24.3 oz Touchdown HiTech
Harmony Extra SG DuPont	0.33 lb thifensulfuron 0.17 lb tribenuron	0.9 oz	0.6 oz Harmony SG 0.3 oz Express SG
Harmony Extra XP DuPont	0.50 lb thifensulfuron 0.25 lb tribenuron	0.4 oz	0.4 oz Harmony SG 0.13 oz Express 75 DF
Harness Xtra 5.6L Monsanto	3.1 lb acetochlor 2.5 lb atrazine	2.3 qt	2.0 pt Harness 7E 1.6 lb atrazine 90 DF
Harness Xtra 6L Monsanto	4.3 lb acetochlor 1.7 lb atrazine	2.3 qt	2.8 pt Harness 7 EC 1.1 lb atrazine 90 DF
Harrow FMC	0.5 lb rimsulfuron 0.25 lb thifensulfuron methyl	0.5 oz	1.0 oz Resolve 0.25 oz Harmony
Hornet WDG Dow AgroSciences	0.185 lb flumetsulam 0.50 lb clopyralid	4.0 oz	0.93 oz Python 80 WG 5.3 fl oz Stinger 3C
Imperium Gowan	1.4 lb acetochlor 5.6 lb EPTC	5.0 pt	1.1 pt Surpass 6.4 EC 4.2 pt Eradicane 6.7 EC
Instigate DuPont	0.0417 lb rimsulfuron 0.4167 lb mesotrione	6.0 oz	5 oz Callisto 1 oz Resolve SG
Keystone NXT Dow AgroSciences	3 lb acetochlor 2.25 lb atrazine	2.6 qt	2.44 pt Surpass EC 1.62 lb atrazine 90 DF
Keystone LA NXT Dow AgroSciences	4 lb acetochlor 1.5 lb atrazine	2.0 qt	2.5 pt Surpass 0.83 lb atrazine 90 DF

¹ai = active ingredient

ae = acid equivalent

²Active ingredients will match, but formulations may differ in the single ingredient products.

Combination Herbicides *(continued)*

Trade name Manufacturer	Equivalent amount (active ingredient) contained in 1 gal or 1 lb of product	If you apply (per acre) ...	Then the equivalent product rates are: ^{1,2}
Landmaster BW Albaugh	0.9 lb ae glyphosate 0.8 lb ae 2,4-D	40.0 fl oz	12.0 oz Roundup Original 8.0 oz 2,4-D
Landmaster II Monsanto	0.9 lb ae glyphosate-IPA 0.8 lb 2,4-D	40.0 fl oz	12.0 oz Roundup Original 8.0 oz 2,4-D 4E
Lariat Monsanto	2.5 lb alachlor 1.5 lb atrazine	3.2 pt	2.0 pt Lasso 4E 1.3 lb atrazine 90 DF
Latir MANA Inc.	0.315 lb flumioxazin 0.235 lb imazethapyr	3.2 oz	1.25 oz Outflank 3.0 oz Pursuit
Lexar EZ Syngenta	0.22 lb mesotrione 1.73 lb S-metolachlor 2.0 lb atrazine	3.0 qt	5.3 oz Callisto 1.4 pt Dual II Magnum 1.4 lb atrazine 90 DF
Lightning 70DG BASF	0.525 lb imazethapyr 0.175 lb imazapyr	1.28 oz	0.96 oz Pursuit 70DG 0.90 fl oz Arsenal 2E
Lineage Clearstand DuPont	0.63 lb imazapyr 0.1 lb metsulfuron	10.0 oz	25 oz Arsenal 1.6 oz Escort XP
Lumax EZ Syngenta	2.68 lb S-metolachlor 0.268 lb mesotrione 1.0 lb atrazine	2.7 qt	1.76 pt Dual II Magnum 5.38 fl oz Callisto 0.7 lb atrazine 90 DF
Marksman 3.2L BASF	1.1 lb dicamba 2.1 lb atrazine	3.5 pt	1.0 pt Banvel 4SC 1.0 lb atrazine 90 DF
Marvel FMC	0.117 lb fluthiacet 2.833 lb fomesafen	7.25 oz	0.9 oz Cadet 10.5 oz Reflex
Nimble FMC	0.5 lb thifensulfuron 0.25 lb tribenuron	0.4 oz	0.4 oz Harmony 0.2 oz Express
Northstar 47.4 WG Syngenta	0.075 lb primisulfuron 0.40 lb dicamba	5.0 oz	0.50 oz Beacon 75 WG 4 fl oz Banvel 4SC
Olympus Flex Bayer	0.0675 lb propoxycarbazone-sodium 0.0450 lb mesosulfuron	3.0 oz	0.3 oz Olympus 3.0 oz Osprey
OpTill BASF	0.178 lb saflufenacil 0.502 lb imazethapyr	2.0 oz	1.0 oz Sharpen 4.0 oz Pursuit
Optill PRO (co-pack) BASF	0.178 lb saflufenacil 0.502 lb imazethapyr 6 lb dimethenamid-P	2.0 oz 10.0 oz	1.0 oz Sharpen 4.0 oz Pursuit 10.0 oz Outlook
Orion Syngenta	2.34 lb MCPA 0.033 lb florasulam	17.0 oz	10.0 oz MCPA
Panoflex DuPont	0.1 lb thifensulfuron 0.4 lb tribenuron	0.3 oz	0.06 oz Harmony 0.24 oz Express
PastureGard Dow	1.5 lb triclopyr 0.5 lb fluroxypyr	2.0 qt	1.5 pt Remedy 1.33 pt Starane
Prefix Syngenta	3.82 lb S-metolachlor 1 lb fomesafen	2.0 pt	1 pt Dual Magnum 1 pt Reflex
Prequel DuPont	0.15 lb rimsulfuron 0.30 lb isoxaflutole	1.66 oz	1.0 oz Resolve SG 1.0 oz Balance Pro
Pulsar Syngenta	0.7275 lb ae dicamba 0.9455 lb ae fluroxypyr	8.3 oz	1.5 oz Clarity 5.2 oz Starane
Pursuit Plus 2.9 EC BASF	2.7 lb pendimethalin 0.2 lb imazethapyr	2.5 pt	2.0 pt Prowl 3.3 EC 4.0 fl oz Pursuit 2SC
Realm Q DuPont	0.075 lb rimsulfuron 0.3125 lb mesotrione	4.0 oz	1.2 oz Resolve SG 2.5 oz Callisto
Redeem R&P 3L Dow Agroscience	2.25 lb triclopyr 0.75 lb clopyralid	2.0 pt	1.5 pt Garlon 3A 0.5 pt Stinger 3L
Report Extra FMC	0.125 lb metsulfuron 0.625 lb chlorsulfuron	0.3 oz	0.0625 oz Ally 0.25 oz Glean
Resolve Q DuPont	0.184 lb rimsulfuron 0.4 lb thifensulfuron	1.25 oz	0.9 oz Resolve SG 0.1 oz Harmony SG
Revulin Q DuPont	0.144 lb nicosulfuron 0.368 lb mesotrione	3.4 fl oz	0.5 oz Accent 75 DF 2.5 oz Callisto
Rezult B&G (co-pack) BASF	B=5.0 lb bentazon G=1.0 lb sethoxydim	1.6 pt 1.6 pt	2.0 pt Basagran 4SC 1.6 pt Poast Plus 1SC
Rowel FX Monsanto	0.3 lb flumioxazin 0.1 lb chlorimuron	3 oz	1.75 oz Valor 1.25 oz Classic

Combination Herbicides *(continued)*

Trade name Manufacturer	Equivalent amount (active ingredient) contained in 1 gal or 1 lb of product	If you apply (per acre) ...	Then the equivalent product rates are: ^{1,2}
Sequence Syngenta	2.25 lb glyphosate IPA 3 lb S-metolachlor	3.0 pt	36.0 oz glyphosate 4 lb ai 1.2 pt Dual II
Surveil Dow AgroSciences	0.51 lb flumioxazin (V) 0.84 lb chloransulam (FR)	3.0 oz	2.5 oz Valor 0.5 oz First Rate
Shotgun 3.25L UAP	2.25 lb atrazine 1.0 lb 2,4-D	2.0 pt	0.62 lb atrazine 90 DF 0.53 pt 2,4-D ester
Solstice FMC	0.216 lb fluthiacet 3.784 lb mesotrione	3.15 oz	0.75 oz Cadet 3.0 oz Callisto
Spartan Charge FMC	3.15 lb sulfentrazone 0.35 lb carfentrazone	4.75 fl oz	4.45 fl oz Spartan 0.83 oz Aim EC
Spirit 57 WDG Syngenta	0.428 lb primisulfuron 0.142 lb prosulfuron	1.0 oz	0.58 oz Beacon 75 WG 0.25 oz Peak 57 WG
Starane + Salvo Dow AgroSciences	0.75 lb fluroxypyr 3.0 lb 2,4-D ester	1.0 pt	0.5 pt Starane 0.6 pt Salvo
Starane + Saber Dow AgroSciences	0.5 lb fluoxypyr 2.0 lb 2,4-D amine	1.5 pt	0.5 pt Starane 0.9 pt 2,4-D amine 4SC
Statement FMC	4.33 lb metolachlor 0.91 lb fomesafen	2.0 pt	1.11 pt Parallel 0.91 pt Dawn
Status BASF	0.4 lb ae dicamba 0.16 lb ae diflufenzopyr	5.0 oz	4.0 oz Clarity 0.8 oz diflufenzopyr
Steadfast 75 DF DuPont	0.50 lb nicosulfuron 0.25 lb rimsulfuron	0.75 oz	0.50 Accent 75 DF 0.38 oz Resolve
Steadfast Q DuPont	0.252 lb nicosulfuron 0.125 lb rimsulfuron	1.5 oz	0.5 oz Accent 75 DF 0.75 oz Resolve SG
Storm 4SC United Phosphorus Inc	2.67 lb bentazon 1.33 lb acifluorfen	1.5 pt	1.0 pt Basagran 4SC 1.0 pt Ultra Blazer
Stout DuPont	0.68 lb nicosulfuron 0.05 lb thifensulfuronl	0.75 oz	0.68 oz Accent 0.05 oz Harmony GT XP
SureStart II Dow AgroSciences	3.75 lb acetochlor 0.12 lb flumetsulam 0.29 lb ae clopyralid	1.5 pt	0.88 pt Surpass EC 0.45 oz Python WDG 2.3 fl oz Stinger
Surveil Co-Pack Dow AgroSciences	0.51 lb flumioxazin (V) 0.84 lb cloransulam (FR)	3.0 oz	2.5 oz Valor SX 0.5 oz FirstRate
Surveil premix Dow Agrosciences	0.36 lb flumioxazin 0.12 lb cloransulam	2.8 oz	2 oz Valor 0.4 oz First Rate
Synchrony DuPont	0.22 lb chlorimuron 0.07 lb thifensulfuron	1.0 oz	0.86 oz Classic 0.09 oz Harmony GT XP
Tackle FMC	4 lb glyphosate-IPA 0.128 lb imazethapyr	1.0 qt	1.0 qt Glyfos 2.0 oz Pursuit
Tailwind MANA Inc.	5.25 lb metolachlor 1.25 lb metribuzin	2.4 pt	1.62 pt Parallel 0.75 pt Glory 4L
Torment MANA Inc.	2.0 lb fomesafen 0.5 lb imazethapyr	1.0 pt	1.0 pt Dawn 4.0 oz Pursuit
Trivence DuPont	0.039 lb chlorimuron 0.128 lb flumioxazin 0.446 lb metribuzin	6.0 oz	0.936 oz Classic 1.5 oz Valor 3.568 oz Metribuzin 75DF
Valor XLT Valent	0.3 lb flumioxazin 0.1 lb chlorimuron	3.0 oz	1.75 oz Valor 1.25 oz Classic
Verdict BASF	0.57 lb saflufenacil 5.0 lb dimethenamid-P	13 oz	2.6 oz Sharpen SC 10.8 oz Outlook
Vise MANA Inc.	4.45 lb metolachlor 0.95 lb fomesafen	2.0 pt	1.14 pt Parallel 0.95 pt Dawn
Warrant Ultra Monsanto	2.82 lb acetachlor 0.63 formasafen	50 fl oz	47 fl oz Warrant 16.75 oz Flexstar
Weedmaster 3.87SC BASF	1.0 lb dicamba 2.87 lb 2,4-D amine	2.0 pt	0.5 pt Banvel 4SC 1.4 pt 2,4-D amine 4SC
Yukon Gowan	0.125 lb halosulfuron-methyl 0.55 lb dicamba (sodium salt)	4.0 oz	0.66 oz Permit 4.0 fl oz Banvel
Zemax Syngenta	3.34 lb S-metolachlor 0.33 lb mesotrione	2.0 qt	1.75 pt Dual II Magnum 5.3 fl oz Callisto

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ae = acid equivalent

²Active ingredients will match, but formulations may differ in the single ingredient products.

2017 Approximate Retail Price (\$) Per Unit of Selected Herbicides for Field Crops

Survey price estimates in September 2016

Product	2017 Price (\$) per Unit
2,4-D amine	14.00/gal
2,4-D ester #4	18.00/gal
2,4-D ester #6	24.00/gal
AAtrex 4L	20.00/gal
AAtrex Nine-O	4.30/lb
Accent Q	22.50/oz
Acuron	77.00/gal
Acuron Flexi	95.00/gal
Affinity BroadSpec	13.50/oz
Agility SG	2.70/oz
Aim EC	200.00/qt
Ally Extra SGW/TOTSOL	9.00/oz
Ally 60XP	10.50/oz
Alluvex	6.10/oz
Amber Custom Pak	13.00/oz
Ammonium Sulfate	0.27/lb
Anthem	430.00/gal
Anthem ATZ	120.00/gal
Anthem Maxx	850.00/gal
Aquathol K	115.00/gal
Armezon	21.00/oz
Armezon Pro	170.00/gal
Arrow (clethodim)	60.00/gal
Arsenal Powerline	150.00/gal
Assure II	105.00/gal
Atrazine 4L	14.00/gal
Atrazine 90 DF	3.30/lb
Authority Assist	430.00/gal
Authority Elite	130.00/gal
Authority First DF	95.00/gal
Authority Maxx	70.00/lb
Authority MTZ DF	28.00/lb
Authority XL	70.00/lb
Autumn Super 51 WDG	25.00/oz
Axial XL	160.00/gal
Balance Flexx	6.00/oz
Banvel	50.00/gal
Basagran 5L	80.00/gal
Basis Blend	8.50/oz
Beacon	11.00/oz
Beyond	625.00/gal
Bicep II Lite Magnum	63.00/gal
Bicep II Magnum	48.00/gal
Boundary 6.5 EC	95.00/gal

Product	2017 Price (\$) per Unit
Breakfree NXT VMI	65.00/gal
Breakfree NXT ATZ VMI	36.00/gal
Breakfree NXT Lite VMI	40.00/gal
Breakfree NXT RMI	66.00/gal
Broadaxe XC	140.00/gal
Brox 2 EC	34.00/gal
Butyrac 200	34.00/gal
Cadet	400.00/qt
Callisto 4SC	850.00/gal
Callisto XTRA Enhanced	110.00/gal
Canopy DG	3.00/oz
Canopy EX	9.00/oz
Capreno	950.00/gal
Cascade	70.00/gal
Casoron 4G	3.50/lb
Chapparal	100.00/lb
Chateau SW	125.00/lb
Cimarron Plus	11.00/oz
Cimarron XTRA	17.00/oz
Cinch VMI	105.00/gal
Cinch ATZ VMI	37.00/gal
Cinch ATZ Lite	70.00/gal
Clarity	100.00/gal
Classic	50.00/oz
Cobra	250.00/gal
Command 3ME	180.00/gal
Copper Sulfate Crystals	3.00/lb
Corvus	1000.00/gal
Crop Oil Concentrate (COC)	9.00/gal
Crossbow	45.00/gal
Curbit EC	48.00/gal
Curtail	65.00/gal
Curtail M	70.00/gal
Degree Extra	52.00/gal
Dicamba	50.00/gal
Diflexx	270.00/gal
Diflexx Dual	120.00/gal
Dimension 2EW	260.00/gal
Diquat 2L AG	70.00/gal
Distinct	40.00/lb
Diuron 80DF	4.50/lb
Dual II Magnum	130.00/gal
Dual Magnum	120.00/gal
Durango DMA	24.00/gal

Product	2017 Price (\$) per Unit
Enlist Duo	25.00/gal
Enlite	7.00/oz
Envive	5.80/oz
Eptam 7E	55.00/gal
Escort XP	6.50/oz
Evik DF	12.00/lb
Expert	37.00/gal
Express SG TotalSol	21.50/oz
Extreme	32.00/gal
Facet L	130.00/gal
Fallow Star	21.00/gal
Fierce	125.00/lb
Fierce XLT	105.00/lb
Finesse	17.00/oz
FirstRate	45.00/oz
Flexstar GT 3.5	40.00/gal
ForeFront HL	65.00/gal
Fultime NXT	45.00/gal
Fusilade DX	140.00/gal
Fusion	230.00/gal
Garlon 3 A	90.00/gal
Garlon 4 Ultra	92.00/gal
Glean XP	24.00/oz
Glory	13.00/lb
Glyphosate (generic) w surfactant 5#	12.50/gal
Goal 2XL	86.00/gal
Gramoxone SL 2.0	38.00/gal
Grazon P&D	40.00/gal
Habitat	158.00/gal
Halex GT	65.00/gal
Harmony Extra and Extra SG with Totsol	15.00/oz
Harness	130.00/gal
Harness XTRA 5.6L	60.00/gal
Hi-Dep	32.00/gal
Hornet WDG	85.00/lb
Huskie	120.00/gal
Hyvar XL	110.00/gal
Impact	26.00/oz
Instigate	3.70/oz
Journey	150.00/gal
Karmex DF	4.70/lb
Keystone	60.00/gal
Keystone LA NXT	80.00/gal

2017 Approximate Retail Price (\$) Per Unit of Selected Herbicides for Field Crops *(continued)*

Product	2017 Price (\$) per Unit
Keystone NXT	65.00/gal
Krenite S	100.00/gal
Krovar1DF	14.00/lb
Landmaster BW	19.00/gal
Latir	62.00/lb
Laudis	830.00/gal
Lexar EZ	70.00/gal
Liberty	85.00/gal
Lightning	18.00/oz
Lumax EZ	80.00/gal
Marvel	240.00/gal
Matrix SG	19.00/oz
MCPA Amine 4 lb	20.00/gal
MCPA Ester 4 lb	27.00/gal
Metribuzin 75 DF	13.00/lb
Milestone	360.00/gal
North Star	1.70/oz
Nortron SC	105.00/gal
Olympus 70 DG	15.00/oz
Opensight	100.00/lb
Optill WG	8.00/oz
Oust 75XP	57.00/lb
Outflank	55.00/lb
Outlook	150.00/gal
Overdrive	57.00/gal
Panoflex w/TotalSOL	10.00/oz
Parallel	40.00/gal
Parallel Plus	30.00/gal
Parazone 3SL	25.00/gal
Pasturegard HL	128.00/gal
Pathfinder II	58.00/gal
Peak	18.00/oz
Permit	24.00/oz
Perspective	95.00/lb
Phoenix	250.00/gal
Plateau	160.00/gal
Poast	110.00/gal
PowerFlex HL	7.50/oz
Pramitol 25E	40.00/gal
Pramitol 5PS	3.00/lb
Prefar 4E	77.00/gal
Prefix	54.00/gal
Prequel	9.50/oz
Princep 4L	27.00/gal
Princep Cal 90	5.40/lb
Prowl 3.3EC	50.00/gal

Product	2017 Price (\$) per Unit
Prowl H ₂ O	52.00/gal
Pummel	62.00/gal
Pursuit	490.00/gal
Python WDG	15.50/oz
Range Star	27.00/gal
Raptor	610.00/gal
Rave WDG	2.30/oz
Realm Q	5.50/oz
Reflex	57.00/gal
Reglone	85.00/gal
Rely 280	90.00/gal
Remedy Ultra	80.00/gal
Resicore	70.00/gal
Resolve Q	10.00/oz
Resource	255.00/gal
Reward AccuGel	90.00/gal
Rhythm	45.00/gal
Rodeo	30.00/gal
Roundup PowerMax	25.00/gal
Roundup Weather Max	32.00/gal
Rowel	120.00/lb
Rowell FX	90.00/lb
Rugged	45.00/gal
Rumble	38.00/gal
Sahara DG	20.00/lb
Salvo	26.00/gal
Sandea	45.00/oz
Sedgehammer	80.00/oz
Select Max	110.00/gal
Sequence	53.00/gal
Sharpen	900.00/gal
Sinbar 80 WDG	57.00/lb
Solida	12.00/oz
Solstice	650.00/gal
Sonalan HFP	56.00/gal
Sonic	92.00/lb
Spartan 4F	600.00/gal
Spartan Charge	440.00/gal
Spartan Elite	135.00/gal
Spike 20P	14.00/lb
Spirit	12.00/oz
Starane NXT	92.00/gal
Starane Ultra	300.00/gal
Status	4.30/oz
Steadfast Q	14.00/oz
Stinger	150.00/qt

Product	2017 Price (\$) per Unit
Storm	94.00/gal
Streamline	105.00/lb
Succeed Ultra	15.00/gal
SureStart II	115.00/gal
Surfactant/Nonionic 90%	16.00/gal
Surmount	64.00/gal
Surpass NXT	135.00/gal
Surveil	125.00/lb
Synchrony XP	14.00/oz
Tailwind	68.00/gal
Targa	130.00/gal
Telar XP	21.00/oz
Teton	75.00/gal
Tordon 22K	76.00/gal
Tordon RTU	14.00/qt
Torment	132.00/gal
Touchdown Hitech	31.00/gal
Transline	270.00/gal
Trifluralin 4EC	30.00/gal
Trifluralin 10G	1.35/lb
Triflurex HFP	30.00/gal
Triple FLEX II	100.00/gal
Trivence	2.90/oz
Trust	30.00/gal
UAN 28-0-0	1.30/gal
UAN 32-0-0	1.50/gal
Ultra Blazer	75.00/gal
Upbeet	20.00/oz
Valor SX	123.00/lb
Valor XLT	92.00/lb
Varisto	165.00/gal
Velpar Alfamax	15.00/lb
Velpar L	98.00/gal
Velpar 75DF	37.00/lb
Verdict	255.00/gal
Vida	4.00/oz
Viewpoint	77.00/lb
Vise	45.00/gal
Vista XRT	300.00/gal
Warrant	41.00/gal
Warrant Ultra	60.00/gal
Weedmaster	32.00/gal
Wide Match	82.00/gal
Yukon	3.80/oz
Zemax	92.00/gal

Restricted Use Herbicides

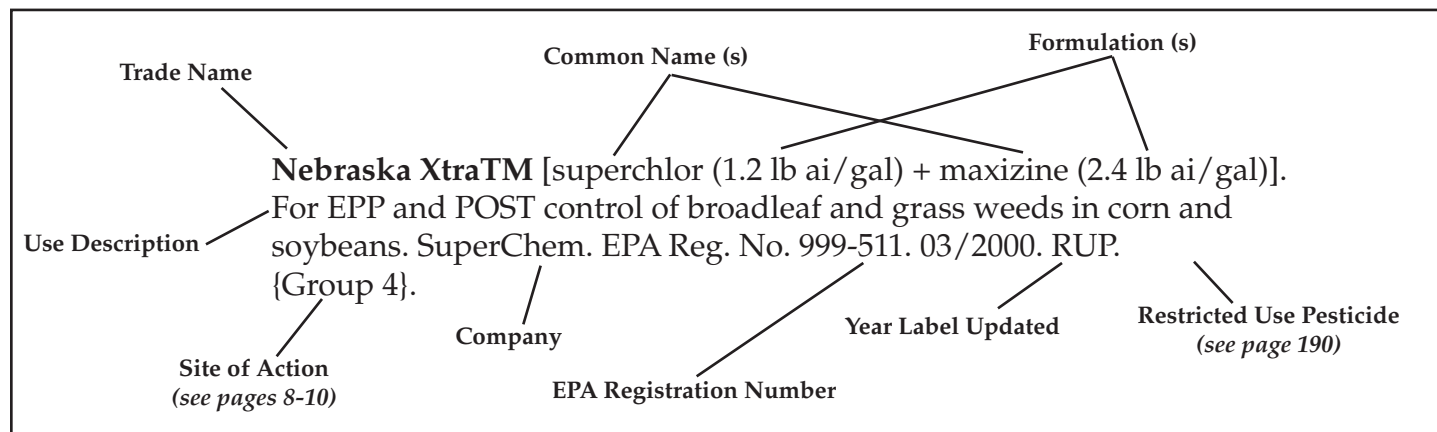
AAtrex 4L / Nine-O	Fultime/NXT	PARA-SHOT 3.0
Acellus ATZ / ATZ LITE	G-Max Lite	Parazone 3SL
Anthem ATZ	Gramoxone Inteon / SL / SL 2.0	Payback ATZ
Atra-V 4L	Grazon P+D	Phenomenon Duo
Atrazine	Graslan L	Picloram + D / 22K
Balance Flexx/Pro	Guardsman Max	Prequel
Basamid	Gunslinger	Quik-Quat
Basis Gold	Harness 20G / Xtra / Xtra 5.6 L	SANAFOAM VAPOROOTER II
Bicep Lite II Magnum/II Magnum/ Magnum FC	Helmquat 3SL	Scoparia
Blanco	Hired Hand P+D	SECTAGON 42 / K5
Bonedry	Infantry 4L / 90 DF	Slider ATZ/ATZ Lite
Brawl II ATZ	Intrro	Sortie ATZ/ATZ Lite
Breakfree/ATZ/ATZ LITE/ NXT ATZ/NXT/NXT LITE	K-PAM HL	Spin Aid
Bridger ATZ LA	KERB 50-W / 50WP / SC T&O/WSP	Stalwart Xtra/Xtra Lite
Brozine	KEYSTONE / LA / LA NXT / NXT	Surmount
Bullet	Lariat	TERR-O-GAS 98
Cadence ATZ NXT / LA NXT	Lexar/EZ	TORDON 101 MIXTURE / 22K / K
Callisto Xtra	Lumax Selective/Lumax EZ	TREMOR ATZ LITE NXT / ATZ NXT
Charger MAX ATZ	Magnacide H	Triangle
Cinch ATZ/ATZ Lite	MEDAL II ATZ	TRI BROM 67 / 98
Commit ATZ	METAM CLR 42% / KLR 54%	TRIUMPH 22K
Confidence Xtra/Xtra 5.6	METH-O-GAS Q	Trizmet II
Corvus	Micro-Tech	TROOPER 22K / P + D
Cyclone SL	Milo-Pro	Vail ATZ
Degree Xtra	OUTPOST 22K	VAPAM / HL
Devour	OVERTIME ATZ LITE NXT / ATZ NXT	VISOR ATZ / S-MOC ATZ
Expert	Parallel Plus	VOLLEY ATZ / ATZ LITE NXT / ATZ LITE / ATZ NXT / NXT / TENKOZ
Firestorm	PARAQUAT 3SL / CONCENTRATE	Xcelerate ATZ 5.6

The label will indicate if a product is Restricted Use. Only certified applicators may apply or supervise the application of restricted use herbicides. See your local extension educator if you need to become certified.

Herbicide Dictionary

This section gives the trade name, common name, formulation, use description, company, EPA registration number, year label updated, whether it's restricted use and classification for herbicide family, mode of action, and herbicide resistance group for herbicides commonly used in Nebraska. Restricted use herbicides are listed as RUPs. For more information on family, mode of action, or herbicide resistance group see pages 8-10.

Read and follow label information before using these products. Below is an example of a herbicide entry and the information provided for each entry. Several brands of herbicides contain the same active ingredient. We have not listed all possible brand names. Some companies use a header for their line of ag chemical products; for example, Winfield Solutions uses AgriSolutions.



Many abbreviations are used in this dictionary and on herbicide labels. Below is a list of some of those abbreviations. Keep in mind that many abbreviations and acronyms cannot be defined since different manufacturers use the same acronyms with different meanings.

AC = Application Concentrate, ATZ = atrazine, CST = Cut Surface Treatment, DF = Dry Flowable, DG = Dispersible Granules, EC = Emulsifiable Concentrate, EPA = Environmental Protection Agency, F = Flowable, FC = Flowable Concentrate, G = Granules, HC = High Concentration, IVM = Industrial Vegetation Management, L = Liquid, ME = Micro-encapsulated, PPE = Personal Protection Equipment, RTU = Ready To Use, RUP = Restricted Use Pesticide, SOA = Site of Action, SC = Suspension Concentrate, SG = Soluble Granules, T/O = Turf/Ornamentals, W = Wettable Powder, WDG = Water Dispersible Granules, WDP = Water Dispersible Powder, WPS = Worker Protection Standard, WSP = Water Soluble Product.

2,4-D. A growth-regulating phenoxy herbicide for broadleaf weed control in grass crops, 2,4-D is used in Amine 4, Amine 4 2,4-D, Aqua-Kleen, Banvel + 2,4-D, Barrage, Bentgrass Selective, Brash, Brushmaster, Campaign, Chaser 2, Chaser Turf Herbicide, Chaser Ultra Weed & Feed, Cimarron Max, Cody, Cornbelt Amine, Cornbelt 4 Lb and 6 Lb, Credit Master, Crossbow, Curtain, D-638, DMA4 IVM, Enlist Duo, Esteron 99, Five Star, Formula 40, Four Power Plus, Grazon P+D, HardBall, Hi-DEP, Kamba Master, Landmaster BW, Low Vol 4 Ester Weed Killer, Maestro D, MEC Amine-D Turf Herbicide, Millennium Ultra, Millennium Ultra Plus, Oasis, Opti-Amine, Outlaw, PastureMaster, Pasture MD, Pathway, Phenoxy 088, Pro-Mate-Three Way SC, Range Star, Recoil, Rugged, Saber, Salvo, Savage, Shotgun, Speed Zone, Starane + Esteron, Starane + Saber, Starane + Salvo, Strike 3, Strike Three Ultra, SWP 2,4-D LV4,

Three-Way Selective Herbicide, Tordon Mixture, Tordon RTU, Triamine, Trimec Broadleaf Herbicide, Trimec Classic, Trimec Plus, Trimec Turf, Triplet, Turf Weed and Brush Control, Turret, 2,4-D Amine 4, 2,4-D LV4, 2,4-D LV6, Unison, Veteran 10G, Weed Rhap A-4D, Weedar 64, Weedone LV4, Weedone LV6 EC, Weedone 638 and Weedmaster Herbicide. {Group 4}.

2,4-D Amine 4 [2,4-D amine (3.8 lb ae/gal)]. PP, PRE and POST control of annual and biennial broadleaf weeds in field and sweet corn, PP to soybean, POST to small grain, grain sorghum, fallow, pastures, rangeland, turfgrass, lawns and aquatic areas. Winfield Solutions. EPA Reg. No. 1381-103. 01/2003. {Group 4}.

2,4-DB. A growth regulating phenoxy herbicide for broadleaf weed control in alfalfa and soybean. An active ingredient in Butoxone 200, Butoxone 7500, Butyrac 175, 2,4-DB 200, Butyrac 200, Chaser Turf Herbicide, D-638 and Phenoxy 088. {Group 4}.

2,4-DB 200 [2,4-DB (2 lb ai/gal)]. For broadleaf weed control in soybeans and alfalfa. Winfield Solutions. EPA. Reg. No. 1381-215. 2011. {Group 4}.

2,4-D LV 4 [2,4-D, 2-ethylhexyl (3.8 lb ae/gal)]. Controls same weeds as 2,4-D Amine 4 except in aquatic areas. Winfield Solutions. EPA Reg. No. 1381-102. 12/2002. {Group 4}.

2,4-D LV 6 [2,4-D, 2-ethylhexyl (5.6 lb ae/gal)]. For control of same weeds listed under 2,4-D Amine 4, except aquatic areas. Winfield Solutions. EPA Reg. No. 1381-101. 11/2001. {Group 4}.

Herbicide Dictionary *(continued)*

2,4-DP. See dichlorprop. {Group 4}.

120 Herbicide [MSMA (6.6 lb ai/gal)]. For control of grass weeds in non-bearing grape, deciduous fruits, nuts and citrus orchards. Controls sandbur, mustards, barnyardgrass, chickweed and wood sorrel in zoysia, buffalograss and Bermuda lawns. Winfield Solutions. EPA Reg. No. 9779-96. 01/2003. {Group 17}.

912 Herbicide [MSMA B (6 lb ai/gal)]. For POST weed control in lawns and turf. Winfield Solutions. EPA Reg. No. 9779-133. 09/1999. {Group 17}.

AAtrex® DF [atrazine (4 lb ai/gal or 90%)]. Used for weed control in corn, sorghum, fallow and CRP. Syngenta. EPA Reg. No. 100-497 or 100-585. 02/2004. RUP. {Group 5}.

Abundit™ Extra (exclusively distributed by DuPont) [glyphosate (3 lb ae/gal or 4 lb ai/gal)]. For POST control of broadleaf and grass weeds in Roundup Ready crops, burndown and noncrop-land weed control. NuFarm. EPA Reg. No. 71368-20. 2012. {Group 9}.

Accent® DF [nicosulfuron (75%)]. POST grass control in corn. DuPont. EPA Reg. No. 352-560. 08/2003. {Group 2}.

Accent® Q [nicosulfuron (54.5%)]. POST grass control in corn. DuPont. EPA Reg. No. 352-773. 09/2008. {Group 2}.

Acclaim® Extra [fenoxaprop-ethyl (0.57 lb ai/gal)]. For selective POST grass control in turfgrass and ornamentals. Bayer Environmental Science. EPA Reg. No. 432-950. 04/2000. {Group 1}.

Accord® Concentrate [glyphosate, isopropylamine (4 lb ae/gal or 5 lb ai/gal)]. For control of woody brush, trees, and herbaceous weeds in utility rights-of-way and aquatic weed control. Dow AgroSciences. EPA Reg. No. 62719-324. 10/2002. {Group 9}.

Accord® SP [glyphosate, isopropylamine (3 lb ae/gal or 4 lb ai/gal)]. For control of woody brush, trees and herbaceous weeds in utility rights-of-way. Dow AgroSciences. EPA Reg. No. 62719-322. 06/2002. {Group 9}.

Accurate® [metsulfuron (60%)]. Used POST in wheat, barley, and fallow for broadleaf and certain grass weed control. 2006. FMC. EPA Reg. No. 67760-68. {Group 2}.

Accurate® Extra [metsulfuron (15%) + thifensulfuron (37.5%) + tribenuron (18.75%)]. Used POST in wheat, barley, and fallow for broadleaf weed control. 2007. FMC. EPA Reg. No. 67760-76. {Group 2}.

Acetochlor. Active ingredient in Break-free, Breakfree ATZ, Breakfree ATZ Lite, Cadence, Confidence, Confidence Xtra, Confidence Xtra 5.6L, Degree, Degree Xtra, Field Master, FulTime NXT, Harness, Harness 20G, Harness Xtra, Harness Xtra 5.6L, Keystone NXT, Keystone LA NXT, SureStart, Surpass NXT, Top-Notch, TripleFLEX, Volley, Volley ATZ, Volley ATZ Lite, and Warrant Ultra for annual grass control in corn. {Group 15}.

Achieve® 40 DG or SC [tralkoxydim (3.33 ai lb/gal)]. Used POST for control of grass weeds in wheat and barley. Syngenta. EPA Reg. No. 100-1105 or 100-1130. 07/2001 or 02/2004. {Group 1}.

Acifluorfen. An active ingredient in Storm and Ultra Blazer for broadleaf weed control in soybean. {Group 14}.

Acuron®. [S-metolachlor (2.14 lbs ai/gal) + atrazine (1.0 lb ai/gal) + mesotrione (0.24 lbs ai/gal) + bicyclopyrone (0.06 lbs ai/gal)]. For control of annual grass and broadleaf weeds in field corn, seed corn, silage corn, sweet corn and yellow popcorn. Syngenta. EPA Reg. No. 100-1466. {Group 5 + 15 + 27}.

Acuron® Flexi [S-metolachlor (2.86 lbs ai/gal) + mesotrione (0.32 lbs ai/gal) + bicyclopyrone (0.08 lbs ai/gal)]. A preemergence and postemergence herbicide for control of annual grass and broadleaf weeds in field corn, seed corn, silage corn, sweet corn and yellow popcorn. Syngenta. EPA Reg. No. 100-1568. {Group 15 + 27}

Affinity® BroadSpec. [thifensulfuron (25%) + tribenuron (25%)]. Used POST for broadleaf weed control in wheat, barley and fallow. DuPont. EPA Reg. No. 352-611. 02/2012. {Group 2}.

Afforia. [flumioazin (40.8%) + thifensulfuron methyl (5%) + tribenuron methyl (5%)]. For burndown and preplant weed control in soybeans. Dupont. EPA Reg. No. 352-889. 2014. {Group 2 + 14}.

Agility™ SG, [dicamba (63.6%) + thifensulfuron (4.7%) + tribenuron (2.4%) + metsulfuron (1.9%)]. For selective POST control in wheat, barley, triticale, and fallow. DuPont. EPA Reg. No. 352-751. 03/2011. {Group 4 + 2}.

Agri Star®, Gly Star® 5 [see Gly Star 5].

Agri Star®, Gly Star® Original [see Gly Star Original].

Agri Star®, Gly Star® Pro [see Gly Star Pro].

Agri Star® Landmaster® [see Landmaster BW].

Aim® EC [carfentrazone-ethyl (2.0 lb ai/gal)]. For PRE, POST, and harvest aid use in various crops including field corn, sweet corn, popcorn, sorghum, small grains, millet, and soybeans. For harvest aid use in potatoes, dry beans and peas. FMC. EPA Reg. No. 279-3241. 06/2008. {Group 14}.

Alachlor. An active ingredient in Alachlor 4 EC, Bullet, INTRRO and Lariat for annual grass control in corn, sorghum and soybean. RUP. {Group 15}.

Alanap® L [naptalam (2 lb ai/gal)]. A PRE or POST broadleaf and grass herbicide for cucurbit and nursery stock. Chemtura. EPA Reg. No. 400-49. 2006. {Group 19}.

Alluvex™ [rimsulfuron (16.7%) + thifensulfuron-methyl (16.7%)]. For pre-plant, preemergence, or burndown weed control in field corn. DuPont. EPA Reg. No. 352-877. {Group 2}

Ally® XP [metsulfuron (60%)]. Used PP, PRE or POST in wheat, barley, grain sorghum and fallow for broadleaf and certain grass weed control. DuPont. EPA Reg. No. 352-435. 04/2010. {Group 2}.

Ally® Extra SG with TotalSol [metsulfuron (15%) + thifensulfuron methyl (37.5%) + tribenuron methyl (18.75%) by weight]. Used POST in wheat, barley and fallow for broadleaf weed control. DuPont. EPA Reg. No. 352-610. 04/2010. {Group 2}.

Herbicide Dictionary *(continued)*

Alphanex® [desmedipham (1.3 lb ai/gal)]. For POST control of redroot pigweed and other weeds in sugarbeets. UPI. EPA Reg. No. 264-620-70506. 03/2004. {Group 5}.

Amber® WDG [triasulfuron (75%)]. A PRE or POST herbicide for broadleaf weed control in wheat, barley, pastures, rangeland, CRP and fallow. Syngenta. EPA Reg. No. 100-768. 02/2004. {Group 2}.

Ametryn. Active ingredient in Evik. Used for directed POST weed control in corn and nonselective weed control in noncrop areas. {Group 5}.

Amine 4 2,4-D [2,4-D amine (3.74 lb ae/gal)]. For selective broadleaf weed control in corn, sorghum, small grain and lawns. Loveland. EPA Reg. No. 34704-120. 10/2001. {Group 4}.

Amine 4 2,4-D Herbicide™ [2,4-D (3.8 lb ae/gal)]. For control of broadleaf weeds in cereal crops, orchard floors, pastures, rangeland and noncrop areas. Tenkoz. EPA Reg. No. 42750-19-55467. 4/2002 {Group 4}.

Amine 4CA 2,4-D Weed Killer™ [2,4-D (3.8 lb ae/gal)]. For selective control of broadleaf weeds in cereal crops, lawns and noncrop areas. Loveland. EPA Reg. No. 34704-5. 7/2004. {Group 4}.

Aminocyclopyrachlor. An active ingredient in Perspective, Streamline and Viewpoint. {Group 4}.

Aminopyralid. An active ingredient in Milestone. {Group 4}.

Anthem™ ATZ [pyroxasulfone (4.006 lb ai/gal) + fluthiacet-methyl (0.014 lb ai/gal) + atrazine (0.485 lb ai/gal)]. For burndown, PPI, PRE and early post-emergence weed control in field corn, popcorn and sweet corn. FMC. EPA Reg. No. 279-3449. RUP. {Group 15 + 14 + 5}.

Anthem Maxx. [pyroxasulfone (4.174 lbs ai/gal) + fluthiacet methyl (0.126 lbs ai/gal)]. High load formulation of Anthem for burndown, PPI, PRE, and early POST weed control in field corn, seed corn, popcorn, sweet corn, and soybean. FMC. EPA Reg. No. 279-3468. 01/2015. {Group 15 + 14}.

Aquamaster® [glyphosate (4 lb ae/gal or 4.5 lb ai/gal)]. For use in aquatic sites. Monsanto. EPA Reg. No. 524-343. 11/2002. {Group 9}.

AquaNeat® [glyphosate (4 lb ae/gal or 5 lb ai/gal)]. For use on emerged aquatic weeds and brush in aquatic and other noncrop sites. Nufarm. EPA Reg. No. 228-365. 12/2002. {Group 9}.

Aquathol® K [endothall (4.23 lb ai/gal)]. An aquatic herbicide for use in still water. UPI. EPA Reg. No. 70506-176. 09/2011. {Not classified}.

Aquathol® Super K Granule [endothall (63%)]. An aquatic herbicide for use in still water. UPI. EPA Reg. No. 70506-191. 09/2011. {Not classified}.

Armezon® [topromezone (2.8 lb ai/gal)]. For POST broadleaf weed control in field corn, popcorn and sweet corn. BASF. EPA Reg. No. 7969-262. 2011. {Group 27}.

Armezon Pro® [toproenzone (0.1 lbs ai/gal) + dimethanemid-P (5.25 lbs ai/gal)]. For POST control of broadleaves and grasses in field corn, popcorn, and sweetcorn. BASF. EPA Reg. No. _____. 2015. {Group 27 + 15}

Arrow™ 2EC Herbicide [clethodim (2 lb ai/gal)]. Used POST for annual and perennial grasses in alfalfa, canola, potato, soybean, sunflower, sugarbeets and others. Makhteshim Agan N.A. EPA Reg. No. 66222-60. 12/2003. {Group 1}.

Arsenal® Herbicide [imazapyr (2 lb ai/gal)]. Provides total vegetation control for noncrop areas. BASF. EPA Reg. No. 241-346. 04/2000. {Group 1}.

Arsenal® AC [imazapyr (4 lb ai/gal)]. Used for POST control of woody and herbaceous weed control for forest site preparation and release of conifers. BASF. EPA Reg. No. 241-299. 04/2000. {Group 2}.

Assert® [imazamethabenz (2.5 lb ai/gal)]. POST control of wild oat and wild buckwheat in spring wheat and barley. NuFarm. EPA Reg. No. 71368-62. 2006. {Group 2}.

Assure® II [quizalofop (0.88 lb ai/gal)]. A POST grass herbicide for use in canola, dry bean, snapbean, soybean, sunflower and sugarbeets. DuPont. EPA Reg. No. 352-541. 04/2010. {Group 1}.

Asulam. Active ingredient in Asulox, Asulam 3.3. {Group 5}.

Asulox® or Asulam 3.3 [asulam (3.34 lb ai/gal)]. For POST weed control in turf, ornamentals, Christmas trees and non-crop areas. UPI. EPA Reg. No. 70506-139. 12/2006. Winfield Solutions. 9779-342. {Group 5}. *Not registered in Nebraska.*

Atrazine. A PP, PRE and POST s-triazine for control of broadleaf and certain grass weeds in corn, sorghum, ecofallow and CRP. Also used for weed control in CRP and control of certain annual grasses in perennial grass roadways. Active ingredient in AAtrex, Acuron, Atrazine 4F, Atrazine 4L, Atrazine 90 DF, Atrazine 90 WDG, Avalanche EW, BicepLite II Magnum, Bicep II Magnum, Bromox Atrazine, Bullet, Breakfree ATZ, Cinch ATZ, Cinch ATZ Lite, Confidence Xtra, Confidence Xtra 5.6L, Cornbelt Atrazine 4L or 90 DF, Degree Xtra, Expert, Field Master, FulTime NXT, G-Max Lite, Guardsman, Guardsman Max, Harness Xtra, Harness Xtra 5.6, Keystone NXT, Keystone LA NXT, Lariat, Lexar EZ, Lumax EZ, Marksman, Moxy + Atrazine, Prompt, Ready Master ATZ, Shotgun, Simazat, Stalwart Xtra, Sterling Plus, Trizmet II, Volley ATZ and Volley ATZ Lite. RUP. {Group 5}.

Atrazine 4 F [atrazine (4 lb/gal)]. Albaugh/Agri Star. EPA Reg. No. 42750-45. 02/2000. RUP. {Group 5}.

Atrazine 4 L [atrazine (4 lb ai/gal)]. Winfield Solutions. EPA Reg. No. 1381-158. 01/2000. RUP. {Group 5}.

Atrazine 4 L [atrazine (4 lb ai/gal)]. Helena. EPA Reg. No. 5905-470. 02/2004. {Group 5}.

Atrazine 90 DF [atrazine (90%)]. Drexel. EPA Reg. No. 10713-76. 02/2004. RUP. {Group 5}.

Atrazine 90 WDG [atrazine (90%)]. Van Diest. EPA Reg. No. 11773-13. RUP. {Group 5}.

Authority® Assist 4SC [sulfentrazone (33.3%) + imazethapyr (6.67%)]. For PRE control of broadleaf and sedge weeds in soybeans. FMC. EPA Reg. No. 279-3330. 02/2008. {Group 14 + 2}.

Herbicide Dictionary *(continued)*

Authority® Elite [sulfentrazone (0.7 lb ai/gal) + S-metolachlor (6.3 lb ai/gal)]. For PRE control of broadleaf and grass weeds in soybeans. FMC. EPA Reg. No. 279-3442. 06/2013. {Group 14 + 15}.

Authority® First 70DF [sulfentrazone (62.1%) + chloransulam-methyl (7.9%)]. For PRE control of broadleaf and grass weeds in soybeans. FMC. EPA Reg. No. 279-3246. 09/2006. {Group 14 + 2}.

Authority® Maxx [sulfentrazone (62.12%) + chlorimuron-ethyl (3.88%)]. For PRE control of annual broadleaf weeds in soybeans. FMC. EPA Reg. No. 279-9560. 10/2013. {Group 14 + 2}.

Authority® MTZ 45DF [sulfentrazone (18%) + metribuzin (27%)]. For burn-down and PRE control of broadleaf and grass weeds in soybeans. FMC. EPA Reg. No. 279-3326. 09/2007. {Group 14 + 5}.

Authority XL® [sulfentrazone (62.22%) + chlorimuron-ethyl (7.78%)]. For PPI and PRE control of broadleaf and grass weeds in soybeans. FMC. EPA Reg. No. 279-3413. 09/2010. {Group 14 + 2}.

Autumn™ [iodosulfuron-methyl (10%)]. For post harvest burndown application prior to planting field corn, popcorn, sweet corn, seed corn and soybean. Bayer CropScience. EPA Reg. No. 264-856. 07/2009. {Group 2}.

Autumn™ Super [iodosulfuron-methyl (6%) + thienicarbazone-methyl (45%)]. For control of many winter annual weeds. Apply at least 30 days prior to corn planting and 60 days prior to soybean planting. Bayer CropScience. EPA Reg. No. 264-1134. 09/2011. {Group 2}.

Avast!® SRP [fluridone (4 lb ai/gal)]. For control of aquatic weeds. SePRO. EPA Reg. No. 1812-447. 06/2003. {Group 12}.

Axial® [pinoxaden (0.83 lb ai/gal)]. For POST control of grass weeds in wheat and barley. Syngenta. EPA Reg. No. 100-1199. 2006. {Group 1}.

Axial XL® [pinoxaden (0.42 lb ai/gal)]. For POST control of grass weeds in wheat and barley. Syngenta. EPA Reg. No. 100-1256. 03/2008. {Group 1}.

Balan™ DF [benefin (60%)]. A PPI herbicide for annual grass control in alfalfa. Loveland. EPA Reg. No. 34704-746. 09/2001. {Group 3}.

Balan™ 2.5 G [benefin (2.5%)]. PRE control of annual grasses in lawns and golf courses. Verdicon [formerly United Horticultural Supply]. EPA Reg. No. 62719-96-65783. 09/2001. {Group 3}.

Balance® Flexx [isoxaflutole (2 lb ai/gal) + cyprosulfamide (safener)]. For selective PP and PRE control of grass and broadleaf weeds in field corn. Bayer Crop Science. EPA Reg. No. 264-1067. 12/2008. RUP. {Group 27}

Balance® PRO [isoxaflutole (4 lb ai/gal)]. For selective PP and PRE control of grass and broadleaf weeds in field corn. Bayer Crop Science. EPA Reg. No. 264-600. 03/2003. RUP. {Group 27}

Banvel® [dicamba, dimethylamine (4 lb ae/gal)]. A POST and PRE herbicide for selective broadleaf weed control in corn, sorghum, small grains and perennial grass. Arysta LifeScience. EPA Reg. No. 66330-276. 2011. {Group 4}.

Banvel® + atrazine [dicamba (1.1 lb ae/gal) + atrazine (2.1 lb ai/gal)]. For weed control in corn, grain sorghum and fallow. Arysta LifeScience. EPA Reg. No. 66330-286. 2008. RUP. {Group 4 + 5}.

Banvel® + 2,4-D [dicamba, DMA (1.0 lb) + 2,4-D, DMA (2.87 lb ae/gal)]. For CRP, fallow systems, general farmstead, sorghum, grass (hay or silage), pastures, rangeland and wheat. Arysta LifeScience. EPA Reg. No. 66330-287. 2009. {Group 4}.

Barrage® HF [2,4-D, 2-ethylhexyl ester (4.7 lb ae/gal)]. For broadleaf weed control in pastures, grassland, rangeland and fallow. PP, PRE, or POST in corn, grain and forage sorghum, wheat and oat. Helena. EPA Reg. No. 5905-529. 02/2004. {Group 4}.

Barricade® 65WG or 4FL [prodiamine]. A PRE herbicide for residual control of annual grass and broadleaf weeds in established turfgrass, lawns, sod nurseries and landscape ornamentals. Syngenta. EPA Reg. No. 100-834 or 100-1139. 06/2001. {Group 3}.

Basagran® [bentazon (4 lb ai/gal)]. A POST dry edible bean, corn, sorghum and soybean herbicide for control of velvetleaf, cocklebur and other broadleaf weeds under 6 inches. Arysta LifeScience; Winfield Solutions. EPA Reg. No. 7969-45-66330; 7969-45-1381. 2006;2009. {Group 6}.

Basagran® 5L [bentazon (5 lb ai/gal)]. For postemergence use in alfalfa grown for seed production, beans, corn, peanut, peas, peppermint, rice, sorghum, soybean, and spearmint. BASF. EPA Reg. No. 7969-112. {Group 6}.

Basagran® T/O, Broadloom [bentazon (4 lb ai/gal)]. POST broadleaf weed control in established turf. BASF. EPA Reg. No. 7969-326. 2010. {Group 6}.

Basis® [rimsulfuron (50%) + thifensulfuron (25%)]. A POST herbicide for selective broadleaf and grass control in corn. DuPont. EPA Reg. No. 352-571. 06/2010. {Group 2}.

Basis® Blend [rimsulfuron (20%) + thifensulfuron (10%)]. For fallow, PRE and POST selective broadleaf and grass control in field corn. DuPont. EPA Reg. No. 352-854. 08/2011. {Group 2}.

Battleship® [MCPA, DMA (3 lb ae/gal) + trichlopyr (0.27 lb ae/gal) + clopyralid (0.13 lb ae/gal)]. For control of annual and perennial broadleaf weeds in ornamental turf including sod. Helena. EPA Reg. No. 228-371-5905. 11/2000. {Group 4}.

Bayonet® [trifluralin (10%)]. For weed control in various horticultural and field crops. *Not registered in Nebraska.* Helena. EPA Reg. No. 1812-328-5906. 09/2003. {Group 3}.

Beacon® WDG [primisulfuron (75%)]. POST grass and broadleaf weed control in field, silage and seed corn and popcorn. Syngenta. EPA Reg. No. 100-705. 03/2002. {Group 2}.

Benefin [Also known as benfluralin.] Active ingredient in Balan DF, Balan 2.5G, Pro-Mate Turf Fertilizer and Team Pro for weed control in seedling alfalfa, turf, and landscape ornamentals. {Group 3}.

Benoxacor. Safener to protect corn from injury. Found in Dual and Bicep products.

Bensulfuron. Active ingredient in Londax. {Group 2}.

Bensulide. Active ingredient in Betasan 4-E or 12.5 G, Bensumec and Prefar 4-E for weed control in melons. {Group 8}.

Herbicide Dictionary *(continued)*

Bensumec™ 4LF [bensulide (4 lb ai/gal)]. For PRE and PPI control of crabgrass and annual bluegrass in turf, ornamentals and ground cover. PBI/Gordon. EPA Reg. No. 2217-696-ZB. 07/2004. {Group 8}.

Bentazon. An active ingredient in Basagran, Basagran T/O, Conclude Xact, Lescogran, Manifest, Prompt, Rezult and Storm for broadleaf weed control in corn, sorghum and soybean. {Group 6}.

Bentgrass Selective [dicamba (0.19 lb ae/gal) + 2,4-D amine (0.49 lb ae/gal) + Mecoprop-p (0.73 lb ae/gal)]. For use in controlling broadleaf weeds in ornamental lawns and turfgrass; not for turf being grown for sale. Lesco. EPA Reg. No. 10404-44. 12/2002. {Group 4}.

Betamix® Herbicide [phenmedipham (0.65 lb) + desmedipham (0.65)]. For POST broadleaf weed control in sugarbeets. Bayer CropScience. EPA Reg. No. 264-621. 05/2003. {Group 5}.

Betanex® Herbicide [desmedipham (1.3 lb ai/gal)]. For POST broadleaf weed control, especially redroot pigweed in sugarbeets. Bayer CropScience. EPA Reg. No. 264-620. 04/2004. {Group 5}.

Betasan® 4-E or 12.5 G Turf Herbicide [bensulide (4 lb ai/gal)]. Used for PRE control of crabgrass and annual bluegrass in turf, ornamentals and ground cover. Loveland. EPA Reg. No. 34704-211 or 34704-209. 05/2001. {Group 8}.

Beyond® [imazamox (1.0 lb ai/gal)]. Used POST to control downy brome and jointed goatgrass in Clearfield® winter wheat varieties. Beyond is also registered POST for weeds in Clearfield® sunflower. BASF. EPA Reg. No. 241-379. 04/2004. {Group 2}.

Bicep II Magnum® FC or Bicep II Magnum® [S-metolachlor (2.4 lb) + atrazine (3.1 lb ai/gal) + benoxacor]. For PRE broadleaf and grass weed control in corn and forage and grain sorghum treated with seed safener. Syngenta. EPA Reg. No. 100-817. 02/2004. RUP. {Group 15 + 5}.

Bicep Lite II Magnum® [S-metolachlor (3.33 lb ai/gal) + atrazine (2.67 lb ai/gal)]. RUP. For weed control in corn and grain or forage sorghum. Syngenta. EPA Reg. No. 100-827. 02/2004. RUP {Group 15 + 5}.

Bicyclopyrone. Active ingredient in Acuron. {Group 27}

Bison® [bromoxynil (2 lb ai/gal) + MCPA (2 lb ae/gal)]. Used to control broadleaf weeds in small grains. Winfield Solutions. EPA Reg. No. 9779-347. 01/2003. {Group 6 + 4}.

Bison® Advanced [bromoxynil (2.5 lb ai/gal) + MCPA (2.5 lb ae/gal)]. For POST broadleaf weed control in small grains. Winfield Solutions. EPA Reg. No. 264-690-1381. 12/2007. {Group 6 + 4}.

Bispyribac-sodium. An active ingredient in Velocity. {Group 2}.

Blade™ Selective Herbicide [metsulfuron (60%)]. For POST control of broadleaf weeds and certain grasses including foxtail and ryegrass in turf. PBI/Gordon. EPA Reg. No. 74477-1-2217. 03/2000. {Group 2}.

BnB Plus™ [phenmedipham (0.6 lb ai/gal) + desmedipham (0.6 lb ai/gal) + ethofumesate (0.6 lb ai/gal)]. For POST weed control in sugarbeets. UPI. EPA Reg. No. 264-632-70506. 11/2005. {Group 5 + 16}.

Bolero® 8 EC [thiobencarb (8 lb ai/gal)]. Rice herbicide. Valent. EPA Reg. No. 59639-79. 01/2000. {Group 8}.

Boundary® 6.5 EC [S-metolachlor (5.25 lb ai/gal) + metribuzin (1.25 lb ai/gal)]. For weed control in soybean. Syngenta. EPA Reg. No. 100-1162. 02/2004. {Group 15 + 5}.

Brash® [dicamba, dimethyl (1 lb ai/gal) + 2,4-D dimethylamine 2.87 lb ae/gal]. For CRP, fallow systems, sorghum, rangeland, pastures and wheat. Winfield Solutions. EPA Reg. No. 51036-308-9779. 10/2001. {Group 4}.

Breakfree® [acetochlor (70.87%) + diclofop (safener)]. For PP, PRE, and early POST weed control in corn. DuPont. EPA Reg. No. 352-722. 05/2010. {Group 15}.

Breakfree® ATZ [acetochlor (3 lb ai/gal) + atrazine (2.25 lb ai/gal) + diclofop (safener)]. For PRE control of annual grass and broadleaf weeds in corn. DuPont. EPA Reg. No. 352-724. 05/2010. RUP {Group 15 + 5}.

Breakfree® ATZ Lite [acetochlor (4 lb ai/gal) + atrazine (1.5 lb ai/gal) + diclofop (safener)]. For PRE control of annual grass and broadleaf weeds in corn. DuPont. EPA Reg. No. 352-723. 05/2010. RUP {Group 15 + 5}.

Broadaxe® XC [sulfentrazone (0.7 lb ai/gal) + S-metolachlor (6.3 lb ai/gal)]. For PPI and PRE broad spectrum control of weeds in soybeans and sunflowers. Syngenta. EPA Reg. No. 279-3442-100. {Group 14 + 15}.

Broadloom® [bentazon (4lb ai/gal)]. For postemergence use in beans, corn, peanuts, peas, peppermint, rice, sorghum, soybeans and spearmint. UPI. EPA Reg. No. 70506-306. {Group 6}.

Broclean® EC [bromoxynil (2 lb ai/gal)]. A contact herbicide for broadleaf weed control in alfalfa, corn, sorghum and small grains. Loveland. EPA Reg. No. 51036-256-34704. 12/1999. {Group 6}.

Bromacil. Active ingredient in Hyvar X, Hyvar X-L and Krovar I DF. {Group 5}.

Bromoxynil. An active ingredient in Bison, Broclean, Bronate Herbicide, Bronate Advanced, Buctril 4 EC, Maestro MA, Maestro D and Moxy 2E. RUP. {Group 6}.

Bronate® Herbicide [bromoxynil (2 lb ai/gal) + MCPA (2 lb ae/gal)]. Used to control broadleaf weeds in small grains. Bayer CropScience. EPA Reg. No. 264-438. 05/2003. {Group 6 + 4}.

Bronate Advanced™ [bromoxynil (2.5 lb ai/gal) + MCPA (2.5 lb ae/gal)]. For broadleaf weed control in small grains. Bayer CropScience. EPA Reg. No. 264-690. 11/2002. {Group 6 + 4}.

Brushmaster® [2,4-D (12.5%) + dichloroprop (6.25%) + dicamba (3.01%)]. For control of brush and broadleaf weeds in some trees. PBI/Gordon Corp. EPA Reg. No. 2217-774. 3/2003. {Group 4}

Buctril® or Buctril® 4EC [bromoxynil (2 lb ae/gal or 4 lb ai/gal)]. A contact herbicide for broadleaf weed control in seedling alfalfa, field corn and popcorn, grain and forage sorghum and small grains. Bayer CropScience. EPA Reg. No. 264-437 or 264-540. 2005 or 2010. {Group 6}.

Herbicide Dictionary *(continued)*

Bullet® [alachlor (2.5 lb ai/gal) + atrazine (1.5 lb ai/gal)]. Used PRE or PPI to control broadleaf and grass weeds in all types of corn and grain sorghum. Monsanto. EPA Reg. No. 524-418. 01/2002. RUP. {Group 15 + 5}.

Butoxone® 200 Herbicide [2,4-DB (2 lb ae/gal)]. For control of seedling broadleaf weeds in alfalfa. Monterey. EPA Reg. No. 56077-26. 07/1999. {Group 4}.

Butoxone® 7500 [2,4-DB (0.75 lb ae/gal)]. For controlling seedling broadleaf weeds in alfalfa. Monterey. EPA Reg. No. 56077-52. 07/2004. {Group 4}.

Butylate. Active ingredient in Sutan+. {Group 8}.

Butyrac® 175 or 200 [2,4-DB (2.0 lb/gal)]. For selective control of cocklebur in soybean and small broadleaf weeds in alfalfa. Albaugh/Agri Star. EPA Reg. No. 42750-39 or -38. 11/2002 or 02/2000. {Group 4}.

Cadence® [acetochlor (6.4 lb ai/gal)]. For PRE control of weeds in corn. Loveland. EPA Reg. No. 34704-926. 05/2006. RUP {Group 15}.

Cadet™ [fluthiacet-methyl (0.91 lb ai/gal)]. For POST control of velvetleaf and other broadleaf weeds in soybeans, field corn, sweet corn, and popcorn. FMC. EPA Reg. No. 279-3338. 03/2008. {Group 14}.

Callisto® [mesotrione (4 lb ai/gal)]. Used PRE and POST primarily for broadleaf weed control in field corn, production seed corn, yellow popcorn, sweet corn and silage corn. Syngenta. EPA Reg. No. 100-1131. 2009. {Group 27}.

Callisto® GT [mesotrione (0.38 lb ai/gal) + glyphosate (3.8 lb ae/gal)]. For broad spectrum POST weed control in glyphosate-tolerant corn. Syngenta. EPA Reg. No. 100-1470. 2013. {Group 27 + 9}.

Callisto® Xtra [mesotrione (0.5 lb ai/gal) + atrazine (3.2 lb ai/gal)]. Used POST primarily for broadleaf weed control in field corn, production seed corn, yellow popcorn, sweet corn and silage corn. Syngenta. EPA Reg. No. 100-1359. 2010. RUP. {Group 27 + 5}.

Camix® [S-metolachlor (3.3 lb ai/gal) + mesotrione (0.33 lb ai/gal)]. For PRE control of annual broadleaf and grass weeds in seed corn, field corn and corn grown for silage and sweet corn. Syngenta. EPA Reg. No. 100-1148. 04/2003. {Group 15 + 27}.

Campaign® [glyphosate IPA (1.2 lb ai/gal or 0.9 lb ae/gal) + 2,4-D amine (1.9 lb ai/gal or 1.5 lb ae/gal)]. For noncrop, rangeland and industrial weed control. Monsanto. EPA Reg. No. 524-351. 11/2002. {Group 9 + 4}.

Canopy® [metribuzin (64.3%) + chlorimuron ethyl (10.7%)]. Used PRE for broadleaf control in soybeans. DuPont. EPA Reg. No. 352-444. 04/2010. {Group 5 + 2}.

Canopy® EX [chlorimuron ethyl (22.7%) + tribenuron methyl (6.8%)]. For burn-down prior to planting soybeans. DuPont. EPA Reg. No. 352-635. 10/2010. {Group 2}.

Capreno® [thiencarbazone-methyl (0.57 lb ai/gal) + tembotrione (2.88 lb ai/gal)]. For control of annual broadleaf and grass weeds in corn. Bayer CropScience. EPA Reg. No. 0264-1063. 04/2009. {Group 2 + 27}.

Carfentrazone. Active ingredient in Aim, Aim EC, Aim EW, Power Zone, Priority, QuickSilver, Speed Zone, Square-One, and Teamwork. {Group 14}.

Cascade® Aquatic Herbicide [endothall (4.23 lb ai/gal)]. For aquatic plant control in irrigation systems and other flowing water aquatic sites and quiescent, or slow moving waters. UPI. EPA Reg. No. 70506-176. 09/2011. {Not classified}.

Casoron® 4G [dichlobenil (4%)]. For PRE weed control in woody plants and certain herbaceous perennials. Chemtura. EPA Reg. No. 400-168. 05/2005. {Group 20}.

Celebrity® Plus [dicamba (42.4%) + diflufenzopyr (17.0%) + nicosulfuron (10.6%)]. For POST weed control in field corn. BASF. EPA Reg. No. 7969-175. 04/2005. {Group 4 + 19 + 2}.

Certainty® Turf Herbicide [sulfosulfuron (75%)]. For control of annual and perennial grass and broadleaf weeds in highly managed warm-season turf sites. Monsanto. EPA Reg. No. 524-534. 2008. {Group 2}.

Chaparral™ [aminopyralid (52.5% ae) + metsulfuron (9.45%)]. For control of broadleaf and woody plants in rangeland, pasture, CRP, and natural areas. Dow AgroScience. EPA Reg. No. 62719-597. 11/2008. {Group 4 + 2}.

Charger Basic® [S-metolachlor (7.62 lb ai/gal)]. For PRE annual grass and broadleaf control in corn, potatoes, sugarbeets, soybean, sorghum, sunflowers and tomatoes. Winfield Solutions. EPA Reg. No. 1381-207. 11/2007. {Group 15}.

Charger MAX® ATZ [atrazine (3.1 lb ai/gal) + S-metolachlor (2.5 lb ai/gal)]. For annual grass and broadleaf weed control in corn and sorghum. Winfield Solutions. EPA Reg. No. 1381-199. 12/2007. RUP. {Group 5 + 15}.

Charger MAX® ATZ Lite [atrazine (2.67 lb ai/gal) + S-metolachlor (3.33 lb ai/gal)]. For annual grass and broadleaf weed control in corn and sorghum. Winfield Solutions. EPA Reg. No. 1381-208. 12/2007. RUP. {Group 5 + 15}.

Charger MAX® [S-metolachlor (7.64 lb ai/gal)]. For PRE annual grass and broadleaf control in corn, potatoes, soybean and sorghum. Winfield Solutions. EPA Reg. No. 1381-194. 11/2007. {Group 15}.

Chaser® Turf Herbicide [2,4-D butoxyethyl ester (2 lb ae/gal) + triclopyr (1 lb ae/gal)]. For POST control of annual and perennial broadleaf weeds in ornamental turf. Verdicon [formerly United Horticultural Supply]. EPA Reg. No. 62719-67-65783. 10/2003. {Group 4}.

Chaser® 2 Amine [2,4-D amine (2.78 lb ae/gal) + triclopyr (1.07 ae/gal)]. For POST control of annual grass and perennial broadleaf weeds in ornamental turf and sod farms. Verdicon [formerly United Horticultural Supply]. EPA Reg. No. 228-316-65783. 01/2001. {Group 4}.

Chaser® Ultra [MCPA (3.74 lb) + clopyralid (0.18) + dichloroprop (0.18 lb ae/gal)]. For broadleaf weed control in golf courses, parks and ornamental lawns. Verdicon [formerly United Horticultural Supply]. EPA Reg. No. 228-372-65783. 08/2002. {Group 4}.

Herbicide Dictionary *(continued)*

Chaser® Ultra Weed & Feed [2,4-D acid (0.861%) + clopralid (0.37%) + dicamba (0.072%)]. For broadleaf weed and feed in lawns. Contains fertilizer. Verdicon [formerly United Horticultural Supply]. EPA Reg. No. 228-376-65783. 08/2001. {Group 4}.

Chateau® SW [flumioxazin (51%)]. For residual and burndown control of many broadleaf weeds and grass suppression in alfalfa and other specialty crops. Valent. EPA Reg. No. 59639-99. 12/2003. {Group 14}.

Chisum® [metsulfuron (48%) + chlorsulfuron (15%)]. For weed control in pastures, rangeland or CRP. FMC. EPA Reg. No. 67760-80. 2008. {Group 2}.

Chlorimuron. Active ingredient in Authority XL, Canopy, Canopy EX, Classic, Enlite, Envive, Fierce XLT, Rowel FX, Synchrony XP, Trivence, and Valor XLT. {Group 2}.

Chlorsulfuron. Active ingredient in Finesse Grass and Broadleaf, Glean XP, Landmark XP, Report, and Telar. {Group 2}.

Chopper® [imazapyr (2 lb ai/gal)]. Mixed with water and/or diesel fuel to control regrowth from cut stumps of brush and trees. BASF. EPA Reg. No. 241-296. 02/2001. {Group 2}.

Cimarron® Max A co-pack of Cimarron A [metasulfuron (60%)] and Cimarron B [dicamba (1 lb ae/gal) + 2,4-D (2.87 lb ae/gal)]. For controlling broadleaf weeds in pastures, rangeland or established grasses or CRP. DuPont. EPA Reg. No. 352-615. 10/2011. {Group 2 + 4}.

Cimarron® Plus [metsulfuron (48%) + chlorsulfuron (15%)]. For weed control in pastures, rangeland or CRP. DuPont. EPA Reg. No. 352-670. 10/2010. {Group 2}.

Cimarron® X-tra. [metsulfuron (30%) + chlorsulfuron (37.5%)]. For controlling broadleaf weeds in pastures, rangeland or established grasses in CRP. DuPont. EPA Reg. No. 352-669. 06/2010. {Group 2}.

Cinch® [S-metolachlor (7.64 lb ai/gal) + benoxacor safener]. Registered for weed control in corn, safflower, grain or forage sorghum, soybean and potato. DuPont. EPA Reg. No. 352-625. 03/2012. {Group 15}.

Cinch® ATZ [S-metolachlor (2.4 lb) + atrazine (3.1 lb ai/gal) + benoxacor safener]. For weed control in corn and grain or forage sorghum. DuPont. EPA Reg. No. 352-624. 05/2010. RUP. {Group 15 + 5}.

Cinch® ATZ Lite [S-metolachlor (3.33 lb) + atrazine (2.67 lb ai/gal) + benoxacor safener]. For weed control in corn and grain or forage sorghum. DuPont. EPA Reg. No. 352-623. 07/2010. RUP. {Group 15 + 5}.

Clarity® [dicamba, diglycolamine (4 lb ae/gal)]. A low volatile formulation of dicamba to be used POST for broadleaf weed control in corn, sorghum and small grains. BASF. EPA Reg. No. 7969-137. 04/2006. {Group 4}.

Classic® Herbicide DF [chlorimuron (25%)]. A POST herbicide for broadleaf weed control in soybean. DuPont. EPA Reg. No. 352-436. 06/2010. {Group 2}.

Clearcast® [imazamox (1 lb ae/gal)]. For vegetation control in and around aquatic and non-cropland sites. BASF. EPA Reg. No. 241-437. 01/2008. {Group 2}.

Clearmax® [imazamox (1.0 lb ae/gal) + (MCPA 3.7 lb ae/gal)]. Used POST for control of downy brome and jointed goatgrass in Clearfield winter wheat varieties. BASF. EPA Reg. No. 7969-238. 2006. {Group 2 + 4}.

ClearOut 41 [glyphosate, IPA (3 lb ae/gal)]. For nonselective weed control and for Roundup Ready corn and soybean. Needs additional surfactant. CPT-LLC {Group 9}.

ClearOut 41 Plus [glyphosate, IPA (3 lb ae/gal)]. For nonselective weed control and for Roundup Ready corn and soybean. CPT-LLC. {Group 9}.

CleanWave® [aminopyralid (0.085 lb ae/gal) + fluroxypyr (1.2 lb ae/gal)]. Used POST for annual and perennial weed control in wheat. Dow AgroSciences. EPA Reg. No. 62719-525. 12/2005. {Group 4}.

Clethodim. Active ingredient in Arrow 2 EC, Intensity 1, Prizm and Select MAX. {Group 1}.

Clodinafop-propargyl. Active ingredient in Discover Herbicide or Discover NG. {Group 1}.

Clomazone. An active ingredient in Command 3ME and Strategy. {Group 13}.

Clopyr® Ag Herbicide [clopyralid (3 lb ae/gal)]. Labeled for asparagus, tree plantations, fallow cropland, field corn, grasses grown for seed, sugarbeets and CRP. Ag Value. EPA Reg. No. 75147-4-73917. 05/2003. {Group 4}.

Clopyralid. An active ingredient in Battleship, Chaser Ultra, Chaser Ultra Weed & Feed, Clopyr AgHerbicide, Cody, Confront, Curtail, Curtail M, Hornet WDG, Lontrel, Millennium Ultra, Millennium Ultra Plus, Reclaim, Redeem R&P, Stinger, Strike 3 Ultra, SureStart, Transline, TripleFLEX, WideMatch and WideMatch M. {Group 4}.

Cloransulam methyl. An active ingredient in Authority First, FirstRate, Gangster, Sonic, and Surveil. {Group 2}.

Cody [clopyralid (5.1%) + 2,4-D (39.0%)]. For selective control of broadleaf weeds in wheat and barley not underseeded with a legume, corn, fallow cropland, grasses grown for seed, rangeland and permanent grass pastures, conservation reserve program (CRP) acres, and non-cropland. Alligare. EPA Reg. No. 81927-28. {Group 4}.

Cobra® [lactofen (2 lb ai/gal)]. For selective weed control PRE and POST in soybeans and cotton. Valent. EPA Reg. No. 59639-34. 05/2003. {Group 14}.

Colt® AS [clopyralid (0.75 lb ai/gal) + fluroxypyr (0.75 lb ai/gal)]. For broadleaf control in wheat, barley, oats, field corn, and sweet corn. Loveland. EPA Reg. No. 34704-895. 2006. {Group 4}.

Colt® + Salvo® [fluroxypyr (0.75 lb ae/gal) + 2,4-D ester (3 lb ae/gal)]. For POST broadleaf weed control in small grains, especially for kochia. Loveland. EPA Reg. No. 34704-1010. 03/2009. {Group 4}.

Colt® + Sword® [fluroxypyr (0.71 lb ae/gal) + MCPA (2.84 lb ae/gal)]. For POST broadleaf weed control in small grains, especially for kochia. Loveland. EPA Reg. No. 34704-1011. 05/2009. {Group 4}.

Command® 3 ME [clomazone (3 lb ai/gal)]. An encapsulated PRE herbicide for grass and broadleaf weed control in soybean. FMC. EPA Reg. No. 279-3158. 05/2003. {Group 13}.

Herbicide Dictionary *(continued)*

Commit® [dimethanamid-P (6 lb ai/gal)]. For PP and PRE use in corn, dry bean, grain sorghum and soybean to control many annual grasses and broadleaves. Winfield Solutions. EPA Reg. No. 7969-156-1381. 2010. {Group 15}.

Commit® ATZ [dimethanamid-P (1.7 lb ai/gal) + atrazine (3.3 lb ai/gal)]. For use in corn (field, pop, seed, sweet) and grain sorghum to control many annual grasses and broadleaves. Winfield Solutions. EPA Reg. No. 7969-192-1381. 2010. {Group 15 + 5}.

Commit® ATZ Lite [dimethanamid-P (2.25 lb ai/gal) + atrazine (2.75 lb ai/gal)]. For use in corn (field, pop, seed, sweet) and grain sorghum to control many annual grasses and broadleaves. Winfield Solutions. EPA Reg. No. 7969-200-1381. 2010. {Group 15 + 5}.

Concep III® WP [flufenoxim (75%)]. A protectant for corn and sorghum seeds to reduce metolachlor injury. Syngenta. EPA Reg. No. 100-NC-2. 09/1998.

Confidence® [acetochlor (7 lb ai/gal)]. PRE for grass weed control in field corn, seed corn, silage and popcorn. Similar to Harness, but without safener. Winfield Solutions. EPA Reg. No. 524-473. 01/2003. RUP {Group 15}.

Confidence® Xtra [acetochlor (4.3 lb) + atrazine (1.7 lb ai/gal)]. PRE for broadleaf and grass weed control in field, seed and silage corn and popcorn. Similar to Harness, but without safener. Winfield Solutions. EPA Reg. No. 524-480. 01/2003. RUP. {Group 15 + 5}.

Confidence® Xtra 5.6L [acetochlor (3.1 lb) + atrazine (2.5 lb ai/gal)]. PRE for broadleaf and grass control in field and seed corn, silage, and popcorn. Winfield Solutions. EPA Reg. No. 524-485. 01/2003. RUP. {Group 15 + 5}.

Confront® [triclopyr (2.25 lb) + clopyralid (0.75 lb ae/gal)]. For control of annual and perennial broadleaf weeds in established turf (golf course). Dow AgroSciences. EPA Reg. No. 62719-92. 08/1998. {Group 4}.

Cool Power® [MCPA (3 lb ae/gal) + triclopyr (0.3 lb ae/gal) + dicamba (0.3 lb ae/gal)]. For broadleaf weed control in golf courses, parks and ornamental turf lawns. Nufarm. EPA Reg. No. 228-317. 07/1998. {Group 4}.

Copper-Komeen®. An aquatic herbicide [see *Komeen*].

Copper Sulfate. Available as crystals or in chelated form for algae control in moving and still water. Several brand names.

Cornbelt® 4 lb or Lo Vol Ester [2,4-D, 2-ethylhexyl ester (3.8 ae/gal)]. For control of many broadleaf weeds susceptible to 2,4-D. May be applied in crop residue management systems in soybean when applied preplant. Van Diest. EPA Reg. No. 11773-3. 04/2002. {Group 4}.

Cornbelt® 6 lb Lo Vol Ester [2,4-D, 2-ethylhexyl ester (5.6 lb ae/gal)]. For control of many broadleaf weeds susceptible to 2,4-D. May be applied in crop residue management systems in soybean when applied preplant. Van Diest. EPA Reg. No. 11773-4. 04/2002. {Group 4}.

Cornbelt® 4 lb amine [2,4-D dimethylamine (3.8 lb ae/gal)]. For broadleaf weed control in grass pastures, rangelands and certain crops. Van Diest. EPA Reg. No. 11773-5. 04/2002. {Group 4}.

Cornbelt® Atrazine 4L or 90DF [atrazine (4 lb ai/gal or 90%)]. For season long weed control in corn, soybean and certain other crops. Van Diest. EPA Reg. No. 11773-1 or 11773-13. 07/1994 or 04/2002. RUP. {Group 5}.

Cornbelt® Trifluralin EX [trifluralin (4 lb ai/gal)]. PPI, PRE immediately after planting; POST or layby application for weed control in many crops. Van Diest. EPA Reg. No. 1812-355-11773. 03/1999. {Group 3}.

Cornerstone® [glyphosate, isopropylamine (3 lb ae/gal)]. For POST control of broadleaf and grass weeds in Roundup Ready corn and soybean, burndown and noncropland weed control. Additional surfactant optional. Winfield Solutions. EPA Reg. No. 524-445-1381. 09/2010. {Group 9}

Cornerstone® Plus [glyphosate, isopropylamine (3 lb ae/gal)]. For POST control of broadleaf and grass weeds in Roundup Ready corn and soybean, burndown and noncropland weed control. Additional surfactant optional. Winfield Solutions. EPA Reg. No. 1381-192. 05/2010. {Group 9}

Cornerstone® 5 Plus [glyphosate, isopropylamine (4 lb ae/gal)]. For POST control of broadleaf and grass weeds in Roundup Ready corn and soybean, burndown and noncropland weed control. Winfield Solutions. EPA Reg. No. 1381-241. 01/2010. {Group 9}.

Corral® 2.68 G [pendimethalin (2.68%)]. For use by commercial nursery, cut flower, foliage and landscape personnel. Scotts. EPA Reg. No. 538-188. 01/2004. {Group 3}.

Corvus® [isoxaflutole (1.88 lb ai/gal) + thiencazuron-methyl (0.75 lb ai/gal) + cyprosulfamide (safener)]. For PP and PRE control of broadleaf and grass weeds in corn. Bayer CropScience. EPA Reg. No. 264-1066. 01/2009. RUP. {Group 27 + 2}.

Crabgrass Preventer with Barricade 295 or 50% Plus [proflumicarb (0.295 or 0.50%)]. For selective control of grass and broadleaf weeds in established turfs, lawns, landscape, ornamentals, established perennials and wild flower plantings. Do not use on golf course putting greens. Verdicon [formerly United Horticultural Supply]. EPA Reg. No. 34704-820-65783. 04/2000 or 08/2002. {Group 3}.

Credit® System Herbicide [glyphosate (3 lb ae/gal or 4 lb ai/gal)]. For POST control of broadleaf and grass weeds in Roundup Ready corn and soybean, burndown and noncropland weed control. Additional surfactant optional. Nufarm. EPA Reg. No. 71368-20. 10/2003. {Group 9}.

Credit® Duo Herbicide or Credit® Duo Extra [isopropylamine (2.7 lb ae/gal) + acid as monoammonium of glyphosate acid (0.3 lb ai/gal)]. Used for certain cropping systems including Roundup Ready corn, Roundup Ready soybean, reduced tillage and fallow systems and many noncrop areas. Additional surfactant of an 80% nonionic optional. Nufarm. EPA Reg. No. 71368-25. 09/2003. {Group 9}.

Credit Master™ [glyphosate (0.9 lb ae/gal) + 2,4-D (1.5 lb ae/gal)]. For POST control or suppression of field bindweed, broadleaf and grass weeds in fallow and reduced tillage systems. Additional surfactant optional. Nufarm. EPA Reg. No. 71368-31. 07/2001. {Group 9 + 4}.

Herbicide Dictionary *(continued)*

Crossbow® [2,4-D (2 lb ae/gal) + triclopyr (1 lb ae/gal)]. For broadleaf weeds and woody plant control in rangeland, pastures, CRP and noncrop areas. Dow AgroSciences. EPA Reg. No. 62719-260. 01/2003. {Group 4}.

Crusher™ [rimsulfuron (25%) + thifensulfuron-methyl (25%)]. For preplant and preemergence weed control in field corn and for preplant weed control in cotton, peanuts and soybeans. FMC. EPA Reg. No. 67760-121. {Group 2}

Curbit® EC [ethalfluralin (3 lb ai/gal)]. Used PRE or PPI in melon, pumpkin, squash and cucumber for grass control. Loveland. EPA Reg. No. 34704-610. 08/1999. {Group 3}.

Curtail® [clopyralid (0.38 lb ae/gal) + 2,4-D (2 lb ae/gal)]. For POST broadleaf control in wheat, barley, fallow, rangeland and pastures. Dow AgroSciences. EPA Reg. No. 62719-48. 06/2001. {Group 4}.

Curtail® M [clopyralid (0.42 lb/gal) + MCPA (2.35 lb/gal)]. For POST broadleaf control in wheat and barley. Dow AgroSciences. EPA Reg. No. 62719-86. 07/2001. {Group 4}.

Cycolate Active ingredient in Ro-Neet. {Group 8}.

Cyprosulfamide A safener in Balance Flexx and Corvus.

Dacthal [also called DCPA]. The active ingredient in Dacthal W-75 and Dacthal Flowable. {Group 3}.

Dacthal® W-75 or Dacthal® Flowable [DCPA (75% or 6 lb ai/gal)]. For control of annual grass weeds in potato and turf. Amvac. EPA Reg. No. 5481-490 or 5481-487. 11/2002 or 08/2003. {Group 3}.

Dagger® [MCPA, isooctyl ester (5.2 lb ae/gal)]. For selective control of broadleaf weeds in small grains, flax, grasses, rangelands, pastures and noncrop areas. Nufarm. EPA Reg. No. 228-267. 03/2003. {Group 4}.

Dawn® [fomesafen (2 lb ai/gal)]. For PRE and POST broadleaf control in soybeans. FMC. EPA Reg. No. 67760-93. 01/2009. {Group 14}.

DCPA. Another name for Dacthal. {Group 3}.

Defendor. [flurasulam (0.42 lbs ai/gal)] For postemergence control of annual and perennial broadleaf weeds in established turfgrass, including residential lawns, golf courses, sports fields, sod farms, and commercial turfgrass areas. Dow AgroSciences. EPA Reg. No. 62719-560. 2014 {Group 2}

Degree® Herbicide [acetochlor (3.8 lb ai/gal)]. An encapsulated acetochlor with safener. EPP or PRE. Monsanto. EPA Reg. No. 524-496. 10/2002. RUP {Group 15}.

Degree Xtra® Herbicide [acetochlor (2.7 lb ai/gal) + atrazine (1.34 lb ai/gal)]. For EPP and PRE control of broadleaf and grass weeds in field corn and grain sorghum. Monsanto. EPA Reg. No. 524-511. 10/2002. RUP. {Group 15 + 5}.

Desmedipham. An active ingredient in Alphanex, Betamix Herbicide, Betanex, Phen-Des 8+8 and Progress Herbicide. {Group 5}.

Devrinol® 50-DF [napropamide (50%)]. For weed control in nut, pome fruit, small fruit, stone fruit and vegetable. United Phosphorus. EPA Reg. No. 100-1035-70506. 07/2003. {Group 15}.

Devrinol® 2 G [napropamide (2%)]. PRE for weed control in home flower gardens, landscape plantings and turfgrass. United Phosphorus. EPA No. 100-1032-AA-70506. 02/2003. {Group 15}.

Dicamba. An active ingredient in Agility SG, Banvel, Banvel + atrazine, Banvel SGF, Banvel + 2,4-D, Bentgrass Selective, Brash, Brushmaster, Celebrity, Celebrity Plus, Chaser Ultra Weed & Feed, Cimarron Max, Clarity, Cool Power, Dicamba DMA Salt, Diflexx, Diflexx DUO, Distinct, Eliminate, Fallow Master Broadspectrum, Fallow Star, Four Power Plus, Fuego, Horsepower, Kamba Master, Marksman, Mec Amine-D Turf Herbicide, Millennium Ultra, Millennium Ultra Plus, NorthStar, Onetime, Op-Till, Outlaw, Overdrive, Pasture-Master, Pasture MD, Power Zone, Range Star, Rave, Require Q, Rifle, Speed Zone, Status, Sterling, Sterling Plus, Strike 3, Three-Way Ester II, Three-way Selective Herbicide, Trimec Broadleaf, Trimec Classic, Trimec Turf, Trimec Plus, Triplet, TriPower Selective, Vanquish, Veteran CST, Veteran 710, Veteran 10G, Weed-master Herbicide and Yukon. {Group 4}.

Dicamba DMA Salt™ [dicamba (4 lb ae/gal)]. For weed control in corn, sorghum, small grains, pasture, hay, rangeland and alfalfa. Albaugh/Agri Star/AgriStar. EPA Reg. No. 42750-40. 02/2000. {Group 4}.

Dichlobenil. Active ingredient in Casoron. {Group 20}.

Dichlormid. Safener in Breakfree, Break-free ATZ, Breakfree ATZ Lite, Keystone, Keystone LA, Surpass, TopNotch, Volley, Volley ATZ and Volley ATZ Lite.

Dichlorprop. Active ingredient in Brushmaster, Chaser Ultra, PRO-mate Three Way SC, Strike 3 Ultra, Triamine, Triamine II and Turf Weed and Brush Control. Also called 2,4-DP. {Group 4}.

Diclofop. Active ingredient in Hoelon. Controls certain annual grasses POST in wheat. {Group 1}.

DiFlexx. [Diglycoamine (4 lbs ae/gal)]. For weed control in field corn for grain, seed and silage, and for fallow crop-lands. Bayer. EPA Reg. No. 264-1173. {Group 4}.

DiFlexx DUO. [Diglycoamine (4 lbs ae/gal)+ tembotrione (0.27 lb ai/gal)]. for weed control of annual broadleaf and grass weeds in field corn, corn grown for silage, popcorn and seed corn and post-harvest burndown weed control. Bayer. EPA Reg. No. 264-1184. {Group 4 + 27}.

Diflufenzopyr. An active ingredient in Celebrity Plus, Distinct, Overdrive and Status. Used POST in corn and pastures for broadleaf weed control. {Group 19}.

Diglycoamine. See dicamba.

Dimension® 40 WP or EC [dithiopyr (1 lb ai/gal)]. Lawn, ornamental turf, and landscape ornamental herbicide for control of annual grasses and broadleaf weeds in several turfgrasses including buffalograss. Dow AgroSciences. EPA Reg. No. 707-245 or 62719-426. 02/2001. {Group 3}.

Dimension® Ultra WPS [dithiopyr (40%)]. Lawn, ornamental turf and landscape ornamental herbicide for control of annual grasses and broadleaf weeds. Each 5 oz WS pouch contains 0.125 lb ai.

Herbicide Dictionary *(continued)*

Dow AgroSciences. EPA Reg. No. 62719-445. 02/2004. {Group 3}.

Dimethenamid. An active ingredient that was replaced by dimethenamid-P. Guardsman contained dimethenamid. {Group 15}.

Dimethenamid-P. Active ingredient in Armezon Pro, G-Max Lite, Guardsman Max and Outlook. It is a more active isomer than dimethenamid. {Group 15}.

Dimetric® [metribuzin (75%)]. For weed control in field corn, soybeans, alfalfa and potatoes. Winfield Solutions. EPA Reg. No. 1381-197. 09/2007. {Group 5}.

Diquat. Active ingredient in QuikPRO, Reglone Desiccant, Reward AccuGel and Weedtrine-D. {Group 22}.

Direx® 4L [diuron (4 lb ai/gal)]. Similar to Karmex. DuPont. EPA Reg. No. 352-678. 02/2011. {Group 7}.

Discover® Herbicide or Discover® NG [clodinafop-propargyl (2 lb ai/gal)]. For POST grass control in spring wheat. Syngenta. EPA Reg. No. 100-907 or 100-1173. 05/2000 or 10/2003. {Group 1}.

Dismiss® [sulfentrazone (4 lb ai/gal)]. For selective weed control in turf, athletic fields, sod farms, and golf course fairways and rough. FMC. EPA Reg. No. 279-3295. 02/2008. {Group 14}.

Distinct® [diflufenzopyr (0.2 lb ae/gal) + dicamba (0.5 lb ae/gal)]. For broadleaf weed control in CRP, pasture, hay, rangeland and preplant burndown before planting corn. BASF. EPA Reg. No. 7969-150. 10/2003. {Group 19 + 4}.

Dithiopyr. Active ingredient in Dimension WP or EC, Dimension Ultra WSP and Pro-Mate Dimension 0.22% Plus Fertilizer. {Group 3}.

Diuron. An active ingredient in Direx 4L, Diuron DF, Diuron 4L, Diuron IVM, Diuron WDG, Karmex DF, Krovar I DF, Sahara, Topsite and Velpar AlfaMax, Velpar AlfaMax Gold. {Group 7}.

Diuron DF or Diuron WDG [diuron (80%)]. A substituted urea for selective annual weed control at low rates in established alfalfa and as a soil sterilant at higher rates. Winfield Solutions, Loveland or Makhteshim Agan. EPA Reg. No. 9779-318 or 34704-648; 66222-51 or 66222-54. 03/2000. {Group 7}.

Diuron 4L IVM or 80 DF IVM [diuron (4 lb ai/gal or 80%)]. For nonselective weed control in noncropland. Dow AgroSciences. EPA Reg. No. 62719-311 or 310. 07/2000 or 02/2002. {Group 7}.

DMA® 4 IVM [2,4-D, diamethylamine (3.8 lb ae/gal)]. For selective broadleaf weed control in noncropland, noncrop turf and aquatic areas. Dow AgroSciences. EPA Reg. No. 62719-3. 02/2001. {Group 4}.

Drive® 75 DF [quinclorac (75%)]. Used PRE or early POST for weed control in turf including crabgrass and foxtail. BASF. EPA Reg. No. 7969-130. 04/2001. {Group 4}.

DSMA. Active ingredient in DSMA Plus. {Group 17}.

DSMA Plus [DSMA (3.6 lb ai/gal)]. Used to control weeds in turfgrass. Loveland. EPA Reg. No. 50534-27-34704. 06/2000. {Group 17}.

Dual Magnum® [S-metolachlor (7.64 lb ai/gal) + benoxacor (safener)]. Active isomer of metolachlor used to control annual broadleaf and grass weeds in corn, grain or forage sorghum, potato, soybean, sugarbeets, sunflower and tomatoes. Needs safened seed for sorghum. Syngenta. EPA Reg. No. 100-816. 10/2003. {Group 15}.

Dual II Magnum® or Dual II G Magnum™ [S-metolachlor (7.64 lb ai/gal or 16%) + benoxacor (safener)]. For annual broadleaf and grass weed control in corn, potato, pod crops, grain or forage sorghum and soybean. The granules are used only on corn [all types], potato and soybean. Syngenta. EPA Reg. No. 100-818 or 910. 11/2002. {Group 15}.

Dual II Magnum® SI [S-metolachlor (6.3 lb ai/gal) + benoxacor (safener)]. Custom application to dry fertilizer for weed control in corn and soybean. Syngenta. EPA Reg. No. 100-829. 05/2003. {Group 15}.

Durango® [glyphosate, isopropylamine salt (4 lb ae/gal or 5.4 lb ai/gal)]. For POST control of broadleaf and grass weeds in Roundup Ready corn and soybean, burndown, fallow cropland and noncropland weed control. Additional surfactant not required. Dow AgroSciences. EPA Reg. No. 62719-517. 10/2004. {Group 9}.

D-638™ [2,4-D acid + 2,4-D butoxyethyl ester (2.8 lb ae/gal)]. For control of field bindweed, Russian knapweed, Canada thistle, cattail, annual broadleaf weeds and brush in pastures, rangeland, fallow ground, CRP, field corn, grain sorghum POST and preplant on soybean. Albaugh/Agri Star. EPA Reg. No. 42750-36. 03/2000. {Group 4}.

Echelon® 4SC [sulfentrazone (13.6%) + prodiamine (27.3%)]. For PRE and early POST control of annual grasses, broadleaves, and sedges in lawns, sod, athletic fields, golf courses, roadsides, rights-of-way and industrial areas. FMC. EPA Reg. No. 279-3323. 09/2007. {Group 14 + 3}.

Edition® TankMix [thifensulfuron (40%) + tribenuron (10%)]. For use on wheat, barley, oat, triticale, and fallow. FMC. EPA Reg. No. 67760-89. FMC. 03/2009. {Group 2}.

Edition® Broadspec [thifensulfuron (25%) + tribenuron (25%)]. For use on wheat, barley, oat, triticale, and fallow. FMC. EPA Reg. No. 67760-89. 06/2008. {Group 2}.

Eliminate Liquid Selective Herbicide [MCPA (3.8 lb) + triclopyr (0.38 lb) + dicamba (0.38 lb ae/gal)]. For selective control of broadleaf weeds in ornamental lawns and turfgrasses. Lesco. EPA Reg. No. 8-318-10404. 09/2003. {Group 4}.

Endothall. Active ingredient in Aquathol K, Aquathol Super K and Cascade. {Not classified}.

Endurance® WP [prodiamine (65%)]. PRE control of weeds in noncrop areas, landscape ornamentals, established perennial and wildflower plantings and conifer and hardwood seedling nurseries. Syngenta. EPA Reg. No. 100-834. 06/2003. {Group 3}.

Engenia™. Under development for use in dicamba tolerant soybean. BASF.

Enlist Duo™. [glyphosate (1.7 lbs/gal) + 2-4D choline (1.6 lbs/gal)]. For control of annual and perennial weeds and use on Enlist™ corn and soybeans; use as a non-selective burndown; chemical fallow; and use as a preplant or preemergence or postemergence herbicide on listed crops, for control of emerged weeds only. Dow Agrosciences. EPA Reg. No. 62719-649. 2014. {Group 4 + 9}.

Herbicide Dictionary *(continued)*

Enlite® [chlorimuron (2.85%) + flumioxazin (36.21%) + thifensulfuron (8.8%)]. For burndown and PRE weed control in soybeans. DuPont. EPA Reg. No. 352-757. 06/2010. {Group 2 + 14}.

Envive® [chlorimuron (9.2%) + flumioxazin (29.2%) + thifensulfuron (2.9%)]. For burndown and PRE weed control in soybeans. DuPont. EPA Reg. No. 352-756. 01/2011. {Group 2 + 14}.

E-99 Herbicide [2,4-D butoxyethyl ester (6.1 lb ae/gal)]. For controlling broadleaf weeds in corn, small grains, pastures and rangeland. Winfield Solutions. EPA Reg. No. 62719-365-1381. 09/2005. {Group 4}.

Eptam® [EPTC (7 lb ai/gal)]. Used PPI for control of grass and broadleaf weeds in legumes, sugarbeets and many horticultural crops. Gowan. EPA Reg. No. 10163-283. 07/2008. {Group 8}.

EPTC. An active ingredient in Double-Play, Eptam, Eptek and Eradicane. {Group 8}.

Eptek® 7E [EPTC (7 lb ai/gal)]. For control of grass and broadleaf weeds in alfalfa and other legumes, sugarbeets and tomato. Drexel. EPA Reg. No. 19713-561. 10/2004. {Group 8}.

Eradicane® 6.7-E [EPTC (6.7 lb/gal) + safener]. PP soil-incorporated treatment for grass control in field, pop, sweet and silage corn. Gowan. EPA Reg. No. 10163-284. 02/2004. {Group 8}.

Escort® XP [metsulfuron (60%)]. Used to control broadleaf weeds and brush in conifers and industrial turfgrass. DuPont. EPA Reg. No. 352-439. 02/2012. {Group 2}.

Esteron® 99® [2,4-D, 2-ethylhexyl ester (3.8 lb ae/gal)]. Used for broadleaf weed control in pastures, certain crops and noncrop areas. Nufarm. EPA Reg. No. 62719-09-AA-71368. 10/2001. {Group 4}.

Ethalfuralin. Active ingredient in Curbit, Sonalan HFP or 10G and Strategy. {Group 3}.

Etho™ SC [ethofumesate (42%)]. A PPI, PRE, or POST herbicide for sugarbeets. Ag Value. EPA Reg. No. 37429-GA-1. 07/2002. {Group 16}

Ethofumesate. An active ingredient in Etho SC, Ethotron, Norton SC, Prograss EC and Progress Herbicide. {Group 16}.

Ethotron™ SC [ethofumesate (4 lb ai/gal)]. A PPI, PRE or POST herbicide for sugarbeets. UPI. EPA Reg. No. 264-613-70506. 02/2008. {Group 16}.

ET [pyraflufen – ethyl (2.5%)]. PPO inhibitor herbicide for a defoliant and a desiccant. Registered for corn, soybean, cotton and potato. Nichino America, Inc. EPA Reg. No. 71711-7. 01/2005. {Group 14}.

Everest® 70 WDG [flucarbazone (70%)]. For control of wild oat and green foxtail in winter and spring wheat. Arvesta. EPA Reg. No. 66330-49. 03/2001. {Group 2}.

Evik® DF [ametryn (80%)]. Used as a POST directed spray for weeds in corn and noncropland. Syngenta. EPA Reg. No. 100-786. 06/2001. {Group 5}.

Expert® [S-metolachlor (1.74 lb ai/gal) + glyphosate, IPA (1.0 lb ai/gal) + atrazine (2.14 lb ai/gal)]. PRE weed control in corn and grain or forage sorghum and after emergence of Roundup Ready corn. Syngenta. EPA Reg. No. 100-1161. 03/2003. RUP. {Group 15 + 9 + 5}.

Express® with TotalSol™ [tribenuron (50%)]. A short residual POST herbicide for broadleaf weed control in wheat, barley and fallow. DuPont. EPA Reg. No. 352-632. 12/2011. {Group 2}.

Extra Credit® [glyphosate (5 lb ai/gal)]. For POST control of weeds in Roundup Ready soybean, Roundup Ready corn, fallow and reduced tillage systems. Nufarm. EPA Reg. No. 71368-43. 09/2004. {Group 9}.

Extreme® Herbicide [imazethapyr (0.17 lb) + glyphosate, isopropylamine (2 lb ai/gal)]. For weed control in Roundup Ready soybean and alfalfa. BASF. EPA Reg. No. 241-405. 04/2005. {Group 2 + 9}.

Fallow Master® Broad Spectrum [glyphosate, isopropylamine (1.6 ae/gal) + dicamba (0.4 lb ae/gal)]. Used to control weeds POST in fallow and reduced tillage systems for selected counties in Nebraska. Monsanto. EPA Reg. No. 524-507. 05/2003. {Group 9 + 4}.

Fallow Star® [glyphosate (1.1 lb ae/gal) + dicamba (0.5 lb ae/gal)]. Controls or suppresses emerged weeds in fallow and reduced tillage small grains. Albaugh/Agri Star. EPA Reg. No. 42750-63. 06/2001. {Group 9 + 4}.

Far-Go® [triallate (10% or 4 lb ai/gal)]. For PRE control of downy brome and other grass weeds in winter wheat and garbanzo bean. Monsanto. EPA Reg. No. 524-292 or 524-145. 01/2000. {Group 8}.

Fenoxaprop. Active ingredient in Acclaim Extra, Fusion, Puma EC and Whip 360. {Group 1}.

Field Master® [acetochlor (2.1 lb ai/gal) + atrazine (1.5 lb ai/gal) + glyphosate (0.56 lb ae/gal)]. For PP or PRE control of weeds in no-till and minimum tillage systems in field, seed and silage corn and popcorn. Also POST in Roundup Ready corn. Monsanto. EPA Reg. No. 524-497. 10/2002. RUP. {Group 15 + 5 + 9}.

Fierce® [flumioxazin (33.5%) + pyroxasulfone (42.5%)]. For broad spectrum residual and burndown control of weeds in corn, fallow, non-crop areas and soybeans. Valent. EPA Reg. No. 63588-93-59639. 2012. {Group 14 + 15}.

Fierce XLT®. [flumioxazin (24.57%) + pyroxasulfone (31.17%) + chlorimuron (6.67%)]. For broad spectrum burndown and residual control of weeds in soybeans. Valent. EPA Reg. No. 59639-194. 2015. {Group 14 + 15 + 2}.

Finale® [glufosinate (1.0 lb ai/gal)]. For nonselective weed control of emerged weeds in turf and noncrop areas. Bayer Environmental Science. EPA Reg. No. 482-1229. 07/2001. {Group 10}.

Finesse® Cereal and Fallow [chlorsulfuron (62.5%) + metsulfuron (12.5%)]. For selective broadleaf weed control in barley, wheat, triticale, fallow and CRP grasses. DuPont. EPA Reg. No. 352-827. 05/2010. {Group 2 + 2}.

Finesse® Grass & Broadleaf [chlorsulfuron (25%) + flucarbazone (44% ae)]. For selective grass and broadleaf control in wheat. DuPont. EPA Reg. No. 352-718. 03/2009. {Group 2 + 2}.

Herbicide Dictionary *(continued)*

Fire Power™ [glyphosate (3 lb ae/gal) + oxyfluorfen (0.25 lb ai/gal)]. For control of weeds in dormant trees and fallow systems. Monsanto. EPA Reg. No. 524-520. 01/2002. {Group 9 + 14}.

FirstRate® WDG [cloransulam methyl (84% ai/gal)]. For PRE and POST broadleaf weed control in soybean. Dow AgroSciences. EPA Reg. No. 62719-275. 11/2002. {Group 2}.

Five Star® [2,4-D isooctyl ester (5 lb ae/gal)]. For control of broadleaf weeds in field and sweet corn, popcorn, grain sorghum, sorghum-sudan grass, wheat, oat, barley and rye. Albaugh/Agri Star. EPA Reg. No. 42750-49. 10/1999. {Group 4}.

Flexstar® [fomesafen (1.88 lb ai/gal)]. POST broadleaf weed control in soybean east of U.S. 281. Syngenta. EPA Reg. No. 100-1101. 10/2003. {Group 14}.

Flexstar GT® [fomesafen (0.66 lb ai/gal) + glyphosate (2.63 lb ae/gal)]. POST grass and broadleaf control in glyphosate-resistant soybeans east of U.S. 281. Syngenta. EPA Reg. No. 100-1325. 05/2009. {Group 14 + 9}.

Florasulam. Active ingredient in Defendor {Group 2}.

Fluazifop. An active ingredient in Fusilade DX, Fusilade II and Fusion. {Group 1}.

Flucarbazone. Active ingredient in Everest 70 WDG. {Group 2}.

Flumetsulam. An active ingredient in Frontrow, Hornet WDG and Python, SureStart and TripleFLEX; controls broadleaf weeds in corn and soybean. {Group 2}.

Flumiclorac. An active ingredient in Resource; controls broadleaf weeds in corn and soybean. {Group 14}.

Flumioxazin. Active ingredient in Afforia, Chateau, Fierce, Fierce XLT, Gangster, Latir, Outflank, Payload, Piper, Rowel, Rowel XLT, SureGuard, Surveillance, Trivence, Valor SX and Valor XLT. {Group 14}.

Fluridone. Active ingredient in Avast! and Sonar A.S. Used for aquatic weed control. {Group 12}.

Fluroxypyr. Active ingredient in PastureGard, Spotlight, Starane, Starane + Estron, Starane + MCPA, Starane + Saber, Starane + Salvo, Starane + Sword, Surmount, Vista, WideMatch and WideMatch M. {Group 4}.

Fluthiacet methyl. Active ingredient in Anthem, Anthem ATZ, Anthem Max, Cadet, Marvel, and Solstice. {Group 14}.

Fluxofenim. Safener for sorghum seed. Sold as Concep III.

Fomesafen. An active ingredient in Dawn, Flexstar, Marvel, Prefix, Reflex, Rhythm, Rumble, Statement, Torment, Vise, and Warrant Ultra. {Group 14}.

Foramsulfuron. An active ingredient in Option Corn Herbicide and Revolver. {Group 2}.

ForeFront® R & P [aminopyralid (0.33 lb/gal) + 2, 4-D amine (2.67 lb/gal)]. For control of broadleaf weeds on rangeland and permanent grass pastures. Dow AgroSciences. EPA Reg. No. 62719-524. 12/2005. {Group 4}.

Formula 40® [2,4-D acid (3.67 lb ai/gal)]. For broadleaf weed control in corn, millet, small grains and sorghum. Nufarm T & S. EPA Reg. No. 228-357. 04/2004. {Group 4}.

Fosamine. Active ingredient in Krenite S. {Not classified}.

Four Power Plus® [dicamba (0.5 lb) + 2,4-D amine (4 lb ae/gal)]. For selective broadleaf weed control in turfgrasses. Verdicon [formerly United Horticultural Supply]. EPA Reg. No. 34704-84-65783. 01/2000. {Group 4}.

Framework® 3.3 EC [pendimethalin (3.3 lb ai/gal)]. For grass and broadleaf control in alfalfa, corn, onion, potatoes, sorghum, soybean, and sunflower. Winfield Solutions. EPA Reg. No. 1381-216. 10/2007. {Group 3}.

Fuego™ [triasulfuron (75%) + dicamba (4 lb ae/gal) co-pack]. For broadleaf control in pasture, rangeland, roadside, industrial, ditches, and rights-of-way. Syngenta. EPA Reg. No. 100-975. 2001. {Group 2 + 4}.

FulTime® NXT [encapsulated acetochlor (2.7 lb ai/gal) + atrazine (1.34 lb ai/gal)]. For preplant and PRE annual grass and broadleaf weed control in field corn, seed corn, sweet corn, popcorn, sorghum, miscanthus and other perennial bioenergy crops. Dow AgroSciences. EPA Reg. No. 62719-668. 04/2013. RUP. {Group 15 + 5}.

Fusilade® DX [fluazifop (2 lb ai/gal)]. A selective POST herbicide for control of shattercane, volunteer corn and other grasses in soybean, fallow, nursery stock and ornamentals. Syngenta. EPA Reg. No. 100-1070. 04/2002. {Group 1}.

Fusilade® II Turf [fluazifop (2 lb ai/gal)]. Used for selective grass control in landscape areas, roadsides, nurseries, greenhouses, flower beds, ground covers, sports fields, golf courses and residential areas. Syngenta. EPA Reg. No. 100-1084. 04/2002. {Group 1}.

Fusion® [fluazifop (2 lb ai/gal) + fenoxaprop (0.56 lb ai/gal)]. For POST annual and perennial grass weed control in soybean and highway rights-of-way. Syngenta. EPA Reg. No. 100-1059. 02/2001. {Group 1}.

Galigan® 2 E [oxyfluorfen (2 lb ai/gal)]. For PRE broadleaf weed control in broccoli, cabbage, cauliflower, nonbearing citrus, conifers and some deciduous trees. Makhteshim Agan. EPA Reg. No. 66222-28. 09/2002. {Group 14}.

Gallery® 75 DF or Gallery T&V [isoxaben (75% ai/gal)]. For PRE control of broadleaf weeds in established turf, landscape ornamentals, ornamental bulb, Christmas trees and nonbearing orchards. Dow AgroSciences. EPA Reg. No. 62719-145. 10/2000. {Group 21}. *Not labeled in Nebraska.*

Garlon® 3 A or Forestry Garlon 4 A [triclopyr (3 or 4 lb ae/gal)]. For control of woody plants and broadleaf weeds on rights-of-way, industrial sites and noncrop areas. Dow AgroSciences. EPA Reg. No. 62719-37 [04/2003] or 62719-40. [02/2002]. {Group 4}.

Glean® XP [chlorsulfuron (75%)]. POST broadleaf herbicide for small grains. Restrictions on crop rotations. DuPont. EPA Reg. No. 352-653. 07/2009. {Group 2}.

Herbicide Dictionary *(continued)*

Glufosinate. Active ingredient in Finale, Ignite, Liberty and Rely. {Group 10}.

Glori™ {metribuzin (75%)}. For PRE control of certain broadleaf and grass weeds in corn, potatoes, soybeans and other crops. MANA. EPA Reg. No. 66222-106. 01/2013. {Group 5}.

Glyfos® Aquatic [glyphosate, isopropylamine (4 lb ae/gal or 2.4 lb ai/gal)]. For control of actively growing partially or fully emerged plants before seed head formation. Cheminova. EPA Reg. No. 4787-34. 07/2002. {Group 9}.

Glyfos® Herbicide [glyphosate, isopropylamine (3 lb ae/gal or 4 lb ai/gal)]. For POST control of broadleaf and grass weeds in Roundup Ready corn and soybean, canola, burndown and noncropland weed control. Additional surfactant optional. Cheminova. EPA Reg. No. 787-31. 07/2002. {Group 9}.

Glyfos® Pro [glyphosate (3 lb ae/gal)]. For professional use for weed control on industrial turf and ornamentals. Labeled for controlling undesirable vegetation by habitat management and natural crops including rangeland and wildlife refuges. Additional surfactant not required. Cheminova. EPA Reg. No. 6776-57. 06/2003. {Group 9}.

Glyfos® X-TRA [glyphosate, isopropylamine salt (3 lb ae/gal or 4 lb ai/gal)]. For POST control of broadleaf and grass weeds in Roundup Ready soybean, burndown and noncropland weed control. Additional surfactant not required. Cheminova. EPA Reg. No. 4787-23. 06/2003. {Group 9}.

Glykamba™ [glyphosate, isopropylamine salt (1.6 lb ae/gal) + dicamba (0.4 lb ai/gal)]. For control of grass and broadleaf weeds in fallow and reduced tillage systems. Nufarm. EPA Reg. No. 71368-30. 09/2003. {Group 9 + 4}.

Glymix™ MT [glyphosate, isopropylamine (3 lb ae/gal) + 2,4-D amine (0.4 lb ae/gal)]. For annual and perennial weed control in noncropland and PP and POST harvest aid in corn, grain sorghum, soybean, and fallow systems in selected counties. Dow AgroSciences. EPA Reg. 62719-366. 06/2001. {Group 9 + 4}.

Glyphogan® [glyphosate, isopropylamine salt (3 lb ae/gal or 4 lb ai/gal)]. For POST control of broadleaf and grass weeds in Roundup Ready crops, other cropping systems, burndown and noncropland weed control. MANA. EPA Reg. No. 6222-105. 02/2005. {Group 9}.

GlyphoMate® [glyphosate (2.8 lb ae/gal or 3.8 lb ai/gal) + surfactant]. Labeled for most aquatic sites plus landscape plantings, turf renovations, nurseries, roadsides and fallow. PBI/Gordon. EPA Reg. No. 2217-847. 08/2003. {Group 9}.

Glyphomax® XRT [glyphosate, isopropylamine salt (4 lb ae/gal or 5.4 lb ai/gal)]. For POST control of broadleaf and grass weeds in Roundup Ready corn and soybean, burndown, fallow cropland and noncropland weed control. Additional surfactant not required. Dow AgroSciences. EPA Reg. No. 62719-517. 10/2004. {Group 9}.

Glyphos® Pro [glyphosate (3 lb ae/gal)]. POST control of weeds in industry, turf and ornamental weed control. Cheminova. EPA Reg. No. 67760-57. 04/2004. {Group 9}.

Glyphosate. Active ingredient in Abundit Extra, Accord Concentrate, Accord SP, Aquamaster, AquaNeat, Buccaneer, Buccaneer Plus, Callisto GT, Campaign, ClearOut 41, ClearOut 41 Plus, Cornerstone, Cornerstone Plus, Cornerstone 5 Plus, Credit System Herbicide, Credit Duo, Credit Duo Extra, Credit Extra, Credit Master, Debit TMF, Durango, Eagre, Engame, Enlist Duo, Expert, Extra Credit 5, Extreme Herbicide, Fallow Master Broadpectrum, Fallow Star, Fire Power, Gly-4, Gly-4 Plus, GlyFlo, Glyfos Herbicide, Glyfos Aquatic, Glyfos Pro, Glyfos X-TRA, Gly Pros Pro, Glymix MT, GlyphoMate, Glyphomax XRT, Glyphosate 41%, Glypro, Glypro Plus, Gly Star, Gly Star 5, Gly Star Plus, Gly Star Pro, Halex GT, Honcho, Honcho Plus, Journey, Kleenup Pro, Landmaster BW, Mad Dog Glyphosate, Mirage Plus, One Step Herbicide, Prosecutor, Protocol, Quik PRO, Ranger Pro, Rattler, Rattler Plus, Razor Pro, Ready Master ATZ, Recoil, Rodeo, Roundup PowerMAX, Roundup Pro, Roundup Pro Concentrate, Roundup ProMAX, Roundup WeatherMAX, RT Master, RT Master II, Sequence, Silhouette, Supersate, Touchdown HiTech, Touchdown CT and Touchdown Total. {Group 9}.

Glyphosate 41% [glyphosate, IPA (3 lb ae/gal or 4 lb ai/gal)]. Used as an aid to tillage, post harvest regrowth of sorghum, pasture renovation, before planting crops, preharvest aid and on Roundup Ready crops. Helms Agro. EPA Reg. No. 74530-4. 05/2003. {Group 9}.

Glypro® [glyphosate, isopropylamine (4 lb ae/gal or 5.4 lb ai/gal)]. For POST control of annual and perennial weeds and woody plants in forests, noncrop sites and around aquatic sites. Dow AgroSciences. EPA Reg. No. 62719-324. 02/2002. {Group 9}.

Glypro® Plus [glyphosate (3 lb ae/gal or 4 lb ai/gal)]. For control of annual and perennial weeds and woody plants in noncropland and industry sites. Dow AgroSciences. EPA Reg. No. 62719-322. 03/2001. {Group 9}.

Gly Star® 5 [glyphosate, isopropylamine (4 lb ae/gal or 4 lb ai/gal)]. For controlling weeds before planting crops. Must add NIS. Albaugh/Agri Star. EPA Reg. No. 42750-59. 02/2003. {Group 9}.

Gly Star® Original [glyphosate, isopropylamine (3 lb ae/gal or 4 lb ai/gal)]. For POST control of emerged broadleaf and grass weeds preplant to corn, sorghum and soybean, burndown and noncropland weed control. Licensed for Roundup Ready corn and soybean. Additional surfactant optional. Albaugh/Agri Star. EPA Reg. No. 42750-60. 03/2001. {Group 9}.

Gly Star® Plus or Pro [glyphosate, isopropylamine (3 lb ae/gal or 4 lb ai/gal) with Transtar technology]. For POST control of emerged broadleaf and grass weeds in PP, PRE, preharvest and postharvest corn, sorghum and soybean, burndown and noncropland weed control. Also POST on Roundup Ready crops. Additional surfactant not required. Albaugh/Agri Star. EPA Reg. No. 42750-61. 01/2002. {Group 9}.

G-Max Lite™ [dimethenamid-P (2.25 lb) + atrazine (2.75 lb ai/gal)]. Used for weed control in field, seed and sweet corn, popcorn and grain sorghum. BASF. EPA Reg. No. 7969-200. 04/2004. RUP. {Group 15 + 5}.

Herbicide Dictionary *(continued)*

Goal® 2XL [oxyfluorfen (2 lb/gal)]. A PRE herbicide for soybean, onion and nursery stock. Dow AgroSciences. EPA Reg. No. 707-243. 07/2002. {Group 14}.

GR1™ [pyroxsulam (13%)]. For post-emergent control of annual grass and broadleaf weeds in winter wheat and triticale. DuPont. EPA Reg. No. 352-884. {Group 2}

Gramoxone® SL [paraquat dichloride (2 lb ae/gal)]. For weed, grass and harvest aid desiccant/defoliant herbicide. Syngenta. EPA Reg. No. 100-1217. 2011. RUP. {Group 22}.

Grazon® P+D [picloram (0.54 lb ae/gal) + 2,4-D (2.0 lb ae/gal)]. For woody and perennial weed control in range and permanent grass pastures. Dow AgroSciences. EPA Reg. No. 62719-182. 03/2001. RUP. {Group 4}.

Guardsman Max® [dimethenamid-P (1.7 lb) + atrazine (3.3 lb ai/gal)]. For selective PRE or EPOST broadleaf and grass weed control in field, pop, sweet corn and grain sorghum. BASF. EPA Reg. No. 7969-192. 04/2004. RUP. {Group 15 + 5}.

Habitat® Herbicide [imazapyr (2 lb ai/gal)]. For aquatic, shoreline and floating weed species including saltcedar and purple loosestrife. BASF. EPA Reg. No. 00241-00426. 04/2003. {Group 2}.

Halex GT™ [S-metolachlor (2.09 lb ai/gal) + glyphosate (2.09 lb ai/gal) + mesotrione (0.209 lb ai/gal)]. For postemergence control of grasses and broadleaves in glyphosate-tolerant corn. Syngenta. EPA Reg. No. 100-1282. 10/2007. {Group 15 + 9 + 27}.

Halosulfuron. Active ingredient in Manage, Permit, Priority, Sandea, Sempra, SedgeHammer and Yukon. {Group 2}.

Harass® [thifensulfuron (75%)]. For use on wheat, barley, oat, triticale, fallow, soybeans and pre-plant or post-harvest burndown. 2007. FMC. EPA Reg. No. 67760-77. {Group 2}.

HardBall® [2,4-D acid (1.74 lb ae/gal)]. For broadleaf weed control in crops and waste areas. Helena. EPA Reg. No. 05905-00549. 04/2004. {Group 4}.

Harmony® Extra SG with TotalSol™ [thifensulfuron (33.33%) + tribenuron (16.67%)]. For broadleaf weed control in wheat (including durum), barley, oat, triticale and fallow. DuPont. EPA Reg. No. 352-714. 06/2010. {Group 2}.

Harmony® SG with TotalSol™ [thifensulfuron (50%)]. For use on wheat, barley, oat, triticale, fallow, soybeans and pre-plant or post-harvest burndown. DuPont. EPA Reg. No. 352-633. 04/2012. {Group 2}.

Harness® [acetochlor + MON 13900 safener (7 lb ai/gal)]. Used PP or PRE for selective grass weed control in field, seed and silage corn, and popcorn. Monsanto. EPA Reg. No. 524-473. 01/2001. {Group 15}.

Harness® 20 G [acetochlor (20%) + MON 13900 safener]. Used PP or PRE for selective grass weed control in field, seed, and silage corn and popcorn. Monsanto. EPA Reg. No. 524-487. 10/2002. {Group 15}.

Harness® Xtra 5.6L [acetochlor (3.1 lb ai/gal) + atrazine (2.5 lb ai/gal) + MON 13900 safener]. For PRE control of broadleaf and grass weeds in field, seed and silage corn and popcorn. Monsanto. EPA Reg. No. 524-485. 10/2002. RUP. {Group 15 + 5}.

Harness® Xtra [acetochlor (4.3 lb ai/gal) + atrazine (1.7 lb ai/gal) + MON 13900 safener]. Used PRE for selective broadleaf and grass weed control in field, seed and silage corn and popcorn. Monsanto. EPA Reg. No. 524-480. 10/2002. RUP. {Group 15 + 5}.

Harrow™ [rimsulfuron (50%) + thifensulfuron-methyl (25%)]. For use in field corn. FMC. EPA Reg. No. 67760-125. {Group 2}

Hat Trick® [MCPA (1.8 lb ae/gal) + fluroxypyr (0.51 lb ae/gal) + clopyralid (0.51 lb ae/gal)]. For control of broadleaf weeds in wheat, barley, and oats not underseeded with a legume. Loveland. EPA. Reg. No. 34704-1017. 04/2009. {Group 4}.

Helosate Plus [glyphosate, isopropylamine (3 lb ae/gal or 4 lb ai/gal)]. For POST control of broadleaf and grass weeds in Roundup Ready corn and soybean, burndown, fallow cropland and noncropland weed control. EPA Reg No. 74530-4. Helm Agro US. 12/2004. {Group 9}.

Hexazinone. Active ingredient in Outstar, Velpar DF, Velpar L, Velpar AlfaMax MP and Westar. {Group 5}.

Hi-Dep® [2,4-D (3.8 lb ai/gal)]. For low volume aerial or ground application to control broadleaf weeds PRE in corn, sorghum, soybeans, pasture and rangeland. PBI/Gordon Corp. EPA Reg. No. 2217-703. 08/2005. {Group 4}

Hoelon® 3 EC [diclofop (3 lb ai/gal)]. Used PPI or POST for certain annual grasses on wheat. Bayer. EPA Reg. No. 264-641. 10/2003. RUP. {Group 1}.

Honcho® Herbicide [glyphosate, isopropylamine (3 lb ae/gal or 4 lb ai/gal)]. Monsanto. EPA Reg. No. 524-445-ZE. 11/2002. {Group 9}.

Honcho® Plus Herbicide [glyphosate, isopropylamine (3 lb ae/gal or 4 lb ai/gal)]. Monsanto. EPA Reg. No. 524-454. 02/2002. {Group 9I}.

Hornet® WDG [flumetsulam (18.5%) + clopyralid (60.0%)]. For selective PP, PRE, or POST broadleaf weed control in field corn. Dow AgroSciences. EPA Reg. No. 62719-315. 12/2003. {Group 2 + 4}.

Horsepower® [MCPA (3.8 lb ae/gal) + triclopyr (0.38 lb ae/gal) + dicamba (0.38 lb ae/gal)]. For broadleaf weed control in ornamental lawns and turfgrasses. Nufarm. EPA Reg. No. 228-313. 07/1999. {Group 4}.

Huskie® [pyrasolfotole (3.3%) + bromoxynil (26.3%)]. For selective control of broadleaf weeds in wheat, barley, triticale and sorghum. Bayer CropScience. EPA Reg. No. 264-1023. 08/2007. {Group 27 + 5}.

Hyvar® X or Hyvar® X-L [bromacil (80%) or (2 lb ai/gal)]. Used as a soil sterilant and for woody plant control. DuPont. EPA Reg. No. 352-287 or 352-346. 06/2010 or 04/2010. {Group 5}.

Image® 70 DG [imazaquin (1.5 lb ai/gal or 70%)]. For weed control in zoysia-grass lawns and selected ornamentals. BASF. EPA Reg. No. 241-319. 09/2000. {Group 2}.

Imazamox. Active ingredient in Beyond, Clearcast, Clearmax and Raptor. {Group 2}.

Imazapic. Active ingredient in Cadre, Imazapic E 2, Imazapic E-AG 2, Impose, Journey, Panoramic 2SL, Plateau, Plateau DG Eco-Pac. {Group 2}.

Imazamethabenz. Active ingredient in Assert. {Group 2}.

Herbicide Dictionary *(continued)*

Imazapyr. An active ingredient in Arsenal, Arsenal AC, Chopper, Habitat, Latir, Lightning, Sahara DG, One Step Herbicide and Topsite. {Group 2}.

Imazaquin. An active ingredient in Image and Scepter. {Group 2}.

Imazethapyr. An active ingredient in Extreme Herbicide, Latir, Lightning, Pursuit Herbicide, Pursuit DG, Pursuit Plus, and Torment. {Group 2}.

Impact[®] [topramezone (2.8 lb ai/gal)]. Amvac. EPA Reg. No. 5481-524. 03/2016. {Group 27}.

Imperium[®] [EPTC (5.6 lb/gal) + acetochlor (1.4 lb/gal)]. Used for weed control in field corn, production seed corn, silage corn and popcorn. Gowan. EPA Reg. No. 10163-285. 09/2005. {Group 8 + 15}.

Impose[®] [imazapic (2 lb ai/gal)]. For PRE or POST control of selected grass and broadleaf weeds in range, pasture, CRP, and noncrop areas. Makhteshim. EPA Reg. No. 66222-141. 05/2007. {Group 2}.

Instigate[™] [rimsulfuron (4.17%) + mesotrione (41.67%)]. For preplant and PRE weed control in field corn. DuPont. EPA Reg. No. 352-873. 2012. {Group 2 + 27}.

Intensity[®] One [clethodim (0.97 lb ai/gal)]. Used POST for annual and perennial grasses in alfalfa, canola, potato, soybean, sunflower, sugarbeets and others. L. C. Loveland. EPA Reg. No. 34704-976. 2007. {Group 1}.

Intrro[®] [alachlor (4.0 lb ai/gal)]. Use PRE and PPI for control of small seeded broadleaves and grasses in soybeans and grain sorghum. Monsanto. EPA Reg. No. 524-314. 12/2003. {Group 15}

Iodosulfuron. An active ingredient in Autumn and AutumnSuper. {Group 2}.

Isoxaben. Active ingredient in Gallery 75DF, Gallery T&V and Snapshot 2.5 TG. {Group 21}.

Isoxadifen. Safener in Option, Status, Laudis, Capreno, and DuPont "Q" products.

Isoxaflutole. Active ingredient in Balance Flexx, Corvus and Scoparia for weed control in corn. RUP. {Group 27}.

Journey[®] Herbicide [imazapic (0.75 lb ai/gal) + glyphosate (1.5 lb ai/gal)]. For noncropland weed control, CRP and before planting native grasses, wildflowers, or legumes. BASF Ag. EPA Reg. No. 00241-00417. {Group 2 + 9}.

KambaMaster[®] Herbicide [dicamba, DMA (1.0 lb ae/gal) + 2,4-D (2.87 lb ae/gal)]. For broadleaf control of CRP, fallow, sorghum, pastures, rangeland and wheat. Nufarm. EPA Reg. No. 71368-34. 11/2002. {Group 4}.

Karmex[®] DF [diuron (80%)]. For annual weed control in alfalfa, asparagus, birds-foot trefoil, grass seedling crops and red clover at low rates. DuPont. EPA Reg. No. 352-692. 09/2006. {Group 7}.

Karmex[®] IWC 4 L [diuron (80% or 4 lb ai/gal)]. For industrial use as a soil sterilant. DuPont. EPA Reg. No. 352-692. 09/2006. {Group 7}.

Kerb[®] 50W or Kerb[®] Specialty Herbicide WS [pronamide (50%)]. Use PRE or EPOST in alfalfa and other legumes, berry crops and fruit trees. Dow AgroSciences. EPA Reg. No. 62719-397. 01/2003. RUP. {Group 3}.

Keystone[®] NXT [acetochlor (3.1 lb ai/gal) + atrazine (2.5 lb ai/gal)]. For PRE control of annual grass and broadleaf control in field corn, seed corn, sweet corn, popcorn, Miscanthus and other perennial bioenergy crops. Dow AgroSciences. EPA Reg. No. 62719-671. 04/2013. RUP. {Group 15 + 5}.

Keystone[®] LA NXT [acetochlor (4.3 lb ai/gal) + atrazine (1.5 lb ai/gal)]. For PRE control of grass and broadleaf weeds in field corn, seed corn, sweet corn, popcorn, Miscanthus and other perennial bioenergy crops. Dow AgroSciences. EPA Reg. No. 62719-479. 02/2003. RUP. {Group 15 + 5}.

Kleenup[®] Pro [glyphosate (3 lb ae/gal)]. For weed control of winter annual and tall fescue in dormant bermudagrass. UHS. EPA Reg. No. 524-445-65783. 08/2001. {Group 9}.

Komeen[®] [elemental copper (8%)]. For aquatic weed control in slow moving or quiescent water. Water may be used for fishing, swimming, drinking and watering livestock. Griffin. EPA Reg. No. 1812-312. 12/2002. {Not classified}.

Krenite[®] S [fosamine (4 lb ai/gal)]. A water soluble brush control agent that can be used on noncropland areas adjacent to water. DuPont. EPA Reg. No. 352-395. 05/2010. {Not classified}.

Krovar[®] I DF [bromacil (40%) + diuron (40%)]. For control of annual weeds in noncropland. DuPont. EPA Reg. No. 352-505. 04/2010. {Group 5 + 7}.

Lactofen. An active ingredient in Cobra and Phoenix. {Group 14}.

Landmark[®] XP [sulfometuron (50%) + chlorsulfuron (25%)]. For PRE control of many weeds in noncrop sites. DuPont. EPA Reg. No. 352-645. 10/2011. {Group 2}.

Landmaster[®] II [glyphosate (0.9 lb ae/gal) + 2,4-D (0.8 lb ae/gal)]. Used primarily for weed control in no-till systems before planting. Monsanto. EPA Reg. No. 524-376. 2009. {Group 9 + 4}.

Landmaster[®] BW [glyphosate (0.9 lb ae/gal) + 2,4-D (1.5 lb ae/gal)]. Used primarily for weed control in no-till systems before planting. Albaugh/Agri Star. EPA Reg. No. 42750-62. 06/2001. {Group 9 + 4}.

Lariat[®] [alachlor (2.5 lb ai/gal) + atrazine (1.5 lb ai/gal)]. Used PRE for selective weed control in field and sweet corn, silage and popcorn and grain sorghum. Monsanto. EPA Reg. No. 524-329. 10/2002. RUP. {Group 15 + 5}.

Latir[™] [flumioxazin (31.5%) + imazethapyr (23.5%)]. For weed control in soybeans. MANA Inc. EPA Reg. No. 66222-258. {Group 14 + 2}

Laudis[®] [tembotrione (3.5 lb ai/gal)]. For POST broadleaf and grass control in field corn, silage, seed corn, sweet corn, and popcorn. Bayer CropScience. EPA Reg. No. 264-860. 05/2008. {Group 27}.

Lescogran [bentazon (4 lb ai/gal)]. For homeowner use in controlling broadleaf weeds and sedge in established turf. Lesco. EPA Reg. No. 7969-45-10404. 10/2003. {Group 6}.

Lexar[®] [S-metolachlor (1.74 lb) + atrazine (1.74 lb) + mesotrione (0.224 lb ai/gal) + benoxacor safener]. For PRE control of weeds in field, seed and silage corn and yellow popcorn. Syngenta. EPA Reg. No. 100-1201. 2012. RUP. {Group 15 + 5 + 27}.

Herbicide Dictionary *(continued)*

Lexar® EZ [S-metolachlor (1.74 lb) + atrazine (1.74 lb) + mesotrione (0.224 lb ai/gal) + benoxacor safener]. For PRE control of weeds in field, seed and silage corn and yellow popcorn. Syngenta. EPA Reg. No. 100-1414. 2012. RUP. {Group 15 + 5 + 27}.

Liberty® 280 SL [glufosinate (2.34 lb ai/gal)]. For non-selective POST weed control in all LibertyLink crops. Bayer CropScience. EPA Reg. No. 264-829. 2011. {Group 10}.

Lightning® WDG [imazethapyr (52.5%) + imazapyr (17.5%)]. Used for POST broadleaf and grass control in Clearfield® corn. BASF. EPA Reg. No. 241-377. 10/2003. {Group 2}.

Lineage® Clearstand™ [imazapyr (63.2%) + metsulfuron (9.5%)]. For control of annual and perennial weeds in rights-of-way, rangeland, non-crop areas, pasture, and industrial sites. DuPont. EPA Reg. No. 352-766. 06/2011. {Group 2}.

Lineage® HWC [imazapyr (37.5%) + sulfometuron-methyl (28.1%) + metsulfuron (7.5%)]. For use in conifer plantations, total vegetation control, and wildlife habitat management. DuPont. EPA Reg. No. 352-765. 08/2011. {Group 2}.

Lineage® Prep [imazapyr (54.5%) + sulfometuron-methyl (15.3%) + metsulfuron (4.1%)]. For use in conifer plantations, total vegetation control, undesirable hardwood control, and wildlife habitat management. DuPont. EPA Reg. No. 352-767. 08/2011. {Group 2}.

Linex® 4L [linuron (4 lb ai/gal)]. For PRE grass and broadleaf weed control in field corn, grain sorghum, soybean and potato. DuPont. EPA Reg. No. 352-677. 08/2006. {Group 7}.

Linuron. Active ingredient in Linex 4L and Lorox DF. {Group 7}.

Londax® [bensulfuron (60%)]. For PRE use in rice. Dow AgroSciences. EPA Reg. No. 352-506. 12/2001. {Group 2}.

Lontrel® Turf and Ornamental [clopyralid (3 lb ae/gal)]. For selective POST control of broadleaf weeds in turf, sod farms and certain ornamental plantings. Dow AgroSciences. EPA Reg. No. 62719-305. 03/2001. {Group 4}.

Lorox® DF [linuron (50%)]. For weed control in corn, potato, soybean and hybrid poplar. NovaSource. EPA Reg. No. 61842-23. 2010. {Group 7}.

Low Vol 4 Ester Weed Killer [2,4-D ester (3.8 lb ai/gal)]. Low volatile formulation for broadleaf control in cereal crops and noncropland. Loveland. EPA Reg. No. 34704-124. 07/2004. {Group 4}.

Lumax® [S-metolachlor (2.68 lb ai/gal) + mesotrione (0.268 lb ai/gal) + atrazine (1.0 lb ai/gal)]. PRE herbicide for field corn, silage, seed corn, and grain sorghum. Syngenta. EPA Reg. No. 100-1152. 07/2002. RUP. {Group 15 + 27 + 5}.

Lumax® EZ [S-metolachlor (2.49 lb ai/gal) + mesotrione (0.249 lb ai/gal) + atrazine (0.935 lb ai/gal)]. PRE herbicide for field corn, silage, seed corn, and grain sorghum. Syngenta. EPA Reg. No. 100-1442. 2012. RUP. {Group 15 + 27 + 5}.

Maestro® D [bromoxynil, octanoic acid (2 lb ai/gal) + 2,4-D, isooctyl (1.9 lb ae/gal)]. For control of broadleaf weeds in wheat, barley, oat, triticale and rye. Nufarm. EPA Reg. No. 71368-39. 01/2004. {Group 6 + 4}.

Maestro® MA [bromoxynil, octanoic acid (2 lb ai/gal) + MCPA (2 lb ai/gal)]. For control of certain broadleaf weeds in small grains, flax and CRP. Nufarm. EPA Reg. No. 71368-28. 10/2003. {Group 6 + 4}.

Makaze® [glyphosate (4 lb ai/gal)]. For POST control of emerged broadleaf and grass weeds preplant to corn, sorghum, and soybean, burndown and noncropland weed control. Licensed for Roundup Ready alfalfa, corn, canola, sugarbeets and soybean. Loveland. EPA Reg. No. 34704-890. 2007. {Group 9}.

Makaze® Yield Pro [glyphosate (4 lb ai/gal) + 3-indolebutyric acid (0.005 lb ai/gal) + cytokinin (0.0009 lb ai/gal)]. For POST control of emerged broadleaf and grass weeds preplant to corn, sorghum and soybean, burndown and noncropland weed control. Licensed for Roundup Ready alfalfa, cotton, corn, canola, sugarbeets and soybeans. Loveland. EPA Reg. No. 34704-1033. 2010. {Group 9 + plant growth hormone + plant growth hormone}.

Marksman® [dicamba (1.1 lb ai/gal) + atrazine (2.1 lb ai/gal)]. For POST broadleaf weed control in corn and sorghum. BASF. EPA Reg. No. 7969-136. 11/2004. RUP. {Group 4 + 5}.

Marvel™ [fluthiacet methyl (0.117 lb ai/gal) + fomesafen (2.883 lb ai/gal)]. For burndown and POST broadleaf control in soybeans. FMC. EPA Reg. No. 279-3455. 02/2013. {Group 2 + 2}.

Matador® [metolachlor (4.01 lb ai/gal) + metribuzin (0.56 lb ai/gal) + imazethapyr (0.13 lb ai/gal)]. For PRE control of annual grasses and broadleaves in soybeans. Loveland. EPA Reg. No. 34704-1054. 07/2011. {Group 15 + 5 + 2}.

Matrix® DF [rimsulfuron (25%)]. Used PRE or POST for selective broadleaf and grass control in potato. DuPont. EPA Reg. No. 352-556. 05/2010. {Group 2}.

Matrix® SG [rimsulfuron (25%)]. Used PRE or POST for selective broadleaf and grass control in potato, non-crop sites and rangeland restoration west of the Mississippi River. DuPont. EPA Reg. No. 352-768. 07/2010. {Group 2}.

Maverick® WDG [sulfosulfuron (75%)]. For selective control of several annual and perennial weeds in winter and spring wheat. Monsanto. EPA Reg. No. 524-500. 01/2002. {Group 2}.

Maverick® PRO WDG [sulfosulfuron (75%)]. For selective control of downy brome, Japanese brome, hairy chess, field pennycress and tansy mustard in winter wheat. For use in Colorado, Kansas, Nebraska, Oklahoma, Texas and Wyoming. Monsanto. EPA Reg. No. 524-525. 05/2003. {Group 2}.

MCPA. A phenoxy similar to 2,4-D for control of broadleaf weeds, but safer on oats and legumes. Active ingredient in Battleship, Bison, Bronate, Bronate Advanced, Bromox-2-2, Chaser Ultra, Cool Power, Curtail M, Dagger, Eliminate, Horsepower, Maestro MA, MCPA Amine, MEC Amine-D Turf Herbicide, Power Zone, Rhomene MCPA Broadleaf, Rhonox MCPA Ester Herbicide, Starane + MCPA, Starane + Sword, Sword, Three-Way Ester II, TriPower Selective herbicide, Triamine II and Triplet. {Group 4}.

Herbicide Dictionary *(continued)*

MCPA-4 Amine Agrilance, Agri Star[®] Solve[™] MCPA ester [Albaugh/Agri Star], Chiptox MCPA Ester. For POST broadleaf weed control in spring and fall-planted small grains, pastures, rangeland, CRP and turf. EPA Reg. No. 1381-104, 42750-22 and 11658-21-71368, respectively. 07/2003, 07/2002, or 05/2003. {Group 4}.

MCPP or mecoprop-p. Active ingredient in herbicides. See mecoprop-p. {Group 4}.

Mecoprop-p or MCPP. Active ingredient in Bentgrass Selective, Onetime, Power Zone, Pro-Mat Three Way SC, Strike 3, Three-Way Selective, Triamine II, Triamine, Trimec Bentgrass Broadleaf Herbicide, Trimec Classic, Trimec Plus, Trimec Turf and TriPower Selective Herbicide. {Group 4}.

Mesosulfuron-methyl. Active ingredient in Olympus FLEX, Osprey and Silverado Wild Oat Herbicide; used for weed control in wheat. {Group 4}

Mesotrione. Active ingredient in Acuron, Callisto, Callisto GT, Callisto Xtra, Camix, Halex GT, Instigate, Lexar EZ, Lumax EZ, Revulin Q, Solstice, Tenacity, and Zemax. {Group 27}.

Method[®] 240 SL. For non-crop use. DuPont. EPA Reg. No. 352-786.

Metolachlor. An active ingredient that was replaced by S-metolachlor. Only Me-Too-Lachlor, Me-Too-Lachlor II, Parallel, Parallel PCS, Stalwart C, Stalwart Extra, Statement, Tailwind, Trizmet II and Vise have metolachlor. It is used for grass control in corn, sorghum, soybean, nurseries and turfgrass. See S-metolachlor for S-metolachlor trade names. {Group 15}.

Me-Too-Lachlor[™] [metolachlor (8 lb ai/gal)]. For control of certain weeds in pod crops, potato, safflower and soybean. Drexel. EPA Reg. No. 19713-548. 02/2004. {Group 15}.

Me-Too-Lachlor[™] II [metolachlor (7 lb ai/gal)]. For PRE control of weeds in field corn and popcorn. Drexel. EPA Reg. No. 19713-549. 02/2004. {Group 15}.

Metribuzin. Used PRE or POST for annual weeds in corn, soybean, alfalfa and potato; often used in combination with other herbicides. An active ingredient in Boundary, Dimetric, Glory, Metribuzin 4L and 75 DF, Tailwind, Tricor, and Trivence. {Group 5}.

Metribuzin 75 [metribuzin (75%)]. An active ingredient in Boundary, Dimetric, Glory, Metribuzin 4L and 75DF, Tailwind, Tricor and Trivence. {Group 5}.

Metribuzin 75DF [metribuzin (75%)]. For control of certain annual weeds in soybean, field corn, potato, alfalfa, asparagus and carrots. MANA. EPA Reg. No. 66222-106. 2008. {Group 5}.

Metsulfuron. Active ingredient in Accurate, Accurate Extra, Ally, Ally Extra, Ally XP, Blade, Chisum, Cimarron Plus, Cimarron Max, Cimarron X-tra, Escort, Escort XP, Finesse, Pasture MD, Metsulfuron Methyl 60 DF and Oust Extra. {Group 2}.

Metsulfuron Methyl 60DF[™] [metsulfuron (60%)]. For broadleaf weed control in wheat and fallow. FarmSaver. EPA Reg. No. 73220-3. 11/2002. {Group 2}.

Milestone[™] [aminopyralid (2 lb ae/gal)]. For selective control of broadleaf weeds on rangeland, pastures, non-cropland and CRP. Dow AgroSciences. EPA Reg. No. 62719-519. 08/2005. {Group 4}.

Milestone[®] VM Plus [aminopyralid (0.1 lb ae/gal) + triclopyr (1 lb ae/gal)]. For selective control of broadleaf weeds on rangeland, pastures, non-cropland and CRP. Dow AgroSciences. EPA Reg. No. 62719-572. 05/2007. {Group 4}.

Millennium Ultra[™] [2,4-D DMA (3 lb ae/gal) + clopyralid (0.375 lb ae/gal) + dicamba (0.375 lb ae/gal)]. For selective control of broadleaf weeds in ornamental lawns and turfgrass. Nufarm. EPA Reg. No. 228-322. 02/2006. {Group 4}.

Millennium Ultra[™] Plus [2,4-D DMA (0.5 lb ae/gal) + clopyralid (0.6 lb ae/gal) + dicamba DAM (0.6 lb ae/gal) + MSMA (18%)]. For control of broadleaves and grasses in ornamental lawns and turfgrasses. Nufarm. EPA Reg. No. 228-382. 02/2005. {Group 4 + 17}.

Mirage[®] Plus [glyphosate, IPA (3 lb ae/gal or 4 lb ai/gal)]. A nonselective, broad spectrum herbicide used for many cropping systems and CRP. Also may be used on Roundup Ready crops. Loveland. EPA Reg. No. 524-454-34704. 01/2003. {Group 9}.

Monument[™] WG [trifloxysulfuron (75%)]. For control of certain broadleaf and grass weeds in turf. Syngenta. EPA Reg. No. 100-1134. 09/2003. {Group 2}.

MON 13900 Safener[®]. Used in Harness, Harness Xtra, Harness Xtra 5.6 and Harness 20 G.

Moxy[™] 2 E [bromoxynil (2 lb/gal)]. For weed control in alfalfa, corn, small grains and grain and forage sorghum. Winfield Solutions. EPA Reg. No. 9779-346. 03/2001. {Group 6}.

MSMA [monosodium methanearsonate]. Active ingredient in Millennium Ultra Plus, MSMA 6.6 Turf, MSMA Plus H.C., 912 Herbicide, 120 Herbicide and Trimec Plus. Used for selective crabgrass control in turf. {Group 17}.

MSMA 6.6 Turf Herbicide [MSMA (6.6 lb ai/gal)]. POST control of grass in turfgrass. Verdicon [formerly United Horticultural Supply]; Loveland. EPA Reg. No. 34704-111-65783; 34704-115. 03/2003. {Group 17}.

MSMA Plus H.C. [MSMA (6.6 lb ai/gal) + surfactant]. POST control of grass in turfgrass. Helena. EPA Reg. No. 5905-164. 03/2000. {Group 17}.

Napropamide. Active ingredient in Devrinol 50 DF or 2G and Pre Pair {Group 15}.

Naptalam. Active ingredient in Alanap L. {Group 19}.

Nicosulfuron. An active ingredient in Accent, Celebrity Plus, NIC-IT, Samson 45C, Revulin Q, Steadfast and Steadfast Q. {Group 2}.

Nimble[®] [thifensulfuron (50%) + tribenuron (25%)]. For broadleaf weed control in barley, wheat (including durum), oat, triticale and fallow. FMC. EPA Reg. No. 67760-78. 2007. {Group 2}.

Norflurazon. Active ingredient in Predict and Solicam. {Group 12}.

Northstar[®] WDG [primisulfuron (7.5%) + dicamba (39.9%)]. For POST control of broadleaf weeds in field corn and popcorn. Syngenta. EPA Reg. No. 100-923. 06/2000. {Group 2 + 4}.

Nortron[®] SC [ethofumesate (4 lb/gal)]. A PPI, PRE, or POST herbicide for sugarbeets. Bayer CropScience. EPA Reg. No. 264-613. 05/2003. {Group 16}.

Nuance[®] [tribenuron (75%)]. A short residual POST herbicide for broadleaf weed control in wheat, barley and fallow. FMC. EPA Reg. No. 67760-73. 2007. {Group 2}.

Herbicide Dictionary *(continued)*

Oasis® [imazapic (2 lb ae/gal) + 2,4-D (4 lb ae/gal)]. For weed control, native grass release and turf growth suppression on roadsides and other noncrop areas. BASF. EPA Reg. No. 241-409. 10/2000. {Group 2 + 4}.

OH2 [oxyfluorfen (2%) + pendimethalin (1%)]. For PRE control of weeds in containers and field grown ornamentals. Scotts. EPA Reg. No. 538-172. 01/2004. {Group 14 + 3}.

Olympus® 70 WDG [propoxycarbazone-sodium (70%)]. For POST control of certain grasses [primarily *Bromus* species] and broadleaf weeds in wheat. Bayer CropScience. EPA Reg. No. 00264-00809. 04/1004. {Group 2}.

Olympus® FLEX [propoxycarbazone-sodium (6.75%) + mesosulfuron methyl (4.5%)]. For POST control of certain grasses and broadleaf weeds in fall sown or winter wheat. Bayer CropScience. EPA Reg. No. 264-833. 05/2005. {Group 2}.

One Step® Herbicide [imazapyr (0.637 lb ai/gal) + glyphosate, IPA (1.53 lb ae/gal)]. POST control of most annual and perennial weeds, vines, brambles, hardwood brush and trees for forestry site preparation. BASF. EPA Reg. No. 241-414. 04/2003. {Group 2}.

Onetime® [quinclorac (1.5 lb ae/gal) + mecoprop (0.75 lb ae/gal) + dicamba (0.2 lb ae/gal)]. For POST control of many broadleaf and some grass weeds in turfgrass sites. BASF. EPA Reg. No. 7969-267. 04/2008. {Group 4}.

Opensight® [aminopyralid (52.5% ae) + metsulfuron methyl (9.45%)]. For control of broadleaf and woody plants in non-crop sites, rights-of-way, non-irrigation ditchbanks, grazed areas and natural areas. Dow AgroScience. EPA Reg. No. 62719-597. 08/2010. {Group 4 + 2}.

Opti-Amine® [2,4-D amine (3.8 lb ae/gal)]. Helena. EPA Reg. No. 5905-501. 02/2004. {Group 4}.

OpTill® [saflufenacil (17.8%) + imazethapyr (50.2%)]. For preplant or pre-emergence use in soybeans, Clearfield® corn and chickpea (garbanzo bean) for broadleaf and grass control. BASF. EPA Reg. No. 7969-280. 09/2009. {Group 14 + 2}.

OpTill® PRO [Co-pack (saflufenacil (17.8%) + imazethapyr (50.2%)) + dimethenamid-P (6 lb ai/gal)]. For broad spectrum preplant or preemergence use in soybeans. BASF. EPA Reg. No. 7969-332. 2011. {Group (14 + 2) + 15}.

Orion® [MCPA (2.34 lb ae/gal) + florasulam (0.33 lb ai/gal)]. For POST broadleaf control in wheat, barley, oats, rye and triticale. Syngenta. EPA Reg. No. 100-1307. 2010. {Group 4 + 2}.

Oryzalin. Active ingredient in Oryzalin 4 A.S., Oryzalin 4 Pro, FarmSaver Oryzalin 4 A.S., Quali-Pro Oryzalin 4 Pro, Surflan A.S., Surflan AS Specialty, Surflan Dry Flowable and Surflan WDG Specialty. {Group 3}.

Oryzalin 4 A.S. [oryzalin (4 lb ai/gal)]. Used PRE for the control of many annual grasses and certain broadleaf weeds in citrus, fruit, and nut trees, berries, vineyards and Christmas tree plantations. MANA. EPA Reg. No. 72167-17-66222. 03/2002. {Group 3}.

Oryzalin 4 Pro [oryzalin (4 lb ai/gal)]. Used PRE for control of annual grasses and many broadleaf weeds in landscape ornamentals, Christmas tree plantations, noncropland and industrial sites, established warm-season turf (including bermudagrass, buffalograss, and zoysiagrass) and tall fescue. Vegetation Management. EPA Reg. No. 72167-15-74477. 03/2002. {Group 3}.

Osprey® WDG [mesosulfuron methyl (4.5%)]. For control of grass and broadleaf weeds in winter wheat. Bayer CropScience. EPA Reg. No. 264-802. 03/2004. {Group 2}.

Oust® Extra [sulfometuron (56.25%) + metsulfuron (15%)]. For controlling many annual and perennial weeds in conifer plantations, unimproved turf and noncrop areas. DuPont. EPA Reg. No. 352-622. 11/2006. {Group 2}.

Oust® XP [sulfometuron (75%)]. For control of weeds in industrial sites and forest sites. DuPont. EPA Reg. No. 352-601. 06/2009. {Group 2}.

Outflank™ [flumioxazin (51%)]. For PRE control of many broadleaf weeds in dry beans, field corn, potato, soybean, fallow and non crop areas. MANA. 2013. {Group 14}.

Outlaw™ [dicamba (1.09 lb ae/gal) + 2,4-D acid (1.45 ai/gal)]. For control of annual, biennial and perennial broadleaf weeds and brush control in pastures, rangeland, grass for silage or hay, wheat and fallow. Albaugh/Agri Star. 05/2003. {Group 4}.

Outlook® Herbicide [dimethenamid-p (6 lb ai/gal)]. For PP and PRE use in field, seed and sweet corn, popcorn, dry edible bean, grain sorghum and soybean. BASF. EPA Reg. No. 7969-156. 10/2003. {Group 15}.

Outrider™ WDG [sulfosulfuron (75%)]. For PRE and POST control of many annual and perennial weeds on noncrop areas. Monsanto. EPA Reg. No. 524-500. 01/2002. {Group 2}.

Overdrive® WG [diflufenzopyr (0.20 lb ae/gal) + dicamba (0.5 lb ae/gal)]. For broadleaf weed control in noncropland areas, pasture, hay and rangeland. BASF. EPA Reg. No. 7969-150. 2008. {Group 19}.

Oxabetrinil. A seed protectant [Concep II] for reducing corn and sorghum injury from metolachlor.

Oxadiazon. An active ingredient in Pre Pair, Ronstar G, Ronstar 0.95% plus fertilizer and Ronstar WSP. {Group 14}.

Oxyfluorfen. Active ingredient in Fire Power, Galigan, Goal 2XL, OH2 and Rout. {Group 14}.

Panoflex™ [tribenuron (40%) + thifensulfuron (10%)]. For use on preplant or post harvest burndown on fallow. DuPont. EPA Reg. No. 352-876. 01/2013. {Group 2 + 2}.

Panoramic 2SL [imazapic (23.3%)]. For use on Conservation Reserve Program (CRP) land, paved surfaces, and pastures and rangeland. Alligare. EPA Reg. No. 66222-141-81927. {Group 2}.

Paramount® DF [quinclorac (75%)]. Used for weed control in fallow systems, grass grown for seed, preplant wheat and preplant and in-crop for grain sorghum. Controls field bindweed. BASF. EPA Reg. No. 7969-113. 01/2004. {Group 4}.

Paraquat. Active ingredient in Gramoxone SL. RUP. {Group 22}.

Herbicide Dictionary *(continued)*

Parallel[®] [metolachlor (7.8 lb ai/gal)]. For control of certain weeds in pod crops, potato, safflower and soybean. MANA. EPA Reg. No. 66222-87. 2011. {Group 15}.

Parallel[®] PCS [metolachlor (8 lb ai/gal)]. For control of certain weeds in pod crops, potato, safflower and soybean. Makhteshim Agan. EPA Reg. No. 66222-86. 09/2004. {Group 15}.

Parallel[®] Plus [atrazine (2.8 lb ai/gal) + metolachlor (2.7 lb ai/gal)]. For preplant or PRE weed control in corn and sorghum. MANA. EPA Reg. No. 66222-132. 2010. RUP. {Group 5 + 15}.

PastureGard[®] [triclopyr (1.5 lb ae/gal) + fluroxypyr (0.5 lb ae/gal)]. For control of woody plants and annual and perennial broadleaf weeds in rangeland and perennial grass pastures, fence rows, nonirrigated ditchbanks and around farm buildings. Dow AgroSciences. EPA Reg. No. 62719-477. 04/2004. {Group 4}.

Pasture MD[™] [Co-pack of dicamba (1 lb/gal) + 2,4-D amine (2.87 lb/gal) + metsulfuron (60%)]. For selective control of annual and perennial broadleaf weeds in pastures and rangeland or brush control. Nufarm. EPA Reg. No. 71368-41. 09/2004. {Group 4 + 2}.

PastureMaster[™] [2,4-D, DMA (1 lb ae/gal) + dicamba (1.0 lb ae/gal)]. For brush and broadleaf weed control in pastures and rangelands. Nufarm. EPA Reg. No. 228-295-71368. 02/2001. {Group 4}.

Pathfinder[®] II [triclopyr (0.75 lb ae/gal)]. Ready to use for control of woody plants in rights-of-way, etc. Dow AgroSciences. EPA Reg. No. 62719-176. 10/2002. {Group 4}.

Pathway[®] [picloram (3%) + 2,4-D acid (11.2%)]. For controlling unwanted trees via cut surface in noncrop areas. Dow AgroSciences. EPA Reg. No. 62719-31. 06/2009. RUP. {Group 4}.

Payload[®] WDG [flumioxazin (51%)]. For maintaining ground weed control in noncrop areas. Valent. EPA Reg. No. 59639-120. 01/2004. {Group 14}.

Peak[®] CP WDG [prosofuron (57%)]. PRE and POST for broadleaf weed control in grain sorghum, cereals, and proso millet. Syngenta. EPA Reg. No. 100-763. 02/2002. {Group 2}.

Pelargonic Acid. Active ingredient in Scythe. {Not classified}.

Pendant. [pendimethalin (37.4%)]. For control of most annual grasses and certain broadleaf weeds. Winfield Solutions. EPA Reg. No. 241-337-1381. 12/2004. {Group 3}.

Pendimethalin. Active ingredient in Corral, Pendant, Pendulum Aqua Cap, Pendulum 2G, Pendulum WDG, Pendulum 3.3 EC, Pentagon WDG, PRE-M 3.3 EC Turf Herbicide, Prowl 3.3 EC, Prowl H2O, Pursuit Plus, and Stealth. {Group 3}.

Pendulum[®] AquaCap[™] [microencapsulated pendimethalin in an aqueous carrier (3.8 lb ae/gal)]. Used PRE in noncrop areas, ornamental plantings and nonresidential turf. BASF. EPA Reg. No. 241-4160. 10/2002. {Group 3}.

Pendulum[®] 2 G [pendimethalin (2%)]. For use in turfgrass, ornamentals, landscape or ground maintenance. BASF. EPA Reg. No. 241-375. 04/2001. {Group 3}.

Pendulum[®] 3.3 EC [pendimethalin (3.3 lb ai/gal)]. For use in turfgrass, ornamentals, landscape or noncrop areas. BASF. EPA Reg. No. 241-341. 04/2001. {Group 3}.

Pendulum[®] WDG [pendimethalin (60%)]. For use in turfgrass, ornamentals, landscape or noncrop areas. BASF. EPA Reg. No. 241-340. 04/2001. {Group 3}.

Pennant Magnum[®] [S-metolachlor (7.62 lb ai/gal)]. For weed control in nurseries, warm-season turfgrasses and landscape plantings. Syngenta. EPA Reg. No. 100-950. 09/2001. {Group 15}.

Pentagon[®] WDG [pendimethalin (60%)]. For weed control in selected crops including sunflower. BASF. EPA Reg. No. 241-268. 02/2002. {Group 3}.

Permit[®] WSG [halosulfuron (75%)]. For selective control of broadleaf weeds and nutsedge in field and seed corn, grain sorghum, dry beans and fallow ground. Gowan. EPA Reg. No. 81880-2-10163. 2007. {Group 2}.

Perspective[™] [aminocyclopyrachlor (39.5%) + chlorsulfuron (15.8%)]. For general weed control in non-cropland areas. DuPont. EPA Reg. No. 352-846. 03/2012. {Group 4 + 2}.

Phenmedipham. An active ingredient in Betamix Herbicide, Phen-Des 8+8, Progress Herbicide and Spin-Aid. {Group 5}.

Phen-Des 8+8 [phenmedipham (8%) + desmedipham (8%)]. For postemergence weed control in sugarbeets. United Phosphorous Incorporated [UPI]. EPA Reg. No. 264-621-70506. 06/2002. {Group 5}.

Phoenix[™] [lactofen (2.0 lb ai/gal)]. Used POST for broadleaf control in soybean. Valent. EPA Reg. No. 639-18. 07/2002. {Group 14}.

Phenoxy 088[™] [2,4-D acid + 2,4-D butoxyethyl ester (2.8 lb ae/gal)]. For broadleaf control. Labeled for PP, PRE and POST in corn, POST in sorghum and PP in soybean. Winfield Solutions. EPA Reg. No. 42750-36-9779. 01/1998. {Group 4}.

Picloram. An active ingredient in Grazon P+D, Pathway, Picloram 22K, Surmount, Tordon K, Tordon 22K, Tordon 101 Mixture and Tordon RTU. {Group 4}.

Picloram 22K [picloram (2 lb ae/gal)]. For control of susceptible annual and perennial broadleaf weeds in rangeland and pasture. Alligare. EPA Reg. No. 81927-18. {Group 4}.

Pinoxaden. An active ingredient in Axial. {Group 1}.

Piper [flumioxazin (33.5%) + pyroxasulfone (42.5%)]. For control and/or suppression of certain weeds to maintain bare ground noncrop areas. Valent. EPA Reg. No. 59639-193. {Group 14 + 15}.

Plateau[®] DG [imazapic, ammonium (2 lb ai/gal) or EcoPac (70%)]. For PRE or POST control of selected grass and broadleaf weeds in range, pasture, wildflower and native grass establishments, crown vetch and noncrop areas. DG is in water-soluble packets. BASF. EPA Reg. No. 241-365. 04/2006. {Group 2}.

Poast[®] [sethoxydim (1.5 lb ai/gal)]. A POST herbicide for control of volunteer corn and grass weeds in alfalfa, soybean and other broadleaf crops. BASF. EPA Reg. No. 7969-88. 04/1999. {Group 1}.

Herbicide Dictionary *(continued)*

Poast Plus® [sethoxydim (1.0 lb ai/gal)]. A combination of sethoxydim + Dash surfactant. A POST herbicide for control of shattercane, volunteer corn and other grass weeds in alfalfa, soybean and other broadleaf crops. BASF. EPA Reg. No. 7969-88-51036. 10/2002. {Group 1}.

PowerFlex® [pyroxsulam (7.5%)]. For POST control of certain annual grass and broadleaf weeds in winter wheat. Dow AgroScience. EPA Reg. No. 62719-569. 02/2009. {Group 2}.

Power Zone® [carfentrazone (0.04 lb ai/gal) + MCPA (2.2 lb ae/gal) + mecoprop (0.44 lb ae/gal) + dicamba (0.22 lb ae/gal)]. POST broadleaf control in turf. PBI/Gordon. EPA Reg. No. 2217-834. 09/2001. {Group 14 + 4}.

Pramitol® 25E [prometon (2 lb ai/gal)]. Used primarily for season-long control of annual and perennial weeds in noncropped areas. Loveland; Winfield Solutions. EPA Reg. No. 66222-22-34704; 66222-22-9779. 01/2003. {Group 5}.

Pramitol® 5PS [prometon (5%) + simazine (0.76%) + sodium chlorate (40%) + sodium metaborate (40%)]. Soil sterilant. Loveland. EPA Reg. No. 66222-23-34704. 02/2002. {Group 5}.

Predict® [norflurazon (78%)]. For control of grass and broadleaf weeds in field-grown nursery stock and noncropland. Syngenta. EPA Reg. No. 100-849. 02/2001. {Group 12}.

Preen Garden Weed Preventer [trifluralin (1.47%)]. For weed control in garden flowers, bulb, roses, shrubs, trees and vegetables. Lebanon Seaboard. EPA Reg. No. 961-280. 10/2005. {Group 3}.

Prefar® 4-E [bensulide (4 lb/gal)]. Used PRE for grass and broadleaf weeds in cantaloupe, cucumber and watermelon. Gowan. EPA Reg. No. 10163-200. 10/2006. {Group 8}.

Prefix® [S-metolachlor (46.4%) + fomesafen (10.2%)]. For grass and small-seeded broadleaf control in soybeans. Syngenta. EPA Reg. No. 100-1268. 04/2007. {Group 15 + 14}.

Prequel® [rimsulfuron (15%) + isoxaflutole (30%)]. For PP or PRE use in field corn to control broadleaf and annual grass weeds. DuPont. EPA Reg. No. 352-779. 02/2011. RUP. {Group 2 + 27}.

Pre-M 3.3 EC Turf Herbicide™ [pendimethalin (3.3 lb ai/gal)]. For PRE control of weeds in lawns, established lawn ornamentals and non-bearing fruit and nut trees. Lesco. EPA Reg. No. 241-360-10404. 12/2002. {Group 3}.

Pre Pair® [napropamide (4%) + oxadiazon (2%)]. Selective control of annual grasses and broadleaf weeds in continuous field-grown nursery stock, ground covers, shade houses, and landscape ornamentals. Verdicon [formerly United Horticultural Supply]. EPA Reg. No. 34704-771-65783. 11/1999. {Group 15}.

Primisulfuron. An active ingredient in Beacon, Exceed, NorthStar and Spirit. {Group 2}.

Princep® 4 L or Princep® Caliber 90® WDG [simazine (4 lb ai/gal or 90%)]. A long lasting PRE for corn and shelterbelts. Syngenta. EPA Reg. No. 100-526 or 100-603. 06/2001. {Group 5}.

Priority™ [halofuron (50%) + carfentrazone (12.5%)]. For controlling broadleaf weeds in field corn, seed corn, popcorn, silage corn, sweet corn and grain sorghum. Tenkoz. EPA Reg. No. 33906-17-55467. 03/2006. {Group 2 + 14}.

Prism® [clethodim (0.94 lb ai/gal)]. Used POST for selective control of grass weeds in dry bulb onion, soybean and sugarbeets. Valent. EPA Reg. No. 59639-78. 01/2002. {Group 1}.

Prodiamine. Active ingredient in Barricade 65 WG or 4L, Crabgrass Preventer, Echelon, Endurance and Pro-Mate Barricade. {Group 3}.

Prograss® [ethofumesate (1.5 lb ai/gal)]. For grass and broadleaf weed control in ornamental turf. Bayer Environmental Science. EPA Reg. No. 432-941. 10/2003. {Group 1}.

Progress® Herbicide [phenmedipham (7%) + desmedipham (7%) + ethofumesate (7%)]. For POST control of weeds in sugarbeets. Bayer CropScience. EPA Reg. No. 264-632. 02/2002. {Group 5 + 16}.

Pro-Mate® Three Way SC [2,4-D (16.5%) + dichlorprop (8.1%) + mecoprop (8.2%)]. For control of broadleaf weeds in turf. Helena. EPA Reg. No. 2217-740-5905. 08/2003. {Group 4}.

Pro-Mate® Barricade® 0.22% Plus Fertilizer [prodiamine (0.22%)]. For PRE use in controlling broadleaf and grass weeds in established turfgrasses (excluding golf course putting greens). Helena. EPA Reg. No. 5905-543. 10/2003. {Group 3}.

Pro-Mate® Dimension 0.22% Plus Fertilizer [dithiopyr]. EPA Reg. No. 5905-538. 03/2003. {Group 3}.

Pro-Mate® Turf Fertilizer. Contains Team® Pro 0.86% [benefin (0.43%) + trifluralin (0.43%)]. A granular fertilizer containing herbicides for PRE control of annual grasses and broadleaf weeds in established turf and established landscape ornamentals. Helena. EPA Reg. No. 62719-289-5905. 2002. {Group 3}.

Prometon. An active ingredient in Pramitol 25E and Pramitol 5PS. {Group 5}.

Pronamide. Active ingredient in Kerb. {Group 3}.

Propel™ [dimethenamid-P (6 lb ai/gal)]. For selective PRE control of annual grasses and broadleaves. Rosen's Inc. EPA Reg. No. 7969-156-32938. 01/2006. {Group 15}.

Propel™ ATZ [dimethenamid-P (1.7 lb ai/gal) + atrazine (3.3 lb ai/gal)]. For selective PRE control of most annual grasses and many annual broadleaves in corn and sorghum. Rosen's Inc. EPA Reg. No. 7969-192-32938. 01/2006. {Group 15 + 5}.

Propel™ ATZ Lite [dimethenamid-P (2.25 lb ai/gal) + atrazine (2.75 lb ai/gal)]. For selective PRE control of most annual grasses and many annual broadleaves in corn and sorghum. Rosen's Inc. EPA Reg. No. 7969-200-32938. 01/2006. {Group 15 + 5}.

Propoxycarbazone. Active ingredient in Olympus and Olympus FLEX. {Group 2}.

Prosecutor® [glyphosate (3 lb ae/gal)]. POST weed control in industrial, turf and ornamental areas. Lesco. EPA Reg. No. 524-536-10404. 10/2003. {Group 9}.

Prosulfuron. Active ingredient in Peak CP and Spirit. {Group 2}.

Prowl® 3.3 EC [pendimethalin (3.3 lb ai/gal)]. Used PRE or EPOST on corn and PP or PRE on soybean and sunflower. BASF. EPA Reg. No. 241-337. 04/2001. {Group 3}.

Herbicide Dictionary *(continued)*

Prowl® H₂O [pendimethalin (3.8 lb ai/gal)]. A water-based formulation for use in controlling weeds in alfalfa, edible bean, corn, soybean and sunflower. BASF. EPA Reg. No. 241-418. 04/2003. {Group 3}.

Pulsar™ [dicamba (0.7275 lb ae/gal) + fluroxypyr (0.9455 lb ae/gal)]. For POST control of broadleaf weeds in wheat and barley. Syngenta. EPA Reg. No. 100-1343. 2009. {Group 4}.

Puma® 1 EC [fenoxaprop-ethyl (1.0 lb ai/gal)]. For selective control of emerged green and yellow foxtail, millet, barnyardgrass and wild oats in wheat and barley. Bayer CropScience. EPA Reg. No. 264-666. 03/2003. {Group 1}.

Pummel™ [metolachlor (5 lb ai/gal) + imazethapyr (0.25 lb ae/gal)]. For preplant, PPI or PRE control of certain grass and broadleaf weeds in soybeans. MANA. 2012. EPA Reg. No. 66222-251. 2013. {Group 15 + 2}.

Pursuit® Herbicide [imazethapyr (2 lb ai/gal)]. For PP, PRE or POST control of broadleaf and grass weeds in alfalfa, pea, dry bean, Clearfield® corn and soybean. BASF. EPA Reg. No. 241-310. 10/2003. {Group 2}.

Pursuit® Plus EC [imazethapyr (0.2 lb ai/gal) + pendimethalin (2.7 lb ai/gal)]. Used PPI to control broadleaf and grass weeds in Clearfield® field corn and soybean. BASF. EPA Reg. No. 241-331. 05/2005. {Group 2 + 3}.

Pyraflufen. Active ingredient in ET and Vida. {Group 14}

Pyramin SC or DF [pyrazon (4.5 lb/gal or 65%)]. Used PRE for control of broadleaf weeds in red table beets and sugarbeets. BASF or Micro Flo. EPA Reg. No. 7969-108 or 7969-81. 04/2000 or 06/2001. {Group 5}.

Pyrasolfotole. Active ingredient in Huskie. {Group 27}.

Pyroxasulfone. Active ingredient in Anthem, Anthem ATZ, Anthem Maxx, Fierce, Fierce XLT, Piper, and Zidua. {Group 15}.

Pyrazon. Active ingredient in Pyramin SC and DF. {Group 5}.

Pyrithiobac sodium. Active ingredient in Staple and Staple Plus.

Python® WDG [flumetsulam (80%)]. For broadleaf weed control in field corn and soybean. Dow AgroSciences. EPA Reg. No. 62719-277. 08/2001. {Group 2}.

Quelex™ [halauxifen-methyl (10.4%) + florasulam (10.0%)]. For postemergence control of annual broadleaf weeds in wheat (including durum), barley, and triticale. Dow AgroSciences. EPA Reg. No. 62719-661. 07/2016. {Group 2 + 4}.

QuickSilver® or QuickSilver IVM [carfentrazone-ethyl (1.9 lb ai/gal)]. For commercial use only on rights-of-way, utility and industrial sites and fence rows. Nufarm; FMC T&O. EPA Reg. No. 279-3772. 10/2003. {Group 14}.

QuikPRO™ [glyphosate ammonium salt (73.3%) + diquat dibromide (2.9%)]. For use in noncrop and non-timber areas to control unwanted vegetation. Monsanto. EPA Reg. No. 524-535. 10/2001. {Group 9 + 22}.

Quinclorac. Active ingredient in Drive, Onetime, Paramount, Solatare, and SquareOne. {Group 4}.

Quizalofop. Active ingredient in Assure II and Matador. {Group 1}.

Q4® [quinclorac (0.5 lb ae/gal) + sulfentrazone (0.06 lb ai/gal) + 2,4-D (0.88 lb ae/gal) + dicamba (0.1 lb ae/gal)]. For POST grassy and broadleaf weed control in established turf. PBI Gordon. EPA Reg. No. 2217-886. 01/2007. {Group 4 + 14}.

Ranger Pro® [glyphosate isopropylamine (3 lb ae/gal)]. Broad spectrum, POST herbicide for industrial, turf and ornamental weed control. Monsanto. EPA Reg. No. 524-517. 01/2004. {Group 9}.

Range Star® [dicamba (1 lb ae/gal) + 2,4-D amine (2.87 lb ae/gal)]. For weed control in pastures, rangeland, wheat and sorghum. Albaugh/Agri Star. EPA Reg. No. 42750-55. 03/2000. {Group 4}.

Raptor® [imazamox (1 lb ai/gal)]. Used for selective POST grass and broadleaf weed control in alfalfa and soybean. BASF. EPA Reg. No. 241-379. 04/2006. {Group 2}.

Rascal® [glyphosate, isopropylamine (3 lb ae/gal or 4 lb ai/gal)]. For nonselective weed control in noncrop areas, fallow and reduced tillage systems including ecofarming and ecofallow, as a harvest aid in grain sorghum, dormant pastures and Roundup Ready crops. Additional NIS may be added. Winfield Solutions. EPA Reg. No. 42750-60-1381. 11/2003. {Group 9}.

Rascal® Plus [glyphosate, isopropylamine (3 lb ae/gal or 4 lb ai/gal)]. For nonselective weed control in noncrop areas, fallow and reduced tillage systems including ecofarming and ecofallow, as a harvest aid in grain sorghum, dormant pastures and Roundup Ready crops. Additional NIS not required. Winfield Solutions. EPA Reg. No. 42750-61-1381. 01/2005. {Group 9}.

Rattler® [glyphosate, isopropylamine (3 lb ae/gal or 4 lb ai/gal)]. For nonselective weed control in noncrop areas, fallow and reduced tillage systems including ecofarming and ecofallow and as a harvest aid in grain sorghum and dormant pastures. Requires extra NIS. Helena. EPA Reg. No. 524-455-5905. 01/2001. {Group 9}.

Rattler® Plus [glyphosate, isopropylamine (3 lb ae/gal or 4 lb ai/gal)]. For nonselective weed control in noncrop areas, fallow and reduced tillage systems including ecofarming and ecofallow, as a harvest aid in grain sorghum, dormant pastures and Roundup Ready crops. May need extra NIS. Helena. EPA Reg. No. 524-455-5905. 02/2003. {Group 9}.

Rave® WDG [triasulfuron (8.8%) + dicamba (50%)]. Used POST for controlling broadleaf weeds in wheat, barley, fallow, CRP and pastures. Syngenta. EPA Reg. No. 100-927. 03/2001. {Group 2 + 4}.

Razor® Pro Herbicide [IPA glyphosate (3 lb ae/gal or 4 lb ai/gal)]. Broad spectrum, postemergence professional herbicide for industry, forestry, turf, vegetative management and ornamental weed control. Nufarm. EPA Reg. No. 228-366. 10/2002. {Group 9}.

Herbicide Dictionary *(continued)*

Ready Master® ATZ [glyphosate (IPA (1.5 lb ae/gal or 2.0 lb ai/gal) + atrazine (2 lb ai/gal)]. Used for POST weed control in Roundup Ready corn and fallow with residual weed control. Monsanto. EPA Reg. No. 524-509. 01/1999. RUP. {Group 9 + 5}.

Realm® Q [rimsulfuron (7.5%) + mesotrione (31.25%)]. For POST broad spectrum weed control in corn. DuPont. EPA Reg. No. 352-837. 07/2012. {Group 2 + 27}.

Recoil® [glyphosate (2.13 lb ai/gal) + 2,4-D (1.67 ai/gal)]. For control of non-selective weeds in cereal crops, preplant sorghum, soybean and corn, and POST harvest for small grain and corn. Nufarm. EPA Reg. No. 71368-35. 12/2003. {Group 9 + 4}.

Redeem® R&P [triclopyr (2.25 lb ae/gal) + clopyralid (0.75 lb ae/gal)]. For control of annual and perennial broadleaf weeds in rangeland and permanent grass pastures. Dow AgroSciences. EPA Reg. No. 62719-337. 05/2003. {Group 4}.

Reflex® Herbicide [fomesafen (2 lb ai/gal)]. Used for selective POST broadleaf weed control in soybean east of U.S. 281. Syngenta. EPA Reg. No. 100-993. 01/2003. {Group 14}.

Reglone® Desiccant [diquat (2 lb ai/gal)]. Used to desiccate seed crops of alfalfa, clover, grain sorghum and soybean; also used for potato. Syngenta. EPA Reg. No. 100-1061. 04/2000. {Group 22}.

Rely® [glufosinate (1 lb ai/gal)]. For control of emerged weeds in apples, grapes and tree nuts and for potato vine desiccation. Bayer CropScience. EPA Reg. No. 264-652. 04/2001. {Group 10}.

Remedy® Ultra [triclopyr (43.46% ae per 4 lb/gal)]. For control of woody plants and broadleaf weeds on rangeland, permanent grass pastures and CRP acres. Dow AgroSciences. EPA Reg. No. 62719-552. 04/2006. {Group 4}.

Report™ [chlorsulfuron (75%)]. POST broadleaf herbicide for small grains. Restrictions on crop rotations. 01/2008. FMC. EPA Reg. No. 67760-81. {Group 2}.

Report® Extra [chlorsulfuron (62.5%) + metsulfuron (12.5%)]. For use on wheat, barley, and fallow. 06/2008. FMC. EPA Reg. No. 67760-82. {Group 2}.

Resicore™ [acetochlor (2.8 lb ai/gal) + mesotrione (0.30 lb ai/gal) + clopyralid (0.19 lb ai/gal)]. A herbicide for control of annual grasses and broadleaf weeds in field corn, field seed corn, field silage corn, and yellow popcorn. Dow AgroSciences. EPA Reg. No. 62719-693. 01/2016. {Group 15 + 27 + 4}.

Resolve® DF [rimsulfuron (25%)]. For fallow, PRE or POST grass and broadleaf weed control in corn. DuPont. EPA Reg. No. 352-556. 06/2010. {Group 2}.

Resolve® Q (mp) [rimsulfuron (18.4%) + thifensulfuron (4%) + isoxadifen (safener)]. For POST grass and broadleaf control in field corn. DuPont. EPA Reg. No. 352-759. 06/2010. {Group 2}.

Resolve® SG [rimsulfuron (25%)]. For fallow, PP, PPI or PRE grass and broadleaf control in field corn. DuPont. EPA Reg. No. 352-748. 06/2010. {Group 2}.

Resource® Herbicide [flumiclorac (0.86 lb/gal)]. For selective POST broadleaf weed control [especially velvetleaf] in soybean and corn. Valent. EPA Reg. No. 59639-82. 07/2002. {Group 14}.

Revolver® Herbicide [foramsulfuron (0.19 lb ai/gal)]. For control of annual and perennial grasses in bermudagrass, zoysiagrass, and buffalograss. Bayer Environmental Science. EPA Reg. No. 432-1266. 10/2006. {Group 2}.

Revolin Q. [Nicosulfuron (14.4%) + mesotrione (36.8%)]. For postemergence use in field corn grown for grain, silage, or seed, yellow popcorn, or sweet corn. Dupont. EPA Reg. No. 352-900. 2015. {Group 2 + 27}.

Reward® AccuGel™ Aquatic Herbicide [diquat dibrome (16.6%)]. For control of aquatic weeds in still water. Syngenta. EPA Reg. No. 100-1194 A-L1. 06/2004. {Group 22}.

Rezult® Herbicide [bentazon (5 lb ai/gal) + sethoxydim (1 lb/gal)]. Sold as a co-pack for POST broadleaf and grass weed control in dry bean and soybean and POST weed control in POST protected corn. BASF. EPA Reg. No. 7969-112. 04/1999. {Group 6}.

Rhomene® MCPA Broadleaf [MCPA, DMA (3.7 lb ae/gal)]. Used for selective POST control of many broadleaf weeds in wheat, oat, barley, rye, flax, established grassland and noncrop areas. Nufarm. EPA Reg. No. 228-143-71368. 06/2005. {Group 4}.

Rhonox® MCPA Ester [MCPA ester (3.7 lb ae/gal)]. Used for control of broadleaf weeds in flax, pasture, rangeland, turf and noncrop areas. Nufarm. EPA Reg. No. 11685-21-71368. 05/2003. {Group 4}.

Rhythm® [fomesafen (1.88 lb ai/gal)]. For PRE and POST broadleaf control in soybeans. FMC. EPA Reg. No. 67760-94. 01/2009. {Group 14}.

Rifle® [dicamba (4 lb ai/gal)]. For broadleaf control in corn, sorghum, small grains, pasture, hay, rangeland, turf and others. Loveland. EPA Reg. No. 34704-861. 2006. {Group 4}.

Rifle-D® [dicamba (1 lb ai/gal) + 2,4-D (2.88 lb ai/gal)]. For use on CRP, fallow, sorghum, pasture, rangeland, and others. Loveland. EPA Reg. No. 34704-869. 2006. {Group 4}.

Rifle Plus® [dicamba (1.1 lb ai/gal) + atrazine (2.1 lb ai/gal)]. For use in corn, grain sorghum, and fallow. Loveland. EPA Reg. No. 34704-860. 2006. RUP. {Group 4 + 5}.

Rimsulfuron. An active ingredient in Alluvex, Basis, Basis Blend, Crusher, Harrow, Instigate, Matrix, Resolve DF, Resolve Q, Require Q, Solida, Steadfast and Steadfast Q. {Group 2}.

Rodeo® [glyphosate (4 lb ae/gal)]. Special formulation of glyphosate for aquatic weed control. Dow AgroSciences. EPA Reg. No. 62719-324. 05/2002. {Group 9}.

Ro-Neet® 6 E [cycloate (6 lb ai/gal)]. Used PPI in sugarbeets, table beets and spinach for controlling annual grasses and some broadleaf weeds. Monterey; Helm Agro. EPA Reg. No. 73767-5-56077; 7376-5-4530. 09/2001. {Group 8}.

Ronstar® G [oxadiazon (2%)]. For PRE weed control in turf and ornamental shrubs, vines and trees. Applied by commercial nursery, turf or landscape personnel only. Bayer Environmental Science. EPA Reg. No. 432-886. 08/2003. {Group 14}.

Herbicide Dictionary *(continued)*

Ronstar® 50 WSP [oxadiazon (50%)]. For selective PRE control of annual weeds in turf including buffalograss and ornamentals. Bayer Environmental Science. EPA Reg. No. 432-893. 07/2001 {Group 14}.

Roundup PowerMAX® [glyphosate, potassium salt (4.5 lb ae/gal or 5.5 lb ai/gal)]. Selective broad spectrum weed control in Roundup Ready crops. Nonselective, broad spectrum weed control for many agricultural systems and farmsteads. Monsanto. EPA Reg. No. 524-549. 01/2007. {Group 9}.

Roundup Pro® [glyphosate, isopropylamine (3 lb ae/gal or 4 lb ai/gal) + surfactant]. A POST nonselective translocated herbicide for annual and perennial grass and broadleaf weed control. Monsanto. EPA Reg. No. 524-475-2A. 10/2003. {Group 9}.

Roundup Pro® Concentrate [glyphosate, isopropylamine (5 lb ai/gal)]. For use in industry, turf and ornamental weed control. Monsanto. EPA Reg. No. 524-529AA. 10/2003. {Group 9}.

Roundup ProMax® [glyphosate, potassium salt (4.5 lb ae/gal or 5.5 lb ai/gal)]. Broad spectrum postemergence herbicide for non-crop, industrial, turf and ornamental weed control. Monsanto. EPA Reg. No. 524-579. 01/2008. {Group 9}.

Roundup WeatherMax® [glyphosate, potassium (4.5 lb ae/gal or 5.5 lb ai/gal)]. Selective control of weeds in Roundup Ready crops. Nonselective control of weeds in other cropping systems. Monsanto. EPA Reg. No. 524-537. 06/2003. {Group 9}.

Rowel. [Flumioxazin (51%)]. For control and/or suppression of certain weeds in cotton, field corn, peanut, soybean, and fallow land. Monsanto. EPA Reg. No. 59639-99-524. 2015. {Group 14}.

Rowel FX. [Flumioxazin (30%) + chlormuron ethyl (10.3%)]. For weed control in soybeans. Monsanto. EPA Reg. No. 59639-117-524. 2015. {Group 2 + 14}.

Rout® [oxylfuorfen 2% + oxyzalin 1%]. For PRE control of weeds in containers, field-grown and landscape ornamentals, cut flowers and foliage crops. Scotts. EPA Reg. No. 58185-27. 12/2003. {Group 14 + 3}.

RT3 [glyphosate, potassium salt (4.5 lb ae/gal or 5.5 lb ai/gal)]. For control of annual and perennial weeds in fallow systems, before crop emergence, or in pasture, range, and CRP. Restricted to counties in western Nebraska. Monsanto. EPA Reg. No. 524-544. 01/2008.

RT Master® II [glyphosate, potassium (4.5 lb ae/gal or 5.5 lb ai/gal)]. Labeled for controlling emerged weeds before Roundup Ready crops as there is no 2,4-D in RT Master II. Not labeled for crop use. The red dye in RT Master was replaced with a blue dye. Designed for use in fallow. *Restricted to counties in western Nebraska.* Monsanto. EPA Reg. No. 524-539. 01/2004 {Group 9}.

Rugged™ Herbicide [2,4-D (3.49 lb ae/gal)]. PP, PRE and POST control of annual and biennial broadleaf weeds in field and sweet corn, PP to soybean, POST to small grain, grain sorghum, fallow, pastures, rangeland, turfgrass, lawns and aquatic areas. Winfield Solutions. EPA Reg. No. 1381-247. 2012. {Group 4}.

Rumble® [fomesafen (1.88 lb ai/gal)]. For POST control of broadleaf weeds in soybeans. MANA. EPA Reg. No. 66222-246. 2012. {Group 14}.

S-metolachlor. Active ingredient in Acuron, Bicep II Magnum FC, Bicep II Magnum, Bicep Lite II Magnum, Boundary, Camix, Cinch, Cinch ATZ, Cinch ATZ Lite, Dual Magnum, Dual II Magnum, Dual II G Magnum, Dual II Magnum SI, Expert, Halex GT, Lexar, Lumax, Pennant Magnum, Prefix and Sequence. More active isomer than metolachlor found in Dual. {Group 15}.

Saber® [2,4-D dimethylamine (3.8 lb ai/gal)]. For control of broadleaf weeds in small grain, corn and grain sorghum. Loveland. EPA Reg. No. 34704-803. 04/1999. {Group 4}.

Saflufenacil. An active ingredient in OpTill, OpTill Pro, Sharpen and Verdict. {Group 14}.

Sahara® DG [imazapyr (7.78%) + diuron (62.22%)]. For control of all plants where bare ground is desired. BASF. EPA Reg. No. 241-372. 04/2001. {Group 2 + 7}.

Salvo® [2,4-D, isooctyl (5 lb/gal)]. A low volatile ester. Loveland. EPA Reg. No. 34704-609. 07/2001. {Group 4}.

Samson™ 4 SC [nicosulfuron (0.33 lb ai/gal)]. For POST grass control in corn. UPI. EPA Reg. No. 71512-16-70506. {Group 2}.

Sandea® WP [halosulfuron (75%)]. A selective POST herbicide for control of some broadleaf weeds and nutsedge in sweet corn. Gowan. EPA Reg. No. 10163-254. 02/2003. {Group 2}.

Savage® WP [2,4-D (95%)]. Water soluble crystals of dimethylamine salt of 2,4-D. Loveland. EPA Reg. No. 34704-606. 05/2002. {Group 4}.

Scepter® 70DG [imazaquin (70%)]. A PPI, PRE or POST broadleaf and grass weed control in soybean. BASF. EPA Reg. No. 241-306. 09/2009. {Group 2}.

Scoparia. [Isoxaflutole (4 lbs ai/gal)]. For weed control. Bayer CropsScience. EPA Reg. No. 264-600. 2015. {Group 27}.

Scythe® [pelargonic acid (4.2 lb ai/gal)]. For burndown and aquatic weed control. Also labeled to mix with glyphosate. Dow AgroSciences. Mycogen. EPA Reg. No. 62719-342 or 53219-7. 05/2002 or 04/1998. {Not classified}.

SedgeHammer® [halosulfuron-methyl (75%)]. For control of nutsedge in turfgrass and landscaped areas. Gowan. EPA Reg. No. 81880-1-10163. 07/2005. {Group 2}.

Section® [clethodim (2 lb ai/gal)]. For POST grass control in many broadleaf crops. Winfield Solutions. EPA Reg. No. 1381-204. 03/2008. {Group 1}.

Select® [clethodim (2 lb ai/gal)]. Used POST for annual and perennial grasses in alfalfa, canola, potato, soybean, sunflower, sugarbeets and others. Valent. EPA Reg. No. 59639-3. 07/2002. {Group 1}.

Select Max® [clethodim (0.97 lb ai/gal)]. Used POST for volunteer corn plus annual and perennial grasses in soybeans only. More flexible adjuvant requirements than Select. Valent. EPA Reg. No. 59639-132. 03/2005. {Group 1}.

Sempre® [halosulfuron-methyl (75%)]. Use for POST broadleaf weeds and nutsedge control in field and sweet corn, popcorn, grain sorghum and turf sod. Monsanto. EPA Reg. No. 524-465. 01/2001. {Group 2}.

Herbicide Dictionary *(continued)*

Sequence® Herbicide [glyphosate (2.25 lb ae/gal) + S-metolachlor (3 lb ai/gal)]. Foliage and PRE control of weeds in soybean, corn, cotton and sorghum before planting. Labeled for use with Roundup Ready soybeans. Syngenta. EPA Reg. No. 100-1185. 03/2004. {Group 9 + 15}.

Sethoxydim. Active ingredient in Conclude Xact, Manifest, Poast, Poast Plus, Rezult and Vantage for grass control in alfalfa, soybean and other broadleaf crops. {Group 1}.

Sharpen® [saflufenacil (2.85 lb ai/gal)]. Broadleaf herbicide for burndown in corn (field, pop, silage), chickpea (garbanzo bean), small grains, sorghum (grain), soybean, sunflower, fallow, postharvest, and rangeland and pasture. BASF. EPA Reg. No. 7969-278. 09/2009. {Group 14}.

Shotgun® [2,4-D (1.0 lb/gal) + atrazine (2.25 lb/gal)]. For POST broadleaf weed control in sorghum and corn. Loveland. EPA Reg. No. 34704-728. 05/1999. RUP. {Group 4 + 5}.

Siduron. Active ingredient in Tupersan. {Group 7}.

Silhouette® [glyphosate (3 lb ae/gal or 4 lb ai/gal)]. For POST control of broadleaf and grass weeds for burndown and non-cropland weed control. Additional surfactant optional. Winfield Solutions. EPA Reg. No. 524-445-1381. 2001. {Group 9}

Silverado™ Wild Oat Herbicide [mesosulfuron (2%)]. For control of wild oat in wheat including durum. Bayer CropSciences. EPA Reg. No. 264-801. 03/2004. {Group 2}

Simazine. An active ingredient in Pramitol 5PS, Princep 4L, Princep Caliber 90, Simazine 4L and 90 DF, Simazat, and Sim-trol. Used for aquatic weed control, corn, shelterbelts, and soil sterilants. {Group 5}.

Simazat™ 4L Herbicide [atrazine (2 lb ai/gal) + simazine (2 lb ai/gal)]. For control of weeds in corn and Christmas tree plantations. Drexel. EPA Reg. No. 19713-171. 08/2002. {Group 5}. RUP.

Simazine 4L or 90 DF [simazine (4 lb ai/gal or 90%)]. Used for weed control in fruit and nut crops, corn and shelterbelts. Winfield Solutions; Loveland. EPA Reg. No. 9779-296 or 9779-295; 34704-687 or 34704-686. Drexel 19713-252. 08/2002 or 10/2002; 02/2003 or 10/1999; 02/2004. {Group 5}.

Sim-trol® 90 DF [simazine (90%)] For weed control in certain crops and ornamental plantings. Sipcam. Agro. EPA Reg. No. 35915-12-60063. 12/2003. {Group 5}.

Sinbar® WDG [terbacil (80%)]. Used in dormant season for control of annual grass and broadleaf weeds in established alfalfa. NovaSource. EPA Reg. No. 61842-27. 2011. {Group 5}.

Snapshot® 2.5 TG [trifluralin (2.0%) + isoxaben (0.5%)]. For PRE control of annual broadleaf and grass weeds in landscape ornamental and ground covers. Dow AgroSciences. EPA Reg. No. 62719-175. 05/2000. {Group 3 + 21}.

Sodium chlorate. An active ingredient in Pramitol 5PS and Sodium Chlorate Weed Killer. {Not classified}.

Sodium Chlorate Weed Killer [sodium chlorate (6 lb/gal)]. Used as a desiccant in corn, dry edible bean, sorghum, soybean or sunflower. Simplot. EPA Reg. No. 7001-342. 08/1999. {Not classified}.

Sodium metaborate. An active ingredient in Pramitol 5PS. {Not classified}.

Solicam® DF [norflurazon (78.6%)]. Used PRE for controlling weeds in asparagus, grapes and fruit trees. Syngenta. EPA Reg. No. 100-849. 10/2002. {Group 12}.

Solida® [rimsulfuron (25%)]. For POST weed control in field corn, stone fruit, grapes, potatoes, field-grown tomatoes, industrial sites and roadsides. FMC. EPA Reg. No. 67760-105. 03/2010. {Group 2}.

Solitaire. [sulfentrazone (18.75%) + quinclorac (56.25%)] For selective weed control in turf including residential, commercial, and institutional lawns, athletic fields, commercial sod farms, golf courses (fairways and roughs) and other non-crop sites. FMC. EPA Reg. No. 279-3355. 2009. {Group 4 + 14}.

Solstice™ [fluthiacet methyl (0.216 lb ai/gal) + mesotrione (3.784 lb ai/gal)]. For weed control in corn. FMC. EPA Reg. No. 279-3461. {Group 14 + 27}

Sonalan® HFP or 10G [ethalfluralin (3 lb ai/gal or 10%)]. Use PPI for annual grasses and certain broadleaf weeds in corn, dry edible bean, soybean and sunflower. Dow AgroSciences. EPA Reg. No. 62719-188 [12/1998] or 62719-184. 06/1999. {Group 3}.

Sonar™ A.S. [fluridone (4 lb ai/gal)]. For aquatic weed control. SePRO. EPA Reg. No. 67690-4. 12/2002. {Group 12}.

Sonic™ [cloransulam methyl (0.08 lb ai/lb product) + sulfentrazone (0.62 lb ai/lb product)]. For residual foundation weed control in glyphosate-tolerant soybeans. Dow AgroSciences. EPA Reg. No. 279-3246-62719. 10/2006. {Group 2 + 14}.

Spartan® [sulfentrazone (75% or 4 lb ai/gal)]. For broadleaf weed control in sunflower. FMC. EPA Reg. No. 279-3189 or 279-3220. 10/2003 or 10/2003. {Group 14}.

Spartan Charge® [carfentrazone (0.35 lb ai/gal) + sulfentrazone (3.15 lb ai/gal)]. For burndown to PRE control of primarily broadleaf weeds in chickpeas, field peas, fallow, soybeans and sunflower. FMC. EPA Reg. No. 279-3337. 10/2008. {Group 14}.

Spartan® Elite [sulfentrazone (0.7 lb ai/gal) + s-metolachlor (6.3 lb ai/gal)]. For burndown to PRE control of primarily broadleaf weeds in dry shelled peas, soybeans and sunflower. FMC. EPA Reg. No. 279-3442. 2012. {Group 14 + 15}.

Speed Zone® [carfentrazone-ethyl (0.05 lb) + 2,4-D ethylhexylester (1.53 lb) + mecoprop (0.48 lb ae/gal + dicamba (0.14 lb ae/gal)]. For broadleaf control in turf. PBI/Gordon. EPA Reg. No. 2217-833. 09/2001. {Group 14 + 4}.

Spike® 80 DF or 20 P [tebuthiuron]. Used for total vegetation and selective brush control in grassland and noncrop areas. Dow AgroSciences. EPA Reg. No. 62719-107 or 62719-121. 09/1999 or 08/2000. {Group 7}.

Spin-Aid® [phenmedipham (1.3 lb ai/gal)]. For POST weed control in spinach and red beets. Bayer CropScience. EPA Reg. No. 264-616. 04/2005. {Group 5}.

Spirit® Herbicide WDG [prosulfuron (14.2%) + rimsulfuron (42.8%)]. For POST broadleaf weed control in field corn and popcorn. Syngenta. EPA Reg. No. 100-911. 05/1999. {Group 2}.

Spotlight™ [fluroxypyr (1 lb/gal)]. For POST control of annual and perennial broadleaf and woody brush in established turf, including residential lawns. Dow AgroSciences. EPA Reg. No. 62719-308. 12/2003. {Group 4}.

Herbicide Dictionary *(continued)*

Spyder® DG [sulfometuron (75%)]. For PRE and POST control of grasses and broadleaf weeds in conifers and hardwood site preparation and release areas. Nufarm. EPA Reg. No. 228-408. 02/2004. {Group 2}.

SquareOne. [carfentrazone-ethyl (3.9%) + quinclorac (66.1%)]. For selective weed control in turf including residential, commercial, and institutional lawns, athletic fields, commercial sod farms, golf courses (fairways and roughs) and other non-crop sites. FMC. EPA Reg. No. 279-3419. 2013. {Group 4 + 14}

Stalwart® [metolachlor (8.0 lb ai/gal)]. For weed control in potatoes, sorghum and soybeans. Sipcam Agro. EPA Reg. No. 60063-24. 12/2007. {Group 15}.

Stalwart® C [metolachlor (7.8 lb ai/gal)]. For weed control in all types of corn. Sipcam Agro. EPA Reg. No. 60063-22. 02/2005. {Group 15}.

Stalwart® Xtra [atrazine (3.1 lb ai/gal) + metolachlor (2.4 lb ai/gal)]. For weed control in all types of corn. Sipcam Agro. EPA Reg. No. 60063-23. 03/2006. {Group 5 + 15}.

Starane® Flex [florasulam (0.042 lb ai/gal) + fluroxypyr (0.833 lb ae/gal)]. For POST control of annual broadleaf weeds in wheat (including durum), barley, oats, rye, and triticale. Dow AgroSciences. EPA Reg. No. 2719-604. 07/2009. {Group 2 + 4}.

Starane® NXT [fluroxypyr (1.5 lb ae/gal) + bromoxynil (2.0 lb ae/gal)]. Used POST for broadleaf weed control in wheat, barley and oats. Dow AgroSciences. EPA Reg. No. 62719-536. 03/2006. {Group 4 + 6}.

Starane® Ultra [fluroxypyr (2.8 lb ae/gal)]. For POST control of broadleaf weeds in small grains, field corn, sweet corn, non-crop land and hay. Dow AgroSciences. EPA Reg. No. 62719-577. 02-2009. {Group 4}.

Starane® + Esteron [fluroxypyr (0.75 lb ae/gal) + 2,4-D ester (3 lb ae/gal)]. For control of broadleaf weeds and volunteer potato in small grain, especially kochia. Dow AgroSciences. EPA Reg. No. 62719-306. 02/2002. {Group 4}.

Starane® + MCPA [fluroxypyr (0.71 lb ae/gal) + MCPA (2.84 lb ae/gal)]. For control of annual and perennial broadleaf weeds, especially kochia and volunteer potato in small grain. Loveland. EPA Reg. No. 62719-307. 12/2003. {Group 4}.

Starane® + Saber® [fluroxypyr (0.5 lb ae/gal) + 2,4-D amine (2.0 lb ae/gal)]. For POST broadleaf control in small grains, especially for kochia. Loveland. EPA Reg. No. 62719-333. 02/2003 {Group 4}.

Starane® + Salvo® [fluroxypyr (0.75 lb ae/gal) + 2,4-D ester (3 lb ae/gal)]. For POST broadleaf weed control in small grains, especially for kochia. Dow AgroSciences, Loveland. EPA Reg. No. 62719-306. 10/2004. {Group 4}.

Starane® + Sword [fluroxypyr (0.71 lb ae/gal) + MCPA (2.84 lb ae/gal)]. For POST broadleaf weed control in small grain, especially for kochia. Dow AgroSciences, Loveland. EPA Reg. No. 62719-307. 05/2003. {Group 4}.

Statement™ [metolachlor (4.33 lb ai/gal) + fomesafen (0.91 lb ai/gal)]. For control of grass and broadleaf weeds in soybean and cotton. Cheminova. EPA Reg. No. 67760-123. {Group 15 + 14}

Status® [diflufenzopyr (16%) + dicamba (40%) + isoxadifen (safener)]. Used POST to control broadleaf weeds in corn. BASF. EPA Reg. No. 7969-242. 2007. {Group 19 + 4}.

Steadfast® [nicosulfuron (50%) + rimsulfuron (25%)]. For POST broadleaf and grass control in field corn. DuPont. EPA Reg. No. 352-608. 05/2010. {Group 2}.

Steadfast® Q [nicosulfuron (50%) + rimsulfuron (25%) + isoxadifen (safener)]. For POST broadleaf and grass control in field corn. DuPont. EPA Reg. No. 352-774. 09/2008. {Group 2}.

Stealth® [pendimethalin (3.3 lb ai/gal)]. Used PRE or EPOST on corn and PP or PRE on soybean and sunflower. Loveland. EPA Reg. No. 34704-868. 2006. {Group 3}.

Sterling Blue® [dicamba, diglycolamine (4 lb ae/gal)]. For PP, PRE, or POST broadleaf weed control in corn, grain sorghum and small grains. Some varieties are more sensitive. Also for pasture, hay, rangeland, soybean, turf and non-cropland. Winfield Solutions. EPA Reg. No. 7969-137-1381. 2009. {Group 4}.

Stinger® [clopyralid (3 lb ae/gal)]. For POST broadleaf weed control in canola, sugarbeets, sweet corn and popcorn. Dow AgroSciences. EPA Reg. No. 62719-73. 03/2001. {Group 4}.

Storm® [bentazon (2.67 lb) + acifluorfen (1.33 lb ai/gal)]. For weed control in soybean. UPI. EPA Reg. No. 70506-59. 06/2006. {Group 6 + 14}.

Stout® [nicosulfuron (67.5%) + thifensulfuron-methyl (5.0%)]. POST grass and broadleaf weed control in field corn. DuPont. EPA Reg. No. 352-721. 05/2010. {Group 2}.

Strategy™ [ethalfluralin (1.6 lb) + clomazone (0.51 lb ai/gal)]. For selective control of annual grass and broadleaf weeds in cucumber, melon, pumpkin, squash and watermelon. Loveland. EPA Reg. No. 34704-836. 07/2003. {Group 2 + 13}.

Streamline® [aminocyclopyrachlor (39.5%) + metsulfuron (12.6%)]. For general weed control in non-cropland areas. DuPont. EPA Reg. No. 352-848. 03/2012. {Group 4 + 2}.

Strike 3® [2,4-D, DMA (2.44 lb ae/gal) + mecoprop (0.63 lb ae/gal) + DMA dicamba (0.22 lb ae/gal)]. For selective control for turfgrasses, including use on sod farms. Winfield Solutions. EPA Reg. No. 14774-02. 01/1999. {SOA Group}.

Strike 3® Ultra [2,4-D, DMA (2.9 lb) + clopyralid (0.15 lb ae/gal) + dichlorprop (0.75 lb ae/gal)]. POST control of broadleaf weeds on golf courses, parks and ornamental turfgrass. Winfield Solutions. EPA Reg. No. 228-374-1381. 07/2001. {Group 4}.

Strut® [dicamba (4 lb ae/gal)]. For POST broadleaf weed control in CRP, corn, fallow, sorghum, hay, proso millet, rangeland, small grains, and turf. Loveland. 12/2009. EPA Reg. No. 34704-1043. {Group 4}.

Sulfentrazone. An active ingredient in Dismiss, Echelon, Spartan, Authority Assist, Authority First, Authority MTZ, Authority XL, Solitaire, and Sonic. {Group 14}.

Sulfometuron. Active ingredient in Landmark XP, Oust, Oust Extra, Oust XP, Oustar and Westar. {Group 2}.

Herbicide Dictionary *(continued)*

Sulfosulfuron. Active ingredient in Maverick and Maverick Pro for control of downy brome in winter wheat, Outrider for noncropland, and Spyder and Certainty for selective grass and broadleaf control in some warm-season turfs. {Group 2}.

Supersate® [glyphosate, isopropylamine (41%)]. For POST control of broadleaf and grass weeds in Roundup Ready corn and soybean, burndown, fallow cropland and noncropland weed control. Loveland. EPA Reg. No. 524-445-34704. 11/2004. {Group 9}.

SureGuard® WDG [flumioxazin (51%)]. For PRE control of weeds in containers and field-grown ornamentals, conifers and deciduous trees. Valent. EPA Reg. No. 59639-120. 01/2004. {Group 14}.

SureStart II® [acetochlor (3.75 lb ai/gal) + furiazole safener + flumetsulam (0.12 lb ai/gal) + clopyralid (0.38 lb ai/gal)]. For PP, PRE and early POST residual foundation weed control in herbicide-tolerant corn. Dow AgroSciences. EPA Reg. No. 62719-679. 03/2014. {Group 15 + 2 + 4}.

Surflan® A.S. or Surflan A.S. Speciality [oryzalin (4 lb ai/gal)]. Used PRE for annual grass and broadleaf weeds in fruit, nut and Christmas trees, turf and ornamentals. Dow AgroSciences; United Phosphorus. EPA Reg. No. 62719-112 or -113; 70506-43 or -44. 05/2002. {Group 3}.

Surge® [sulfentrazone (0.06 lb ai/gal) + 2,4-D (1.4 lb ae/gal) + mecoprop (0.5 lb ae/gal) + dicamba (0.22 lb ae/gal)]. For POST broadleaf control in established turf. PBI Gordon. EPA Reg. No. 2217-867. 04/2008. {Group 14 + 4}.

Surmount® [fluroxypyr (0.67 lb ae/gal) + picloram (0.67 lb ae/gal)]. For control of woody plants and annual and perennial broadleaf weeds in rangeland and perennial grass pastures, fence rows, nonirrigated ditchbanks and around farm buildings. Dow AgroSciences. EPA Reg. No. 62719-480. 10/2004. {Group 4}.

Surpass® NXT [acetochlor (7 lb ai/gal)]. For PRE control of annual grasses and some broadleaf weeds in field corn, sweet corn, seed corn, popcorn, Miscanthus and other perennial bioenergy crops. Dow AgroSciences. EPA Reg. No. 62719-672. 04/2013. {Group 15}.

Surveil™ Co-Pack [flumioxazin (51%) {Surveil™ V} + cloransulam-methyl (84%) {Surveil FR}]. A multi-pack product for preemergent control of certain weeds in soybeans. Dow AgroSciences. EPA Reg. No. 59639-131-62719. 12/2013. {Group 14 + 2}.

Sword® [MCPA (5.2 lb/gal)]. For broadleaf weed control in small grains and pastures. Loveland. EPA Reg. No. 228-267-34704. 10/2001. {Group 4}.

SWB™ 2,4-D LV4 [2,4-D, 2-ethyhexl (3.76 lb ae/gal)]. Used to control broadleaf weeds in cereal crops, corn, sorghum, soybean, weeds and brush in rangeland, pastures and rights-of-way. Winfield Solutions. EPA Reg. No. 42750-22-9779. 19/2004. {Group 4}.

Synchrony® XP [chlorimuron (21.5%) + thifensulfuron (6.9%)]. For PRE, PPI, burndown and POST broadleaf control in soybean. DuPont. EPA Reg. No. 352-648. 06/2010. {Group 2}.

Tacoma® [fenoxaprop (1 lb ai/gal)]. For POST control of green and yellow foxtail, wild millets, wild oat and barnyard grass in wheat and barley. Winfield Solutions. EPA Reg. No. 264-666-1381. 12/2009. {Group 1}.

Tahoe® 3A or 4E [triclopyr (3 or 4 lb ae/gal)]. For control of woody plants and broadleaf weeds on rights-of-way, forests and wildlife openings, including grazed areas. Nufarm. EPA Reg. No. 228-384 or 228-385. 02/2003. {Group 4}.

Tailwind™ [metolachlor (5.25 lb ai/gal) + metribuzin (1.25 lb ai/gal)]. For PRE control of annual grasses and broadleaf weeds in soybeans and potatoes. MANA. EPA Reg. No. 66222-245. 12/2012. {Group 15 + 5}.

Targa® [quizalofop (0.88 lb ai/gal)]. A POST grass herbicide for use in canola, dry bean, snapbean, soybean and sugarbeets. Gowan. EPA Reg. No. 33906-9-81880. 01/2005. {Group 1}.

Team® Pro Fertilizer with 0.86% Team® [benefin (0.43%) + trifluralin (0.43%)]. A granular fertilizer containing herbicides for PRE control of annual grasses and broadleaf weeds in established turf and established landscape ornamentals. Verdicon [formerly United Horticultural Supply]. EPA No. 62719-289. 06/2001. {Group 3}.

Tebuthiuron. Active ingredient in Spike 80W or 20 P. {Group 7}.

Telar® XP [chlorsulfuron (75%)]. For weed control in noncrop and industrial sites. DuPont. EPA Reg. No. 352-654. 03/2011. {Group 2}.

Tembotrione. Active ingredient in Laudis. Used to control grass and broadleaf weeds in field corn, seed corn, sweet corn and popcorn. {Group 27}.

Tenacity® [mesotrione (4 lb ai/gal)]. For selective weed control in turf and lawns. Syngenta. EPA Reg. No. 100-1267. 01/2008. {Group 27}.

Terbacil. Active ingredient in Sinbar. {Group 5}.

Thiencarbazone-methyl. An active ingredient in Corvus, Capreno and AutumnSuper. {Group 2}.

Thifensulfuron. An active ingredient in Accurate Extra, Affinity BroadSpec, Afforia, Alluvex, Ally Extra, Basis Blend, Crusher, Edition, Envive, Harass, Harmony Extra, Harmony GT XP, Harmony SG, Harrow, Nimble, Panoflex, Synchrony XP, TNT Broadleaf, and Unity WDG. {Group 2}.

Thiobencarb. Active ingredient in Bolero. {Group 8}.

Three-Way Selective Herbicide [2,4-D (2.38 lb) + mecoprop (0.63 lb) + dicamba (0.22 lb ae/gal)]. Lesco. EPA Reg. No. 10404-43. 10/2003. {Group 4}.

Three-Way™ Ester II [MCPA (3 lb) + triclopyr (0.3 lb) + dicamba (0.3 lb ae/gal)]. Used for POST control of broadleaf weeds in turfgrass. Lesco. EPA Reg. No. 228-317-10404. 10/2003. {Group 4}.

Throttle® XP [chlorsulfuron (9%) + sulfometuron (18%) + sulfentrazone (48%)]. For control of annual and perennial grass and broadleaf weeds in non-crop sites. DuPont. EPA Reg. No. 352-725. 05/2009. {Group 2 + 14}.

TNT Broadleaf [thifensulfuron-methyl (50%) + tribenuron-methyl (25%)]. For broadleaf control in wheat, barley, oat, triticale, and fallow. Gowan. EPA Reg. No. 10163-300. 03/2008. {Group 2}.

Herbicide Dictionary *(continued)*

TopNotch® [acetochlor (3.2 lb ai/gal) + dichlormid safener]. An encapsulated form of acetochlor for selective PRE weed control in field, seed and silage corn and popcorn. Dow AgroSciences. EPA Reg. No. 62719-369. 03/2003. {Group 15}.

Topramezone. Active ingredient in Armezon, Armezone Pro, and Impact. {Group 27}.

Topsite™ G [imazapyr (0.5%) + diuron (2.0%)]. Controls many annual and perennial weeds in noncrop areas. Loveland. EPA Reg. No. 228-308-34704. 02/1996. {Group 2 + 7}.

Tordon® 101 Mixture [picloram (0.54 lb) + 2,4-D (2.0 lb ae/gal)]. For control of annual and perennial broadleaf weeds, woody plants and vines on noncrop areas. Dow AgroSciences. EPA Reg. No. 62719-5. 05/2003. RUP. {Group 4}.

Tordon® 22K or Tordon® K [picloram (2 lb ae/gal)]. A POST herbicide for annual and perennial broadleaf weeds. Residues may last for several years in the soil. Dow AgroSciences. EPA Reg. No. 62719-6. 01/2005. RUP. {Group 4}.

Tordon® RTU [picloram (3.0%) + 2,4-D TPA (11.2%)]. For control of unwanted trees via cut surface treatments in forest and noncrop areas. Dow AgroSciences. EPA Reg. No. 62719-31. RUP. 06/2003. {Group 4}.

Torment™ [fomesafen (2 lb ae/gal) + imazethapyr (0.5 lb ae/gal)]. For preplant, PRE and POST broadleaf and grass control in soybeans. MANA. EPA Reg. No. 66222-249. 2013. {Group 14 + 2}.

Touchdown® [glyphosate, diammonium (3 lb ae/gal or 3.75 lb ai/gal)]. For nonselective weed control and POST in glyphosate-tolerant corn or soybean. An NIS surfactant may be added. Syngenta. EPA Reg. No. 100-1117. 10/2003. {Group 9}.

Touchdown® CT [glyphosate, potassium (4.17 lb ae/gal or 5 lb ai/gal)]. For nonselective weed control in crop, fallow, cropland and pastures. Not registered on Roundup Ready crops. Syngenta. EPA Reg. No. 100-1212 11/2004. {Group 9}.

Touchdown® HiTech [glyphosate, potassium (5 lb ae/gal)]. For nonselective foliar systemic control of weeds in Roundup Ready crops, fallow, cropland and pastures. Syngenta. EPA Reg. No. 100-1182. 02/2004. {Group 9}.

Touchdown® Pro [glyphosate, diammonium (3 lb ae/gal or 3.75 lb ai/gal)]. For nonselective weed control in turf, industrial and noncropland uses. Contains IQ Technology. Additional surfactant optional. Syngenta. EPA Reg. No. 100-1121. 01/2002. {Group 9}.

Touchdown® Total [glyphosate, potassium (4.17 lb ae/gal) or IQTM Technology (5 lb ai/gal)]. For nonselective weed control and POST in glyphosate-tolerant corn or soybean. Syngenta. EPA Reg. No. 100-1169. 12/2003. {Group 9}.

Tralkoxydim. Active ingredient in Achieve; used for summer annual grass control in wheat and barley. {Group 1}.

Transline® [clopypalid (3 lb ae/gal)]. For selective control of broadleaf weeds in noncrop areas. Dow AgroSciences. EPA Reg. No. 62719-259. 07/1999. {Group 4}.

Treflan® HFP or TR-10 [trifluralin (4 lb/gal or 10%)]. Used PPI or PRE [sprinkler irrigation] in corn, dry edible bean, soybean, several vegetables and nursery stock for annual grass and broadleaf weed control. Dow AgroSciences. EPA Reg. No. 62719-250 or 131. 02/2003 or 02/2003. {Group 3}.

Triallate. Active ingredient in Far-Go. {Group 8}.

Triamine® [2,4-D (1.24 lb ae/gal) + mecoprop (0.63 lb ae/gal) + dichlorprop (0.6 lb ae/gal)]. For broadleaf weed control in commercial lawns. Nufarm. EPA Reg. No. 228-178. 09/2003. {Group 4}.

Triamine® II [Amine MCPA (1.27 lb ae/gal) + mecoprop (0.63 lb ae/gal) + dichlorprop (8.34 lb ae/gal)]. For use in golf courses, parks, highways and turf lawns for control of broadleaf weeds. Nufarm. EPA Reg. No. 228-206. 09/2003. {Group 4}.

Triasulfuron. Active ingredient of Amber, Fuego and Rave {Group 2}.

Tribenuron. An active ingredient of Accurate Extra, Affinity BroadSpec, Afforia, Ally Extra, Ally Extra SG, Edition, Express with TotalSol, Harmony Extra SG with TotalSol, Nimble, Nuance, Panoflex and TNT Broadleaf. {Group 2}.

Triclopyr. Active ingredient in Battleship, Chaser 2 Amine, Chaser Turf Herbicide, Confront, Cool Power, Crossbow, Eliminate, Garlon 3A or 4A, Horsepower, PastureGard, Pathfinder II, Redeem R&P, Remedy, Tahoe 3A, Three-Way Ester II and Turflon Ester. {Group 4}.

TriCor™ DF [metribuzin (75%)]. For control of certain annual weeds in soybean, field corn, alfalfa, barley, and winter wheat. UPI. EPA Reg. No. 70506-103. 05/2008. {Group 5}.

Trifloxysulfuron. Active ingredient in Monument. {Group 2}.

Trifluralin. Active ingredient in Agri-Star Trifluralin 4EC, Bayonet, Cornbelt Trifluralin, Preen, Pro-Mate Turf Fertilizer, Snapshot 2.5 TG, Team Pro, Treflan HFP or 10 G, Trifluralin HF Clean Crop, Triflurex HFP, Trillin 5A and Trust. {Group 3}.

Trifluralin 4 EC Agri Star®, Cornbelt® Trifluralin EC or Helena Trifluralin 4 EC [trifluralin (4 lb ai/gal)]. For PPI control of weeds in established alfalfa, pea, canola, potato and soybean. Albaugh/Agri Star, Van Diest, or Helena. EPA Reg. No. 42750-32, 1812-355-11773 or 5905-519. 10/1999, 03/1999, or 05/2003. {Group 3}.

Trifluralin HF Clean Crop [trifluralin (4 lb ai/gal)]. May be used under paved surfaces at higher rates. Loveland. EPA Reg. No. 34706-792. 07/2003. {Group 3}.

Triflurex® HFP [trifluralin 4 lb (ai/gal)]. For PPI weed control in established alfalfa, asparagus, most dry and fresh bean or pea, chicory, many vegetables, trees and soybean. Makhteshim Agan. EPA Reg. No. 66222-46. 09/2004. {Group 3}.

Triflusulfuron. Active ingredient in Upbeet. {Group 2}.

Trimec® Broadleaf Herbicide. Bentgrass formula [mecoprop, DMA (0.71 lb ae/gal) + 2,4-D, DMA (0.44 lb ae/gal) + dicamba (0.18 lb ae/gal)]. For POST control of broadleaf weeds in lawns. PBI/Gordon. EPA Reg. No. 2217-529. 09/2001. {Group 4}.

Trimec Classic [2,4-D (1.98 lb ae/gal) + mecoprop (0.53 lb ae/gal) + dicamba (0.21 lb ae/gal)]. For broadleaf weed control in warm- and cool-season grasses by lawn care professionals. PBI/Gordon Corp. EPA Reg. No. 2217-543. 11/2003 {Group 4}.

Herbicide Dictionary *(continued)*

Trimec® Plus [MSMA (1.8 lb) + 2,4-D (0.48 lb ae/gal) + mecoprop (0.24 lb ae/gal) + dicamba (0.12 lb ae/gal)]. For POST control of grass and broadleaf weeds in lawns. PBI/Gordon. EPA Reg. No. 2217-709. 11/2000. {Group 4 + 17}.

Trimec® Turf Herbicide [2,4-D (2.44 lb ae/gal) + mecoprop (1.3 lb ae/gal) + dicamba (0.22 lb ae/gal)]. For broadleaf weed control in lawns. PBI/Gordon. EPA Reg. No. 2217-517. 10/2000. {Group 4}.

TripleFLEX® II [clopyralid (0.29 lb ae/gal) + flumetsulam (0.12 lb ai/gal) + acetochlor (3.75 lb ai/gal) + dichlormid safener]. For broad spectrum PP, PRE and early POST weed control in field corn and silage. Monsanto. EPA Reg. No. 524-614. {Group 4 + 2 + 15}.

Triplet® SP [2,4-D (2.38 lb ae/gal) + MCPA (0.63 lb ae/gal) + dicamba (0.22 lb ae/gal)]. For broadleaf control in turfgrasses. Nufarm. EPA Reg. No. 228-312. 12/2000. {Group 4}.

Tri-Power® Selective Herbicide [MCPA (3.1 lb ae/gal) + mecoprop-p (0.6 lb ae/gal) + dicamba (0.3 lb ae/gal)]. For selective broadleaf weed control in lawns. Nufarm Turf and Specialty. EPA Reg. No. 228-262. 09/1999 {Group 4}.

Trivence™ [chlorimuron ethyl (3.9%) + flumioxazin (12.8%) + metribuzin (44.6%)]. For burndown, preplant and preemergence weed control in soybeans. DuPont. EPA Reg. No. 352-887. {Group 2 + 14 + 5}.

Trizmet II Herbicide [atrazine (2.1 lb ai/gal) + metolachlor (2.4 lb ai/gal)]. For weed control in field corn and popcorn. Drexler. EPA Reg. No. 19173-517. 09/2003. RUP. {Group 5 + 15}

Trust® 4 EC or 10 G [trifluralin (4 lb ai/gal or 10%)]. For PPI control of weeds in established alfalfa, canola, pea, potato and soybean. Winfield Solutions. EPA Reg. No. 1381-146. 03/2003 or 62719-131-1381 09/2007. {Group 3}.

Tupersan® [siduron (50% w/w)]. For control of annual grasses in turfgrasses. Gowan. EPA Reg. No. 10163-213. 12/1999. {Group 7}.

Turf Weed & Brush Control [iso-octyl ester of 2,4-D and dichlorprop 1.83 and 1.87 lb ae/gal]. For controlling mixed brush and perennial broadleaf weeds on both crop and noncrop plants plus lawns, golf courses and parks. Nufarm. EPA Reg. No. 228-167. 08/2005. {Group 4}.

Turflon® Ester [triclopyr (4 lb ae/gal)]. For control of annual and perennial broadleaf weeds in ornamental turf. Dow AgroSciences. EPA Reg. No. 62719-258. 08/2002. {Group 4}.

Turret® [2,4-D, solventless (5.5 lb ai/gal)]. For control of broadleaf weeds in crop and noncrop areas. Nufarm. EPA Reg. No. 228-95-71368. 03/2006. {Group 4}

Ultra Blazer® [acifluorfen (2 lb ai/gal)]. A POST herbicide for broadleaf weed control in soybean. Ultra Blazer has less leaf burn than Blazer. UPL. EPA Reg. No. 70506-60. 07/2006. {Group 14}.

UpBeet® [triflurosulfuron (50%)]. POST control of broadleaf and grass weeds in sugarbeets. DuPont. EPA Reg. No. 352-569. 04/2011. {Group 2}

Unison® [2,4-D acid (1.74 lb/gal)]. For POST broadleaf weed control in cereal and corn crops, pastures and rangeland. Helena. EPA Reg. No. 5905-542. 02/2004. {Group 4}.

Unity™ WDG. [thifensulfuron-methyl (75%)]. For use on wheat, barley, oat, triticale, fallow, corn, and soybean. Gowan. EPA Reg. No. 10163-294. 09/2007. {Group 2}.

Valor® SX [flumioxazin (51%)]. For PRE residual and burndown control of many broadleaf weeds and grass suppression in soybeans, corn, and other crops. Valent. EPA Reg. No. 59639-99. 02/2010. {Group 14}.

Valor® XLT [flumioxazin (30%) + chlorimuron (10.3%)]. For selective PRE or burndown control of susceptible broadleaf weeds and suppression of certain annual grasses in soybeans. Valent. EPA Reg. No. 59639-117. 01/2007. {Group 14 + 2}.

Vanquish® [dicamba diglycolamine (4 lb ai/gal)]. For selective broadleaf and brush control on noncropland and lawns. Syngenta. EPA Reg. No. 100-884. 06/2001. {Group 4}.

Varisto® [imazamox (2.0%) + bentazon (43.66)] For use in clover grown for seed, dry beans, dry peas, English pea, lima bean (succulent), snap bean, and soybean. BASF. EPA Reg. No. 241-447. 2015. {Group 2 + 6}.

Velocity® SG [Bispyribac-sodium (0.011 lb ai/oz)]. For selective POST control of annual bluegrass, roughstalk bluegrass, and some broadleaves on golf courses and sod. Valent. EPA Reg. No. 59639-136. 2009. {Group 2}.

Velpar® DF or Velpar® L [hexazinone (75% or 2 lb ai/gal)]. Used for nonselective POST weed control on noncropland, Christmas tree plantings and alfalfa. DuPont. EPA Reg. No. 352-581. [12/2010] or 352-392. [12/2010]. {Group 5}.

Velpar® AlfaMax™ [hexazinone (35%) + diuron (42.4%)]. For PRE broadleaf weed control in dormant alfalfa. DuPont. EPA Reg. No. 352-665. 05/2010. {Group 5 + 7}.

Velpar® AlfaMax™ Gold [hexazinone (23.1%) + diuron (55.4%)]. For PRE broadleaf weed control in dormant alfalfa. DuPont. EPA Reg. No. 352-666. 05/2010. {Group 5 + 7}.

Verdict™ [saflufenacil (0.57 lb ai/gal) + dimethenamid-p (5 lb ai/gal)]. For use in field corn (grain, silage), popcorn, grain sorghum and soybean for control of broadleaf and grass weeds. BASF. EPA Reg. No. 7969-279. 09/2009. {Group 14 + 15}.

Veteran® 720 or Veteran 10 G [2,4-D, DMA (1.9 lb ae/gal) + dicamba (1.0 lb ae/gal or dicamba 10%)]. Water soluble industrial herbicide for controlling broadleaf weeds. Nufarm. EPA Reg. No. 228-295 or 228-309. 05/2003. {Group 4}.

Veteran® CST [dicamba, DMA (1 lb ae/gal)]. For cut surface treatment to control undesirable trees. Nufarm. EPA Reg. No. 228-297. 06/2003. {Group 4}.

Vise™ [metolachlor (4.45 lb ai/gal) + fomesafen (0.95 lb ai/gal)]. For PRE control of annual grasses and broadleaf weeds in soybeans. MANA. EPA Reg. No. 66222-244. 12/2012. {Group 15 + 14}.

Vida® [pyraflufen (0.208 lb ai/gal)]. A contact herbicide for broadleaf weed control, defoliation, and desiccation. Gowan. EPA Reg. No. 71711-7-10163. 02/2009. {Group 14}.

Herbicide Dictionary *(continued)*

Viewpoint® [imazapyr (31.6%) + aminocyclopyrachlor (22.8%) + metsulfuron (7.3%)]. For general weed control in non-cropland areas. DuPont. EPA Reg. No. 352-847. 01/2011. {Group 2 + 4}.

Vista® [fluroxypyr (1.5 lb ae/gal)]. Selective POST control of annual and perennial broadleaf weeds in noncrop areas. Dow AgroSciences. EPA Reg. No. 62719-308. 06/2005. {Group 4}.

Vista® XRT [fluroxypyr (2.8 lb ae/gal)]. For selective POST control of annual and perennial broadleaf weeds and woody brush in noncrop areas. Dow AgroSciences. EPA Reg. No. 62719-586. 12/2007. {Group 4}.

Volley® [acetochlor (6.4 lb ai/gal) + safener]. Used PRE for control of annual grass weeds in corn. Tenkoz. EPA Reg. No. 55467-8. 12/2003. {Group 15}.

Volley® ATZ [acetochlor (3.0 lb ai/gal) + atrazine (2.25 lb ai/gal) + safener]. A PP and PRE herbicide for weed control in corn. Tenkoz. EPA Reg. No. 55467-7. 01/2004. {Group 15 + 5}.

Volley® ATZ Lite [acetochlor (4 lb ai/gal) + atrazine (1.5 lb ai/gal) + safener]. Used PRE for controlling grass and broadleaf weeds in field corn, production seed corn, silage corn and popcorn. Tenkoz. EPA Reg. No. 55467-6. 12/2003. {Group 15 + 5}.

Volunteer™ [clethodim (2 lb ai/gal)]. Used POST for annual and perennial grasses in alfalfa, canola, potato, soybean, sunflower, sugarbeets and others. Tenkoz. EPA Reg. No. 59639-3-55467. 2004. {Group 1}.

Warrant® [acetochlor (3 lb ai/gal)]. An encapsulated formulation for residual control of annual grasses and some broadleaf weeds when applied PRE in soybeans or POST in corn, sorghum, soybeans and cotton. Monsanto. EPA Reg. No. 524-591. 05/2010. {Group 15}.

Warrant Ultra®. [Acetaclor (2.82 lbs ai/gal) + formesafen (0.63 lbs ai/gal)]. For weed control in soybean and cotton. Monsanto. EPA Reg. No. 524-620. 2015. {Group 15 + 14}.

Weedar® 64 [2,4-D, dimethylamine (3.8 lb ae/gal)]. For broadleaf weed control in small grains, field and sweet corn, grain sorghum and preplant to soybean. Nufarm. EPA Reg. No. 71368-1. 10/2003. {Group 4}.

Weedmaster® Herbicide [dicamba (1 lb ae/gal) + 2,4-D, dimethylamine (2.87 lb ae/gal)]. For use in barley, forage sorghum, oat, rye, sudangrass, wheat, pastures, rangeland and noncrop land. Nufarm. EPA Reg. No. 7969-133. 04/2004. {Group 4}.

Weedone® 638 [2,4-D acid (1 lb) + 2,4-D ester (1.8 lb)]. Nufarm. EPA Reg. No. 71368-3. 05/2003. {Group 4}.

Weedone® LV4 EC [2,4-D, isooctyl [2-ethylhexyl] (4 lb ae/gal)]. For broadleaf weed control in small grains, field and sweet corn, grain sorghum and preplant to soybean. Nufarm. EPA Reg. No. 228-139-71360. 01/2004. {Group 4}.

Weedone® LV4 Solventless [2,4-D, isooctyl (3.8 lb ae/gal)]. For broadleaf control of weeds in small grains, field corn, grain sorghum and preplant to soybean. Nufarm. EPA Reg. No. 71368. 02/2004. {Group 4}.

Weedone® LV6 EC [2,4-D, isocotyl (5.4 lb ae/gal)]. For broadleaf control of weeds in small grain, field corn, grain sorghum and preplant to soybean. Nufarm. EPA Reg. No. 71368-11. 02/2004. {Group 4}.

Weed Rhap A-4D [2,4-D, DMA (3.8 lb ae/gal)]. For broadleaf weed control in small grain, field and sweet corn, grain sorghum, turf, established pastures and rangeland and fallow. Helena. EPA Reg. No. 5905-501. 02/2004. {Group 4}.

Weedtrine®-D [diquat (0.4 lb) + diquat (cation/gal or 0.7 lb salt/gal)]. Aquatic herbicide for use in and around still lakes, ponds, and ditches. EPA Reg. No. 8959-9. 09/1998. RUP. {Group 22}.

Westar® [hexazinone (68.6%) + sulfomethuron (6.5%)]. For weed control in noncrop land plus conifers, especially Douglas fir. DuPont. EPA Reg. No. 00352-00626. 10/2003. {Group 5 + 2}.

Whiteout 2,4-D [2,4-D (3.7 lb ae/gal)]. A low volatile ester formulation for broadleaf weed control in cereals, corn, sorghum, rangeland, pasture, turf, and fallow land. Loveland. EPA Reg. No. 34704-1032. 2010. {Group 4}.

WideMatch® [fluroxypyr (0.75 lb ae/gal) + clopyralid (0.5 lb ae/gal)]. For POST control of kochia, Canada thistle, wild buckwheat and more than 20 broadleaf weeds in small grains like wheat, durum, barley and oat. Dow AgroSciences. EPA Reg. No. 62719-512. 09/2008. {Group 4}.

Wolverine® [fenoxaprop-p-ethyl (0.38 lb ai/gal) + pyrasulfotole (0.17 lb ai/gal) + bromoxynil (0.83 lb ai/gal)]. For selective POST control of annual grassy and broadleaf weeds in wheat and barley. Bayer CropScience. EPA Reg. No. 264-1075. 05/2010. {Group 1 + 27 + 6}.

Yukon® WDG [halosulfuron (12.5%) + dicamba, sodium (55%)]. For selective control of broadleaf and nutsedge in corn and field corn grown for seed and grain sorghum. Gowan. EPA Reg. No. 81880-6-10163. 2005. {Group 2 + 4}.

Zemax™ [S-metolachlor (3.34 lb ai/gal) + mesotrione (0.33 lb ai/gal) + benoxacor (safener)]. For PRE and POST control of annual broadleaf and grass weeds in seed corn, field corn and corn grown for silage, sweet corn and grain sorghum. Syngenta. EPA Reg. No. 100-1410. 2011. {Group 15 + 27}.

Zidua® [pyroxasulfone (85%)]. For EPP, PPI, PRE, and EPOST annual grass and small seeded broadleaf weed control in field corn, popcorn, sweet corn and soybeans. BASF. EPA Reg. No. 7969-338. 2012. {Group 15}.

Zidua® PRO [saflufenacil (0.48 lb ai/gal) + imazethapyr (1.33 lb ai/gal) + pyroxasulfone (2.28 lb ai/gal)]. Residual herbicide for use in soybeans. BASF. EPA Reg. No. 7969-365. 2016. {Group 2 + 14 + 15}.

Online Weed Science Classes

Meet Dual Purposes

Online classes give practitioners, professionals and students the opportunity to learn about weed science from the comfort of their offices or homes.

The Department of Agronomy and Horticulture at the University of Nebraska–Lincoln will offer three classes over the next year that provide both academic credit at UNL and Continuing Education Units (CEUs) for the Certified Crop Advisor program. The Certified Crop Advisor program is through the American Society of Agronomy (ASA) and the Soil Science Society of America (SSSA). The CEU credits may be split between five categories: Nutrient Management, Soil and Water Management, Pest Management, Crop Management, and Professional Development.

The three classes are:

- AGRO 107 Invasive Plant Species: Impacts on Ecosystems, spring 2016 and fall 2015, 2 Crop Mgt., 1 Pest Mgt., 1 Soil & Water, and 1 Nutrient Mgt.;
- AGRO 412/812 Crop and Weed Genetics, spring 2016, 3 Crop Mgt. and 2 Pest Mgt.; and
- AGRO 822 Integrated Weed Management, spring 2016, 3 Crop Mgt., and 2 Pest Mgt.

Course Descriptions

AGRO 107, Invasive Plant Species: Impacts on Ecosystems, taught by Robert Vavala

The flora of the earth is constantly being redistributed by natural and human forces. In this course, students will learn how invasive plants establish and spread in ecosystems. They will also develop an understanding of the importance of invasive plants and their impacts on local to global ecosystems. 3 credits.

AGRO 412/812, Crop and Weed Genetics, taught by Donald Lee

This course applies classical and molecular genetic principles to the explanation of variation observed in plant families and populations. Information gathered from whole plant trait observation and from molecular analysis is interpreted as well as relationships between crops and weeds. Examples from genetic studies on both crop and weed species are the basis of this course. 1 credit.

AGRO 822, Integrated Weed Management, taught by Stevan Knezevic

Principles and application of Integrated Weed Management (IWM) including noxious and invasive weed species, crops and weed control, plant population shifts, use of herbicides and the biologically effective dose, critical period of weed control and weed threshold, and herbicide-tolerant crops. 1 credit.

For more information, contact Kathy Schindler, Department of Agronomy and Horticulture Distance Education Program, kschindler1@unl.edu, 402-472-1730.



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Resources

Extension Publications

The Nebraska Extension Publications website at extensionpubs.unl.edu offers more than 75 publications on plant disease identification and management. Browse by topic or use the search engine to locate specific information.

CropWatch.unl.edu/plantdisease

This section of CropWatch offers disease identification and management guides organized by crop, including characteristic symptoms to assist with disease diagnosis and current disease management information, observations, and forecasts. The site also includes reports of the latest disease management field trials and contact information for UNL extension plant pathologists.

Written by UNL Extension specialists and educators from across the state, CropWatch.unl.edu is a one-stop resource for crop production and pest management information for Nebraska.

Diagnostic Services

The Plant and Pest Diagnostic Clinic on UNL's East Campus in Lincoln was formally organized in 1994 and provides diagnostic services in plant pathology, entomology, horticulture, and weed science. In addition to accurate diagnosis of pest problems, it provides the most current information and recommendations.

The Panhandle Plant Disease Diagnostic Lab at UNL's Panhandle Research and Extension Center at Scottsbluff was organized in 1999. This lab focuses its diagnostic service only on plant disease identification. While most samples are sugarbeets or soil samples from sugarbeet fields, diagnostic services are provided for any plant disease in the Panhandle. See <http://CropWatch.unl.edu/plantdiagnosticclinics>.



CropWatch.unl.edu/plantdisease

Plant and Pest Diagnostic Clinic



University of Nebraska–Lincoln Extension

CropWatch.unl.edu/plantdiagnosticclinics

Symptoms of Common Diseases

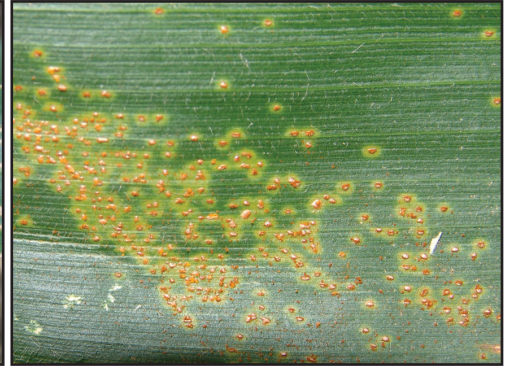
Corn



Bacterial Leaf Streak



Gray Leaf Spot



Southern Rust

Soybeans



Bacterial Blight

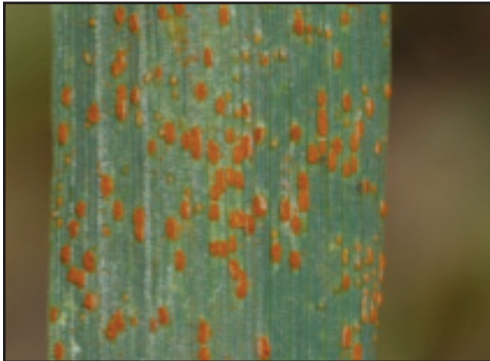


Frogeye Leaf Spot



Septoria Brown Spot

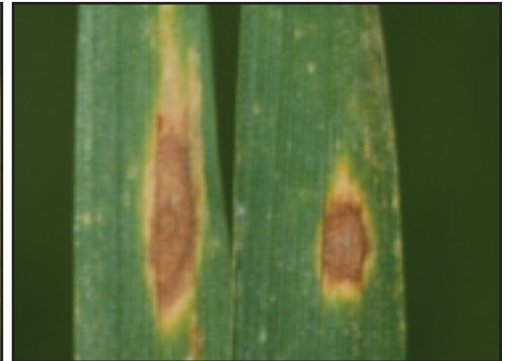
Wheat



Leaf Rust



Stripe Rust



Tan Spot

Specialty Crops



Aphanomyces Root Rot (Sugar beet)



Bacterial Brown Spot (Dry Bean)



Downy Mildew (Sunflower)

Source for all photos: UNL Department of Plant Pathology

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Disease Management for Field Crops

Fungicides are an important component of the pesticide program for some Nebraska fields. While not all fields of corn, dry bean, sorghum, soybean, sugarbeet, sunflower, and wheat will require a fungicide application, it's critical that you know the correct product for the disease in your field when you do need it.

- **Identification.** The first step with any disease management program is to make sure you have correctly identified the problem. Identification is critical as there are many bacterial diseases with symptoms similar to fungal diseases and fungicides will have no activity on them.

For help identifying crop diseases, visit the Plant Disease section of UNL's CropWatch at <http://cropwatch.unl.edu/plantdisease>.

- **Timing.** The second step is to ensure accurate timing of the application. With some diseases it is critical to apply the fungicide before there is significant disease development.

Fungicides are plant protection compounds, but have some of the same restrictions as many other pesticides, such as preharvest intervals and post-application field reentry restrictions. Read and carefully follow all label directions.

Resistance

The use of pesticides, including fungicides, has resulted in the development of organisms that are resistant to their effects. Currently, the only major field crop pathogen with known resistance is *Cercospora soja* (Frogeye leaf spot of soybean) with resistance to the strobilurin (QoI) fungicide group. This has been identified in other parts of the U.S. and not in Nebraska as of 2016. Misuse of products may result in the development of other resistant populations and jeopardize the benefits that are provided by those products and other closely related fungicides.

Resistance can develop after the repeated use of products with the same modes of action, particularly with single-site modes of

action. Also, organisms vary in their ability to become resistant and the frequency that they develop resistant strains. The Fungicide Resistance Action Committee (FRAC) is responsible for ranking the risk for resistance development in fungal pathogen populations. FRAC assigns codes to each fungicide class based on its mode of action (MOA) and likelihood that its use could lead to the development of resistant strains. Rotating the use of products with different or mixed modes of action and avoiding repeated applications can help prevent the development of resistant populations. It's important to carefully read and follow the directions described in the most recent version of the product label in an attempt to avoid the development of resistant populations.

Using this Resource

When crop diseases become a problem, use the following section to assist with the decision-making process for fungicide applications.

Fungicide Mode of Action Table

FRAC Code	Code Number	Mode of Action	Site of Action	Common Name	Chemical Group
Group 1	B1 β-tubulin assembly in mitosis	MBC (Methyl Benzimidazole Carbamates)	mitosis and cell division	thiabendazole	benzimidazoles
				thiophanate-methyl	thiophanates
Group 3	G1 C14-demethylase in sterol biosynthesis	DMI (DeMethylation Inhibitors)	sterol biosynthesis in membranes	cyproconazole	triazoles
				difenoconazole	
				flutriafol	
				ipconazole	
				metconazole	
				myclobutanil	
				propiconazole	
				tebuconazole	
				tetraconazole	
				triticonazole	
				imazalil	imidazoles
				prothioconazole	triazolinthione
Group 4	A1 RNA polymerase I	PA (PhenylAmides)	nucleic acids synthesis	mefenoxam	acylalanines
				metalaxyl	
Group 7	C2 complex II: succinate-dehydrogenase	SDHI (Succinate Dehydrogenase Inhibitors)	respiration	carboxin	oxathiin-carboxamides
				fluopyram	pyridinyl-ethyl-benzamides
Group 11	C3 complex III: cytochrome bc1 (ubiquinol oxidase) at QoI site	QoI (Quinone Outside Inhibitors)	respiration	azoxystrobin	methoxy-acrylates
				picoxystrobin	dihydro-dioxazines
				fluoxastrobin	
				pyraclostrobin	methoxy-carbamates
				trifloxystrobin	oximino-acetates
Group 12	E2 MAP/Histidine-Kinase in osmotic signal transduction	PP (PhenylPyrroles)	signal transduction	fludioxonil	phenylpyrroles
Group 14	F3 lipid peroxidation (proposed)	AH (Aromatic Hydrocarbons)	lipids and membrane synthesis	chloroneb	aromatic hydrocarbons
				PCNB	
				tolclofos-methyl	
Group 22	B3 β-tubulin assembly in mitosis	thiazole carboxamide	mitosis and cell division	ethaboxam	ethylamino-thiazole-carboxamide

Fungicide Mode of Action Table *(continued)*

FRAC Code	Code Number	Mode of Action	Site of Action	Common Name	Chemical Group
Group 30	C6 inhibition of oxidative phosphorylation, ATP synthase	organo tin compounds	respiration	triphenyltin hydroxide	tri phenyl tin compounds
Group M1	multi-site contact activity	inorganic	multi-site contact activity	copper	inorganic
Group M3	multi-site contact activity	dithiocarbamates and relatives	multi-site contact activity	mancozeb thiram	dithiocarbamates and relatives
Group M4	multi-site contact activity	phthalimides	multi-site contact activity	captan	phthalimides
Group M5	multi-site contact activity	chloronitriles	multi-site contact activity	chlorothalonil	chloronitriles

*Based on Fungicide Resistance Action Committee (FRAC) information on the Web at <http://www.frac.info/frac/index.htm>.

Management of Corn Diseases Fungicide Efficacy for Control of Foliar Diseases

The Corn Disease Working Group (CDWG) has developed the following information on fungicide efficacy for control of major corn diseases in the United States. Efficacy ratings for each fungicide listed in the table were determined by field testing the materials over multiple years and locations by the members of the committee. Efficacy ratings are based upon level of disease control achieved by product, and are not necessarily reflective of yield increases obtained from product application. Efficacy depends upon proper application timing, rate, and application method to achieve optimum effectiveness of the fungicide as determined by labeled instructions and overall level of disease in the field at the time of application. Differences in efficacy among fungicide products were determined by direct comparisons among products in field tests and are based on a single application of the labeled rate as listed in the table. Table includes systemic fungicides available that have been tested over multiple years and locations. The table is not intended to be a list of all labeled products¹. Efficacy categories: NR=Not Recommended; P=Poor; F=Fair; G=Good; VG=Very Good; E=Excellent; NL = Not Labeled for use against this disease; U = Unknown efficacy or insufficient data to rank product

Fungicides ¹				Anthracnose Leaf Blight	Common Rust	Eyespot	Gray Leaf Spot	Northern Leaf Blight	Southern Rust
Class	Trade Name	Active Ingredient(s) (%)	Rate/A (fl oz)						
DMI Triazoles (Group 3)	Folicur 3.6 F / Multiple Generics	Tebuconazole 38.7%	4.0-6.0	NL	U	NL	U	VG	F-G
	Domark 230 ME / Multiple Generics	Tetraconazole 20.5%	4.0-6.0	U	U	U	E	U	G
	Proline 480 SC	Prothioconazole 41.0%	5.7	U	VG	E	U	VG	G
	Tilt 3.6 EC / Multiple Generics	Propiconazole 41.8%	2.0-4.0	NL	VG	E	G	G	F-G
QoI Strobilurins (Group 11)	Approach 2.08 SC	Picoxystrobin 22.5%	3.0-12.0	VG	VG-E	VG	F-VG	VG	G
	Headline 2.09 EC Headline/SC	Pyraclostrobin 23.6%	6.0-12.0	VG	E	E	E	VG	VG
	Quadris 2.08 SC / Multiple Generics	Azoxystrobin 22.9%	6.0-15.5	VG	E	VG	E	G	G
Mixed Modes of Action	3+11	Affiance 1.5 SC	Azoxystrobin 9.35% + Tetraconazole 7.48%	10.0-14.0	U	U	U	U	G
		Approach Prima 2.34 SC	Cyproconazole 7.17% + Picoxystrobin 17.94%	3.4-6.8	U	U	E	VG	G-VG
		Fortix 3.22 SC / Preemptor 3.22 SC	Flutriafol 19.3% + Fluoxastrobin 14.84%	4.0-6.0	U	U	E	VG-E	VG
		Headline AMP 1.68 SC	Pyraclostrobin 13.6% + Metconazole 5.1%	10.0-14.4	U	E	E	VG	G-VG
		Quilt Xcel	Azoxystrobin 13.5% + Propiconazole 11.7%	10.5-14.0	VG	VG-E	VG-E	E	VG
		Stratego YLD 4.18 SC	Prothioconazole 10.8% + Trifloxystrobin 32.3%	4.0-5.0	VG	E	VG	E	VG
	7+11	Priaxor 4.17 SC	Fluxapyroxad 14.33% + Pyraclostrobin 28.58%	4.0-8.0	U	VG	U	VG	G
	3+7+11	Trivapro Co-Pack Trivapro A 0.83	Benzovindiflupyr 10.27%	4.0	U	U	U	E	VG
		Trivapro B 2.2 SE	Azoxystrobin 13.5% + Propiconazole 11.7%	10.5					

¹Additional fungicides are labeled for disease on corn, including contact fungicides such as chlorothalonil. Certain fungicides may be available for diseases not listed in the table, including Gibberella and Fusarium ear rot. Applications of Proline 480 SC for use on ear rots requires a FIFRA Section 2(ee) and is only approved for use in Illinois, Indiana, Iowa, Louisiana, Maryland, Michigan, Mississippi, North Dakota, Ohio, Pennsylvania, and Virginia.

²Many products have specific use restrictions about the amount of active ingredient that can be applied within a period of time or the amount of sequential applications that can occur. Please read and follow all specific use restrictions prior to fungicide use. This information is provided only as a guide. It is the responsibility of the pesticide applicator by law to read and follow all current label directions. Reference to products in this publication is not intended to be an endorsement to the exclusion of others that may be similar. Persons using such products assume responsibility for their use in accordance with current directions of the manufacturer. Members or participants in the CDWG assume no liability resulting from the use of these products.

³ This table was adapted to maintain consistency with the formatting of this publication.

Corn: Foliar Fungicide and Bactericide

Product Information

Fungicides				Application			REI (hours)	PHI (days)
Class	Trade Name Active Ingredient (%)	Rate (per acre)	Formulation ²	Aerial	Chemigation	Ground		
QoI Strobilurins (Group 11)	AfterShock Fluoxastrobin 40.3%	2.0-5.7 oz	F	5 gpa minimum	Allowed	10 gpa minimum	12	30
	Approach Picoxystrobin 22.5%	3.0-12.0 oz	F	Adequate for coverage and canopy penetration	Allowed	Adequate for coverage and canopy penetration	12	7
	Evito 480 SC Fluoxastrobin 40.3%	2.0-5.7 oz	F	2 gpa minimum	Allowed, < 0.4"	10 gpa minimum	12	30
	Headline Pyraclostrobin 23.6%	6.0-12.0 oz	EC	2 gpa minimum	Allowed, < 0.5" application	Adequate for coverage and canopy penetration	12	7
	Quadris Flowable Azoxystrobin 22.9%	6.0-15.5 oz	SC	Adequate for coverage and canopy penetration	Allowed, 0.1-0.25" application	Adequate for coverage and canopy penetration	4	7
	Satori Azoxystrobin 22.9%	6.0-15.5 oz	SC	Adequate for coverage and canopy penetration	Allowed, 0.1-0.25" application	Adequate for coverage and canopy penetration	4	7
DMI Triazole (Group 3)	Bumper 41.8 EC Propiconazole 41.8%	2.0-4.0 oz	EC	2 gpa minimum	Allowed, 0.1-0.25" application	10 gpa minimum	12	30
	Bumper ES Propiconazole 40.85%	2.0-4.0 oz	EC	2 gpa minimum	Allowed, 0.1-0.25" application	10 gpa minimum	12	30
	Domark 230 ME Tetraconazole 20.5%	4.0-6.0 oz	EC	2 gpa minimum	Allowed	10 gpa minimum	12	Do not apply after R3 (milk)
	Fitness Propiconazole 41.8%	2.0-4.0 oz	EC	2 gpa minimum	Allowed, 0.1-0.25" application	10 gpa minimum	12	30
	Monsoon Tebuconazole 38.7%	4.0-6.0 oz	F	5 gpa minimum	Not allowed	10 gpa minimum	12	36
	Orius 3.6F Tebuconazole 38.7%	4.0-6.0 oz	EC	5 gpa minimum	Not allowed	10 gpa minimum	12	36
	Proline 480 SC Prothioconazole 41.0%	5.7 oz	SC	2 gpa minimum	Allowed, 0.125- 0.5" application	10 gpa minimum	12	14
	PropiMax EC Propiconazole 41.8%	2.0-4.0 oz	EC	2 gpa minimum	Allowed, 0.1-0.25" application	10 gpa minimum	12	30
	Prosaro Prothioconazole 19.0% + Tebuconazole 19.0%	6.5 oz	SC	2 gpa minimum	Allowed	10 gpa minimum	12	36
	TebuStar 3.6L Tebuconazole 38.7%	4.0-6.0 oz	F	5 gpa minimum	Allowed	10 gpa minimum	12	36
	Tebuzol 3.6F Tebuconazole 38.7%	4.0-6.0 oz	F	5 gpa minimum	Allowed	10 gpa minimum	12	36
	Tilt Propiconazole 41.8%	2.0-4.0 oz	EC	2 gpa minimum	Allowed, 0.1-0.25" application	10 gpa minimum	12	30
	Topguard Flutriafol 11.8%	7.0-14.0 oz	SC	5 gpa minimum	Not allowed	10 gpa minimum	12	80
SDHI Carboxamides (Group 7)	Vertisan Penthiopyrad 20.6%	10.0-24.0 oz	EC	2 gpa minimum	Allowed	15 gpa minimum	12	7

¹Rate is fluid ounces per acre unless otherwise noted

²Formulations: DF=Dry Flowable; EC=Emulsifiable Concentrate; F=Flowable; SC=Suspension Concentrate; SE=Suspo-Emulsion; ; G=Granule; WP=Wettable Powder

Corn: Foliar Fungicide and Bactericide Product Information *(continued)*

Fungicides				Application			REI (hours)	PHI (days)	
Class	Trade Name Active Ingredient (%)	Rate (per acre)	Formulation ²	Aerial	Chemigation	Ground			
Dithiocarbamates (Group M3)	Dithane F-45 Rainshield Mancozeb 75.0%	1.5 lb	WP	2 gpa minimum	Allowed, <0.25” application	Adequate for coverage and canopy penetration	24	7	
	Dithane M45 Mancozeb 80.0%	1.5 lb	WP	2 gpa minimum	Allowed, <0.25” application	Adequate for coverage and canopy penetration	24	40	
	Penncozeb Mancozeb 75.0%	1.0-1.5 lb	DF	2 gpa minimum	Allowed, 0.1- 0.25” application	Adequate for coverage and canopy penetration	24	40	
	Penncozeb Mancozeb 80.0%	1.0-1.5 lb	WP	2 gpa minimum	Allowed, 0.1- 0.25” application	Adequate for coverage and canopy penetration	24	40	
Inorganics (Group M1)	Badge SC Copper oxychloride 16.81% + Copper hydroxide 15.36%	0.5-2.5 pt	EC	3 gpa minimum	Allowed	10 gpa minimum	48	0	
	Kocide 2000 Copper hydroxide 53.8%	1.0-3.0 lb	G	3 gpa minimum	Allowed	20 gpa minimum	48	0	
	Kocide 3000 Copper hydroxide 46.1%	0.5-0.75 lb	G	3 gpa minimum	Allowed	20 gpa minimum	48	0	
Mixed Modes of Action	3+11	Absolute Maxx Tebuconazole 22.63% + Trifloxystrobin 22.63%	5.0-6.0	SC	2 gpa minimum	Allowed	10 gpa minimum	12	36
		Affiance Azoxystrobin 9.35% + Tetraconazole 7.48%	10.0-17.0	SC	2 gpa minimum	Allowed, 0.1-0.25” application	10 gpa minimum	12	7
		Approach Prima Picoxystrobin 17.94% + Cyproconazole 7.17%	3.4-6.8	EC	Adequate for coverage and canopy penetra- tion	Allowed	Adequate for coverage and canopy penetration	12	30
		Evito T Fluoxastrobin 18.0% + Tebuconazole 25.0%	4.0-6.0	SC	3 gpa minimum	Allowed, <0.4” application	10 gpa minimum	12	36
		Fortix / Preemptor Fluoxastrobin 14.84% + Flutriafol 19.3%	4.0-6.0	SC	2 gpa minimum	Not allowed	10 gpa minimum	12	30
		Headline AMP Pyraclostrobin 13.64% + Metconazole 5.14%	10.0-14.4	SC	2 gpa minimum	Allowed, <0.5” application	10 gpa minimum	12	20
		Quilt Azoxystrobin 7.0% + Propiconazole 11.7%	7.0-14.0	SE	2 gpa minimum	Allowed, 0.1-0.25” application	10 gpa minimum	12	30
		Quilt Xcel Azoxystrobin 13.5% + Propiconazole 11.7%	10.5-14.0	SE	2 gpa minimum	Allowed, 0.125-0.25” application	10 gpa minimum	12	30
		Stratego YLD Prothioconazole 10.8% + Trifloxystrobin 32.3%	4.0	SC	2 gpa minimum	Allowed, 0.125-0.5” application	10 gpa minimum	12	35
		Zolera FX Fluoxastrobin 17.76% + Tetraconazole 17.76%	4.4-6.8	EC	2 gpa minimum	Adequate for coverage and canopy penetra- tion	10 gpa minimum	12	30
	7+11	Priaxor Fluxapyroxad 14.33% + Pyraclostrobin 28.58%	4.0-8.0	SC	2 gpa minimum	Allowed, <0.5” application	Adequate for coverage and canopy penetration	12	21
	3+7+11	Trivapro Co-Pack Trivapro A Benzovindiflupyr 10.27%	4	EC	2 gpa minimum	Allowed, 0.1-0.25” application	10 gpa minimum	12	14
		Trivapro B Azoxystrobin 13.5% + Propiconazole 11.7%	10.5	SE					

¹Rate is fluid ounces per acre unless otherwise noted

²Formulations: DF=Dry Flowable; EC=Emulsifiable Concentrate; F=Flowable; SC=Suspension Concentrate; SE=Suspo-Emulsion; ; G=Granule; WP=Wettable Powder

Dry Bean

Foliar Fungicide and Bactericide Product Information

Fungicides				Application			REI (hours)	PHI (days)
Class	Trade Name Active Ingredient (%)	Rate/A	Formulation ¹	Aerial	Chemigation	Ground		
MBC Thiophanates (Group 1)	Topsin 4.5FL Thiophanate-methyl 45.0%	20.0- 40.0 oz	F	5 gpa minimum	Allowed, <0.4" application	20 gpa minimum	72	28
	Topsin M WSB Thiophanate-methyl 70.0%	1.0-2.0 lb	WSB	5 gpa minimum	Allowed, <0.4" application	20 gpa minimum	72	28
DMI Triazoles (Group 3)	Orius 3.6F Tebuconazole 38.7%	4.0-6.0 oz	F	5 gpa minimum	Not allowed	10 gpa minimum	12	7
	Proline 480 SC Prothioconazole 41.0%	5.7 oz	SC	2 gpa minimum	Allowed, 0.125-0.5" application	10 gpa minimum	12	7
	Tebuzol 3.6F Tebuconazole 38.7%	4.0-6.0 oz	F	5 gpa minimum	Allowed	10 gpa minimum	12	14
SDHI Carboxi- mides (Group 7)	Endura Boscalid 70.0%	8.0-11.0 oz	WDG	5 gpa minimum	Allowed, <0.5" application	Adequate for cov- erage and canopy penetration	12	21
	Vertisan Penthiopyrad 20.6%	14.0- 20.0 oz	EC	2 gpa minimum	Allowed	15 gpa minimum	12	21
QoI Strobilurins (Group 11)	Aproach Picoxystrobin 22.5%	6.0- 12.0 oz	SC	Adequate for coverage and canopy penetration	Allowed	Adequate for cov- erage and canopy penetration	12	14
	Headline Pyraclostrobin 23.6% Headline SC Pyraclostrobin 23.3%	6.0-9.0 oz	EC / SC	2 gpa minimum	Allowed, <0.5" application	Adequate for cov- erage and canopy penetration	12	21
	Quadris Flowable Azoxystrobin 22.9%	6.0- 15.5 oz	SC	Adequate for coverage and canopy penetration	Allowed, 0.1-0.25" application	Adequate for cov- erage and canopy penetration	4	14
Inorganics (Group M1)	Badge SC Copper oxychloride 16.81% Copper hydroxide 15.36%	1.0-2.0 pt	SC	3 gpa minimum	Allowed	Adequate for cov- erage and canopy penetration	48	0
	Champ Formula 2 Flowable Copper hydroxide 37.5%	0.66- 2.0 pt	F	3 gpa minimum	Allowed	Adequate for cov- erage and canopy penetration	48	0
	Kocide 2000 Copper hydroxide 53.8%	0.75- 2.25 lb	DF	3 gpa minimum	Allowed	20 gpa minimum	48	0
	Kocide 3000 Copper hydroxide 46.1%	0.5- 1.25 lb	DF	3 gpa minimum	Allowed	20 gpa minimum	48	0
Mixed Modes of Action	7+11 Priaxor Fluxapyroxad 14.33% + Pyraclostrobin 28.58%	4.0-8.0 oz	SC	2 gpa minimum	Allowed, <0.5" application	Adequate for cov- erage and canopy penetration	12	21
	3+7 Propulse Fluopyram 17.4% + Prothioconazole 17.4%	8.0- 10.3 oz	SC	5 gpa minimum	Allowed	10 gpa minimum	48	14
	11+M5 Quadris Opti Azoxystrobin 4.6% + Chlorothalonil 46.0%	1.6-2.4 oz	SC	5 gpa minimum	Allowed, <0.5" application	Adequate for cov- erage and canopy penetration	12	14

¹ Formulations: DF=Dry Flowable; EC=Emulsifiable Concentrate; F=Flowable; SC=Suspension Concentrate; WDG=Water-Dispersible Granules; WSB=Water-Soluble Bag

Sorghum

Foliar Fungicide Product Information

Fungicide				Application			REI (hours)	PHI (days)
Class	Active Ingredient (%)	Rate (per acre)	Formulation ¹	Aerial	Chemigation	Ground		
QoI Strobilurins (Group 11)	Approach Picoxystrobin 22.5%	6.0-12.0 oz	F	Adequate for coverage and canopy penetration	Allowed	Adequate for coverage and canopy penetration	12	Do not apply after flowering
	Headline Pyraclostrobin 23.6%	6.0-12.0 oz	EC	2 gpa minimum	Allowed, <0.5" application	Adequate for coverage and canopy penetration	12	Apply no later than 25% flowering
	Headline SC Pyraclostrobin 23.3%	6.0-12.0 oz	SC	2 gpa minimum	Allowed, <0.5" application	Adequate for coverage and canopy penetration	12	Apply no later than 25% flowering
	Quadris Flowable Azoxystrobin 22.9%	6.0-15.5 oz	SC	Adequate for coverage and canopy penetration	Allowed, 0.1-0.25" application	Adequate for coverage and canopy penetration	4	14
	Bumper ES Propiconazole 40.85%	3.0-4.0 oz	EC	2 gpa minimum	Allowed, 0.1-0.25" application	10 gpa minimum	12	21
	Topguard Flutriafol 11.8%	7-14 oz	G	2 gpa minimum	Not allowed	10 gpa minimum	12	30
SDHI Carboxamides (Group 11)	Vertisan Penthiopyrad 20.6%	10.0-24.0 oz	EC	2 gpa minimum	Allowed	15 gpa minimum	12	30
Mixed Modes of Action	3+11	Quilt Azoxystrobin 7.0% + Propiconazole 11.7%	EC	2 gpa minimum	Allowed, 0.1-0.25" application	10 gpa minimum	12	30
		Quilt Xcel Azoxystrobin 13.5% + Propiconazole 11.7%	EC	2 gpa minimum	Allowed, 0.125-0.25" application	10 gpa minimum	12	30

¹Rate is fluid ounces per acre unless otherwise noted

²Formulations: DF=Dry Flowable; EC=Emulsifiable Concentrate; F=Flowable; SC=Suspension Concentrate; SE=Suspo-Emulsion; G=Granule

Soybean

Fungicide Efficacy for Control of Soybean Seedling Diseases

The members of the Identification and Biology of Seedling Pathogens of Soybean project funded by the North Central Soybean Research Program and plant pathologists across the United States have developed the following ratings for how well fungicide seed treatments control seedling diseases of soybeans in the United States. Efficacy ratings for each fungicide active ingredient listed in the table were determined by field-testing the materials over multiple years and locations by the members of this group, and include ratings summarized from national fungicide trials published in Plant Disease Management Reports (and formerly Fungicide and Nematicide Tests) by the American Phytopathological Society at <http://www.apsnet.org>. Each rating is based on the fungicide's level of disease control, and does not necessarily reflect efficacy of fungicide active ingredient combinations and/or yield increases obtained from applying the active ingredient.

The list includes the most widely marketed products available. It is not intended to be a list of all labeled active ingredients and products. Additional active ingredients may be available, but have not been evaluated in a manner allowing a rating. Products listed are the most common products available as of the release date of the table; all available products may not be listed. Additional active ingredients may be included in some products for insect and nematode control, however; only active ingredients for pathogen control are listed and rated.

Many active ingredients and their products have specific use restrictions. Read and follow all use restrictions before applying any fungicide to seed, or before handling any fungicide-treated seed. This information is provided only as a guide. It is the applicator's and users legal responsibility to read and follow all current label directions. Reference in this publication to any specific commercial product, process, or service, or the use of any trade, firm, or corporation name is for general informational purposes only and does not constitute an endorsement, recommendation, or certification of any kind by members of the group, or by the North Central Soybean Research Program. Individuals using such products assume responsibility for their use in accordance with current directions of the manufacturer. Efficacy categories: E = Excellent; VG = Very Good; G = Good; F = Fair; P = Poor; NR = Not Recommended; NS = Not Specified on product label; U = Unknown efficacy or insufficient data to rank product. Please note: Efficacy ratings may be dependent on the rate of the fungicide product on seed.

Fungicides ¹							
Class	Active Ingredient	<i>Pythium</i> spp. ²	<i>Phytophthora</i> Root Rot	<i>Rhizoctonia</i> spp.	<i>Fusarium</i> spp. ³	Sudden Death Syndrome (SDS) (<i>F. virguliforme</i>)	<i>Phomopsis</i> spp.
MBC Benzimidazoles (Group 1)	Thiabendazole	NS	NS	NS	NS	U	U
DMI Triazoles (Group 3)	Ipconazole	P	NR	F-G	F-E	NR	G
	Prothioconazole	NR	NR	G	G	NR	G
PA Acylalanines (Group 4)	Mefenoxam	E	E	NR	NR	NR	NR
	Metalaxyl	E	E	NR	NR	NR	NR
SDHI Carboxamides (Group 7)	Carboxin	U	U	G	U	NR	U
	Fluopyram	NR	NR	NR	NR	VG	NR
	Fluxapyroxad	U	U	E	G	NR	G
	Penflufen	NR	NR	G	G	NR	G
	Sedaxane	NS	NS	E	NS	NR	G
QoI Strobilurins (Group 11)	Azoxystrobin	P	NS	VG	G	NR	G
	Pyraclostrobin	P	NR	F	F	NR	F
	Trifloxystrobin	P	P	F-E	F-G	NR	G
Phenylpyrroles (Group 12)	Fludioxonil	NR	NR	G	F-VG	NR	G
Aromatic Hydrocarbons (Group 14)	Chloroneb	U	P	E	P	NR	P
	PCNB	NR	NR	G	U	NR	G
Thiazole Carboxamides (Group 22)	Ethaboxam	E	E	U	U	U	U
Multi Site Action (Group M3)	Thiram	F	P	G	F	U	F
Multi Site Action (Group M4)	Captan	G	P	G	F	U	F

¹Table includes seed treatment fungicides available that have been tested over multiple years and locations. Efficacy categories: NR=Not Recommended; P=Poor; F=Fair; G=Good; VG=Very Good; E=Excellent; NS=Not Specified on label for use against this disease; U=Unknown efficacy or insufficient data.

²Products may vary in efficacy against different *Fusarium* and *Pythium* species.

³Ratings listed for *Fusarium* species are not efficacy ratings for *F. virguliforme*, the causal agent of sudden death syndrome (SDS)

Soybean

Seed Treatment Fungicide Product Information

Fungicides		Rate (oz per 100 lbs) ¹	Application	Comments	
Class	Trade Name Active Ingredients (%)				
MBC Benzimidazoles (Group 1)	Mertect 340-F Thiabendazole 42.3%	0.08-0.16	Commercially applied, slurry		
PA Acylalanines (Group 4)	Acceleron DX-309 Metalaxyl 28.35%	0.75-1.5	Commercially applied, slurry	Insecticide and additional treatments can be added to base fungicide	
	Acquire Metalaxyl 29.99%	0.75-1.5	Commercially applied, slurry	Acquire comes with Charter seed treatment	
	Allegiance Dry Metalaxyl 12.5%	1.5-2.0	On farm application, planter box		
	Allegiance FL Metalaxyl 28.35%	0.75-1.5	Commercially applied, slurry		
	Allegiance LS Metalaxyl 17.7%	1.2-2.4	Commercially applied, slurry	Use higher rate for Phytophthora control	
	Apron XL Mefenoxam 33.3%	0.16-0.64	Commercially applied, slurry	Use higher rate for Phytophthora control	
SDHI Carboxamides (Group 7)	Acceleron DX-612 Fluxapyroxad 28.7%	0.24-0.47	Commercially applied, slurry	Insecticide and additional treatments can be added to base fungicide	
	Kickstart VP Carboxin 14.0% + <i>Permethrin</i> 10.42% (I) ²	3.0	On farm application, planter box	Contains insecticide (Group 3A)	
	ILeVO Fluopyram 48.4%	1.18-1.97 oz per 140,000 seed	Commercially applied, slurry	Specific seed treatment for Sudden Death Syndrome	
	Vibrance Sedaxane 43.7%	0.075-0.16	Commercially applied, slurry	Add Apron XL to improve Phytophthora control	
QoI Strobilurins (Group 11)	Acceleron DX-109 Pyraclostrobin 18.4%	0.4-1.5	Applied commercially or on farm, slurry	Insecticide and additional treatments can be added to base fungicide	
	Dynasty Azoxystrobin 9.6%	0.153-0.459	Commercially applied, slurry		
Phenylpyrroles (Group 12)	Maxim 4FS Fludioxonil	0.08-0.16	Commercially applied, slurry		
Aromatic Hydrocarbons (Group 14)	Rizolex Tolclofos-methyl 42.0%	0.3	Commercially applied		
Mixed Modes of Action	3+4	Inovate Ipconazole 0.72% + Metalaxyl 1.153% + <i>Clothianidin</i> 14.34% (I)	4.74	Commercially applied	Add additional metalaxyl or mefenoxam in high Phytophthora pressure areas. Contains insecticide (Group 4A).
		Inovate Pro Ipconazole 1.203% + Metalaxyl 0.965% + <i>Clothianidin</i> 24.03% (I)	2.81	Commercially applied, slurry	Contains insecticide (Group 4A).
	4+M3	Protector-L-Allegiance Metalaxyl 1.61% + Thiram 14.29%	6.7	Application in hopper box or on farm application seed treatment equipment	
	4+12	ApronMaxx RFC Fludioxonil 2.31% + Mefenoxam 3.46%	1.5	Applied commercially or on farm, slurry	Add Apron XL to improve Phytophthora control
		ApronMaxx RTA Fludioxonil 0.73% + Mefenoxam 1.1%	5.0	On farm application, slurry	Add Apron XL to improve Phytophthora control
		ApronMaxx RTA + Moly Fludioxonil 0.68% + Mefenoxam 1.02%	5.0	On farm application, slurry	

Soybean

Seed Treatment Fungicide Product Information (*continued*)

Fungicides		Rate (oz per 100 lbs) ¹	Application	Comments	
Class	Trade Name Active Ingredients (%)				
MixedMixed Modes of Action	4+12	Warden RTA Fludioxonil 0.72% + Mefenoxam 2.21%	5.0	On farm application, slurry	
		Trilex 2000 Metalaxyl 5.69% + Trifloxystrobin 7.12%	1.0	Commercially applied, slurry	
		CruiserMaxx Fludioxonil 1.12% + Mefenoxam 1.7% + Thiamethoxam 22.61% (I)	3.0	Commercially applied, slurry	Add Apron XL to improve Phytophthora control. Contains insecticide (Group 4A).
		CruiserMaxx Advanced Fluioxonil 1.07% + Mefenoxam 3.21% + Thiamethoxam 21.5% (I)	3.2	Commercially applied, slurry	Add Apron XL to improve Phytophthora control. Contains insecticide (Group 4A).
		CruiserMaxx EZ Fludioxonil 1.15% + Mefenoxam 3.46% + Thiamethoxam 23.1% (I)	3.15	Commercially applied, slurry	Add Apron XL to improve Phytophthora control. Contains insecticide (Group 4A).
		CruiserMaxx Plus Fludioxonil 1.07% + Mefenoxam 3.21% + Thiamethoxam 21.5% (I)	3.2	Commercially applied, slurry	Add Apron XL to improve Phytophthora control. Contains insecticide (Group 4A).
		UpShot Soybean Seed Treatment Fludioxonil 1.15% + Mefenoxam 3.46% + Thiamethoxam 23.1% (I)	2.94	Commercially applied, slurry	Add Apron XL to improve Phytophthora control. Contains insecticide (Group 4A).
	4+14	Catapult XL Chloroneb 30.0% + Mefenoxam 1.95%	5.5-7.0	On farm application, RTA	
	3+4+7	EverGol Energy SB Metalaxyl 5.74% + Penflufen 3.59% + Prothioconazole 7.18%	1.0	Commercially applied	Add Allegiance FL in high Phytophthora pressure areas
	3+4+22	Intego Suite Soybeans Ethaboxam 2.97% + Ipconazole 0.99% + Metalaxyl 0.79% + Clothianidin 20.0% (I)	3.37	Commercially applied	Contains insecticide (Group 4A).
	4+7+M4	Bean Guard / Allegiance Captan 24.45% + Carboxin 12.5% + Metalaxyl 3.75%	3.3	On farm application, planter box	
	4+7+12	CruiserMaxx Vibrance Fludioxonil 1.04% + Mefenoxam 3.13% + Sedaxane 1.04% + Thiamethoxam 21.5% (I)	3.22	Commercially applied, slurry	Add Apron XL to improve Phytophthora control. Contains insecticide (Group 4A).
		Warden CX Fludioxonil 1.0% + Mefenoxam 5.99% + Sedaxane 1.0% + Thiamethoxam 20.0% (I)	3.38	Commercially applied, slurry	Contains insecticide (Group 4A).
	4+7+14	Prevail Carboxin 15.0% + PCNB 15.0% + Metalaxyl 3.12%	2.0-4.0 oz per bushel	Applied commercially or on farm	

¹Rate is fluid ounces per 100 pounds of seed unless otherwise noted² Insecticide components are italicized with (I) for designation.

Soybean

Fungicide Efficacy for Control of Foliar Diseases

The North Central Regional Committee on Soybean Diseases (NCERA-137) has developed the following information on foliar fungicide efficacy for control of major foliar soybean diseases in the United States. Efficacy ratings for each fungicide listed in the table were determined by field-testing the materials over multiple years and locations by the members of the committee. Efficacy ratings are based upon level of disease control achieved by product, and are not necessarily reflective of yield increases obtained from product application. Efficacy depends upon proper application timing, rate, and application method to achieve optimum effectiveness of the fungicide as determined by labeled instructions and overall level of disease in the field at the time of application. Differences in efficacy among fungicide products were determined by direct comparisons among products in field tests and are based on a single application of the labeled rate as listed in the table, unless otherwise noted. **Table includes systemic fungicides available that have been tested over multiple years and locations. The table is not intended to be a list of all labeled products¹.** Efficacy categories: NR=Not Recommended; P=Poor; F=Fair; G=Good; VG=Very Good; E=Excellent; NL = Not Labeled for use against this disease; U = Unknown efficacy or insufficient data to rank product efficacy.

Fungicides ¹				Aerial Web Blight	Anthracnose	Brown Spot	Cercospora Leaf Blight ²	Frogeye Leaf Spot ³	Phomopsis/ Diaporthe (Pod and Stem Blight)	Soybean Rust	White Mold ⁴
Class	Trade Name	Active Ingredient(s) (%)	Rate/A (fl oz)								
MBC Thiophanates (Group 1)	Topsin 4.5FL / Multiple Generics ⁵	Thiophanate-methyl 45.0%	10.0-20.0	U ⁶	U	U	F	VG	U	G	F
DMI Triazoles (Group 3)	Alto 100SL	Cyproconazole 8.9%	2.75-5.5	U	U	VG	F	F	U	VG	NL
	Domark 230 ME / Multiple Generics	Tetraconazole 20.5%	4.5-5.0	NL	VG	VG	P-G	G-VG	U	VG-E	F
	Proline 480 SC ⁷	Prothioconazole 41.0%	2.5-5.0	NL	NL	NL	NL	G-VG	NL	VG	F
	Tilt / Multiple Generics	Propiconazole 41.8%	4.0-6.0	P	VG	G	NL	F	NL	VG	NL
	Topguard	Flutriafol 11.8%	7.0-14.0	U	VG	VG	P-G	VG	U	VG-E	F
SDHI Carboximides (Group 7)	Endura	Boscalid 70.0%	3.5-11.0	U	NL	VG	U	P	NL	NL	VG
	Vertisan ⁸	Penthiopyrad 20.6%	10.0-30.0	NL	U	U	U	U	U	U	U
QoI Strobilurins (Group 11)	Aftershock / Evito 480 SC	Fluoxastrobin 40.3%	2.0-5.7	VG	G	G	P	P	U	U	NL
	Aproach	Picoxystrobin 22.5%	6.0-12.0	VG	G	G	P	P	U	G	G ⁹
	Headline / Headline SC	Pyraclostrobin 23.6% 23.3%	6.0-12.0	VG	VG	G	P	P	U	VG	NL
	Quadris Flowable	Azoxystrobin 22.9%	6.0-15.5	VG	VG	G	P	P	U	G-VG	P
Mixed Modes of Action	3+11	Affiance	Azoxystrobin 9.35% + Tetraconazole	10.0-14.0	U	VG	VG	F	G	U	U
		Aproach Prima	Cyproconazole 7.17% + Picoxystrobin 17.94%	5.0-6.8	U	U	VG	P-G	G	U	NL
		Avaris / Quilt	Azoxystrobin 7.0% + Propiconazole 11.7%	14.0-20.5	U	U	G	F	F	U	VG
		Evito T	Fluoxastrobin 18.0% + Tebuconazole 25.0%	4.0-6.0	U	F	VG	P-F	F	U	NL
		Fortix / Preemptor	Flutriafol 19.3% + Fluoxastrobin 14.84%	4.0-6.0	U	U	G	U	G	U	U
		Quadris Top / Quadris Top SB	Azoxystrobin 18.2% + Difenconazole 11.4%	8.0-14.0	U	U	G-VG	P-G	VG	U	VG
		Quadris Top SBX	Azoxystrobin 19.8% + Difenconazole 19.8%	7.0-7.5	U	U	U	G-VG	U	U	U

Soybean

Fungicide Efficacy for Control of Foliar Diseases (*continued*)

Fungicides ¹				Aerial Web Blight	Anthracnose	Brown Spot	Cercospora Leaf Blight ²	Frogeye Leaf Spot ³	Phomopsis/ Diaporthe (Pod and Stem Blight)	Soy- bean Rust	White Mold ⁴	
Class		Trade Name	Active Ingredient(s) (%)									Rate/A (fl oz)
Mixed Modes of Action	3+11	Quilt Xcel	Azoxystrobin 13.5% + Propiconazole 11.7%	10.5-21.0	E	VG	G	F	F	U	VG	NL
		Stratego YLD ¹⁰	Prothioconazole 10.8% + Trifloxystrobin 32.3%	4.0-4.65	VG	VG	VG	F	F	U	VG	NL
		Zolera FX	Fluoxastrobin 17.76% + Tetraconazole 17.76%	4.4-6.8	U	U	U	U	U	U	U	U
	7+11	Priaxor	Fluxapyroxad 14.33% + Pyraclostrobin 28.58%	4.0-8.0	E	VG	E	P-G	P-F	U	VG	P
	1+3	Topsin XTR2	Tebuconazole 7.5% + Thiophanate-methyl 37.5%	20	U	U	U	U	U	U	U	U
	3+7+11	Priaxor D Component A	Fluxapyroxad 14.33% + Pyraclostrobin 28.58%	4.0	U	U	VG	U	G-VG	U	U	P
		Component B	Tetraconazole 20.5%	4.0								
		Trivapro Co-Pack Trivapro A	Benzovindiflupyr 10.27%	4.0	U	U	VG	U	VG	U	U	NL
		Trivapro B	Azoxystrobin 13.5% + Propiconazole 11.7%	10.5								

¹ Table includes systemic fungicides available that have been tested over multiple years and locations. Table is not intended to be a list of all labeled products. Multiple fungicides are labeled for soybean rust only, powdery mildew, and *Alternaria* leaf spot, including tebuconazole (multiple products) and Laredo (myclobutanil). Contact fungicides such as chlorothalonil may also be labeled for use.

² *Cercospora* leaf blight efficacy relies on accurate application timing, and standard R3 application timings may not provide adequate disease control. Fungicides with a solo or mixed QoI or MBC mode of action may not be effective in areas where QoI or MBC resistance has been detected in the fungal population that causes *Cercospora* leaf blight.

³ In areas where QoI-fungicide resistant isolates of the frogeye leaf spot pathogen are not present, QoI fungicides may be more effective than indicated in this table.

⁴ White mold efficacy is based on R1-R2 application timing, and lower efficacy is obtained at R3 or later application timings, or if disease symptoms are already present at the time of application.

⁵ Multiple generic products containing this mode of action may also be labeled in some states.

⁶ Efficacy categories: NR=Not Recommended; P=Poor; F=Fair; G=Good; VG=Very Good; E=Excellent; NL=Not Labeled for use against this disease; U=Unknown efficacy or insufficient data.

⁷ Proline has a supplemental label (2ee) for soybean, only for use on white mold in IL, IN, IA, MI, MN, NE, ND, OH, SD, WI. A separate 2ee for NY exists for white mold.

⁸ Vertisan, Zolera FX, and Topsin XTR2 were not included in regional fungicide efficacy trials.

⁹ Rating is based on two applications of a 9 oz/A rate of Aproach at R1 and R3.

¹⁰ Stratego YLD has a supplemental label (2ee) for soybean, only for use on white mold in IL, IN, IA, MI, MN, NE, ND, OH, SD, WI.

Soybean

Foliar Fungicide Product Information

Fungicides				Application			REI (hours)	PHI (days)
Class	Trade Name Active Ingredient (%)	Rate/A (fl oz) ¹	Formulation ²	Aerial	Chemigation	Ground		
MBC Thiophanates (Group 1)	Topsin 4.5FL Thiophanate-methyl 45.0%	10.0-20.0	F	5 gpa minimum	Allowed, <0.4" application	20 gpa minimum	24	21
	Topsin M WSB Thiophanate-methyl 70.0%	0.5-1.0 lb	WSB	5 gpa minimum	Allowed, <0.4" application	20 gpa minimum	24	21
DMI Triazoles (Group 3)	Alto 100SL Cyproconazole 8.9%	2.75-5.5	SC	2 gpa minimum	Allowed, <0.5" application	10 gpa minimum	12	30
	Bumper 41.8 EC Propiconazole 41.8%	4.0-6.0	EC	2 gpa minimum	Not allowed	10 gpa minimum	12	Do not apply after R5 (pod fill)
	Bumper ES Propiconazole 40.85%	4.0-6.0	EC	2 gpa minimum	Not allowed	10 gpa minimum	12	Do not apply after R5 (pod fill)
	Domark 230 ME Tetraconazole 20.5%	4.5-5.0	ME	2 gpa minimum	1Allowed	10 gpa minimum	12	Do not apply after R5 (pod fill)
	Proline 480 SC Prothioconazole 41.0%	2.5-5.0	SC	2 gpa minimum	Allowed, 0.125-0.5" application	10 gpa minimum	12	21
	Tilt Propiconazole 41.8%	4.0-6.0	EC	2 gpa minimum	Allowed, 0.1-0.25" application	10 gpa minimum	12	Do not apply after R5 (pod fill)
	Topguard Flutriafol 11.8%	7.0-14.0	SC	5 gpa minimum	Not allowed	10 gpa minimum	12	21
SDHI Carboximides (Group 7)	Endura Boscalid 70.0%	3.5-11.0	WDG	5 gpa mini- mum	Allowed	Adequate for coverage and canopy penetration	12	21
	Vertisan Penthiopyrad 20.6%	10.0-30.0	EC	2 gpa minimum	Allowed	15 gpa minimum	12	14
QoI Strobilurins (Group 11)	Aftershock / Evito 480 SC Fluoxastrobin 40.3%	2.0-5.7	SC	2 gpa minimum	Allowed, <0.4" application	10 gpa minimum	12	30
	Approach Picoxystrobin 22.5%	6.0-12.0	SC	Adequate for coverage and canopy penetration	Allowed	Adequate for coverage and canopy penetration	12	14
	Headline Pyraclostrobin 23.6% Headline SC Pyraclostrobin 23.3%	6.0-12.0	EC / SC	2 gpa minimum	Allowed, <0.5" application	Adequate for coverage and canopy penetration	12	21
	Quadris Flowable / Satori Azoxystrobin 22.9%	6.0-15.5	SC	Adequate for coverage and canopy penetration	Allowed, 0.1-0.25" application	Adequate for coverage and canopy penetration	4	14
Mixed Modes of Action	Affiance Azoxystrobin 9.35% + Tetraconazole 7.48%	10.0-14.0	SC	2 gpa mini- mum	Allowed, 0.1-0.25" application	10 gpa minimum	12	7
	Approach Prima Cyproconazole 7.17% + Picoxystrobin 17.94%	5.0-6.8	SC	Adequate for coverage and canopy penetration	Allowed	Adequate for coverage and canopy penetration	12	30
	Avaris / Quilt Azoxystrobin 7.0% + Propiconazole 11.7%	14.0-20.5	SE	2 gpa minimum	Allowed, 0.1-0.25" application	10 gpa minimum	12	Apply up to R6 (full seed)

Soybean

Foliar Fungicide Product Information *(continued)*

Fungicides					Application			REI (hours)	PHI (days)
Class	Trade Name Active Ingredient (%)	Rate/A (fl oz) ¹	Formulation ²	Aerial	Chemigation	Ground			
Mixed Modes of Action	3+11	Evito T Fluoxastrobin 18.0% + Tebuconazole 25.0%	4.0-6.0	SC	3 gpa minimum	Allowed, <0.4” application	10 gpa minimum	12	30
		Fortix / Preemptor Flutriafol 19.3% + Fluoxastrobin 14.84%	4.0-6.0	SC	5 gpa minimum	Not allowed	10 gpa minimum	12	30
		Quadris Top SB Azoxystrobin 18.2% + Difenconazole 11.4%	8.0-14.0	SC	2 gpa minimum	Allowed, 0.1-0.25” application	10 gpa minimum	12	14
		Quadris Top SBX Azoxystrobin 19.8% + Difenconazole 19.8%	7.0-7.5	SC	2 gpa minimum	Allowed, 0.1-0.25” application	10 gpa minimum	24	14
		Quadris Xtra Azoxystrobin 18.2% + Cyproconazole 7.3%	4.0-6.8	SC	2 gpa minimum	Allowed, <0.5” application	10 gpa minimum	12	30
		Quilt Xcel Azoxystrobin 13.5% + Propiconazole 11.7%	10.5-21.0	SE	2 gpa minimum	Allowed, 0.125-0.25” application	10 gpa minimum	12	Do not apply after R5 (pod fill)
		Stratego YLD Prothioconazole 10.8% + Trifloxystrobin 32.3%	4.0-4.65	SC	2 gpa minimum	Allowed, 0.125- 0.5” application	10 gpa minimum	12	21
		Zolera FX Fluoxastrobin 17.76% + Tetraconazole 17.76%	4.4-6.8	SC	2 gpa minimum	Allowed	10 gpa minimum	12	Do not apply after R5 (pod fill)
	7+11	Priaxor Fluxapyroxad 14.33% + Pyraclostrobin 28.58%	4.0-8.0	SC	2 gpa minimum	Allowed, <0.5” application	Adequate for coverage and canopy penetration	12	21
	1+3	Topsin XTR2 Tebuconazole 7.5% + Thiophanate-methyl 37.5%	20	SC	5 gpa minimum	Not Allowed	20 gpa minimum	24	21
	3+7+11	Priaxor D Component A Fluxapyroxad 14.33% + Pyraclostrobin 28.58%	4.0	SC	2 ppa minimum or 5 gpa minimum for white mold and Asian soy- bean rust	Not allowed	10 gpa minimum	12	21
		Component B Tetraconazole 20.5%	4.0	ME					
		Trivapro Co-Pack Trivapro A Benzovindiflupyr 10.27%	4.0	EC	2 gpa minimum	Allowed, 0.1-0.25” application	10 gpa minimum	12	14
		Trivapro B Azoxystrobin 13.5% + Propiconazole 11.7%	10.5	SE					

¹ Rate is fluid ounces per acre unless otherwise noted

² Formulations: EC=Emulsifiable Concentrate; F=Flowable; ME=Microencapsulated; SC=Suspension Concentrate; SE=Suspo-Emulsion; WDG=Water-Dispersible Granules; WSB=Water-Soluble Bag

Sugar beet

Foliar Fungicide and Bactericide Product Information

Fungicides				Application			REI (hours)	PHI (days)
Class	Trade Name Active Ingredient (%)	Rate/A	Formulation ¹	Aerial	Chemigation	Ground		
DMI Triazoles (Group 3)	Caramba Metconazole 8.6%	9.0-14.0 oz	EC	5 gpa minimum	Allowed, <0.5" application	5 gpa minimum	12	14
	Eminent VP Tetraconazole 11.6%	8.0-13.0 oz	ME	10 gpa minimum	Allowed, 0.1-0.25" application	Adequate for coverage and canopy penetration	12	14
	Proline 480 SC Prothioconazole 41.0%	5.0-5.7 oz	SC	2 gpa minimum	Allowed, 0.125-0.5" application	10 gpa minimum	12	7
	Tilt Propiconazole 41.8%	4.0 oz	EC	2 gpa minimum	Allowed, 0.1-0.25" application	10 gpa minimum	12	21
	Topguard Flutriafol 11.8%	10.0-14.0 oz	SC	5 gpa minimum	Not allowed	10 gpa minimum	12	21
SDHI Carboximides (Group 7)	Vertisan Penthiopyrad 20.6%	14.0-30.0 oz	EC	2 gpa minimum	Allowed	15 gpa minimum	12	7
QoI Strobilurins (Group 11)	Headline Pyraclostrobin 23.6% Headline SC Pyraclostrobin 23.3%	9.0-12.0 oz	EC / SC	2 gpa minimum	Allowed, <0.5" application	Adequate for coverage and canopy penetration	12	7
	Quadris Flowable Azoxystrobin 22.9%	6.0-15.5 oz	SC	2 gpa minimum	Allowed, 0.1- 0.25" application	Adequate for coverage and canopy penetration	4	0
Organo Tin Compounds (Group 30)	Super Tin 80WP Triphenyltin hydroxide 80%	2.5-5.0 oz	WP	5 gpa minimum	Not Allowed	15 gpa minimum	48	21
Inorganics (Group M1)	Badge SC Copper oxychloride 16.81% Copper hydroxide 15.36%	0.5-2.5 pt	SC	3 gpa minimum	Allowed	Adequate for coverage and canopy penetration	48	0
	Champ Formula 2 Flowable Copper hydroxide 37.5%	0.66-2.0 pt	F	3 gpa minimum	Allowed	Adequate for coverage and canopy penetration	48	0
Dithiocarbamates (Group M3)	Penncozeb 75DF Mancozeb 75.0%	1.0-2.0 lb	DF	2 gpa minimum	Allowed, 0.1-0.25" application	Adequate for coverage and canopy penetration	24	14
	Penncozeb 80WP Mancozeb 80.0%	1.0-2.0 lb	WP	2 gpa minimum	Allowed, 0.1-0.25" application	Adequate for coverage and canopy penetration	24	14
Mixed Modes of Action	7+11 Priaxor Fluxapyroxad 14.33% + Pyraclostrobin 28.58%	6.0-8.0 oz	SC	2 gpa minimum	Allowed, <0.5" application	Adequate for coverage and canopy penetration	12	7
	3+7 Propulse Fluopyram 17.4% + Prothioconazole 17.4%	8.55 oz	SC	Not allowed	Allowed	10 gpa minimum	48	7

¹ Formulations: EC=Emulsifiable Concentrate; F=Flowable; ME=Micro Emulsion; SC=Suspension Concentrate; WP=Wettable Powder

Sunflower

Foliar Fungicide Product Information

Fungicides				Application			REI (hours)	PHI (days)
Class	Trade Name Active Ingredient (%)	Rate/A (fl oz)	Formulation ¹	Aerial	Chemigation	Ground		
DMI Triazoles (Group 3)	Monsoon or Onset 3.6L or Orius 3.6F Tebuconazole 38.7%	4.0-6.0	F	5 gpa minimum	Not allowed	20 gpa minimum	12	50
	Muscle 3.6F Tebuconazole 38.7%	6.0	F	5 gpa minimum	Not allowed	20 gpa minimum	12	50
	TebuStar 3.6L or Tebuzol 3.6F or Toledo 3.6F Tebuconazole 38.7%	4.0-6.0	F	5 gpa minimum	Allowed	20 gpa minimum	12	50
SDHI Carboximides (Group 7)	Vertisan Penthiopyrad 20.6%	10.0-30.0 oz	EC	2 gpa minimum	Allowed	15 gpa minimum	12	14
QoI Strobilurins (Group 11)	Headline Pyraclostrobin 23.6% Headline SC Pyraclostrobin 23.3%	6.0-12.0 oz	EC / SC	2 gpa minimum	Allowed, <0.5" application	Adequate for coverage and canopy penetration	12	21
	Quadris Flowable Azoxystrobin 22.9%	6.0-15.5 oz	SC	Adequate for coverage and canopy penetration	Allowed, 0.1-0.25" application	10 gpa minimum	4	30
Mixed Modes of Action 7+11	Priaxor Fluxapyroxad 14.33% + Pyraclostrobin 28.58%	4.0-8.0 oz	SC	2 gpa minimum	Allowed, <0.5" application	Adequate for coverage and canopy penetration	12	21

¹Formulations: EC=Emulsifiable Concentrate; F=Flowable; SC=Suspension Concentrate

Wheat

Fungicide Efficacy for Control of Foliar Diseases

The North Central Regional Committee on Management of Small Grain Diseases (NCERA-184) has developed the following information on fungicide efficacy for control of certain foliar diseases of wheat for use by the grain production industry in the U.S. Efficacy ratings for each fungicide listed in the table were determined by field testing the materials over multiple years and locations by the members of the committee. Efficacy is based on proper application timing to achieve optimum effectiveness of the fungicide as determined by labeled instructions and overall level of disease in the field at the time of application. Differences in efficacy among fungicide products were determined by direct comparisons among products in field tests and are based on a single application of the labeled rate as listed in the table. This table includes most widely marketed products, and is not intended to be a list of all labeled products.

Efficacy of fungicides for wheat disease control is based on appropriate application timing

Fungicides ¹			Powdery Mildew	Stagonos- pora Leaf/ Glume Blotch	Septoria Leaf Blotch	Tan Spot	Stripe Rust	Leaf Rust	Stem Rust	Head Scab	
Class	Trade Name	Active Ingredient(s) (%)									
DMI Triazoles (Group 3)	Caramba	Metconazole 8.6%	VG	VG	U	VG	E ²	E	E	G	
	Folicur / Multiple Generics ³	Tebuconazole 38.7%	NL	NL	NL	NL	E	E	E	F	
	Proline 480 SC	Prothioconazole 41.0%	U	VG	VG	VG	U	VG	VG	G	
	Tilt / Multiple Generics ⁴	Propiconazole 41.8%	VG	VG	VG	VG	VG	VG	VG	P	
QoI Strobilurins (Group 11)	Aproach	Picoxystrobin 22.5%	G	U	VG	VG	E	VG	VG	NL	
	Evito 480 SC	Fluoxastrobin 40.3%	G	VG	U	VG	U	VG	U	NL	
	Headline SC	Pyraclostrobin 23.3%	G	VG	VG	E	E	E	G	NL	
Mixed Modes of Action	3+3	Prosaro 421 SC	Prothioconazole 19.0% + Tebuconazole 19.0%	G	VG	VG	VG	E	E	E	G
	3+11	Absolute Maxx SC	Flutriafol 19.3% +Propiconazole 11.7%	U	U	VG	VG	E	VG	U	NL
		Aproach Prima	Cyproconazole 7.17% + Picoxystrobin 17.94%	G	VG	VG	VG	E	VG	U	NR
		Fortix / Preemptor	Flutriafol 19.3% + Fluoxastrobin 14.84%	FG	U	VG	VG	E	VG	U	NL
		Quilt Fungicide / Multiple Generics ⁵	Azoxystrobin 7.0% + Propiconazole 11.7%	VG	VG	VG	VG	E	E	VG	NL
		Quilt Xcel	Azoxystrobin 13.5% + Propiconazole 11.7%	VG	VG	VG	VG	E	E	VG	NL
		Stratego YLD	Prothioconazole 10.8% + Trifloxystrobin 32.3%	G	VG	VG	VG	VG	VG	VG	NL
		TwinLine	Metconazole 7.4% + Pyraclostrobin 12.0%	G	VG	VG	E	E	E	VG	NL
	7+11	Priaxor	Fluxapyroxad 14.33% + Pyraclostrobin 28.58%	G	VG	VG	E	VG	VG	G	NL
		Trivapro Co-Pack Trivapro A	Benzovindiflupyr 10.3%	VG	VG	VG	VG	E	E	VG	NL
		Trivapro B	+ Propiconazole 11.7% + Azoxystrobin 13.5%	VG							

¹ Efficacy categories: NL=Not Labeled; NR=Not Recommended; P=Poor; F=Fair; G=Good; VG=Very Good; E=Excellent; U=Unknown efficacy or insufficient data.

² Efficacy may be significantly reduced if solo strobilurin products are applied after stripe rust infection has occurred.

³ Multiple generic products containing the same active ingredients also may be labeled in some states. Products containing tebuconazole include: Embrace, Monsoon, Muscle 3.6 F, Onset, Orius 3.6 F, Tebucon 3.6F, Tebustar 3.6 F, Tebuzol 3.6 F, Tegrol, and Toledo.

⁴ Multiple generic products containing the same active ingredients also may be labeled in some states. Products containing propiconazole include: Bumper 41.8 EC, Fitness, Propiconazole E-AG, and PropiMax 3.6 EC.

⁵ Multiple generic products containing the same active ingredients also may be labeled in some states. Products containing azoxystrobin + propiconazole include: Avaris 200 SC.

Wheat

Seed Treatment Fungicide Product Information

Class		Trade Name Active Ingredients (%)	Rate (per 100 lb)*
MBC Benzimidazoles (Group 1)		LSP Thiabendazole 30.0%	2.0-4.0 oz
		Mertect 340-F Thiabendazole 42.3%	0.17-3.19 oz
DMI Triazoles (Group 3)		Charter Triticonazole 2.4%	3.1 oz
		Raxil Tebuconazole 28.3%	0.1 oz
PA Acylalanines (Group 4)		Allegiance Dry Metalaxyl 12.5%	1.5-2.0 oz
		Allegiance FL Metalaxyl 28.35%	0.1-0.375 oz
		Allegiance LS Metalaxyl 17.7%	1.175-0.66 oz
		Apron XL Mefenoxam 33.3%	0.0425-0.085 oz
		Dyna-Shield Metalaxyl Metalaxyl 28.35%	0.1-0.375 oz
		Dyna-Shield Metalaxyl 318 FS Metalaxyl 30.14%	0.1-0.375 oz
SDHI Carboxamides (Group 7)		Vibrance Sedaxane 43.7%	0.08-0.16 oz
		Vitavax-34 Carboxin 34.0%	2.0-3.0 oz
QoI Strobilurins (Group 11)		Dynasty Azoxystrobin 9.6%	0.153-0.382 oz
Phenylpyrroles (Group 12)		Dyna-Shield Fludioxonil Fludioxonil 40.3%	0.08-0.16 oz
		Maxim 4FS Fludioxonil 40.3%	0.08-0.16 oz
Dithiocarbamates (Group M3)		Dithane F-45 Rainshield Mancozeb 37.0%	1.6 qt/ac
		Dithane M-45 Mancozeb 80.0%	2.0 lb
		Grain Guard Mancozeb 50.0%	3.3 oz
		Penncozeb 75DF Mancozeb 75.0%	2.3-3.5 oz
		Penncozeb 80WP Mancozeb 80.0%	2.2-3.3 oz
Mixed Modes of Action	3+3+4	Proceed Metalaxyl 2.75% + Prothioconazole 6.88% + Tebuconazole 1.38%	1.0-1.5 oz
		Raxil MD Extra Imazalil 1.0% + Metalaxyl 0.58% + Tebuconazole 0.43%	5.0 oz
		Raxil MD Extra-W Imazalil 0.965% + Metalaxyl 0.56% + Tebuconazole 0.415% + Imidacloprid 1.384% (I)	5.14 oz
	3+4	Charter F2 Metalaxyl 0.79% + Triticonazole 1.32%	5.4 oz
		CruiserMaxx Cereals Difenoconazole 3.36% + Mefenoxam 0.56% + Thiamethoxam 2.8% (I)	5.0 oz
		Dyna-Shield Foothold Metalaxyl 0.668% + Tebuconazole 0.499%	5.0-6.5 oz
		Dyna-Shield Foothold Extra Metalaxyl 0.607% + Tebuconazole 0.455% + Imidacloprid 11.374% (I)	3.4-5.0 oz

*All rates are units per 100 lbs of seed unless otherwise noted

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Wheat

Seed Treatment Fungicide Product Information *(continued)*

Class		Trade Name Active Ingredients (%)	Rate (per 100 lb)
Mixed Modes of Action	3+4	Dyna-Shield Small Grains Metalaxyl 0.64% + Tebuconazole 0.48%	5.0-6.5 oz
		Incentive RTA Difenoconazole 3.21% + Mefenoxam 0.27%	2.5-10.0 oz
		NipsIt Suite Cereals Metalaxyl 0.88% + Metconazole 0.44% + <i>Clothianidin</i> 2.93% (I)	5.0-7.5 oz
		Rancona Crest Ipconazole 0.421% + Metalaxyl 0.562% + <i>Imidacloprid</i> 14.1% (I)	5.0-8.33 oz
		Rancona Pinnacle Ipconazole 0.434% + Metalaxyl 0.579%	5.0-8.33 oz
		Raxil MD Metalaxyl 0.64% + Tebuconazole 0.48%	5.0-6.5 oz
		Raxil MD-W Metalaxyl 0.615% + Tebuconazole 0.461% + <i>Imidacloprid</i> 1.538% (I)	5.0 oz
		Raxil XT Wettable Powder Metalaxyl 20.0% + Tebuconazole 15.0%	0.16-0.2 oz
	3+4+7	CruiserMaxx Vibrance Cereals Difenoconazole 3.34% + Mefenoxam 0.86% + Sedaxane 0.72% + <i>Thiamethoxam</i> 2.78% (I)	5.0-10.0 oz
		EverGol Energy Metalaxyl 5.74% + Penflufen 3.59% + Prothioconazole 7.18%	1.0 oz
		Rancona V RTU FS Carboxin 12.58% + Ipconazole 0.47% + Metalaxyl 1.26%	4.6 oz
		Vibrance Extreme Difenoconazole 5.86% + Mefenoxam 1.46% + Sedaxane 1.22%	2.8-5.6 oz
	3+7	Rancona V 100 Pro FS Carboxin 35.52% + Ipconazole 2.22%	0.9-1.5 oz
	3+M3	Charter PB Thiram 12.5% + Triticonazole 1.25%	5.5 oz
		Raxil Thiram Tebuconazole 0.6% + Thiram 20.0%	3.5-4.6 oz
	4+7+14	Prevail Carboxin 15.0% + PCNB 15.0% + Metalaxyl 3.12%	1.5-3.0 oz per bushel
	4+12	Maxim XL Fludioxonil 21.0% + Mefenoxam 8.4%	0.167-0.334 oz
	M1+M3	ManKocide Copper Hydroxide 46.1% + Mancozeb 15.0%	4.0 oz

Wheat

Foliar Fungicide Product Information

Fungicides				Application			REI (hours)	PHI (days)
Class	Trade Name Active Ingredient (%)	Rate/A (fl oz) ¹	Formulation ²	Aerial	Chemigation	Ground		
DMI Triazoles (Group 3)	Alto 100SL Cyproconazole 8.9%	1.5-5.5	SC	2 gpa minimum	Allowed, <0.5" application	10 gpa minimum	12	30
	Bumper 41.8 EC Propioconazole 41.8%	2.0-4.0	EC	2 gpa minimum	Not allowed	10 gpa minimum	12	Apply no later than Feekes 10.5
	Bumper ES Propioconazole 40.85%	2.0-4.0	EC	2 gpa minimum	Not allowed	10 gpa minimum	12	Apply no later than Feekes 10.5
	Caramba Metconazole 8.6%	10.0-17.0	EC	2 gpa minimum	Allowed, <0.5" application	10 gpa minimum	12	30
	Folicur 3.6F <i>or</i> Monsoon <i>or</i> Muscle 3.6F <i>or</i> Orius 3.6F <i>or</i> Tebuconazole 38.7%	4.0	F	5 gpa minimum	Not allowed	10 gpa minimum	12	30
	Proline 480 SC Prothioconazole 41.0%	4.3-5.7	SC	2 gpa minimum	Allowed, 0.125-0.5" application	10 gpa minimum	12	30
	TebuStar 3.6L <i>or</i> Toledo 3.6F Tebuconazole 38.7%	4.0	F	5 gpa minimum	Allowed	10 gpa minimum	12	30
	Tebuzol 3.6F Tebuconazole 38.7%	2.0-4.0	F	5 gpa minimum	Allowed	10 gpa minimum	12	30
	Tilt Propiconazole 41.8%	2.0-4.0	EC	2 gpa minimum	Allowed, 0.1-0.25" application	10 gpa minimum	12	Apply no later than Feekes 10.5
	Topguard Flutriafol 11.8%	10.0-14.0	SC	2 gpa minimum	Not allowed	10 gpa minimum	12	30
SDHI Carboximides (Group 7)	Vertisan Penthiopyrad 20.6%	10.0-24.0	EC	2 gpa minimum	Allowed	15 gpa minimum	12	Apply no later than Feekes 10.5
QoI Strobilurins (Group 11)	Aproach Picoxystrobin 22.5%	3.0-12.0	SC	Adequate for coverage and canopy penetration	Allowed	Adequate for coverage and canopy penetration	12	45
	Evito 480 SC Fluoxastrobin 40.3%	2.0-4.0	SC	2 gpa minimum	Allowed, <0.4" application	10 gpa minimum	12	40
	Headline Pyraclostrobin 23.6% Headline SC Pyraclostrobin 23.3%	6.0-12.0	EC / SC	2 gpa minimum	Allowed, <0.5" application	Adequate for coverage and canopy penetration	12	Apply no later than Feekes 10.5
	Quadris Flowable Azoxystrobin 22.9%	4.0-12.0	SC	Adequate for coverage and canopy penetration	Allowed, 0.1-0.25" application	10 gpa minimum	4	Apply no later than Feekes 10.5
	Satori Azoxystrobin 22.9%	4.0-12.0	SC	Adequate for coverage and canopy penetration	Allowed, 0.1-0.25" application	Adequate for coverage and canopy penetration	4	Apply no later than Feekes 10.5

Wheat

Foliar Fungicide Product Information (continued)

Fungicides				Application			REI (hours)	PHI (days)	
Class	Trade Name Active Ingredient (%)	Rate/A (fl oz) ¹	Formulation ²	Aerial	Chemigation	Ground			
Inorganics (Group M1)	Champ Formula 2 Flowable Copper hydroxide 37.5%	1.0-1.33 pt	F	3 gpa minimum	Allowed	Adequate for coverage and canopy penetration	48	0	
Mixed Modes of Action	3+11	Absolute Maxx 500 SC Tebuconazole 22.63% + Trifloxystrobin 22.63%	5.0	SC	5 gpa minimum	Allowed, 0.125- 0.5" application	10 gpa minimum	12	35
		Approach Prima Cyproconazole 7.17% + Picoxystrobin 17.94%	3.4-6.8	SC	Adequate for coverage and canopy penetra- tion	Allowed	Adequate for coverage and canopy penetration	12	45
		Evito T Fluoxastrobin 18.0% + Tebuconazole 25.0%	4.0-6.0	SC	3 gpa minimum	Allowed, <0.4" application	10 gpa minimum	12	Apply no later than Feekes 10.5
		Fortix / Preemptor Fluoxastrobin 14.84% + Flutriafol 19.3%	2.0-6.0	SC	2 gpa minimum	Not allowed	10 gpa minimum	12	40
		Quilt Azoxystrobin 7.0% + Propiconazole 11.7%	7.0-14.0	SE	2 gpa minimum	Allowed, 0.125- 0.25" application	10 gpa minimum	12	Apply no later than Feekes 10.5
		Quilt Xcel Azoxystrobin 13.5% + Propiconazole 11.7%	7.0-14.0	SE	2 gpa minimum	Allowed, 0.125- 0.25" application	10 gpa minimum	12	Apply no later than Feekes 10.5
		Stratego Propiconazole 11.4% + Trifloxystrobin 11.4%	10.0	SC	2 gpa minimum	Allowed, 0.125- 0.5" application	10 gpa minimum	12	35
		Stratego YLD Prothioconazole 10.8% + Trifloxystrobin 32.3%	4.0	SC	2 gpa minimum	Allowed, 0.125- 0.5" application	10 gpa minimum	12	35
		TwinLine Metconazole 7.4% + Pyraclostrobin 12.0%	6.0-9.0	EC	5 gpa minimum	Allowed, <0.5" application	10 gpa minimum	12	Apply no later than Feekes 10.5
	7+11	Priaxor Fluxapyroxad 14.33% + Pyraclostrobin 28.58%	4.0-8.0	SC	2 gpa minimum	Allowed, <0.5" application	Adequate for coverage and canopy penetration	12	Apply no later than Feekes 10.5
	3+7+11	Trivapro Co-Pack Trivapro A Benzovindiflupyr 10.3	4.0 oz	EC	2 gpa minimum	Allowed	10 gpa minimum	12	Apply no later than Feeks 10.54
		Trivapro B Propiconazole 11.7% Azoxystrobin 13.5%	10.5 oz	SE					
	M1+M3	ManKocide Copper hydroxide 46.1% + Mancozeb 15.0%	1.7 lb	DF	3-10 gpa minimum	Allowed	25 gpa minimum	48	26

¹ Rate is fluid ounces per acre unless otherwise noted

² Formulations: DF=Dry Flowable; EC=Emulsifiable Concentrate; F=Flowable; SC=Suspension Concentrate; SE=Suspo-Emulsion

Nematicides for Field Crops

Nematicides Active Ingredients (concentration)	Registered Nebraska Crops	Application	Rate
Acceleron HX-209 harpin alpha beta protein (1.0%)	Corn (field, popcorn, silage, sweet) dry bean, soybean	Seed treatment	Corn (0.75 oz per 100 lb seed) Soybean (0.25 oz per 100 lb seed)
Avicta 500 FS abamectin (46.3%)	Soybean	Seed treatment	Commercially applied
Avicta Complete Beans 500 abamectin (22.2%) + thiamethoxam (11.1%) + mfenoxam (1.67%) + fludioxonil (0.55%)	Soybean	Seed treatment	Commercially applied
Avicta Complete Corn 250 thiamethoxam (11.7%) + abamectin (10.3%) + thiabendazole (2.34%) + fludioxonil (0.3%) + mfenoxam (0.23%) + azoxystrobin (0.12%)	Corn (field, popcorn, seed, sweet)	Seed treatment	Commercially applied
Avicta Complete Corn 500 thiamethoxam (23.1%) + abamectin (10.2%) + thiabendazole (2.31%) + fludioxonil (0.3%) + mfenoxam (0.23%) + azoxystrobin (0.12%)	Corn (field, popcorn, seed, sweet)	Seed treatment	Commercially applied
Avicta Duo Corn abamectin (12.4%) + thiamethoxam (28.1%)	Corn (field, popcorn, seed, sweet)	Seed treatment	Commercially applied
AzaGuard azadirachtin (3.0%)	Corn (field, popcorn), sorghum (grain), soybean, wheat	Ground, aerial, chemigation	15.0 fl oz / A
Counter 15G Smartbox terbufos (15.0%)	Corn (field, popcorn, seed, sweet) sorghum (grain), sugarbeet	Soil-applied granule (banded or in-furrow)	Corn (< or = 8.7 lb / A) Sorghum (grain) (< or = 11.3 lb / A) Sugarbeet (< or = 13.1 lb / A)
Counter 20G Lock'n Load terbufos (20.0%)	Corn (field, popcorn, seed, sweet) sorghum (grain), sugarbeet	Soil-applied granule (banded or in-furrow)	Corn (< or = 6.5 lb / A) Sorghum (grain) (< or = 8.4 lb / A) Sugarbeet (< or = 9.8 lb / A)
Counter 20G Smartbox terbufos (20.0%)	Corn (field, popcorn, seed, sweet) sorghum (grain), sugarbeet	Soil-applied granule (banded or in-furrow)	Corn (< or = 6.5 lb / A) Sorghum (grain) (< or = 8.4 lb / A) Sugarbeet (< or = 9.8 lb / A)
Clariva pn <i>Pasteuria nishizawae</i> - Pn1 (15.0%)	Soybean, sugarbeet	Seed treatment	0.9-33.8 fl oz / 100 lb seed
Ecozin Plus 1.2% ME azadirachtin (1.2%)	Corn, sorghum, soybean, wheat	Ground, aerial, chemigation, soil drench	25.0-56.0 fl oz / A
N-Hibit Gold CST harpin alpha beta protein (1.0%)	Corn, (field, popcorn, silage, sweet) soybean	Seed treatment	Commercially applied
Poncho VOTiVO clothianidin (40.3%) + <i>Bacillus firmus</i> I-1582	Corn (field, popcorn, sweet), soybean	Seed treatment	Commercially applied
Telone C-17 1,3-dichloropropene (81.2%) + chloropicrin (16.5%)	All field crops	Soil fumigation	10.8-17.1 gal / A
Telone C-35 1,3-dichloropropene (63.4%) + chloropicrin (34.7%)	All field crops	Soil fumigation	13.0-20.5 gal / A
Telone II 1,3-dichloropropene (97.5%)	All field crops	Soil fumigation	9.0-12.0 gal / A
Temik 15G aldicarb (15.0%)	Sugarbeet	Soil-applied granule (banded or in-furrow)	27.0-33.0 lb / A
Temik 15G Lock'n Load aldicarb (15.0%)	Sugarbeet	Soil-applied granule (banded or in-furrow)	27.0-33.0 lb / A

Biological Products for Crop Disease Management

Trade name Active Ingredients (concentration)	Registered Crops	Applications & Rate	Comments
Actinovate AG + <i>Streptomyces lydicus</i> WYEC 108	Corn, dry bean, dry peas, root/ tuber crops, tomatoes	Soil drench, in-furrow, in irrigation, seed treatment or as foliar spray. 1-12 fl oz/acre depending on crop	Biofungicide against many soilborne diseases and some foliar pathogens
Afla-Guard GR <i>Aspergillus flavus</i> (0.0094%)	Corn, field corn, popcorn	Ground and aerial applications. Apply 10-20 lb/acre	Biofungicide - competes to reduce aflatoxin contamination
Clariva pn <i>Pasteuria nishizawae</i> - Pn1 (15.0%)	Soybean, sugarbeets	Seed Treatment 0.9-33.8 fl oz/100 lb seed	Nematicide
Ethos XB Biofungicide <i>Bacillus amyloliquefaciens</i> strain D747 (5%) + bifenthrin insecticide	Corn	3.4-17.0 oz per acre. Product con- tains 1.5 lb bifenthrin per gal plus <i>B. amyloliquefaciens</i> at 1 x 10 ¹⁰ cfu per ml	Biofungicide
Integral <i>Bacillus subtilis</i> MBI600 (0.18%)	Soybean	Applied in-furrow, soil/growing media, pre-plant/commercial seed	Liquid biological fungicide, alternate brand name is Subtilex NG
Majestene <i>Burkholderia</i> sp strain A396 heat-killed cells	Alfalfa, apples, corn, potatoes, soybean, tomatoes, and wheat.	1-2 gallon per acre	Bionematicide
Poncho/VOTiVO <i>Bacillus firmus</i> I-1582 (8.10%) + clothianidin (40.3%)	Corn (field, popcorn, sweet), sorghum, soybean, sugarbeet	Seed treatment. Commercially applied	Soybean cyst nematode
Regalia Rx <i>Reynoutria</i> spp. extract	Corn, soybean	Tank-mixed with leading fungicides 10.5 oz/acre.	Biofungicide - induced systemic resistance against some fungi and bacteria. Promotes plant growth
SabrEx <i>Trichoderma</i> spp. (3.5% w/w)	Corn, wheat, sorghum, soybean, rye and oats	Seed treatment Rates may vary, see label	Induce resistance against diseases. Enhanced nutrient use
Serenade Opti <i>Bacillus subtilis</i> QST 713 (26.2%)	Soybean, dry beans, potatoes	Foliar spray or soil drench. Rates may vary, see label	White mold, gray mold, bacterial leaf spot, etc.
Xanthion <i>Bacillus subtilis</i> MBI600 (9.9%)	Corn (field and sweet)	In-furrow treatment at a rate of 0.6 to 1.2 oz per acre	Biological fungicide to be used with chemistry

2017 Approximate Retail Price (\$) Per Unit of Selected Fungicides for Field Crops

Survey price estimates in September 2016

Product	2017 Price (\$) per Unit
Affiance	195.00/gal
Allegiance FS (FL)	500.00/gal
Alto 100SL	380.00/gal
Apron XL	980.00/gal
ApronMaxx RFC	380.00/gal
ApronMaxx RTA	125.00/gal
Bumper ES	87.00/gal
Captan Gold	18.00/gal
Captan 80WDG	6.50/lb
Caramba	170.00/gal
Cruiser 5SF Wheat	870.00/gal
CruiserMaxx Adv	680.00/gal
CruiserMaxx Beans	630.00/gal
Custodia	130.00/gal
Dithane F-45 Rainshield	34.00/gal
Dividend XL RTA	85.00/gal
Domark 230 ME	420.00/gal
Equus 720	35.00/gal
Evito	9.00/oz
Headline AMP	340.00/gal
Incognito 4.5	47.00/gal
Manzate Max	35.00/gal
Manzate Pro-Stick	4.50/lb
Mastercop	63.00/gal

Product	2017 Price (\$) per Unit
Maxim 4FS Potato	18.00/oz
Mertect 340-F	440.00/gal
Orius 3.6F	45.00/gal
Penncozeb 75DF	4.50/lb
Proline 480SC	720.00/gal
PropiMax EC	105.00/gal
Prosaro SC	350.00/gal
Quadris	300.00/gal
Quadris Top	350.00/gal
Quilt	160.00/gal
Quilt Xcel	220.00/gal
Raxil MD Extra-W	79.00/gal
Raxil PRO MD	80.00/gal
Stamina F3	420.00/gal
Stratego YLD	600.00/gal
Stratego	210.00/gal
Tebuzol 3.6F	45.00/gal
Tilt	105.00/gal
Toledo	45.00/gal
Topguard	230.00/gal
Trilex 2000	385.00/gal
Twinline	270.00/gal
Warden Cereal	120.00/gal

Disease Management Dictionary

See page 203 for a guide to reading dictionary entries. Number/letters in brackets in the Fungicide Dictionary correspond to the product Mode (s) of Action listed on page 235-239 and are provided by the Fungicide Resistance Action Committee (FRAC).

Absolute® [tebuconazole (2.18 lb ai/gal) + trifloxystrobin (2.18 lb ai/gal)]. For control of certain diseases on wheat. Bayer CropScience. EPA Reg. No. 264-849. 11/2010. {3+11}.

Absolute Maxx® [tebuconazole (2.18 lb ai/gal) + trifloxystrobin (2.18 lb ai/gal)]. For control of certain diseases on barley, corn and wheat. Bayer CropScience. EPA Reg. No. 264-849. 2015. {3+11}.

Acceleron® DC-309 [metalaxyl (2.6 lb/gal)]. For control of Pythium and Phytophthora damping off in corn. Monsanto. EPA Reg. No. 264-935-524. 2009. {4}.

Acceleron® DC-509 [ipconazole (3.77 lb/gal)]. For control of Rhizoctonia, Fusarium, and Phomopsis seedling diseases in corn. Monsanto. EPA Reg. No. 264-988-524. 2009. {3}.

Acceleron® DX-109 [pyraclostrobin (1.67 lb/gal)]. Registered for control of Rhizoctonia damping off and suppression of *Pythium* spp. and *Fusarium* spp. in soybeans. Monsanto. EPA Reg. No. 7969-266-524. 2010. {11}.

Acceleron® DX-309 [metalaxyl (2.6 lb/gal)]. Registered for control of Pythium and Phytophthora damping off in soybeans. Monsanto. EPA Reg. No. 264-935524. 2010. {4}.

Acceleron® DX-612 [fluxapyroxad (2.72 lb/gal)]. Registered for control of seed and seedling *Rhizoctonia solani* damping off and suppression of *Fusarium* spp. in soybeans. Monsanto. EPA Reg. No. 7969-308-524. 2012. {7}.

Acceleron® DX-709 [trifloxystrobin (22%)]. Protects corn seedlings against *Rhizoctonia solani* and *Fusarium* spp. Monsanto. EPA Reg. No. 264-989-524. 2010. {11}.

Acceleron® HX-209 [harpin alpha beta (1%)]. A seed treatment for nematode egg production suppression in corn, dry bean, and soybean. Monsanto. EPA Reg. No. 71771-3-524.

Acquire® [metalaxyl (2.65 lb/gal)]. Seed treatment controlling Pythium and Phytophthora damping off in soybean, sorghum, sunflower, small grains, turfgrass, canola, corn, and millet. BASF. EPA Reg. No. 71532-22-7969. 2010. {4}.

Actinovate® AG [*Streptomyces lydicus* WYEC 108]. A biofungicide against many soilborne diseases and some foliar pathogens. For use in corn, dry bean, dry peas, root/tuber. Delivered as soil drench, in-furrow, in irrigation, seed treatment or as foliar spray at 1-12 fl oz/acre depending on crop. Novozymes-Monsanto BioAg. EPA Reg. No. 73314-1.

Affiance™ [tetraconazole (0.66 lb ai/gal) + azoxystrobin (0.834 lb ai/gal)]. A broad spectrum foliar fungicide for leaf spot, blight, and rust control in corn and soybean. Gowan. EPA Reg. No. 80289-19-10163. {3 + 11}.

Afla-Guard® GR [*Aspergillus flavus* (0.0094%) + Inert ingredients (99.0096%)]. A biofungicide, which the active ingredient competes to reduce aflatoxin contamination from a pathogen. For use with corn, field corn, and popcorn. Delivery through ground and aerial applications at a rate of 10-20 lb/acre. Syngenta. EPA Reg. No. 75624-2-100

AfterShock™ [fluoxastrobin (4.0 lb ai/gal)]. Broad spectrum fungicide for the control of certain plant diseases in various crops, including corn, soybean, and wheat. Loveland Products, Inc. EPA Reg. No. 66330-64-34704. 2010. {11}.

Allegiance® Dry [metalaxyl (12.5%)]. For control of Pythium and Phytophthora damping off in soybean, sorghum, sunflower, small grains, turfgrass, and corn. Chemtura. EPA Reg. No. 264-1014400. {4}.

Allegiance® FL [metalaxyl (2.6 lb/gal)]. For control of Pythium and Phytophthora damping off in soybean, sorghum, sunflower, small grains, turfgrass, canola, corn, wheat, and millet. Bayer CropScience. EPA Reg. No. 264-935. 09/2007. {4}.

Allegiance LS [metalaxyl (1.63 lb ai/gal)]. To aid in the control of seed decay and damping off caused by *Pythium* in corn, dry beans, sorghum, soybean, sugarbeet, sunflower and wheat. Bayer. EPA Reg. No. 264-956. {4}.

Alto® [cyproconazole (0.83 lb ai/gal)]. Broad spectrum foliar fungicide for control of plant diseases in soybean. Syngenta. EPA Reg. No. 100-1226. 2008. {3}.

Approach™ [picoxystrobin (2.08 lb ai/gal)]. A foliar fungicide for the control of certain diseases in corn, dry bean, sorghum, soybean and wheat. DuPont. EPA Reg. No. 352-840. 11/2012. {11}.

Approach® Prima [picoxystrobin (1.67 lb ai/gal) + cyproconazole (0.67 lb ai/gal)]. A foliar fungicide for the control of certain diseases in corn, soybean, and wheat. DuPont. EPA Reg. No. 352-883. {3 + 11}.

Apron XL® [mefenoxam (3.0 lb/gal)]. For control of Pythium and Phytophthora damping off in small grains, field corn, sweet corn, popcorn, forage grasses, millet, sorghum, soybean, sunflower, wheat, and turfgrass. Syngenta. EPA Reg. No. 100-799. 08/2009. {4}.

ApronMaxx® RFC [fludioxonil (0.21 lb/gal) + mefenoxam (0.31 lb/gal)]. Registered for control of Pythium, Phytophthora, Fusarium, and Rhizoctonia seedling diseases in soybean and dry edible beans. Syngenta. EPA Reg. No. 100-1195. 10/2009. {12 + 4}.

ApronMaxx® RTA [fludioxonil (0.064 lb/gal) + mefenoxam (0.096 lb/gal)]. Ready to apply formulation of ApronMaxx. Registered for control of Pythium, Phytophthora, Fusarium, and Rhizoctonia seedling diseases in soybean and dry edible beans. Syngenta. EPA Reg. No. 100-946. 08/2009. {12 + 4}.

Disease Management Dictionary *(continued)*

Avicta® 500FS [abamectin (4.17 lb ai/gal)]. A seed treatment to protect soybean seedlings from early-season nematode damage. Syngenta. EPA Reg. No. 100-1204.

Avicta® Complete Beans 500 [abamectin (22.2%) + thiamethoxam (11.1%) + mefenoxam (1.67%) + fludioxonil (0.55%)]. A seed treatment to protect soybean seedlings from early-season nematode damage, including soybean cyst nematode, and insects, plus control of *Pythium*, *Phytophthora*, *Fusarium*, and *Rhizoctonia* seedling diseases. Syngenta. EPA Reg. No. 100-1457. {4+12}.

Avicta® Complete Corn 250 [abamectin (10.3%) + thiamethoxam (11.7%) + thiabendazole (2.34%) + mefenoxam (0.23%) + fludioxonil (0.3%) + azoxystrobin (0.12%)]. A seed treatment to protect corn seedlings from early-season nematode, insect, and damping off and seedling blight disease damage from *Pythium*, *Fusarium*, and *Rhizoctonia*. Syngenta. EPA Reg. No. 100-1405. {1 + 4 + 12 + 11}.

Avicta® Complete Corn 500 [abamectin (10.2%) + thiamethoxam (23.1%) + thiabendazole (2.31%) + mefenoxam (0.23%) + fludioxonil (0.3%) + azoxystrobin (0.12%)]. A seed treatment to protect corn seedlings from early-season nematode, insect, and damping off and seedling blight disease damage from *Pythium*, *Fusarium*, and *Rhizoctonia*. Syngenta. EPA Reg. No. 100-1405. {1 + 4 + 12 + 11}.

Avicta® Duo Corn [abamectin (12.4%) + thiamethoxam (28.1%)]. A seed treatment to protect corn seedlings from early-season nematodes and insects. Syngenta. EPA Reg. No. 100-1321.

AzaGuard™ [azadirachtin (0.28 lb ai/gal)]. Registered for controlling and repelling insects and nematodes in various crops including corn, dry bean, sorghum, soybean, sugarbeet, sunflower, and wheat. BioSafe Systems. EPA Reg. No. 70299-17.

Azoxystrobin. An active ingredient in Affiance, Dynasty, Quadris, Quadris Opti, Quadris Top, Quadris Top SB, Quadris Xtra, Quilt, Quilt Xcel, and Satori. [11].

Badge® [copper oxychloride + copper hydroxide (2.27 lb/gal metallic copper)]. A fungicide/bactericide for disease control in alfalfa, corn, dry bean, sugarbeet, and wheat. Gowan. EPA Reg. 80289-3. {M1}.

Bean Guard/Allegiance [carboxin (12.5%) + metalaxyl (3.75%) + captan (24.45%)]. Registered to control certain seed and seedling diseases, including *Pythium* and *Rhizoctonia*, in soybeans. Chemtura. EPA Reg. No. 400-561. {7 + 4 + M4}.

Boscalid. An active ingredient in Endura. {7}.

Bumper® [propiconazole (41.8%)]. A foliar fungicide for the control of certain diseases in corn, sorghum, soybean, and wheat. Makhteshim Agan of North America, Inc. EPA Reg. No. 66222-42. 04/2009. {3}.

Captan. An active ingredient in Captan 400 and Captan 400-C. {M4}.

Caramba® [metconazole (0.75 lb ai/gal)]. For use in disease control in sugarbeet and wheat. BASF. EPA Reg. No. 7969-246. 2008. {3}.

Carboxin. Active ingredient in Kickstart VP, Prevail, RTU-Vitavax-Thiram, Vitavax-34, and Vitavax 200. {7}.

Catapult™ XL [chloroneb (2.9 lb/gal) + mefenoxam (0.19 lb/gal)]. Registered for control of *Phytophthora*, *Pythium*, and *Rhizoctonia* seedling diseases in soybean and dry edible beans. Winfield Solutions, LLC. EPA Reg. No. 1381-183. {14 + 4}.

Champ® Formula 2 Flowable [copper hydroxide (4.5 lb ai/gal)]. A fungicide/bactericide for control of certain diseases of alfalfa, dry bean, sugar beet, and wheat. Nufarm. EPA Reg. No. 55146-64. {M1}.

Charter® [triticonazole (0.213 lb/gal)]. Registered for control of seed-borne diseases in wheat and barley. BASF. EPA Reg. No. 7969-386. 02/2010. {3}.

Charter® PB [triticonazole (0.12 lb/gal) + thiram (1.2 lb/gal)]. For control of seed-borne diseases in wheat and barley with the addition of thiram fungicide. BASF. EPA Reg. No. 7969-387. 02/2010. {3 + M3}.

Charter® F² [triticonazole (0.12 lb ai/gal) + metalaxyl (0.07 lb ai/gal)]. Liquid seed treatment for control or suppression of certain seed-borne and soil-borne diseases in cereals including wheat. BASF. EPA Reg. No. 7969-295. 2010. {3}.

Clariva™ pn [*Pasteuria nishizawae* (15%)]. A biological seed treatment product for protection against cyst nematodes on soybean and sugarbeet. Syngenta. EPA Reg. No. 100-1524.

Cloroneb. Active ingredient in Catapult XL. {14}.

Clothianidin. An active ingredient in Inovate System and NipsIt SUITE Cereals OF. {4A}.

Copper Hydroxide. Active ingredient in Badge, Kocide 2000, Kocide 3000 and ManKocide. {M1}.

Counter® 15G Smartbox [terbufos (15%)]. Insecticide/nematicide for use in corn, sugarbeet, and grain sorghum. AMVAC. EPA Reg. No. 5481-545. RUP. {Insecticide 1B}.

Counter® 20G Lock'n Load and Counter® 20G Smartbox [terbufos (20%)]. Insecticide/nematicide for use in corn, sugarbeet, and grain sorghum. AMVAC. EPA Reg. No. 5481-562. RUP. {Insecticide 1B}.

Cruiser Maxx® [thiamethoxam (2.15 lb ai/gal) + mefenoxam (0.16 lb ai/gal) + fludioxonil (0.11 lb ai/gal)]. Protects against soil-borne and seed-borne diseases (*Pythium*, *Phytophthora*, *Fusarium*, and *Rhizoctonia*) in dry beans and soybeans. Syngenta. EPA Reg. No. 100-1247. 2014. {4 + 12}.

Cruiser Maxx® Advanced [thiamethoxam (2.06 lb ai/gal) + mefenoxam (0.31 lb ai/gal) + fludioxonil (0.10 lb ai/gal)]. Protects against damage from soil-borne and seed-borne diseases (*Pythium*, *Phytophthora*, *Fusarium*, and *Rhizoctonia*) in soybeans. Syngenta. EPA Reg. No. 100-1283. 2014. {4 + 12}.

Disease Management Dictionary *(continued)*

CruiserMaxx® Beans [thiamethoxam (2.15 lb/gal) + mefenoxam (0.16 lb/gal) + fludioxonil (0.11 lb/gal)]. ApronMaxx product with the addition of an insecticide for control of early season insect pests on soybean and dry edible beans. Syngenta. EPA Reg. No. 100-1247. 12/2009. {Insecticide 4A + 4 + 12}.

CruiserMaxx® Cereals [thiamethoxam (0.26 lb/gal) + mefenoxam (0.05 lb/gal) + difenoconazole (0.31 lb/gal)]. Registered for control of Fusarium, Pythium, and Rhizoctonia damping off diseases on winter wheat, spring wheat, barley, and triticale. Also contains an insecticide for wireworm, aphid, and Hessian fly control. Syngenta. EPA Reg. No. 1001305. 2009. {Insecticide 4A + 4 + 3}.

Cruiser Maxx® EZ [thiamethoxam (2.17 lb ai/gal) + mefenoxam (0.33 lb ai/gal) + fludioxonil (0.11 lb ai/gal)]. Protects against damage from soil-borne and seed-borne diseases (*Pythium*, *Phytophthora*, *Fusarium*, and *Rhizoctonia*) in soybeans. Syngenta. EPA Reg. No. 100-1427. 2014. {4 + 12}.

CruiserMaxx® Plus [thiamethoxam (2.06 lb/gal) + mefenoxam (0.31 lb/gal) + fludioxonil (0.10 lb/gal)]. CruiserMaxx Beans product with additional mefenoxam for enhanced *Phytophthora* control. Syngenta. EPA Reg. No. 100-1283. {Insecticide 4A + 4 + 12}.

CruiserMaxx® Vibrance™ Cereals [sedaxane (0.0667 lb/gal) + difenoconazole (0.308 lb/gal) + mefenoxam (0.079 lb/gal) + thiamethoxam (0.256 lb/gal)]. A seed treatment product for protection against damage from certain insects and diseases in cereals including wheat. Syngenta. EPA Reg. No. 100-1383. 2012. {Insecticide 7 + 3 + 4 + 4A}.

Cyproconazole. An active ingredient in Alto, Aproach Prime and Quadris Xtra. {3}.

Difenoconazole. An active ingredient in CruiserMaxx Cereals, CruiserMaxx, Quadris Top SB, Vibrance Cereals, Dividend Extreme, Dividend XL RTA, Incentive RTA, Quadris Top, and Vibrance Extreme. {3}.

Dithane® F-45 Rainshield [mancozeb (4.0 lb ai/gal)]. A foliar fungicide used for the control of certain diseases in corn and wheat. Dow AgroSciences. EPA Reg. No. 62719-396. 01/2007. {M3}.

Dithane® M-45 [mancozeb (80%)]. A foliar fungicide used for the control of certain diseases in corn and wheat. Dow AgroSciences. EPA Reg. No. 62719-387. 01/2007. {M3}.

Dividend Extreme® [difenoconazole (0.77 lb/gal) + mefenoxam (0.19 lb/gal)]. Used for control of many seed-borne diseases in barley, sweet corn, wheat, and triticale. Syngenta. EPA Reg. No. 100-1141. 07/2010. {3 + 4}.

Dividend® XL RTA® [difenoconazole (0.31 lb/gal) + mefenoxam (0.025 lb/gal)]. RTA formulation of Dividend Extreme for use on barley and wheat. Syngenta. EPA Reg. No. 100-826. 09/2009. {3 + 4}.

Domark® [tetraconazole (1.9 lb ai/gal)]. For control and/or suppression of certain diseases in corn and soybean. Valent. EPA Reg. No. 80289-7. 04/2007. {3}.

Dyna-Shield® Fludioxonil [fludioxonil (4.0 lb ai/gal)]. A seed treatment for controlling seed-borne and soil-borne diseases such as seedling blight and damping off in various crops including corn, dry bean, sorghum, soybean, sugarbeet, sunflower, and wheat. Loveland. EPA Reg. No. 34704-1074. {12}.

Dyna-Shield® Foothold™ [tebuconazole (0.042 lb ai/gal) + metalaxyl (0.056 lb ai/gal)]. A seed treatment that aids in control of seed, seedling, and soil-borne diseases in wheat. Loveland. EPA Reg. No. 34704-1049. {3 + 4}.

Dyna-Shield® Foothold™ Extra [tebuconazole (0.042 lb ai/gal) + metalaxyl (0.056 lb ai/gal) + imidacloprid (1.0 lb ai/gal)]. A seed treatment for early season insects; aids in control of seed, seedling, and soil-borne diseases in wheat. Loveland. EPA Reg. No. 34704-1046. {3 + 4 + 4A}.

Dyna-Shield® Metalaxyl [metalaxyl (2.54 lb ai/gal)]. A seed treatment for control of seed rot and damping off diseases of certain crops including corn, dry bean, sorghum, soybean, sugarbeet, sunflower, and wheat. Loveland. EPA Reg. No. 34704-942. {4}.

Dyna-Shield® Metalaxyl 318 FS [metalaxyl (2.65 lb ai/gal)]. A seed treatment for control of *Pythium* seed rot, *Pythium* damping off, and *Phytophthora* diseases of certain crops including corn, dry bean, sorghum, soybean, sugarbeet, sunflower, and wheat. Loveland. EPA Reg. No. 34704-942. {4}.

Dyna-Shield® Small Grains [tebuconazole (0.039 lb ai/gal) + metalaxyl (0.051 lb ai/gal)]. A seed treatment that aids in control of seed, seedling, and soil-borne diseases in wheat. Loveland. EPA Reg. No. 34704-933. {3 + 4}.

Dynasty® [azoxystrobin (0.83 lb/gal)]. For control of seed and soil-borne seedling diseases on corn, sunflower, barley, canola, dry edible beans, sorghum, soybeans, wheat, and triticale. Syngenta. EPA Reg. No. 100-1159. 08/2010. {11}.

EcoZin® Plus 1.2% ME [azadirachtin (1.2%, or 0.1 lb ai/gal)]. For controlling and repelling insects and nematodes in various crops including corn, dry bean, sorghum, soybean, sugarbeet, sunflower, and wheat. Amvac. EPA Reg. No. 5481-559.

Eminent® 125SL [tetraconazole (1.0 lb ai/gal)]. A foliar fungicide for the control of certain diseases in sugarbeets. Sipcam Agro USA, Inc., EPA Reg. No. 60063-12. 03/2009. {3}.

Endura® [boscalid (5.632 lb ai/gal)]. A foliar fungicide for the control of certain diseases in dry bean and soybean. BASF. EPA Reg. No. 7969-197. 2012. {7}.

Ethaboxam. An active ingredient in Intego. {22}.

Disease Management Dictionary *(continued)*

Ethos XBTM. *Bacillus amyloliquefaciens* strain D747 + bifenthrin insecticide. A biofungicide that builds on FMC's in-furrow insect control product and provides additional seedling disease suppression for early season damping-off and seedling blights caused by *Pythium*, *Rhizoctonia*, *Fusarium*, and *Phytophthora*. Product contains 1.5 lb per gallon of bifenthrin plus *B. amyloliquefaciens* at 1 x 10¹⁰ cfu per milliliter. Use rate is 3.4-17.0 oz per acre (0.2-0.98 oz/1000 ft of row) for pests other than corn rootworm. FMC Corporation EPA Reg. No. 279-3473.

Evergol™ Energy [prothioconazole (0.64 lb ai/gal) + penflufen (0.32 lb ai/gal) + metalaxyl (0.51 lb ai/gal)]. For control of soilborne, seedborne, and early season postemergence diseases in various crops including soybean and wheat. Bayer CropScience. EPA Reg. No. 264-1123. 2012. {3 + 7 + 4}.

Evito® [fluoxastrobin (3.98 lb ai/gal)]. A foliar fungicide for the control of certain diseases in corn, soybean, and wheat. Arysta LifeScience. EPA Reg. No. 6633064. 2010. {11}.

Evito® T [fluoxastrobin (1.67 lb ai/gal) + tebuconazole (2.32 lb ai/gal)]. A broad spectrum fungicide for the control of certain diseases in various crops including corn and soybean. Arysta LifeScience. EPA Reg. No. 66330-383. 2010. {11+3}.

Fitness® [propiconazole (3.6 lb ai/gal)]. A foliar fungicide for the control of certain diseases in various crops including corn and wheat. Loveland Products, Inc. EPA Reg. No. 34704-1031. 2011. {3}.

Flutriafol. Active ingredient found in Fortix, Preemptor, and Topguard. {3}.

Fluoxastrobin. An active ingredient in Aftershock, Evito, Evito T, Fortix, Preemptor, and Topguard {11}.

Fluidioxonil. Active ingredient in ApronMaxx RC, ApronMaxx RTA, CruiserMaxx, CruiserMaxx Advanced, CruiserMaxx EZ, CruiserMaxx Plus, Maxim 4FS, Maxim XL, Warden CZ, and Warden RTA. {12}.

Fluopyram. The active ingredient in ILeVO. {7}

Fluxapyroxad. An active ingredient in Priaxor. {7}.

Folicur® 3.6F [tebuconazole (3.6 lb ai/gal)]. A foliar fungicide providing control of rusts and suppression of head blight (scab) diseases in wheat. Bayer. EPA Reg. No. 264-752. {3}.

Fortix® [fluoxastrobin (1.4 lb ai/gal) + flutriafol (1.82 lb ai/gal)]. A foliar fungicide for the control of certain diseases in corn and soybean. Cheminova. EPA Reg. No. 66330-409. {3 + 11}.

Grain Guard® [mancozeb (50%)]. For control of seed-borne bunts and smuts of wheat, oats, barley, rye, and sorghum. Chemtura. EPA Reg. No. 400-558. {M3}.

Headline® [pyraclostrobin (2.09 lb ai/gal)]. For use in disease control and plant health in corn, dry bean, sorghum, soybean, sugarbeet, sunflower, and wheat. BASF. EPA Reg. No. 7969-186. 2009. {11}.

Headline® SC [pyraclostrobin (2.08 lb ai/gal)]. For use in disease control and plant health in corn, dry bean, sorghum, soybean, sugarbeet, sunflower, and wheat. BASF. EPA Reg. No. 7969-289. 2013. {11}.

Headline AMP® [pyraclostrobin (1.22 lb ai/gal) + metconazole (0.46 lb ai/gal)]. For disease control and plant health in corn and dry bean. BASF. EPA Reg. No. 7969-291. 2009. {11 + 3}.

ILeVO. [fluopyram (5.0 lb ai/gal)]. Seed treatment for protection against early season pathogenic nematodes and seedling infections by *Fusarium virguliforme*, causal agent of Sudden Death Syndrome. Bayer CropScience. EPA Reg. No. 264-1167. 2015. {7}.

Imazalil. Active ingredient in Raxil MD Extra and Raxil MD Extra W. {3}.

Incentive® RTA® [difenoconazole (0.31 lb/gal) + mefenoxam (0.025 lb/gal)]. Used for controlling seedborne diseases in barley and wheat. Winfield Solutions, LLC. EPA Reg. No. 100-826-1381. 09/2007. {3 + 4}.

Imidaclopid. Active ingredient in Raxil MD-W. {Insecticide 4A}.

Intego™ Suite Soybeans. [clothianidin (1.91 lb ai/gal) + ethaboxam (0.282 lb ai/gal) + ipconazole (0.094 lb) + metalaxyl (0.075 lb ai/gal)]. A fungicide and insecticide seed treatment providing systemic seed and seedling protection against seedling diseases and insects of soybeans. Valent. 2015. EPA Reg. No. 59639-205. {Insecticide 4A + 22 + 3 + 4}.

Inovate™ [clothianidin (1.34 lb ai/gal) + methalaxyl (0.108 lb ai/gal) + ipconazole (0.72 lb ai/gal)]. A fungicide and insecticide seed treatment providing systemic seed and seedling protection against early season seedling diseases and insects of soybeans. Valent. 2015. EPA Reg. No. 59639-176. {Insecticide 4A + 3 + 4}.

Inovate Pro. [clothianidin (2.27 lb ai/gallon) + ipconazole (0.1137 lb ai/gal) + metalaxyl (0.0912 lb ai/gal)]. A fungicide and insecticide seed treatment providing systemic seed and seedling protection against listed early season seedling disease and insects of soybeans. Valent. 2015. EPA Reg. No. 59639-195. {Insecticide 4A + 3 + 4}.

Integral [*Bacillus subtilis* MBI 600]. Alternate brand name of Subtlex. A liquid biological fungicide for use in-furrow, as a growing media treatment, or as a pre-plant seed treatment. BASF and Becker Underwood, Inc. EPA Reg. No. 71840-5.

Ipconazole. Active ingredient in Inovate System. {3}.

Kickstart® VP [carboxin (10.4%) + permethrin (14%)]. Planter box seed treatment for corn and soybeans for control of various seedling diseases and insects. Helena. EPA Reg. No. 42056-21-5905. {7 + Insecticide 3A}.

Kocide 2000® [copper hydroxide (53.8%)]. A fungicide/bactericide for control of specified diseases on various crops including corn, dry bean, sugarbeet, and wheat. DuPont. EPA Reg. No. 352-656. 01/2011. {M1}.

Disease Management Dictionary *(continued)*

Kocide 3000® [copper hydroxide (46.1%)]. A fungicide/bactericide for control of specified diseases on various crops including corn, soybean, sugarbeet, and wheat. DuPont. EPA Reg. No. 352-662. 01/2011. {M1}.

Laredo® [myclobutanil (2.0 lb ai/gal)]. A foliar fungicide for the control of soybean rust in soybean. Dow AgroSciences. EPA Reg. No. 62719-412. 03/2007. {3}.

Majestene™. Burkholderia sp strain A396 heat-killed cells. A bionematicide with application rate of 1-2 gallon per acre. Crops include alfalfa, apples, corn, potatoes, soybean, tomatoes, and wheat. Product can be used in-furrow, foliar applied or in chemigation. It is listed by the Organic Materials Review Institute (OMRI). Marrone Bio Innovations, Inc. EPA Reg No. 84059-14

ManKocide® [mancozeb (15%) + copper hydroxide (46.1%)]. For control of some seed-borne and foliar diseases in wheat, sugarbeet, and barley. DuPont. EPA Reg. No. 352-690. 06/2012. {M3 + M1}.

Mancozeb. An active ingredient in Dithane F-45, Rainshield, Dithane M-45, ManKocide, Penncozeb 75DF, and Penncozeb 80WP. {M3}.

Maxim® 4FS [fludioxonil (4 lb/gal)]. Registered for controlling seedborne and soilborne fungal diseases in barley, corn, millet, oats, rye, sorghum, triticale, wheat, canola, sunflower, dry edible beans, and soybean. Syngenta. EPA Reg. No. 100-758. 2010. {12}.

Maxim® XL [fludioxonil (1.9 lb/gal) + mefenoxam (0.8 lb/gal)]. For control of seedborne and soilborne diseases in soybean, wheat, barley, rye, oats, triticale, millet, corn, alfalfa, edible beans, sorghum, sunflower, and turfgrass. Syngenta. EPA Reg. No. 100-916. 2010. {12 + 4}.

Mefenoxam. Active ingredient in Apron XL, ApronMaxx RFC, ApronMaxx RTA, Catapult XL, CruiserMaxx, CruiserMaxx Advanced, CruiserMaxx Cereals, CruiserMaxx EZ, CruiserMaxx Plus, CruiserMaxx Vibrance Cereals, Dividend Extreme, Dividend RTA, Incentive RTA, Maxim XL, Warden CZ, and Warden RTA. {4}.

Mertect 340-F. [thiabendazole (4.1 lb ai/gal)]. Soybean seed treatment for the control of Phomopsis. Syngenta. EPA Reg. No. 100-889. {1}.

Metalaxyl. Active ingredient in Acceleron, Acquire, Allegiance Dry, Allegiance FL, Allegiance LS, Evergol Energy, Inovate System, NipsIt SUITE Cereals OF, Prevail, Proceed MD, Raxil MD, Raxil MD Extra, Raxil MD Extra W, Raxil MD-W, Raxil XT Wettable Powder, and Trilex 2000. {4}.

Metconazole. An active ingredient in Caramba, Headline AMP, and Twinline. {3}.

Monsoon® [tebuconazole (3.6 lb ai/gal)]. A foliar fungicide for control of specified diseases on various crops including corn, soybean, sunflower, and wheat. Loveland Products, Inc. EPA Reg. No. 34704-900. 2009. {3}

Muscle® [tebuconazole (3.6 lb ai/gal)]. For control of specified diseases on soybean, sunflower, and wheat. Sipcam Agro USA, Inc. EPA Reg. No. 60063-29. 06/2009. {3}.

Myclobutanil. An active ingredient in Laredo. {3}.

N-Hibit™ Gold CST [harpin alpha beta (1%)]. A seed treatment suppresses nematode egg production on soybean. Plant Health Care. EPA Reg. No. 71771-3.

NipsIt™ SUITE Cereals OF [clothianidin (2.93%) + metalaxyl (0.88%) + metconazole (0.44%)]. A seed treatment fungicide providing systemic seed and seedling protection against certain diseases in cereals including wheat. Valent. EPA Reg. No. 59639-183. 03/2012. {Insecticide 4A + 4 + 3}.

Onset® [tebuconazole (3.6 lb ai/gal)]. For control of specified diseases on various crops including corn, soybean, sunflower, and wheat. Winfield Solutions, LLC. EPA Reg. No. 1381-203. 09/03/2009. {3}.

Orius® [tebuconazole (3.6 lb ai/gal)]. A foliar fungicide for control of certain diseases in corn, dry bean, soybean, sunflower, and wheat. Makhteshim Agan of North America, Inc. EPA Reg No. 66222-117. {3}.

PCNB. Active ingredient in Prevail seed treatment. {14}.

Penflufen. An active ingredient in Evergol Energy. {7}.

Penncozeb® 75DF [mancozeb (75%)]. A foliar fungicide used for the control of certain diseases in corn, sugarbeet, and wheat. Cerexagri-Nisso, LLC. EPA Reg. No. 4581-370-82695. {M3}.

Penncozeb® 80WP [mancozeb (80%)]. A foliar fungicide used for the control of certain diseases in corn, sugarbeet, and wheat. Cerexagri-Nisso, LLC. EPA Reg. No. 4581-358-82695. {M3}.

Penthiopyrad. An active ingredient in Vertisan {7}.

Permethrin. An active ingredient in Kickstart VP. {3A}.

Picoxystrobin. An active ingredient in Aproach and Aproach Prima. {11}.

Poncho®/VOTIVO® [clothianidin (4.17 lb ai/gal) + *Bacillus firmus* (0.84 lb/gal (8.1%))]. A systemic insecticide and seed treatment for use on corn, sorghum, soybean, and sugarbeet for insect control and protection from various nematodes. Bayer. EPA Reg. No. 264-1109.

Preemptor™SC [fluoxastrobin (1.4 lb ai/gal) + flutriafol (1.82 lb ai/gal)]. A foliar fungicide for the control of certain diseases in corn and soybean. FMC Corporation. EPA Reg. No. 66330-409-279. {3 + 11}.

Prevail® [carboxin (15%) + PCNB (15%) + metalaxyl (3.12%)]. Registered for control of damping off caused by *Pythium* and *Rhizoctonia* fungi in barley, oats, edible beans, corn, wheat, and soybeans. Chemtura. EPA Reg. No. 264-1015-400. 2007. {7 + 14 + 4}.

Priaxor® D [fluxapyroxad (1.39 lb ai/gal) + pyraclostrobin (2.78 lb ai/gal) + tetraconazole (1.9 lb ai/gal)]. For disease control and plant health in soybean. BASF. EPA Reg. No. 7969-361. {3 + 7 + 11}.

Priaxor(R) Xemium(R) [fluxapyroxad (1.39 lb ai/gal) + pyraclostrobin (2.78 lb ai/gal)]. For use in disease control and plant health in corn, dry bean, soybean, sugarbeet, sunflower, and wheat. BASF. EPA Reg. No. 7969-311. 2012. {7 + 11}.

Disease Management Dictionary *(continued)*

Proceed™ Concentrate [prothioconazole (6.88%) + tebuconazole (1.38%) + metalaxyl 2.75%]. A seed treatment that aids in control or suppression of seed, seedling, and soil-borne diseases in wheat. Bayer. EPA Reg. No. 264-1102. {3 + 4}.

Proceed™ MD [prothioconazole (0.128 lb/gal) + tebuconazole (0.025 lb/gal) + metalaxyl (0.052 lb/gal)]. Registered for control of smuts, Pythium damping off, root rots, and seedborne Fusarium scab in barley, wheat, and triticale. Bayer CropScience. EPA Reg. No. 264-1072. 09/2009. {3 + 3 + 4}.

Proline® [prothioconazole (4.0 lb ai/gal)]. For control of specific diseases in corn, dry bean, soybean, sugarbeet, and wheat. Bayer CropScience. EPA Reg. No. 264-825. 2010. {3}.

Propiconazole. An active ingredient in Bumper, Fitness, PropiMax EC, Quilt, Quilt Xcel, and Tilt. {3}.

PropiMax® EC [propiconazole (3.6 lb ai/gal)]. For control of certain diseases in corn and wheat. Dow AgroSciences. EPA Reg. No. 62719-346. 08/14/2008. {3}.

Prosaro® [prothioconazole (1.76 lb ai/gal) + tebuconazole (1.76 lb ai/gal)]. For control of specified diseases in wheat and corn. Bayer CropScience. EPA Reg. No. 264862. 2010. {3 + 3}.

Protector™-L-Allegiance® [thiram (14.29%) + metalaxyl (1.61%)]. Registered to reduce seed rot and seedling blight diseases including *Pythium* and *Rhizoctonia* in soybean. Chemtura. EPA Reg. No. 264-1018-400. 2010. {M3 + 4}.

Prothioconazole. An active ingredient in Evergol Energy, Proline, Proceed Concentrate, Prosaro, Proceed MD, and Stratego YLD. {3}.

Pyraclostrobin. An active ingredient in Acceleron DX-109, Headline AMP, Headline EC, Headline SC, Priaxor, Stamina, and Twinline. {11}.

Quadris® [azoxystrobin (2.08 lb ai/gal)]. Broad spectrum fungicide control of plant diseases in corn, dry bean, sorghum, soybean, sunflower, and wheat. Syngenta. EPA Reg. No. 100-1098. 2009. {11}.

Quadris® Opti [azoxystrobin (0.5 lb ai/gal) + chlorothalonil (5.0 lb ai/gal)]. Broad spectrum fungicide for control of plant diseases in dry bean. Syngenta. EPA Reg. No. 100-1171. 2010. {11 + M}.

Quadris® Top [azoxystrobin (1.67 lb ai/gal) + difenoconazole (1.05 lb ai/gal)]. Broad spectrum fungicide for the control of plant diseases in soybean. Syngenta. EPA Reg. No. 100-1313. 2012. {11 + 3}.

Quadris® Top SB [azoxystrobin (1.67 lb ai/gal) + difenoconazole (1.05 lb ai/gal)]. Provides disease control of many leaf spots in soybean. Syngenta. EPA Reg. No. 100-1313. 2010. {11 + 3}.

Quadris Top® SBX [azoxystrobin (1.88 lb ai/gal) + difenoconazole (1.88 lb ai/gal)]. For broad spectrum disease control in soybean. Syngenta. EPA Reg. No. 100-1554. {3 + 11}.

Quadris® Xtra [azoxystrobin (1.67 lb ai/gal) + cyproconazole (0.67 lb ai/gal)]. Broad spectrum fungicide for control of plant diseases in soybean. Syngenta. EPA Reg. No. 100-1225. 2008. {11 + 3}.

Quilt® [propiconazole (1.04 lb ai/gal) + azoxystrobin (0.62 lb ai/gal)]. Broad spectrum fungicide for control of plant diseases in corn, sorghum, soybean, and wheat. Syngenta. EPA Reg. No. 100-1178. 2009. {3 + 11}.

Quilt Xcel® [propiconazole (1.02 lb ai/gal) + azoxystrobin (1.18 lb ai/gal)]. Broad spectrum fungicide for control of plant diseases in corn, sorghum, soybean, and wheat. Syngenta. EPA Reg. No. 100-1324. 2009. {3 + 11}.

Raxil 2.6F [tebuconazole (2.6 lb ai/gal)]. A seed treatment that aids in control or suppression of seed, seedling, and soil-borne diseases in corn and wheat. Bayer. EPA Reg. No. 264-964. {3}.

Raxil® MD [tebuconazole (0.039 lb/gal) + metalaxyl (0.051 lb/gal)]. Registered for use on wheat, barley, oats, and triticale for control of certain smuts, root rots, and damping off. Bayer CropScience. EPA Reg. No. 264-967. 9/21/05. {3 + 4}.

Raxil® MD Extra [tebuconazole (0.04 lb/gal) + metalaxyl (0.05 lb/gal) + imazalil (0.09 lb/gal)]. Controls various smuts, root rots, and damping off on wheat, barley, and triticale. Bayer CropScience. EPA Reg. No. 264-976. 9/21/05. {3 + 4 + 3}.

Raxil® MD-W [imidacloprid (1.54%) + tebuconazole (0.46%) + metalaxyl (0.62%)]. Raxil MD product with the addition of an insecticide for control of early season insects on wheat, barley, and triticale. Bayer CropScience. EPA Reg. No. 264-996. 6/22/05. {Insecticide 4A + 3 + 4}.

Raxil®-Thiram [tebuconazole (0.055 lb/gal) + thiram (1.84 lb/gal)]. Controls various Septoria, Pythium, Rhizoctonia, and Fusarium seedling diseases in barley, oats, triticale, and wheat. Bayer CropScience. EPA Reg. No. 264-955. 9/21/05. {3 + M3}.

Raxil® XT [tebuconazole (15%) + metalaxyl (20%)]. Controls early season root rots and smuts on wheat, triticale, barley, and oats. Bayer CropScience. EPA Reg. No. 264-966. 9/23/05. {3 + 4}.

Regalia® Rx [*Reynoutria* spp. extract]. A biofungicide that promotes plant growth and induces systemic resistance against some fungi and bacteria in corn and soybean. It can be tank-mixed with leading fungicides at the rate of 10.5 oz/acre. Marrone Bio Innovations.

Rizolex. [tolclofos-methyl (4.17 lb ai/gal)]. A fungicide seed treatment providing seedling protection against rizoctonia. Valent. 2015. EPA Reg. No. 59639-178.

SabrEx [*Trichoderma* sp.(3.5% w/w)]. Product enhances nutrient use and induce systemic resistance against diseases in cereals including corn, wheat, sorghum, rye and oats. It is a seed treatment inoculant. Advanced Biological Marketing (ABM).

Satori™ [azoxystrobin (2.08 lb ai/gal)]. Broad spectrum fungicide for control of plant diseases in corn, soybean, and wheat. Loveland Products, Inc. EPA Reg. No. 34704-1068. 4/2013. {11}.

Sedaxane. An active ingredient in CruiserMaxx Vibrance Cereals, Vibrance, and Vibrance Extreme. {7}.

Disease Management Dictionary *(continued)*

Serenade® Opti [*Bacillus subtilis* QST 713 (26.2%) + Other ingredients (73.8%)]. Product can be used in the management of white mold, gray mold, bacterial leafspot, etc in soybean, dry beans and potatoes. It is delivered as a foliar spray or soil drench. Bayer. EPA Reg. No. 264-1160.

Stamina® [pyraclostrobin (1.67 lb/gal)]. Registered for control of various seedling diseases on barley, corn, edible beans, rye, and wheat. BASF. EPA Reg. No. 7969-266. 2010. {11}.

Stratego® YLD [prothioconazole (1.05 lb ai/gal) + trifloxystrobin (3.13 lb ai/gal)]. For control of certain diseases and plant health in corn and soybean. Bayer CropScience. EPA Reg. No. 264-1093. 5/28/2010. {3 + 11}.

Subtlex L [*Bacillus subtilis* MBI 600]. Alternate brand name of Integral. A liquid biological fungicide for use in-furrow, as a growing media treatment, or as a pre-plant seed treatment. BASF and Becker Underwood, Inc. EPA Reg. No.

Tebuconazole. An active ingredient in Absolute, Dyna-Shield Foothold, Dyna-Shield Foothold Extra, Dyna-Shield Small Grains, Evito T, Folicur, Monsoon, Muscle, Onset, Orius, Proceed Concentrate, Proceed MD, Prosaro, Raxil 2.6F, Raxil MD, Raxil MD Extra, Raxil MD-W, Raxil-Thiram, Raxil XT, TebuStar, Tebuzol, Toledo, and Topsin XTR2. {3}.

TebuStar® [tebuconazole (3.6 lb ai/gal)]. Fungicide for control of specified diseases on corn, soybean, sunflower, and wheat. Albaugh, Inc. EPA Reg. No. 42750-99. {3}.

Tebuzol™ [tebuconazole (3.6 lb ai/gal)]. For control of specific diseases in corn, dry bean, soybean, and wheat. United Phosphorus, Inc. EPA Reg. No. 70506114. 03/04/2009. {3}.

Telone® II [1,3-dichloropropene (9.85 lb ai/gal)]. A multi-purpose liquid fumigant for preplant treatment of soil to control nematodes and certain other soil-borne pathogens and invertebrates affecting crops. Dow AgroSciences. EPA Reg. No. 62719-32. RUP. {Insecticide MoA 1B}.

Telone® C-17 [1,3-dichloropropene (8.6 lb ai/gal) and chloropicrin (1.75 lb ai/gal)]. A multi-purpose liquid fumigant for preplant treatment of soil to control nematodes and certain other soil-borne pathogens and invertebrates affecting crops. Dow AgroSciences. EPA Reg. No. 62719-12. RUP. {Insecticide MoA 1B}.

Telone® C-35 [1,3-dichloropropene (7.10 lb ai/gal) and chloropicrin (3.89 lb ai/gal)]. A multi-purpose liquid fumigant for preplant treatment of soil to control nematodes and certain other soil-borne pathogens and invertebrates affecting crops. Dow AgroSciences. EPA Reg. No. 62719-302. RUP. {Insecticide MoA 1B}.

Temik 15G, Temik 15G Lock N Load [aldicarb (15%)]. Soil-applied granules for control of certain insects, mites, and nematodes of sugarbeet. EPA Reg. No. 264-330. RUP {Insecticide MoA 1A}.

Tetraconazole. An active ingredient in Affiance, Domark, and Eminent 125SL. {3}.

Thiabendazole. Active ingredient in Mertect 340-F and LSP. {1}.

Thiamethoxam. An active ingredient in CruiserMaxx, CruiserMaxx Advanced, CruiserMaxx Cereals, CruiserMaxx EZ, CruiserMaxx Plus, CruiserMaxx Vibrance Cereals, and Warden CZ. {Insecticide 4A}.

Thiophanate-methyl. The active ingredient in Topsin M. {1}.

Thiram. Active ingredient in Charter PB, Raxil-Thiram and RTU-Vitavax-Thiram. {M3}.

Tilt® [propiconazole (3.6 lb ai/gal)]. Broad spectrum fungicide control of plant diseases in corn, soybean, sugarbeet and wheat. Syngenta. EPA Reg. No. 100-617. 2009. {3}.

Toledo® [tebuconazole (3.6 lb ai/gal)]. For control of specific diseases in corn, soybean, and wheat. Rotam North America, Inc. EPA Reg. No. 83100-183979. 05/05/2009. {3}.

Topguard® [flutriafol (1.04 lb ai/gal)]. For control of various foliar diseases in corn, soybean, and sugarbeet. Cheminova. EPA Reg. No. 67760-75. {3}.

Topsin® 4.5FL [thiophanate-methyl (45% ai)]. For broad spectrum disease control in dry bean, soybean, and wheat. United Phosphorus, Inc. EPA Reg. No. 73545-13-70506. {1}.

Topsin® M [thiophanate-methyl (70% ai)]. For broad spectrum disease control in various crops including soybean. United Phosphorus, Inc. EPA Reg. No. 73545-11-70506. {1}.

Topsin® M WSB [thiophanate-methyl (70% ai)]. For foliar disease control in soybean. United Phosphorus, Inc. EPA Reg. No. 73545-16-70506. {1}.

Topsin® XTR2 [thiophanate-methyl (3.6 lb ai/gal) + tebuconazole (0.7 lb ai/gal)]. For broad spectrum disease control in dry bean, soybean, and wheat. United Phosphorus, Inc. EPA Reg. No. 73545-19-70506. {1 + 3}.

Trifloxystrobin. An active ingredient in Absolute, Acceleron DX-709, Stratego YLD, Trilex, and Trilex 2000. {11}.

Trilex® [trifloxystrobin (22%)]. Controls Rhizoctonia and Fusarium seedling diseases in corn, soybean, and edible beans. Bayer CropScience. EPA Reg. No. 264-989. 06/22/2007. {11}.

Trilex® 2000 [trifloxystrobin (0.64 lb/gal) + metalaxyl (0.51 lb/gal)]. Controls Rhizoctonia, Fusarium, and Pythium damping off diseases in corn, soybean, and edible beans. Bayer CropScience. EPA Reg. No. 264-1068. 06/12/2008. {11 + 4}.

Triticonazole. Active ingredient in Charter, Charter PB, and Charter F2. {3}.

Twinline® [pyraclostrobin (1.083 lb ai/gal) + metconazole (0.67 lb ai/gal)]. For use in disease control and plant health in wheat. BASF. EPA Reg. No. 7969-247. 2008. {11+3}.

Trivapro™A [benzovindiflupry (0.83 lb ai/gal)]. For disease control in corn, soybean, and wheat. Syngenta Crop Protection. EPA Reg. No. 100-1471. {7}.

Trivapro™B [propiconazole (1.02 lb ai/gal) + azoxystrobin (1.18 lb ai/gal)]. Broad spectrum fungicide for control of plant diseases in corn, soybean, and wheat. Syngenta. EPA Reg. No. 100-1324. {3 + 11}.

Disease Management Dictionary *(continued)*

UpShot™ Soybean Seed Treatment [thiamethoxam (2.17 lb ai/gal) + mefenoxam (0.33 lb ai/gal) + fludioxonil (0.11 lb ai/gal)]. For protection against damage from certain insects, seed-borne diseases and seedling diseases on soybean. FMC Corporation. EPA Reg. No. 100-1427-279. {Insecticide 4A + 4 + 12}.

Vertisan™ [penthiopyrad (1.67 lb ai/gal)]. For broad spectrum control of foliar and seed-borne fungal diseases in corn, dry bean, sorghum, soybean, sunflower, and wheat. DuPont. EPA Reg. No. 352-836. 02/29/2012. {7}.

Vibrance® [sedaxane (4.3 lb ai/gal)]. Seed treatment providing protection against seed decay and seedling blight and damping off caused by *Rhizoctonia solani* in various crops including corn, dry beans, soybean, and loose smut in wheat. Syngenta. EPA Reg. No. 100-1374. 2014. {7}.

Vibrance® Extreme [sedexane (0.115 lb ai/gal) + difenoconazole (0.552 lb ai/gal) + mefenoxam (0.138 lb ai/gal)]. Seed treatment providing protection against seed-borne, soil-borne, and early season foliar diseases in wheat. Syngenta. EPA Reg. No. 100-1382. 2012. {7 + 3 + 4}.

Vitavax®-34 [carboxin (34%)]. Registered to control certain smuts and bunts and other seedling diseases on barley, oats, wheat, triticale, corn, and soybeans. Chemtura. EPA Reg. No. 400-107. 2010. {7}.

Vitavax® CT [carboxin (5.7%) + thiram (5.7%)]. Ready-to-use formulation that controls various smuts, bunts, seed decays, and damping off on soybeans, barley, oats, wheat, and triticale. Helena. EPA Reg. No. 400-156-5905. 2002. {7 + M3}.

Warden® CX [thiamethoxam (1.9 lb ai/gal) + mefenoxam (0.57 lb ai/gal) + fludioxonil (0.09 lb ai/gal) + sedaxane (0.09 lb ai/gal)]. Provides protection against damping off and seed-borne rots due to *Pythium*, *Phytophthora*, *Fusarium*, and *Rhizoctonia*, and early season *Phytophthora* root rot in soybeans. WinField. EPA Reg. No. 100-1459-1381. {4 + 7 + 12}.

Warden® CZ [thiamethoxam (2.04 lb/gal) + mefenoxam (0.3 lb/gal) + fludioxonil (0.1 lb/gal)]. Seed treatment to protect soybeans from *Pythium*, *Phytophthora*, *Fusarium*, and *Rhizoctonia* seedling diseases and early season insects. Winfield Solutions, LLC. EPA Reg. No. 100-1283-1381. {Insecticide 4A + 4 + 12}.

Warden® RTA [mefenoxam (2.21%) + fludioxonil (0.72%)]. Registered for control of *Pythium*, *Phytophthora*, *Fusarium*, and *Rhizoctonia* seedling diseases in soybeans. Winfield Solutions, LLC. EPA Reg. No. 100-1146-1381. 09/2007. {4 + 12}.

Xanthion [*Bacillus subtilis* MBI 600]. A biofungicide for soilborne/seedling disease control and plant health used in-furrow corn (field and sweet). BASF. EPA Reg. No. 7969-368.

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Resources

Department of Entomology

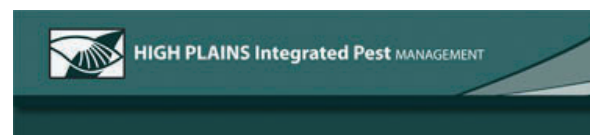
This UNL Department of Entomology Website provides information on insect management options for crops, links to UNL Extension publications, and includes light trap monitoring reports. It also offers information on UNL undergraduate and graduate degree programs including a distance-delivered masters degree in entomology.



<http://entomology.unl.edu>

High Plains Integrated Pest Management Guide for Colorado, Western Nebraska, Wyoming, Montana, and Western South Dakota

This guide, available at <http://highplainsipm.org>, provides current, effective management options for insect and other arthropod pests, weeds, and plant pathogens affecting all major field crops grown in Colorado, Montana, Wyoming, and western Nebraska. Chemical and non-chemical control practices, when available, are described in detail for individual pests and pathogens.



<http://highplainsipm.org>

Entomological Society of America

The Entomological Society of America (ESA) is the largest organization in the world serving the professional and scientific needs of entomologists and people in related disciplines. The Society publishes four internationally acclaimed scientific journals, an annual comprehensive collection of short reports on preliminary and routine screening tests for the management of arthropod pests, and American Entomologist, a colorful, quarterly magazine.



<http://entsoc.org>

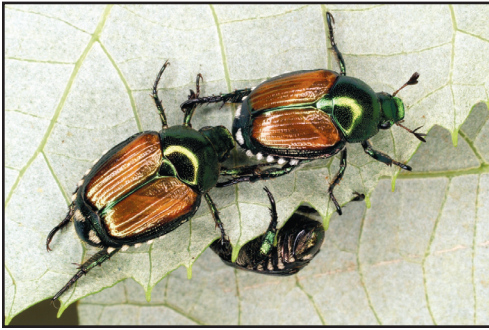
NCGA Insect Resistance Management Course

The Insect Resistance Management Learning Center (IRMLC) is a web-based tool developed by the National Corn Growers Association (NCGA) with support from leading ag biotechnology companies. The website offers information and training on insect resistance management (IRM), Compliance Assurance Program (CAP), integrated pest management (IPM), corn borer, and corn rootworm. Users who satisfactorily complete testing on individual sections can print out a certificate.

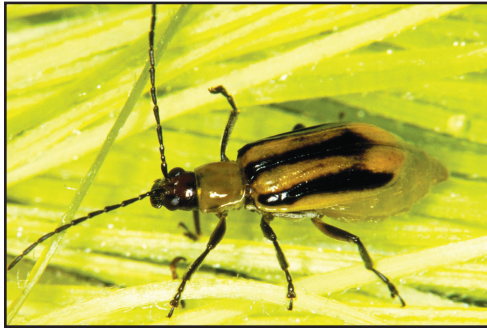
http://ncga.adayana.com/htmls/ncga_irm/htmls/mainmenu.htm

Insect Pests

Corn



Japanese Beetles



Western Corn Rootworm



Western Bean Cutworm Larva

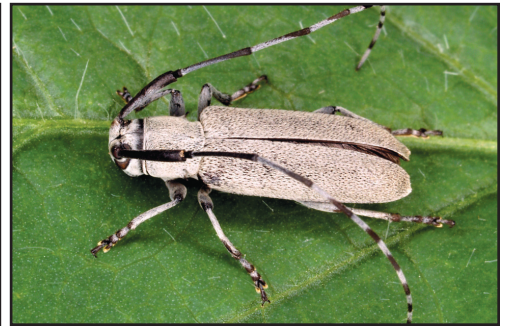
Soybeans



Brown Marmorated Stink Bug



Silverspotted Skipper Larva



Soybean Stem Borer

Wheat



Birdcherry Oat Aphid



Differential Grasshopper



Wheat Stem Sawfly

Alfalfa



Alfalfa Weevil Larva



Potato Leafhopper



Spotted Alfalfa Aphid

Source for all photos: UNL Department of Entomology

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Insecticides for Field Crops

Insect pest management includes several approaches — cultural practices (planting dates, harvest dates, tillage), resistant varieties, biological control, and insecticides. Regular monitoring (scouting) of fields is important to identify which insects are present and at what density and to determine the potential economic impact of pest populations and whether control measures will be cost effective.

Additional information and publications on crop insect identification and integrated pest management (IPM) practices for Nebraska can be found on the Web at CropWatch at <http://cropwatch.unl.edu> and at the UNL Department of Entomology at <http://entomology.unl.edu>

Information in the following tables provides a summary of label information for common insecticides for the control of insect and mite pests of field corn, soybeans, and wheat. Because of space considerations, all label information is not included. Always read and follow label instructions.

Insecticide Resistance Management

A key strategy to delay development of insecticide resistance is to avoid repeated applications of products with the same mode of action. See the table below on mode of action of common insecticides labeled for Nebraska field crops. This table includes a key to the mode of action code numbers used in the insecticide tables. It is based on information from the international Insecticide Resistance Action Committee (IRAC). A table showing modes of action of all commercially available insecticides is available at <http://www.irac-online.org/documents/moa-classification/?ext=pdf>.

Insecticide Mode of Action

Code Number*	Chemical Sub-group	Mode of Action	Site of Action
1A	carbamates	acetylcholine esterase inhibitors	nerve action
1B	organophosphate	acetylcholine esterase inhibitors	nerve action
2B	phenylpyrazoles (fiproles)	GABA-gated chloride channel antagonist	nerve action
3A	pyrethroids, pyrethrins	sodium channel modulators	nerve action
4A	neonicotinoids	nicotinic acetylcholine receptor agonists	nerve action
4C	sulfoxaflor	nicotinic acetylcholine receptor agonists	nerve action
4D	butenolides	nicotinic acetylcholine receptor agonists	nerve action
5	spinosyns	nicotinic acetylcholine receptor allosteric activators	nerve action
6	Avermectins	Chloride channel activators	nerve action
10A	clofentezine, hexythiazox	mite growth inhibitors	growth regulation
10B	etoxazole	mite growth inhibitors	growth regulation
11	<i>Bacillus thuringiensis</i> and the insecticidal proteins they produce	microbial disruptors of insect midgut membranes	insect midgut
12C	propargite	inhibitors of mitochondrial ATP synthase	energy metabolism
15	benzoylureas	inhibitors of chitin biosynthesis	growth regulation
18	diacylhydrazines	ecdysone receptor agonists	growth regulation
22A	indoxacarb	voltage-dependent sodium channel blockers	nerve action
23	tetronic and tetramic acid derivatives	inhibitors of acetyl CoA carboxylase	lipid synthesis, growth regulation
28	diamides	ryanodine receptor modulators	nerve and muscle action

*Based on international Insecticide Resistance Action Committee (IRAC) information on the Web at <http://www.irac-online.org>.

Alfalfa

Insecticides Listed By Active Ingredient

Class	Active ingredient(s)	Product/Trade Name(s)	Signal word	OMRI?	Restricted Use?	Application via		Re-Entry (hours)	Days to Harvest
						Air	Chemigation		
1A	Carbamates								
	Carbaryl	Carbaryl, Sevin	Caution	No	No	Yes	Yes	12	7
	Methomyl	Lannate LV	Danger	No	Yes	Yes	Yes	48	7
1B	Organophosphate								
	Chlorpyrifos	Lorsban Advanced, Lorsban 4E,	Warning	No	Yes	Yes	Yes	24	7, 14 or 21
		Nufos, Vulcan, Warhawk							(rate dependent)
		Lorsban 75WG	Warning	No	No	Yes	Yes	24	7, 14, or 21
	Dimethoate	Cygon, Dimethoate (several)	Warning	No	No	Yes	No	48	10
		Cygon LV, Dimethoate 400	Warning	No	No	Yes	Yes	48	10
	Malathion	Malathion (several)	Caution	No	No	No	Yes	12	0, 7
		Fyfanon ULV, Malathion ULV	Caution	No	No	Yes	No	12	0, 5, 10
	Phosmet	Imidan	Warning	No	No	Yes	Yes	120	7
3A	Pyrethroids/ pyrethrins								
	Alpha-cypermethrin	Fastac EC	Danger	No	Yes	Yes	Yes	12	3
	Beta-cyfluthrin	Baythroid XL	Warning	No	Yes	Yes	Yes	12	7
	Cyfluthrin	Renounce 20 WP	Caution	No	Yes	Yes	Yes	12	7
		Tombstone	Danger	No	Yes	Yes	Yes	12	7
		Tombstone Helios	Warning	No	Yes	Yes	Yes	12	7
	Gamma-cyhalothrin	Declare, Proaxis	Caution	No	Yes	Yes	Yes	24	1 forage, 7 hay
	Lambda-cyhalothrin	Paradigm	Caution	No	Yes	Yes	Yes	24	1 forage, 7 hay
		Silencer, Warrior, Warrior II	Warning	No	Yes	Yes	Yes	24	1 forage, 7 hay
	Permethrin	Permethrin	Caution	No	Yes	Yes	Yes	12	0, 14 above 0.1 lb ai
		Ambush, Pounce	Warning	No	Yes	Yes	Yes	12	0, 14 above 0.1 lb ai
	Zeta-cypermethrin	Mustang Maxx, Respect	Warning	No	Yes	Yes	Yes	12	3
4D	Butenolides								
	Flupyradifurone	Silvanto 200 SL	Caution	No	No	Yes	Yes	4	7
5	Spinosyn								
	Spinosad	Entrust SC	Caution	Yes	No	No	No	4	0 forage, 3 hay, fodder

Alfalfa

Insecticides Listed By Active Ingredient *(continued)*

Class	Active ingredient(s)	Product/Trade Name(s)	Signal word	OMRI?	Restricted Use?	Application via		Re-Entry (hours)	Days to Harvest
						Air	Chemigation		
11	subspecies = aizawai								
	Strain CG-91	Agree WG	Caution	Yes	No	Yes	Yes	4	0
	subspecies = kurstaki								
	strain SA-12	CoStar, Deliver	Caution	Yes	No	Yes	No	4	0
	strain SA-11	Javelin WG	Caution	Yes	No	Yes	No	4	0
	strain EG7841	Crymax WDG	Caution	No	No	Yes	No	4	0
18	Diacylhydrazine								
	Methoxyfenozide	Intrepid 2F, Troubadour	Caution	No	No	Yes	No	4	0 grazing
									7 hay
22	Indoxacarb								
	Indoxacarb	Steward	Caution	No	No	Yes	Yes	12	7
28	Diamide								
	Chlorantraniliprole	Prevathon	Caution	No	No	Yes	Yes	4	0
	Flubendiamide	Belt SC	Caution	No	No	Yes	Yes	12	0
Unclassified									
	Azadiractin	Neemix 4.5	Warning	Yes	No	Yes	Yes	4	0
Mixed									
1B + 3A	Chlorpyrifos +	Cobalt	Danger	No	Yes	Yes	Yes	24	7, 14 or 21
	gamma-cyhalothrin	Cobalt Advanced	Warning	No	Yes	Yes	Yes	24	(rate dependent)
1B + 3A	Chlorpyrifos +	Stallion	Warning	No	Yes	Yes	Yes	24	7
	zeta-cypermethrin								
3A + 28	Lambda-cyhalothrin +	Beseige	Warning	No	Yes	Yes	No	12	1 forage, 7 hay
	chlorantraniliprole	Volium Xpress	Warning	No	Yes	Yes	No	24	1 forage, 7 hay

Alfalfa

Forage or Hay Insecticides

Insecticide	Insects with Chewing Mouthparts												Insects with Piercing-Sucking Mouthparts					
	Alfalfa Caterpillar	Army Cutworm	Alfalfa Webworm	Alfalfa Weevil (Larvae)	Alfalfa Weevil (Adult)	Black Cutworm	Blister Beetle	Clover Root Curculio (Adult)	Garden Webworm	Grasshoppers	Green Cloverworm	Variagated Cutworm	Blue Alfalfa Aphid	Cowpea Aphid	Pea Aphid	Plant Bug	Potato Leafhopper	Spotted Alfalfa Aphid
Agree™ WG	X																	
Ambush®	X	X	X	X		X			X		X	X	X		X	X	X	X
Ambush® 25W	X	X	X	X		X			X		X	X	X		X	X	X	X
Baythroid® XL	X	X	X	X		X				X	X	X	X	X	X	X	X	
Besiege®	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Belt SC	X	X	X			X					X	X	X	X		X	X	X
BT sulfur 15-50 dust	X																	
Carbaryl 4L	X	X	X	X		X	X		X		X	X					X	
Cobalt™	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Cobalt™ Advanced	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
CoStar®	X										X							
Cygon™ LV										X			X	X	X	X	X	X
Declare®	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Dimethoate 2.67				X						X			X	X	X	X	X	X
Dimethoate 400				X						X			X	X	X	X	X	X
Entrust® SC		X	X			X			X			X					X	
Fastec EC	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Fyfanon® ULV Ag	X			X						X								
Imidan® 70W				X	X					X					X	X	X	
Intrepid® 2F	X		X						X									
Javelin® WG	X	X				X					X	X						
Lannate® LV	X			X								X	X	X	X			X
Lorsban® 4E	X	X	X	X	X	X				X		X	X	X	X	X	X	
Lorsban® 75WG				X	X					X			X		X	X	X	
Lorsban® Advanced	X	X	X	X	X	X				X		X	X	X	X	X	X	
Malathion 57EC				X						X					X		X	X
Malathion 8 Aquamul										X			X	X	X		X	X
Malathion 8E				X						X			X	X	X		X	X
Malathion ULV	X			X						X								
Mustang Maxx®	X	X	X	X		X			X	X	X	X	X		X	X	X	X
Neemix® 4.5																	X	
Nufos® 4E	X		X	X	X					X			X		X	X	X	
Paradigm™	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Permethrin	X	X	X	X		X			X		X	X	X		X	X	X	X
Pounce™ 25WP	X	X	X	X		X			X		X	X	X		X	X	X	X
Prevathon®	X																X	
Proaxis™	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X
Renounce® 20WP	X	X		X		X				X		X	X	X	X	X	X	
Respect®	X	X	X	X		X			X	X	X	X	X		X	X	X	X
Sevin® 80S	X	X	X	X		X	X		X		X	X					X	
Silencer®	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Silencer® VC	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Sivanto 200 SC													X	X	X	X	X	
Stallion™	X	X	X	X		X			X	X	X	X	X		X	X	X	X
Steward® EC	X			X													X	
Tombstone™	X	X		X		X				X	X	X	X	X	X	X	X	
Tombstone™ Helios	X	X		X		X				X	X	X	X	X	X	X	X	
Troubadour 2F	X	X	X						X									
Voliam Xpress®	X	X	X	X			X	X	X	X	X		X	X	X	X	X	X
Vulcan™	X	X	X	X	X	X				X		X	X	X	X	X	X	X
Warhawk®	X	X	X	X	X	X				X		X	X	X	X	X	X	
Warrior with Zeon Technology®	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X
Warrior II with Zeon Technology®	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X

X = insecticide labeled for control against this pest.

Alfalfa

Forage or Hay Insecticides

Insecticide Active Ingredient	Mode of Action	Target Pest	Rate	Comments*
Agree WG <i>Bacillus thuringiensis aizawai</i>	11	Alfalfa caterpillar	0.5-2.0 lb / A	REI is 4 hours. Use of a contact insecticide along with <i>Bt</i> product is recommended if 4th and 5th instar larvae are present.
Ambush** permethrin	3A	1. Alfalfa caterpillar, black cutworm, variegated cutworm, army cutworm, green cloverworm, alfalfa webworm, garden webworm, blue alfalfa aphid, pea aphid, spotted alfalfa aphid, potato leafhopper 2. Plant bugs, alfalfa weevil larvae	1. 3.2-12.8 oz / A 2. 6.4-12.8 oz / A	REI is 12 hours. PHI is 14 days when rates greater than 0.1 lb active ingredient are used. Do not apply to mixed stands with intentionally grown forage grasses. Do not apply more than 0.2 lb active ingredient per cutting. Avoid application when bees are actively foraging.
Ambush 25 W** permethrin	3A	1. Alfalfa caterpillar, black cutworm, variegated cutworm, army cutworm, green cloverworm, alfalfa webworm, garden webworm, blue alfalfa aphid, pea aphid, spotted alfalfa aphid, potato leafhopper 2. Plant bugs, alfalfa weevil larvae	1. 3.2-12.8 oz / A 2. 6.4-12.8 oz / A	REI is 12 hours. PHI is 14 days when rates greater than 0.1 lb active ingredient are used. Do not apply to mixed stands with intentionally grown forage grasses. Do not apply more than 0.2 lb active ingredient per cutting. Avoid application when bees are actively foraging.
Baythroid XL** beta-cyfluthrin	3A	1. Black cutworm, variegated cutworm, army cutworm, green cloverworm, potato leafhopper 2. Alfalfa caterpillar, alfalfa webworm, plant bugs, alfalfa weevil larvae 3. Grasshoppers 4. Blue alfalfa aphid, cowpea aphid, pea aphid	1. 0.8-1.6 oz / A 2. 1.6-2.8 oz / A 3. 2.0-2.8 oz / A 4. 2.8 oz / A	REI is 12 hours. PHI is 7 days. Maximum of 5.6 oz per cutting, and 22.4 oz / A for crop season. Allow at least 5 days between applications. Do not exceed 0.35 lb of active ingredient per season for cyfluthrin + beta-cyfluthrin products.
Belt SC Flubendiamide	28	Alfalfa caterpillar, armyworm, alfalfa looper, alfalfa webworm, cutworms, green cloverworm, loopers	2.0-4.0 fl. oz./acre	REI = 12 hours. PHI = 0 days Do not apply more than 4 fl. oz./cutting. Do not apply within 21 days of previous treatment. Do not apply more than 12 fl. oz./acre/year. May be applied through some irrigation systems. Minimum of 10 gpa by ground, 2 gpa by aerial application
Besiege** lambda-cyhalothrin + chlorantraniliprole	3A, 28	1. Alfalfa caterpillar, cutworms, green cloverworm, leafhoppers, loopers, webworms and threecornered alfalfa hoppers 2. Alfalfa weevil, aphids, armyworms, bean leaf beetle adults, blister beetles, grasshoppers, weevils, stinkbugs, clover root curculio (adult), stink bugs and various adult beetles.	1. 5-8 fl oz / A 2. 6-10 fl oz / A	REI is 24 hours. PHI is 1 day for forage, 7 days for hay. Make applications when bees are not foraging by applying during early morning or evening hours. Remove bee shelters during and for 2-3 days following application. Do not exceed a total of 31 fl oz/A of Besiege or 0.12 lb/A active ingredient of lambda-cyhalothrin-containing products or 0.2 lb/A active ingredient of chlorantraniliprole-containing products per year. Do not apply more than 10 fl oz/A of Besiege per cutting, nor more than 1 application per cutting. Apply in a minimum of 5 GPA by air and 10 GPA by ground.

*REI = Restricted Entry Interval PHI = Preharvest Interval

**Restricted Use Insecticide

Alfalfa

Forage or Hay Insecticides *(continued)*

Insecticide Active Ingredient	Mode of Action	Target Pest	Rate	Comments*
<i>BT</i> Sulfur 15-50 dust <i>Bacillus thuringiensis</i> <i>kurstaki</i>	11	Alfalfa caterpillar	1. 10.0-20.0 lb / A	REI is 24 hours. Use of a contact insecticide along with a <i>Bt</i> product is recommended if 4th and 5th instar larvae are present. Do not apply materials containing sulfur just prior to or during periods of excessively high temperatures or within 2 weeks of an oil spray.
Carbaryl 4L carbaryl	1A	1. Alfalfa weevil larvae 2. Blister beetles 3. Alfalfa caterpillar, green cloverworm, potato leafhopper 4. Black cutworm, variegated cutworm, army cutworm, alfalfa webworm, garden webworm	1. 24.0 oz / A 2. 16.0-32.0 oz / A 3. 32.0 oz / A 4. 32.0-48.0 oz / A	REI is 12 hours. PHI is 7 days. Do not apply more than once per cutting. Do not apply this product to crops or weeds in bloom.
Cobalt** chlorpyrifos + gamma-cyhalothrin	1B, 3A	1. Grasshoppers, potato leafhopper 2. Alfalfa caterpillar, black cutworm, variegated cutworm, army cutworm, green cloverworm, alfalfa webworm, garden webworm, blue alfalfa aphid, pea aphid 3. Cowpea aphid, plant bugs, alfalfa weevil adult, alfalfa weevil larvae, blister beetle, clover root curculios adult	1. 7.0-13.0 oz / A 2. 13.0-26.0 oz / A 3. 19.0-38.0 oz / A	REI is 24 hours. PHI is 7 days for less than 13.0 oz, 14 days for 13.0-26.0 oz, and 21 days for more than 26.0 oz. Do not apply if nearby bees are clustered outside hives and are actively foraging in the treated area. Do not irrigate within 24 hours of application. Do not exceed 0.06 lb of active ingredient per year for gamma cyhalothrin. Do not make a second application of a product containing chlorpyrifos within 10 days of first application.
Cobalt Advanced* chlorpyrifos + gamma-cyhalothrin	1B, 3A	1. Grasshoppers, potato leafhopper 2. Alfalfa caterpillar, black cutworm, variegated cutworm, army cutworm, green cloverworm, alfalfa webworm, garden webworm, blue alfalfa aphid, pea aphid 3. Cowpea aphid, plant bugs, alfalfa weevil adult, alfalfa weevil larvae, blister beetle, clover root curculios adult	1. 6.0-13.0 oz / A 2. 11.0-26.0 oz / A 3. 16.0-38.0 oz / A	REI is 24 hours. PHI is 7 days for less than 13.0 oz, 14 days for 13.0-26.0 oz, and 21 days for more than 26.0 oz. Do not apply if nearby bees are clustered outside hives and are actively foraging in the treated area. Do not irrigate within 24 hours of application. Do not exceed 0.06 lb of active ingredient per year for gamma cyhalothrin. Do not make a second application of a product containing chlorpyrifos within 10 days of first application.
Costar <i>Bacillus thuringiensis</i> <i>kurstaki</i>	11	Alfalfa caterpillar, green cloverworm	0.25-1.5 lb / A	REI is 4 hours. Use of a contact insecticide along with a <i>Bt</i> product is recommended if 4th and 5th instar larvae are present.
Cygon LV dimethoate	1B	Aphids, grasshoppers, leafhoppers, lygus bugs. Reduction of alfalfa weevil larvae	9.6-19.1 fl oz / A	REI is 48 hours. PHI is 10 days. Do not apply to alfalfa in bloom. Do not apply if bees are visiting areas to be treated when crop or weeds are in bloom. Make only one application per cutting. Make no more than 3 applications per year.

*REI = Restricted Entry Interval PHI = Preharvest Interval

**Restricted Use Insecticide

Alfalfa

Forage or Hay Insecticides *(continued)*

Insecticide Active Ingredient	Mode of Action	Target Pest	Rate	Comments*
Declare** Gamma-cyhalothrin	3A	1. Army cutworm 2. Alfalfa caterpillar, cutworms, green cloverworm, leafhoppers, loopers, threecornered alfalfa hopper, webworms 3. Alfalfa weevil, armyworm, bean leaf beetle, blister beetles, blue alfalfa aphid, clover leaf weevils, clover root curculios, cowpea aphid, grasshoppers, pea aphid, plant bugs (including Lygus), spotted alfalfa aphid, stinkbugs	1. 0.51-0.77 fl oz / A 2. 0.77-1.28 fl oz / A 3. 1.02-1.54 fl oz / A	REI is 24 hours. PHI is 1 day for forage, 7 days for hay. Apply only to fields planted to pure stands of alfalfa. Apply in a minimum of 2 gpa by air and 10 gpa by ground. Use higher gallons per acre when foliage is dense and/or pest populations are high. Avoid application when bees are actively foraging by applying during early morning or evening hours. Avoid direct application to bee shelters. It may be advisable to remove bee shelters during and for up to 2-3 days following application. Do not apply more than 0.015 lb active ingredient (0.096 pt) per acre per cutting. Do not apply more than 0.06 lb active ingredient (0.038 pint) per acre per year. If both gamma-cyhalothrin and lambda-cyhalothrin products are used on a crop during the same growing season, refer to charts found on labels for maximum total annual allowance of cyhalothrin-containing products.
Dimethoate 2.67 dimethoate	1B	Blue alfalfa aphid, cowpea aphid, pea aphid, spotted alfalfa aphid, plant bugs, potato leafhopper, alfalfa weevil adult, grasshoppers	12.0-20.0 oz / A	REI is 48 hours. PHI is 10 days. Do not apply if bees are actively visiting the field or if weeds or alfalfa are in bloom. Maximum of 0.5 lb active ingredient per year. Only one application of 2.67 EC per year is allowed.
Dimethoate 400 dimethoate	1B	Blue alfalfa aphid, cowpea aphid, pea aphid, spotted alfalfa aphid, plant bugs, potato leafhopper, alfalfa weevil adult, grasshoppers	8.0-16.0 oz / A	REI is 48 hours. PHI is 10 days. Do not apply if bees are actively visiting the field or if weeds or alfalfa are in bloom. Maximum of 0.5 lb active ingredient per year.
Entrust SC spinosyn	5	Alfalfa caterpillar, cutworms, loopers, webworms, armyworms	2-4 fl oz. / A	REI is 4 hours. PHI is 3 days for hay or fodder, 0 days forage. Do not apply more than 12 oz./acre/season. Do not apply cattle to graze until spray has dried.
Fastac EC** alpha-cypermethrin	3A	1: Alfalfa caterpillar, alfalfa weevil, aphids, cutworms, green cloverworms, potato leafhoppers, webworms 2. Armyworms, grasshoppers, plant bugs	1. 2.2-3.8 fl. oz. / A 2. 2.8-3.8 fl oz. / A	1. 2.2-3.8 fl. oz. / A 2. 2.8-3.8 fl oz. / A
Fyfanon ULV AG malathion	1B	Alfalfa caterpillars, western yellow striped armyworm, alfalfa weevil larvae, beet armyworms, grasshoppers	8 fl oz / A	REI is 12 hours. PHI is 0 days. Do not apply to alfalfa in bloom. For beet armyworm and alfalfa caterpillar control, apply when caterpillars are small. For alfalfa weevil larvae, apply when day temperature is expected to be above 65°F. Maximum of 2 applications per cutting, with minimum of 14 days between applications.

*REI = Restricted Entry Interval PHI = Preharvest Interval

**Restricted Use Insecticide

Alfalfa

Forage or Hay Insecticides *(continued)*

Insecticide Active Ingredient	Mode of Action	Target Pest	Rate	Comments*
Imidan 70 W phosmet	1B	Pea aphid, plant bugs, potato leafhopper, alfalfa weevil adult, alfalfa weevil larvae, grasshoppers	1.0-1.33 lb / A	REI is 5 days. PHI is 7 days. Do not apply more than once per cutting. Do not apply to alfalfa in bloom. Do not apply when bees are in the area. Do not use with latex- or pineolene-based adjuvants or any agricultural sticker or extender.
Intrepid 2F methoxyfenozide	18	Alfalfa caterpillar, alfalfa webworm, garden webworm	4.0-8.0 oz / A	REI is when dry. PHI is 7 days. No more than 1 application per cutting, 32.0 oz per year.
Javelin WG <i>Bacillus thuringiensis</i> <i>kurstaki</i> strain SA-11	11	Alfalfa caterpillar, black cutworm, variegated cutworm, army cutworm, green cloverworm	0.25-1.5 lb / A	REI is 4 hours. Use of a contact insecticide along with a <i>Bt</i> product is recommended if 4th and 5th instar larvae are present.
Lannate LV methomyl	1A	1. Variegated cutworm 2. Alfalfa caterpillar, blue alfalfa aphid, cowpea aphid, pea aphid, spotted alfalfa aphid 3. Alfalfa weevil larvae	1. 12.0-48.0 oz / A 2. 24.0-48.0 oz / A 3. 48.0 oz / A	REI is 48 hours. PHI is 7 days. Do not apply to dormant or semi-dormant alfalfa when minimum daily temperature is less than 50°F. Do not apply more than 12.0 pints or 10 applications of product per acre per crop.
Lorsban 4E chlorpyrifos	1B	1. Potato leafhopper, grasshoppers 2. Alfalfa caterpillar, black cutworm, variegated cutworm, army cutworm, blue alfalfa aphid, cowpea aphid, pea aphid, plant bugs, alfalfa weevil adult, alfalfa weevil larvae 3. Alfalfa webworm	1. 8.0-16.0 oz / A 2. 16.0-32.0 oz / A 3. 24.0 oz / A	REI is 24 hours. PHI is 7 days for less than 8.0 oz, 14 days for 8.0-16.0 oz, and 21 days for more than 16.0 oz / A. Do not make a second application of a product containing chlorpyrifos within 10 days of first application. One application per cutting, no more than 4 applications per acre per crop. Do not apply if nearby bees are clustered outside hives and are actively foraging in the treated area.
Lorsban 75 WG chlorpyrifos	1B	1. Potato leafhopper, grasshoppers 2. Blue alfalfa aphid, pea aphid, plant bugs, alfalfa weevil adult, alfalfa weevil larvae	1. 0.33-0.67 lb / A 2. 0.67-1.33 lb / A	REI is 24 hours. PHI is 7 days for less than 0.33 lb, 14 days for 0.33-0.67 lb, and 21 days for more than 0.67 lb / A. Do not make a second application of a product containing chlorpyrifos within 10 days of first application. One application per cutting, no more than 4 applications per acre per crop. Do not apply if nearby bees are clustered outside hives and are actively foraging in the treated area.
Lorsban® Advanced chlorpyrifos	1B	1. Potato leafhopper, grasshoppers 2. Alfalfa caterpillar, black cutworm, variegated cutworm, army cutworm, blue alfalfa aphid, cowpea aphid, pea aphid, plant bugs, alfalfa weevil adult, alfalfa weevil larvae 3. Alfalfa webworm	1. 8.0-16.0 oz / A 2. 16.0-32.0 oz / A 3. 24.0 oz / A	REI is 24 hours. PHI is 7 days for less than 8.0 oz, 14 days for 8.0-16.0 oz, and 21 days for more than 16.0 oz / A. Do not make a second application of a product containing chlorpyrifos within 10 days of first application. One application per cutting, no more than 4 applications per acre per crop. Do not apply if nearby bees are clustered outside hives and are actively foraging in the treated area.
Malathion 57 EC malathion	1B	Pea aphid, spotted alfalfa aphid, potato leafhopper, alfalfa weevil larvae, grasshoppers	20.0-36.0 oz / A	REI is 12 hours. Apply to alfalfa in bloom only when bees are not working in the field.
Malathion 8 Aquamul malathion	1B	Blue alfalfa aphid, cowpea aphid, pea aphid, spotted alfalfa aphid, potato leafhopper, grasshoppers	20-32 oz / A	REI is 12 hours. PHI is 7 days for rates greater than 24.0 oz / A. Apply to alfalfa in bloom only when bees are not working in the field.

*REI = Restricted Entry Interval PHI = Preharvest Interval

Alfalfa

Forage or Hay Insecticides *(continued)*

Insecticide Active Ingredient	Mode of Action	Target Pest	Rate	Comments*
Malathion 8E malathion	1B	Blue alfalfa aphid, cowpea aphid, pea aphid, spotted alfalfa aphid, potato leafhopper, alfalfa weevil larvae, grasshoppers	16.0-24.0 oz/A	REI is 12 hours. PHI is 7 days for rates greater than 24.0 oz/A. Apply to alfalfa in bloom only when bees are not working in the field.
Malathion ULV malathion	1B	1. Alfalfa caterpillar, grasshoppers 2. Alfalfa weevil larvae	1. 8 oz/A 2. 16 oz/A	REI is 12 hours. PHI is 0 days for 8.0 oz/A rate and 10 days for 16.0 oz/A rate. Apply to alfalfa in bloom only when bees are not working in the field.
Mustang Maxx** zeta-cypermethrin	3A	1. Alfalfa caterpillar, black cutworm, variegated cutworm, army cutworm, green cloverworm, alfalfa webworm, garden webworm, blue alfalfa aphid, pea aphid, spotted alfalfa aphid, potato leafhopper, alfalfa weevil larvae 2. Plant bugs, grasshoppers	1. 2.24-4.0 oz/A 2. 2.8-4.0 oz/A	REI is 12 hours. PHI is 3 days. Do not make applications less than 7 days apart. Do not apply more than 4.0 oz/A per cutting. Do not apply more than 12.0 oz/A per year.
Neemix 4.5 azadirachtin	U***	Potato leafhopper	7.0-16.0 oz/A	REI is 12 hours. Do not apply when weather conditions favor drift or likelihood of runoff is high.
Nufos 4E chlorpyrifos	1B	1. Corn rootworm adults, grasshoppers, leafhoppers 2. Alfalfa caterpillar, alfalfa weevil adults and larvae, armyworms, blue alfalfa aphid, cowpea aphid, pea aphid, cutworms, plant bugs, (suppression of spotted alfalfa aphid)	1. 8-16 fl oz/A 2. 16-32 fl oz/A	REI is 24 hours. PHI is 7 days for 8.0 fl oz, 14 days for 16.0 fl oz, 21 days for more than 16.0 fl oz. Highly toxic to bees exposed to direct treatment on alfalfa. Do not apply if nearby bees are clustered outside of hives and bees are foraging in the treated areas. Do not flood irrigate within 24 hours following application of Nufos 4E to avoid contamination of irrigation tail waters. Do not make more than 4 applications per season of products containing chlorpyrifos, or apply such products more than once per cutting. Do not make a second application of a product containing chlorpyrifos within 10 days of first application.
Paradigm** lambda-cyhalothrin	3A	1. Alfalfa caterpillar, army cutworm, black cutworm, variegated cutworm, green cloverworm, alfalfa webworm, garden webworm, potato leafhopper 2. Blue alfalfa aphid, cowpea aphid, pea aphid, spotted alfalfa aphid, plant bugs, alfalfa weevil larvae, blister beetle, clover root curculio adult, grasshoppers	1. 1.92-3.2 oz/A 2. 2.56-3.84 oz/A	REI is 24 hours. PHI is 1 day for forage and 7 days for hay harvest. Do not apply more than 3.84 oz/A per cutting or more than 15.36 oz/A per year. Do not apply when bees are actively foraging.
Permethrin** permethrin	3A	1. Alfalfa caterpillar, black cutworm, variegated cutworm, army cutworm, green cloverworm, alfalfa webworm, garden webworm, blue alfalfa aphid, pea aphid, spotted alfalfa aphid 2. Plant bugs, potato leafhopper, alfalfa weevil larvae	1. 2.0-8.0 oz/A 2. 4.0-8.0 oz/A	REI is 12 hours. PHI is 14 days when rates greater than 0.1 lb active ingredient are used. Do not apply to mixed stands with intentionally grown forage grasses. Do not apply more than 0.2 lb active ingredient per cutting. Avoid application when bees are actively foraging.

*REI = Restricted Entry Interval PHI = Preharvest Interval

**Restricted Use Insecticide

***Unclassified

Alfalfa

Forage or Hay Insecticides *(continued)*

Insecticide Active Ingredient	Mode of Action	Target Pest	Rate	Comments*
Pounce 25WP** permethrin	3A	1. Alfalfa caterpillar, black cutworm, variegated cutworm, army cutworm, green cloverworm, alfalfa webworm, garden webworm, blue alfalfa aphid, pea aphid, spotted alfalfa aphid 2. Plant bugs, potato leafhopper, alfalfa weevil larvae	1. 3.2-12.8 oz/A 2. 6.4-12.8 oz/A	REI is 12 hours. PHI is 14 days when rates greater than 0.1 lb active ingredient are used. Do not apply to mixed stands with intentionally grown forage grasses. Do not apply more than 0.2 lb active ingredient per cutting. Avoid application when bees are actively foraging.
Prevathon chlorantraniliprole	28	1. Alfalfa caterpillar, armyworms, loopers 2. Grasshoppers	1. 14-20 oz./A 2. 8-20 oz./A	REI is 4 hours. PHI is 0 days. Do not apply more than 0.2 lb active ingredient of chlorantraniliprole containing products/acre/year. For best grasshopper control, add methylated seed oil adjuvant at 1% v/v and when majority of nymphs are 2nd-3rd instars. Make only one application/cutting.
Proaxis** gamma-cyhalothrin	3A	1. Alfalfa caterpillar, black cutworm, variegated cutworm, army cutworm, green cloverworm, alfalfa webworm, garden webworm, potato leafhopper 2. Blue alfalfa aphid, cowpea aphid, pea aphid, spotted alfalfa aphid, plant bugs, alfalfa weevil larvae, blister beetle, clover root curculios adult	1. 1.92-3.2 oz/A 2. 2.56-3.84 oz/A	REI is 24 hours. PHI is 1 day for forage and 7 days for hay. Do not apply more than 0.24 pt per cutting or 0.96 pt/A per year. Apply only to fields planted to pure stands of alfalfa. Avoid application when bees are actively foraging.
Renounce®20WP** cyfluthrin	3A	1. Black cutworm, variegated cutworm, army cutworm 2. Alfalfa caterpillar, alfalfa weevil larvae, plant bugs 3. Grasshoppers 4. Blue alfalfa aphid, cowpea aphid, pea aphid	1. 1.0-2.0 oz/A 2. 2.0-3.5 oz/A 3. 2.5-3.5 oz/A 4. 3.5 oz/A	REI is 12 hours. PHI is 7 days. Do not exceed 0.35 lb of active ingredient per season. Do not apply more than 7.0 oz per cutting/A, 28.0 oz/A per year. Do not apply to alfalfa stands with intentionally grown forage grasses.
Respect** zeta-cypermethrin	3A	1. Alfalfa caterpillar, black cutworm, variegated cutworm, army cutworm, green cloverworm, alfalfa webworm, garden webworm, blue alfalfa aphid, pea aphid, spotted alfalfa aphid, potato leafhopper, alfalfa weevil larvae 2. Plant bugs, grasshoppers	1. 2.24-4.0 oz/A 2. 2.8-4.0 oz/A	REI is 12 hours. PHI is 3 days. Do not make applications less than 7 days apart. Do not apply more than 4.0 oz/A per cutting. Do not apply more than 12.0 oz/A per year.
Sevin 80S carbaryl	1A	1. Blister beetle 2. Alfalfa caterpillar, green cloverworm, potato leafhopper 3. Black cutworm, variegated cutworm, army cutworm, alfalfa webworm, garden webworm 4. Alfalfa weevil larvae	1. 0.625-1.25 lb/A 2. 1.25 lb/A 3. 1.25-1.625 lb/A 4. 1.875 lb/A	REI is 12 hours. PHI is 7 days. Do not apply more than once per cutting. Do not apply this product to crops or weeds in bloom.
Silencer** lambda-cyhalothrin	3A	1. Alfalfa caterpillar, army cutworm, black cutworm, variegated cutworm, green cloverworm, alfalfa webworm, garden webworm, potato leafhopper 2. Blue alfalfa aphid, cowpea aphid, pea aphid, spotted alfalfa aphid, plant bugs, alfalfa weevil larvae, blister beetle, clover root curculio adult, grasshoppers	1. 1.92-3.2 oz/A 2. 2.56-3.84 oz/A	REI is 24 hours. PHI is 1 day for forage and 7 days for hay harvest. Do not apply more than 3.84 oz/A per cutting or more than 15.36 oz/A per year. Do not apply when bees are actively foraging.

*REI = Restricted Entry Interval PHI = Preharvest Interval

**Restricted Use Insecticide

Alfalfa

Forage or Hay Insecticides *(continued)*

Insecticide Active Ingredient	Mode of Action	Target Pest	Rate	Comments*
Silencer VC** lambda-cyhalothrin	3A	1. Alfalfa caterpillar, army cutworm, black cutworm, variegated cutworm, green cloverworm, alfalfa webworm, garden webworm, potato leafhopper 2. Blue alfalfa aphid, cowpea aphid, pea aphid, spotted alfalfa aphid, plant bugs, alfalfa weevil larvae, blister beetle, clover root curculio adult, grasshoppers	1. 1.92-3.2 oz./A 2. 2.56-3.84 oz./A	REI is 24 hours. PHI is 1 day for forage and 7 days for hay harvest. Do not apply more than 3.84 oz./A per cutting or more than 15.36 oz./A per year. Do not apply when bees are actively foraging.
Sivanto 200 SL flupyradiflurone	4D	1. Aphids, leafhoppers 2. Threecornered alfalfa hopper, whiteflies	7.0-10.5 fl. oz./acre 10.5-14 fl. oz./acre	REI = 4 hours. PHI = 7 days Do not apply within 10 days of previous treatment. Do not apply more than 28 fl. oz./acre/year. May be applied through some irrigation systems. Minimum of 10 gpa by ground, 2 gpa by aerial application
Stallion** chlorpyrifos + zeta-cypermethrin	1B, 3A	1. Black cutworm, variegated cutworm, army cutworm 2. Alfalfa caterpillar, green cloverworm, alfalfa webworm, garden webworm, potato leafhopper 3. Blue alfalfa aphid, pea aphid, spotted alfalfa aphid, alfalfa weevil larvae, grasshoppers 4. Plant bugs	1. 2.5-11.75 oz./A 2. 5.0-11.75 oz./A 3. 9.25-11.75 oz./A 4. 11.75 oz./A	REI is 24 hours. PHI is 7 days. Do not make applications less than 10 days apart. Do not make more than 4 applications per season or apply more than once per cutting. Do not apply if bees are actively foraging in the treated area.
Steward EC indoxacarb	22	1. Grasshoppers 2. Alfalfa caterpillar, alfalfa weevil larvae, granulate cutworm 3. Western yellow striped armyworm, suppression of potato leafhoppers.	1. 4.6-11.3 oz./A 2. 6.7-11.3 oz./A 3. 9.2-11.3 oz./A	REI is 12 hours. PHI is 7 days. Do not apply more than 11.3 oz./A per cutting or 45.0 oz./A per year.
Tombstone** cyfluthrin	3A	1. Black cutworm, variegated cutworm, army cutworm, green cloverworm, potato leafhopper 2. Alfalfa caterpillar, plant bugs, alfalfa weevil larvae 3. Grasshoppers 4. Blue alfalfa aphid, cowpea aphid, pea aphid	1. 0.8-1.6 oz./A 2. 1.6-2.8 oz./A 3. 2.0-2.8 oz./A 4. 2.8 oz./A	REI is 12 hours. PHI is 7 days. Do not apply more than 3.2 oz per cutting/A, 12.8 oz./A per year. Do not apply to alfalfa stands with intentionally grown forage grasses.
Tombstone Helios** cyfluthrin	3A	1. Black cutworm, variegated cutworm, army cutworm, green cloverworm, potato leafhopper 2. Alfalfa caterpillar, plant bugs, alfalfa weevil larvae 3. Grasshoppers 4. Blue alfalfa aphid, cowpea aphid, pea aphid	1. 0.8-1.6 oz./A 2. 1.6-2.8 oz./A 3. 2.0-2.8 oz./A 4. 2.8 oz./A	REI is 12 hours. PHI is 7 days. Do not apply more than 3.2 oz./A per cutting, 12.8 oz./A per year. Do not apply to alfalfa stands with intentionally grown forage grasses.
Troubadour 2F methoxyfenozide	18	Armyworms, alfalfa caterpillars, alfalfa loopers, webworms	4.0-8.0 fl. oz./acre	REI = 4 hours PHI = 0 days for grazing, 7 days for hay harvest Do not apply more than 32 fl oz./year. Do not make more than 1 application/ cutting. Apply in a minimum of 10 gpa by ground, 5 gpa by air.

*REI = Restricted Entry Interval PHI = Preharvest Interval

**Restricted Use Insecticide

Alfalfa

Forage or Hay Insecticides *(continued)*

Insecticide Active Ingredient	Mode of Action	Target Pest	Rate	Comments*
Voliam Xpress** lambda-cyhalothrin + chlorantraniliprole	3A, 28	1. Alfalfa caterpillar, army cutworm, green cloverworm, alfalfa web- worm, garden webworm, potato leafhopper 2. Blue alfalfa aphid, cowpea aphid, pea aphid, spotted alfalfa aphid, plant bugs, alfalfa weevil larvae, blister beetle, clover root curculios adult, grasshoppers	1. 5.0-8.0 oz / A 2. 6.0-9.0 oz / A	REI is 24 hours. Do not apply more than 9.0 oz / A per cutting or 31.0 oz / A per year. Do not exceed 0.12 lb ai / A of lambda-cyhalothrin or 0.2 lb ai of chlorantraniliprole-containing products per acre per growing season.
Vulcan chlorpyrifos	1B	1. Grasshoppers, leafhoppers 2. Alfalfa caterpillar, alfalfa weevil (adults and larvae), armyworms, blue alfalfa aphid, cutworms, pea aphid, plant bugs, spotted alfalfa aphid 3. Alfalfa webworm	1. 8.0-16.0 oz / A 2. 16.0-32.0 oz / A 3. 24.0 oz / A	REI is 24 hours. PHI is 7 days after application of 8.0 oz / A, 14 days after application of 16.0 oz / A, and 21 days if rate is above 16.0 oz / A. Do not make more than four applications of products containing chlorpyrifos per year, or apply more than once per cutting. Do not make a second application within 10 days of first application. Do not apply if bees are clustered outside of hives and are foraging.
Warhawk chlorpyrifos	1B	1. Potato leafhopper, grasshoppers 2. Alfalfa caterpillar, black cutworm, variegated cutworm, army cut- worm, blue alfalfa aphid, cowpea aphid, pea aphid, plant bugs, alfalfa weevil adult, alfalfa weevil larvae 3. Alfalfa webworm	1. 8-16 oz / A 2. 16-32 oz / A 3. 24 oz / A	REI is 24 hours. PHI is 7 days for less than 8.0 oz, 14 days for 8.0-16.0 oz, and 21 days for more than 16.0 oz / A. Do not make a second application of a product containing chlorpyrifos within 10 days of first application. One application per cutting, no more than 4 applications per acre per crop. Do not apply if nearby bees are clustered outside hives and are actively foraging in the treated area.
Warrior with Zeon Technology** lambda-cyhalothrin	3A	1. Alfalfa caterpillar, black cut- worm, variegated cutworm, army cutworm, green cloverworm, alfalfa webworm, garden webworm, po- tato leafhopper 2. Blue alfalfa aphid, cowpea aphid, pea aphid, spotted alfalfa aphid, plant bugs, alfalfa weevil larvae, blister beetle, clover root curculios adult, grasshoppers	1. 1.92-3.2 oz / A 2. 2.56-3.84 oz / A	REI is 24 hours. PHI is 1 day for forage and 7 days for hay. Do not apply more than 0.03 lb ai / A per cutting or 0.12 lb ai / A per year. Do not make applica- tions when bees are actively foraging.
Warrior II with Zeon Technology** lambda-cyhalothrin	3A	1. Alfalfa caterpillar, black cut- worm, variegated cutworm, army cutworm, green cloverworm, alfalfa webworm, garden webworm, po- tato leafhopper 2. Blue alfalfa aphid, cowpea aphid, pea aphid, spotted alfalfa aphid, plant bugs, alfalfa weevil larvae, blister beetle, clover root curculios adult, grasshoppers	1. 0.96-1.6 oz / A 2. 1.28-1.92 oz / A	REI is 24 hours. PHI is 1 day for forage and 7 days for hay. Do not apply more than 0.03 lb ai / A per cutting or 0.12 lb ai / A per year. Do not make applica- tions when bees are actively foraging.

*REI = Restricted Entry Interval PHI = Preharvest Interval

**Restricted Use Insecticide

Corn

Seed, Soil, and Foliar Insecticides

Insecticide	Armyworm	Chinch Bug	Common Stalk Borer	Corn Flea Beetle	Corn Leaf Aphid	Corn Rootworm Larvae	Corn Rootworm Adult	European Corn Borer	Grasshopper	Soil Cutworm	Spider Mite	Western Bean Cutworm	White Grubs	Wireworm
Seed Treatment														
Avicta Complete Corn		X		X									X	X
Cruiser 5FS		X		X	X	X				X			X	X
Gaucha 600		X				X							X	X
Lumivia													X	X
Poncho 600		X		X		X				X			X	X
Poncho/VOTIVO		X		X	X					X			X	X
Soil-Applied														
Aztec HC						X				X			X	X
Aztec 4.67G						X				X			X	X
Bifenture 2E, Brigade, Discipline 2E, Sniper 2E, Tundra 2EC						X				X			X	X
Capture LFR, Capture 3RIVE 3D, Ethos XB	X					X				X			X	X
Counter 20G				X		X				X			X	X
Defcon 2.1G						X				X			X	X
Force 3G						X				X			X	X
Force CS						X				X			X	X
Hero EC										X			X	X
Lorsban 15G						X		X					X	X
Mustang Maxx										X			X	X
Pounce 1.5G						X				X				X
SmartChoice 5G						X				X			X	X
Thimet 20G				X		X							X	X
Foliar-Applied														
Ambush 2EC	X		X	X			X	X		X		X		
Arctic EC	X		X	X			X	X		X		X		
Asana XL	X	X	X	X	X		X	X	X	X		X		
Baythroid XL		X	X	X			X	X	X	X		X		
Belt SC	X						X	X	X	X		X		
Bifenture 2E, Brigade 2EC, Discipline 2E, Sniper 2E, Tundra 2EC	X	X	X	X	X		X	X	X		X	X		
Cobalt, Cobalt Advanced	X	X	X	X	X		X	X	X	X		X		X
Comite II											X			
Coragen								X				X		
Delta Gold	X	X	X	X			X	X	X	X		X		
Dimate 4E, Dimethoate					X		X		X		X			
DiPel ES	X													
Govern 4E, Hatchet 4E, Lorsban 4E, Warhawk 4E, Yuma 4E	X	X	X	X	X	X	X	X	X	X	X	X		
Hero	X	X	X	X	X		X	X	X	X	X	X		
Intrepid 2F	X							X				X		
Lannate LV	X		X		X		X	X				X		
Lorsban 15G						X		X						X
Malathion 57EC	X				X		X		X					
Methyl 4EC	X				X		X		X	X				
Mustang Maxx	X	X	X	X	X		X	X	X	X		X		
Oberon 2SC											X			
Onager											X			
PennCap-M	X			X	X		X	X	X	X		X		
Prevathon								X	X			X		
Proaxis		X		X	X		X	X	X	X		X		
Radiant SC	X							X				X		
Respect	X	X	X	X	X		X	X	X	X		X		
Sevin XLR Plus	X	X		X			X	X	X	X		X		
Sivanto 200 SL					X									
SmartChoice						X				X			X	X
Stallion	X	X	X	X	X	X				X		X		
Swagger	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Tracer	X							X	X			X		
Tundra					X	X				X			X	X
Warrior II with Zeon Technology, Lambda Cy Ec, Taiga Z	X	X	X	X			X	X	X	X		X	X	X
Zeal											X			

X = insecticide labeled for control against this pest.

Field Corn

Seed, Soil, and Foliar Insecticides

Insecticide Active Ingredient	Mode of Action	Target Pest	Rate	Comments*
Ambush 2EC permethrin	3A	1. Western bean cutworm 2. Armyworm, fall armyworm, cutworm, European corn borer, flea beetle, corn earworm, corn rootworm beetle, stalk borer	1. 3.2-6.4 fl oz/A 2. 6.4-12.8 fl oz/A	REI is 12 hours. Do not apply within 30 days of harvest of grain or fodder.
Arctic EC permethrin	3A	1. Western bean cutworm 2. Armyworm, fall armyworm, European corn borer, corn earworm, corn rootworm beetle, cutworm, flea beetle, stalk borers	1. 2.0-4.0 fl oz/A 2. 4.0-6.0 fl oz/A	REI is 12 hours. Do not apply within 30 days of harvest of grain or fodder.
Asana XL esfenvalerate	3A	1. Western bean cutworm 2. Armyworm, black cutworm, chinch bug, corn leaf aphid, corn rootworm (adult control), cutworm, flea beetle, grasshopper, stalk borer 3. European corn borer	1. 2.9-5.8 fl oz/A 2. 5.8-9.6 fl oz/A 3. 7.8-9.6 fl oz/A	PHI is 21 days. Do not apply more than 0.25 lb ai per acre per season. Do not enter or allow worker entry into treated areas during the REI of 12 hours.
Avicta Complete Corn thiamethoxam	4A	Wireworm, white grub, seed corn beetle, chinch bug, southern corn leaf beetle, seed corn maggot, corn flea beetle, grape colaspis	0.5 mg ai/kernel	
Aztec HC tebuprimifos + cyfluthrin	1B, 3A	Corn rootworm larvae, cutworm, wireworm, seedcorn maggot, seed-corn beetle, white grub	1.5 ounces/1000 row-ft	REI is 48 hours (72 hours where average rainfall is less than 25 inches per year). T-band or in-furrow application. Apply with SmartBox system.
Aztec 4.67 G tebuprimifos + cyfluthrin	1B, 3A	Corn rootworm larvae, cutworm, wireworm, seedcorn maggot, seed-corn beetle, white grub	3.0 ounces/1000 row-ft	REI is 48 hours (72 hours where average rainfall is less than 25 inches per year). T-band or in-furrow application. Apply with either SmartBox or mechanical system. (Aztec 4.67G is available in 50 lb bag).
Ballista LFC lambda-cyhalothrin	3A	Corn rootworm larvae, seedcorn beetle, seedcorn maggot, white grub, wireworm	11.5 fl oz per acre (0.66 fl oz per 1000 row-ft) may be applied in furrow or as T-band application	
Baythroid XL beta-cyfluthrin	3A	1. Black cutworm, corn flea beetle 2. Chinch bug, corn rootworm adult, European corn borer, stalk borer, western bean cutworm 3. Grasshopper	1. 0.8-1.6 fl oz/A 2. 1.6-2.8 fl oz/A 3. 2.1-2.8 fl oz/A	REI is 12 hours. PHI for grain or fodder is 21 days. Maximum of 4 applications per crop season.
Belt SC flubendiamide	28	Armyworm, fall armyworm, black cutworm, European corn borer, western bean cutworm	2.0-3.0 fl oz/A	REI is 12 hours.
Brigade 2EC bifenthrin	3A	1. Corn rootworm larvae 2. Cutworms, wireworm, seed corn maggot, seed corn beetle, white grubs 3. Aphids, army cutworm, chinch bug, common stalk borer, corn earworm, corn rootworm adults, cutworm species, European corn borer, fall armyworm, flea beetle, grasshoppers, greenbug, southern corn leaf beetle, stink bugs, armyworm species, western bean cutworm 4. Banks grass mite, twospotted spider mite	1. 0.30 oz/1000 row-ft 2. 0.15-0.30 oz/1000 row-ft 3. 2.1-6.4 fl oz/A 4. 5.12-6.4 fl oz/A	1 and 2. Apply as a 5- to 7-inch T-band treatment over an open seed furrow. Position spray nozzle behind the planter shoe, in front of the press wheel centered over the row. 2. Use highest rate under heavy insect pressure. Do not apply within 30 days of harvest. Do not graze livestock or cut crops for feed within 30 days of last application.
Capture LFR bifenthrin	3A	1. Corn rootworm larvae 2. Wireworm, grub, seedcorn maggot, root aphid	1. 0.39-0.98 fl oz/1000 row-ft 2. 0.2-0.78 fl oz/1000 row-ft	Apply as a 5-7 inch band (T-band) over an open furrow, or in-furrow with the seed. REI is 12 hours.

*REI = Restricted Entry Interval PHI = Preharvest Interval

Field Corn

Seed, Soil, and Foliar Insecticides *(continued)*

Insecticide Active Ingredient	Mode of Action	Target Pest	Rate	Comments*
Cobalt chlorpyrifos + gamma-cyhalothrin	1B, 3A	1. White grub, seed corn beetle, seed corn maggot and wireworm 2. Cutworm 3. Grasshopper 4. Aphid, armyworm, corn rootworm adult, cutworm, flea beetle adult 5. Chinch bug, European corn borer, stalk borer, southern corn leaf beetle, western bean cutworm	1. 2.87 fl oz/1000 row-ft (T-band) 2. 1.89 fl oz/1000 row-ft (T-band) 3. 7.0-13.0 fl oz/A 4. 13.0-26.0 fl oz/A 5. 19.0-38.0 fl oz/A	REI is 24 hours unless wearing PPE required for early entry. Do not apply within 21 days before harvest of grain or ears. Do not allow meat or dairy animals to graze treated areas. Do not harvest treated corn silage as feed for meat or dairy animals within 14 days after last treatment.
Cobalt Advanced chlorpyrifos + gamma cyhalothrin	1B, 3A	1. White grub, seed corn beetle, seed corn maggot and wireworm 2. Cutworm 3. Grasshopper 4. Aphid, armyworm, corn rootworm adult, cutworm, flea beetle adult 5. Chinch bug, European corn borer, stalk borer, southern corn leaf beetle, western bean cutworm 6. billbugs, common stalk borer, corn rootworm larvae, Japanese beetle adult	1. 2.87 fl oz/1000 row-ft (T-band) 2. 1.89 fl oz/1000 row-ft (T-band) 3. 6.0-13.0 fl oz /A 4. 11.0-26.0 fl oz/A 5. 16.0-38.0 fl oz/A 6. 32.0-42.0 fl oz/A	REI is 24 hours unless wearing PPE required for early entry. Do not apply within 21 days before harvest of grain or ears.
Comite II propargite	12C	Twospotted spider mite, Banks grass mite	2 1/4- 3 3/8 pt/A	REI is 7 days. PHI is 30 days. Apply 1 time per year.
Coragen chlorantraniliprole	28	Corn earworm, European corn borer, fall armyworm, western bean cutworm	3.5-5.0 fl oz/A	PHI is 14 days. REI is 4 hours.
Counter 15G terbufos	1B	1. Corn rootworm, wireworm, white grub, seedcorn maggot, seedcorn beetle, corn flea beetle, maize billbug, southern corn billbug 2. Corn rootworm	1. At planting; 6.0-8.0 oz per 1000 row-ft applied banded or in-furrow 2. Cultivation time; 8.0 oz per 1000 row-ft	REI is 48 hours (72 hours where average rainfall is less than 25 inches a year). If application is made at planting, do not make postemergence or cultivation time treatments.
Cruiser 5FS thiamethoxam	4A	1. Wireworm, seedcorn maggot, southern corn leaf beetle, chinch bug, corn flea beetle, grape colaspis, white grub, black cutworm, thrip, southern green stink bug, seedcorn beetle, and corn leaf aphid 2. Corn rootworm larvae and billbug	1. 0.125-0.80 mg ai/kernel 2. 1.25 mg ai/kernel	REI is 12 hours. Treated seeds exposed on soil surface may be hazardous to wildlife. Cover or collect treated seeds spilled during loading. Dispose of all excess treated seed. Leftover treated seed may be doublesown around the headland or buried away from water sources in accordance with local requirements. Do not contaminate water bodies when disposing of planting equipment wash water. Do not make any soil or foliar application of products containing thiamethoxam to crops grown from seed treated with Cruiser (thiamethoxam).

*REI = Restricted Entry Interval PHI = Preharvest Interval

Field Corn

Seed, Soil, and Foliar Insecticides *(continued)*

Insecticide Active Ingredient	Mode of Action	Target Pest	Rate	Comments*
Declare Gamma-cyhalothrin	3A	(Planting time) 1. Corn rootworm larvae, cutworm spp., seedcorn beetle, seedcorn maggot, white grub spp. (Foliar applications) 1. Corn earworm, cutworms, western bean cutworm 2. European corn borer, fall armyworm, flea beetle, grasshopper spp., Japanese beetle adult, corn rootworm adult, stalk borer, stink bug spp., yellow striped armyworm 3. Beet armyworm, chinch bug	1. 0.26 fl oz per 1000 row-ft 1. 0.77-1.28 fl oz per acre 2. 1.02-1.54 fl oz per acre 3. 1.54 fl oz per acre	PHI is 21 days for grain, livestock grazing or silage harvest. PHI is 21 days.
Defcon 2.1G phosphorothionate + cyfluthrin	1B, 3A	Corn rootworm larvae, cutworm, wireworm, seedcorn maggot, seedcorn beetle, white grub	6.7 oz/1000 row-ft	May be applied as band, T-band, or in-furrow at planting. REI is 48 hours (72 hours for areas with annual average rainfall less than 25 inches).
Delta Gold deltamethrin	3A	1. Cutworm, grasshopper, flea beetle 2. Armyworm, chinch bug, corn earworm, corn rootworm adult, European corn borer, stalk borer, stink bugs, webworm	1. 1.0-1.5 fl oz/A 2. 1.5-1.9 fl oz/A	REI is 12 hours. Do not apply within 21 days of harvest for grain or fodder, or within 12 days of cutting or grazing for forage.
Dimethoate 4E dimethoate	1B	1. Banks grass mite, twospotted spider mite, aphid 2. Grasshopper	1. 2/3-1.0 pt/A 2. 1.0 pt/A	REI is 48 hours. PHI is 14 days. Do not apply more than three times per year. Do not feed or graze within 14 days of last application. Do not apply to corn during the pollen-shed period if bees are present.
DiPel ES and others <i>Bacillus thuringiensis</i>	11	European corn borer, corn earworm, variegated cutworm, webworm, armyworm	See product label	See product label.
Fortress 3G tefluthrin	3A	1. Corn rootworm, cutworm, seedcorn maggot, seedcorn beetle, lesser cornstalk borer, white grub, wireworm 2. Corn rootworm, seedcorn beetle, seedcorn maggot, white grub, wireworm	1. 4.0-5.0 oz/1000 row-ft, Banded, T-banded or in-furrow 2. 4.0-5.0 oz/1000 row-ft at cultivation within 30 days of seedling emergence 0.46-0.57 fl oz/1000 row-ft	REI is 0 hours. Runoff from treated areas may be hazardous to aquatic organisms in adjacent aquatic sites. Do not apply this product within 20 yards of water. Cover or incorporate spills (including end row spillage). Use only once per crop. For best wireworm and/or white grub control, apply the granules as an in-furrow treatment.
Force CS tefluthrin	3A	Cutworm, lesser cornstalk borer, corn rootworm, seedcorn beetle, seedcorn maggot, white grub, wireworm	0.46-0.57 fl oz/1000 row-ft	T-band or in-furrow application. REI is 12 hours. For best wireworm and/or white grub control, apply the liquid as an in-furrow treatment.
Gaucha 600 imidacloprid	4A	1. Corn rootworm 2. Seed corn beetle, chinch bug, white grub, seed corn maggot, wireworm, southern corn leaf beetle	1. 1.34 mg ai/kernel 2. 0.60 mg ai/kernel	1. Use only in areas of light to moderate corn rootworm populations

*REI = Restricted Entry Interval PHI = Preharvest Interval

Field Corn

Seed, Soil, and Foliar Insecticides *(continued)*

Insecticide Active Ingredient	Mode of Action	Target Pest	Rate	Comments*
Hero zeta-cypermethrin + bifenthrin	3A	1. Army cutworm, common stalk borer, cutworm species, flea beetle, grasshopper, western bean cutworm 2. Aphid species, beet armyworm, fall armyworm, armyworm, armyworm species, yellowstriped armyworm, chinch bug, corn blotch leafminer adult, corn earworm, corn rootworm adult, European corn borer, greenbug, southern corn leaf beetle, stink bug, webworm 3. Banks grass mite, twospotted spider mite 4. Cutworm spp., including army cutworm, seed corn maggot, white grub, and wireworms	1. 2.6-6.1 oz/A 2. 4.0-10.3 oz/A 3. 10.3 oz/A 4. 4.0-10.3 oz/A applied at planting	REI is 12 hours. Do not apply within 30 days of harvest for grain and stover and 60 days for forage. Do not graze livestock in treated areas or cut treated crops for feed within 30 days of the last application. Use of ultra low volume (ULV) application on corn is prohibited. Do not make aerial or ground applications to corn if heavy rainfall is imminent.
Intrepid 2F methoxyfenozide	18	European corn borer, armyworm, western bean cutworm	4.0-8.0 fl oz/A	REI is 4 hours. PHI is 21 days.
Lannate LV methomyl	1A	1. Earworm, armyworm, fall armyworm, European corn borer, corn rootworm adult, flea beetles, aphids 2. Variegated cutworm, beet armyworm	1. 0.075-1.5 pt/A 2. 1.5 pt/A	REI is 48 hours. PHI is 21 days for grain and stover.
Lorsban 4E Lorsban Advanced chlorpyrifos	1B	1. Grasshopper 2. Aphid, armyworm, chinch bug, corn rootworm adult, cutworm, European corn borer, flea beetle adult, southern corn leaf beetle, western bean cutworm 3. Common stalk borer, corn rootworm larvae, billbug	1. 0.5 -1.0 pt/A 2. 1.0-2.0 pt/A 3. 2.0 pt/A	Do not enter or allow worker entry into treated areas during the REI of 24 hours unless wearing the PPE required for early entry. Apply as a postemergence broadcast spray using sufficient spray volume to ensure thorough coverage of treated plants, but no less than 15 gpa for ground spray equipment or 2 to 5 gpa for aircraft equipment. Lorsban 4E may be broadcast applied postemergence through sprinkler irrigation systems at recommended application rates to control listed foliar pests. For best results, tank mix Lorsban 4E with 2 pints of non-emulsifiable oil.
Lorsban 15G chlorpyrifos	1B	1. Corn rootworm larvae seed corn beetle, seed corn maggot, wireworm, white grub 2. European corn borer (1st generation) 3. European corn borer (2nd generation)	1. 8.0 oz per 1000 row-ft T-band or in-furrow application 2. 3.5-8.0 oz per 1000 row-ft (banded); 5.0-6.5 lb/A (aerial) 3. 6.0-8.0 oz per 1000 row-ft (banded); 6.5 lb/A (aerial)	Do not enter or allow worker entry into treated areas during the REI of 24 hours unless wearing PPE required for early entry. Do not apply within 21 days before harvest of grain.
Lumivia chlorantriliprole	28	wireworms, white grubs, black cutworm, seed corn maggot, fall armyworm	0.25-0.75 mg ai per seed	Do not exceed a maximum of 0.054 lb ai per acre
Malathion 57EC Malathion	1B	Aphids, corn earworm, corn rootworm adults, small armyworms	1.5 pt/A	PHI is 7 days. REI is 3 days for detasseling, 12 hours for all other activities. Maximum of two applications per season.
Methyl 4EC methyl parathion	1B	1. Armyworm, climbing cutworm, corn leaf aphid, corn rootworm adult, fall armyworm, stink bug 2. Grasshoppers	1. 0.5 pt/A 2. 1.0 pt/A	Do not apply within 12 days of harvest. Do not apply during the pollen shed period. The REI is 3 days. Do not apply more than 0.5 lb ai/A per application. Do not apply more than 1.0 lb ai/A per year. Do not make more than 2 applications per year

*REI = Restricted Entry Interval PHI = Preharvest Interval

Field Corn

Seed, Soil, and Foliar Insecticides *(continued)*

Insecticide Active Ingredient	Mode of Action	Target Pest	Rate	Comments*
Mustang Maxx zeta-cypermethrin	3A	1. Cutworms 2. Corn earworm, western bean cutworm 3. European corn borer, corn rootworm beetle, flea beetle, grasshopper, southern corn leaf beetle, stalk borer, stink bug, webworm, aphid 4. Armyworm, fall armyworm, chinch bug	1. 1.28-2.8 oz/A 2. 1.76-4.0 oz/A 3. 2.72-4.0 oz/A 4. 3.2-4.0 oz/A	REI is 12 hours. Do not apply more than 0.10 lb active ingredient per acre per season including at-planting plus foliar applications. PHI is 7 days for grain, stover, and forage harvest.
Nufos 4E chlorpyrifos	1B	1. Grasshopper 2. Aphids, armyworms, chinch bugs, corn rootworm adults, cutworms, European corn borer, flea beetle adults, southern corn leaf beetle, Western bean cutworm 3. Corn earworm 4. Billbugs, common stalk borer, corn rootworm larvae	1. 0.5-1.0 pt/A 2. 1.0-2.0 pt/A 3. 1.5-2.0 pt/A 4. 2.0 pt/A	PHI is 21 days. REI is 24 hours unless PPE worn. Maximum of three applications of any chlorpyrifos product per season.
Oberon 2SC spiromesifen	23	Banks grass mite, twospotted spider mite	2.85-8.0 fl oz/A	REI is 12 hours following application. PHI: green forage and silage – 5 days; grain or stover – 30 days. Maximum allowed per 14-day interval: 8.5 fl oz per acre. Maximum allowed per crop season: 8.5 fl oz per acre. Maximum number of applications per crop season: 2. Minimum application volume: 10.0 gpa ground, 5.0 gpa aerial.
Onager hexythiazox	10A	Banks grass mite, twospotted spider mite	10.0-24.0 fl oz/A	May only be applied west of Highway 281. REI is 12 hours. May be applied by air, ground, or chemigation. Do not apply more than a total of 24 oz formulated product per acre per year. Do not make more than one application per year. Do not harvest field corn forage, stover, and grain for 45 days after application. Application after the V15 crop growth stage is prohibited. Minimum application volume: 15-20 gpa — ground, 5 gpa — aerial application.
PennCap-M methyl parathion	1B	1. Corn rootworm adults 2. Stink bugs 3. Aphid, flea beetle, grasshopper, true armyworm 4. European corn borer, western bean cutworm 5. Black cutworm	1. 1.0-2.0 pt/A 2. 1.0-3.0 pt/A 3. 2.0-3.0 pt/A 4. 2.0-4.0 pt/A 5. 4.0 pt/A	REI is 31 days. Do not apply during pollen shed if bees are foraging in the areas to be treated. Do not harvest, cut for forage, or graze within 12 days of application.
Poncho 600 clothianidin	4A	1. Chinch bug, corn flea beetle, corn leaf aphid, black cutworm, grape colaspis, seedcorn maggot, southern corn leaf beetle, white grub, thrips, wireworm 2. Corn rootworm, southern corn billbug	1. 0.25-0.50 mg ai/kernel 2. 1.25 mg ai/kernel	Dispose of all excess treated seed. Leftover treated seed may be doublesown around the headland or buried away from water sources in accordance with local requirements. Do not contaminate water bodies when disposing of planting equipment wash water. Treated seeds exposed on the soil surface may be hazardous to wildlife. Cover or collect treated seeds spilled during loading.

*REI = Restricted Entry Interval PHI = Preharvest Interval

Field Corn

Seed, Soil, and Foliar Insecticides *(continued)*

Insecticide Active Ingredient	Mode of Action	Target Pest	Rate	Comments*
Poncho/VOTIVO clothianidin	4A	Chinch bug, corn flea beetle, corn leaf aphid, black cutworm, grape colapsis, seedcorn maggot, southern corn leaf beetle, white grubs, wireworm	0.50 mg ai /seed of clothianidin	
Prevathon chlorantraniliprole	28	Corn ear worm, European corn borer	14.0-20.0 fl oz / A	REI is 4 hours. PHI is 14 days.
Proaxis gamma-cyhalothrin	3A	1. Corn rootworm larvae, cutworm, seedcorn beetle, seedcorn maggot, white grub 2. Corn earworm, western bean cutworm. 3. European corn borer, fall armyworm, flea beetle, grasshopper, corn rootworm beetle, stalk borer, stink bug, webworm, corn leaf aphid 4. Chinch bug	1. 0.66 fl oz / 1000 row-ft applied in-furrow, T-band, or banded at planting 2. 1.93-3.20 fl oz / A (foliar application) 3. 2.56-3.84 fl oz / A (foliar application) 4. 3.84 fl oz / A (foliar application)	REI is 24 hours. Do not apply within 21 days of harvest. Do not allow livestock to graze treated areas or harvest treated corn forage within 1 day after last treatment. Do not feed treated corn forage or fodder or silage within 21 days after the last treatment.
Radiant SC spinetoram	5	Corn earworm, European corn borer, western bean cutworm, armyworm	3.0-6.0 fl oz / A	REI is 4 hours. Do not apply within 28 days of grain harvest or within 3 days of fodder or forage harvest.
Respect zeta-cypermethrin	3A	1. Cutworms 2. Corn earworm, western bean cutworm 3. European corn borer, corn rootworm beetle, flea beetle, grasshopper, southern corn leaf beetle, stalk borer, stink bug, webworm, aphid 4. Armyworm, fall armyworm, chinch bug	1. 1.28-2.8 oz / A 2. 1.76-4.0 oz / A 3. 2.72-4.0 oz / A 4. 3.2-4.0 oz / A	REI is 12 hours. Do not apply more than 0.10 lb active ingredient per acre per season including at-planting plus foliar applications. Do not apply within 30 days of harvest for grain and stover and 60 days for forage.
Sevin XLR Plus carbaryl	1A	1. Armyworm, chinch bug, corn rootworm adult, fall armyworm, flea beetle 2. European corn borer 3. Western bean cutworm, cutworm 4. Grasshoppers	1. 1.0-2.0 qt / A 2. 1.5-2.0 qt / A 3. 2.0 qt / A 4. 0.5-3.4 qt / A; small nymphs. 1.0-1.5 qt / A; mature grasshoppers	REI of 12 hours. Do not apply within 48 days of harvest of grain and fodder or within 14 days of harvest or grazing of forage or silage. Do not apply more than a total of 8 quarts per acre per crop.
Sivanto 200 SL Flupyradiflurone	4D	Aphids, leafhoppers	7.0-10.5 fl oz / A	PHI 7days (forage), 21 days (grain, stover or straw) Min application volume; 10 gal/A (ground) 2 gal/A (aerial)
SmartChoice 5G chlorethoxyfos + bifenthrin	1B, 3A	1. Cutworms, wireworms, white grubs, seedcorn maggots, grape colapsis, symphylans 2. Corn rootworm larvae, cutworms, wireworms, white grubs, seedcorn maggots, grape colapsis, symphylans	1. 3.0-3.5 oz per 1000 row-ft applied in furrow 2. 4.5-5.0 oz per 1000 row-ft applied in furrow	Do not make more than one application per year. Must be applied using Smart-Box or Lock 'N Load closed handling and application system.
Stallion zeta cypermethrin + chlorpyrifos	3A, 1B	1. Cutworm species (other than western bean cutworm) 2. Aphid species, armyworms, chinch bug, European corn borer, common stalk borer, corn earworm, corn rootworm beetle, grasshopper species, Japanese beetle adult, sap beetle adult, southern corn leaf beetle, stink bug species	1. 3.75-11.75 fl oz / A 2. 9.25-11.75 fl oz / A	Do not apply within 30 days of harvest for grain and stover, and 60 days of harvest for forage. 24 hour REI. Do not apply in tank mixes with Steadfast or Lightning herbicides.

*REI = Restricted Entry Interval PHI = Preharvest Interval

Field Corn

Seed, Soil, and Foliar Insecticides *(continued)*

Insecticide Active Ingredient	Mode of Action	Target Pest	Rate	Comments*
Swagger bifenthrin + imidacloprid	3, 4A	1. Aphids, army cutworm, beet armyworm, chinch bug, common stalk borer, corn earworm, corn rootworm adults, cutworm spp., European corn borer, fall armyworm, flea beetles, grasshoppers, southern corn leaf beetle, stink bug, armyworm spp., webworms, western bean cutworm 2. Twospotted spider mite, Banks grass mite 3. Corn rootworm larvae	1. 8.45-25.6 fl oz/A 2. 20.48-25.6 fl oz/A 3. 2.4 fl oz/1000 row-ft (at planting)	PHI is 30 days, with a 7 day minimum interval between applications. Do not graze livestock in treated areas or cut treated crops for feed within 30 days of last application. Apply in a minimum of 2.0-5.0 gal of finished spray/A by air, or a minimum of 10.0 gal/A by ground.
Thimet 20G phorate	1B	1. Corn rootworm, wireworm, white grub, seedcorn maggot, seedcorn beetle, flea beetle 2. corn rootworm	1. 4.5-6.0 oz/1000 row-ft (at planting); band or T-band only 2. 4.5-6.0 oz/1000 row-ft (at cultivation)	REI is 48 hours (72 hours in areas where average annual rainfall is less than 25 inches a year). Do not apply more than one application of Thimet 20G per crop per season. Do not harvest, graze, or cut forage within 30 days of last treatment.
Tracer spinosad	5	1. European corn borer, fall armyworm, true armyworm 2. Beet armyworm, corn earworm, western bean cutworm	1. 1.0-3.0 fl oz/A 2. 2.0-3.0 fl oz/A	REI is 4 hours. Do not apply within 28 days of grain harvest or within 3 days of fodder or forage harvest. Do not apply more than a total of 6 fl oz per acre per year.
Tundra Supreme chlorpyrifos + bifenthrin	1B, 3	1. Aphids, army cutworm, beet armyworm, chinch bug, common stalk borer, corn earworm, corn rootworm adults, European corn borer, fall armyworm, flea beetle, grasshoppers, southern corn leaf beetle, stink bugs, western bean cutworm, armyworm spp. 2. Twospotted spider mite and Banks grass mite	1. 5.6-12.8 fl oz/A 2. 13.5-16.8 fl oz/A	Do not graze livestock in treated areas or cut treated crops for feed within 30 days of last application. Do not apply in tank mixes with Steadfast or Lightning herbicides.
Warrior II with Zeon Technology lambda-cyhalothrin	3A	1. Corn rootworm larvae, cutworm, lesser cornstalk borer, seedcorn beetle, seedcorn maggot, white grub, wireworm 2. Corn earworm, cutworm, western bean cutworm 3. Armyworm, corn rootworm beetle, European corn borer, fall armyworm, flea beetle, grasshopper, stalk borer, stink bug, webworm, yellowstriped armyworm 4. Chinch bug	1. 0.33 fl oz/1000 row-ft at planting, banded, T-band or in-furrow 2. 0.96-1.60 fl oz/A (foliar application) 3. 1.28-1.92 fl oz/A (foliar application) 4. 1.92 fl oz/A (foliar application)	REI is 24 hours. Do not harvest or graze livestock or cut treated crops for feed within 21 days of at-planting application. Do not apply within 21 days of harvest. Do not allow livestock to graze in treated areas or harvest treated corn forage as feed for meat or dairy animals within 1 day after last treatment. Do not feed treated corn fodder or silage to meat or dairy animals within 21 days after last treatment.
Zeal etoxazole	10B	Twospotted spider mite and Banks grass mite	1.0-3.0 oz/A	PHI is 21 days. Do not apply more than two times per season. Do not apply less than 14 days apart. Do not apply more than 6.0 oz (0.27 lb ai) per acre per season.

*REI = Restricted Entry Interval PHI = Preharvest Interval

Grain Sorghum

Seed, Soil and Foliar Insecticides

Insecticide	Sugarcane aphids	Aphids	Chinch bugs	Wireworms	White grubs	Grasshopper	Spider mites	Corn earworm	Fall armyworm	Soil cutworms
Cruiser	X	X	X	X	X					
Gaicho		X	X	X	X					
Poncho	X	X	X	X	X					
Lorsban 15G										X
Counter 15G				X	X					
Asana XL			X			X		X		X
Baythroid			X			X		X	X	X
Belt								X	X	X
Cobalt		X	X							X
Comite II							X			
Delta Gold			X			X		X	X	X
Dimethoate		X				X	X			
Fastac EC		X	X			X		X	X	X
Lannate								X	X	
Mustang MAXX		X	X			X		X	X	X
Lorsban Advanced		X	X			X		X	X	X
Prevathon			X					X	X	
Proaxis			X			X		X	X	X
Sevin 4F			X					X	X	X
Sivanto SL	X									
Stallion		X	X			X		X	X	
Tracer								X	X	
Transform	X									
Warrior II			X			X		X	X	

Grain Sorghum

Seed, Soil and Foliar Insecticides

Insecticide Active ingredient	Mode of Action	Target Pest	Rate	Comments
Asana XL esfenvalerate	3A	Black cutworm, chinch bugs, corn earworm (headworm), cutworms	5.8-9.6 fl oz per acre	For chinch bug control, spray should be directed at the base of the plant. 21 d PHI
Baythroid XL beta-cyfluthrin	3A	Cutworms Armyworm, beet armyworm, black woolly bear, European corn borer, fall armyworm, false chinch bug, flea beetle, stalk borer, stink bugs, webworms, yellowstriped armyworm Chinch bug, grasshoppers	1.0-1.3 fl oz per acre 1.3-2.8 fl oz per acre 2.0-2.8 fl oz per acre	14 d PHI.
Belt flubendiamide	28	Armyworm, beet armyworm, cutworms, European corn borer, fall armyworm, sorghum headworm, stalk borer, webworms, yellow-striped armyworm	2.0-4.0 fl oz per acre	12 h REI. 3 d PHI for forages, 14 d PHI for grain and stover. Min application volume; 1 gpa (ground), 2 gpa (air)
Cobalt chlorpyrifos + gamma- cyhalothrin	1B, 3A	grasshoppers, yellow sugarcane aphid and other aphids chinch bugs, cutworms, fall armyworms, flea beetle spp., greenbug, yellowstriped armyworm beet armyworm, corn earworm, European corn borer, stink bug spp., webworms	6-13 fl oz per acre 11-38 fl oz per acre 16-38 fl oz per acre	Do not harvest for grain, forage, fodder, hay or silage within 30 days after application of 26 fl oz per acre rate, or within 60 days after application of rates above 26 fl oz per acre
Comite II propargite	12C	Twospotted spider mite, Banks grass mite	24-35 fl oz per acre	Apply in min of 20 gal per acre by ground or 5 gal per acre by air. Do not make more than 1 application per season. 2 d REI. Do not harvest silage within 30 days of application or grain within 60 days of application
Counter 15G terbufos	1B	wireworms, white grubs,	7 oz per 1000 row-ft for any row spacing; no more than 11.3 lb per acre	At planting time; banded or knifed-in. Do not place granules in direct contact with seed as crop injury may occur. Only one application per year allowed. Do not graze or harvest forage within 50 days, and fodder or grain within 100
Cruiser 5FS thiamethoxam	4A	chinch bug, corn leaf aphid, greenbug, seed corn maggot, wireworm, yellow sugarcane aphid	5.1-7.6 fl oz per 100 lb seed, or 0.062-0.093 mg ai per seed	
Delta Gold deltamethrin	3A	corn earworm, cutworms, flea beetles, grasshoppers Armyworm (all species), chinch bug, European corn borer, stalk borer, stinkbugs	1.0-1.5 fl oz per acre 1.3-1.9 fl oz per acre 1.5-1.8 fl oz per acre	Apply with min spray volume of 2 gal per acre by air, or 5 gal per acre by ground. Do not apply more than 3.8 fl oz per acre per growing season. Do not apply within 14 d of harvest of grain. Do not cut or graze forage within 14 d of application
Dimethoate 4E dimethoate	1B	Banks grass mites, Spidermites, grasshoppers Aphids	1 pint per acre 0.5-1 pint per acre	28 d PHI. 48h REI. Maximum total rate per season, 1 lb ai per acre
Fastac EC alpha- cypermethrin	3A	cutworms spp. fall armyworm, true armyworm, yellow-striped armyworm, European corn borer, corn earworm, flea beetle spp. stink bugs spp. aphid spp., beet armyworm, chinch bug, false chinch bug, grasshopper spp.,	1.3-3.8 fl oz per acre 1.8 to 3.8 fl oz per acre 3.2 to 3.9 fl oz per acre	12 d PHI for grain and stover; 45 day PHI for forage. Apply using minimum of 10 gal per acre by ground and 2 gal per acre by air
Gaucho 600 imidacloprid	4A	corn leaf aphid, greenbug, English grain aphid, yellow sugarcane aphid, wireworms, chinch bugs	6.4 fl oz per 100 lb seed	Do not graze or feed livestock on treated areas for 45 d after planting
Lannate methomyl	1A	fall armyworm, beet armyworm, corn earworm, armyworm	0.25-0.5 lb per acre	14 d PHI feeding forage or cutting for hay 48 h REI. Do not make more than 2 applications per crop
Lorsban Advanced chlorpyrifos	1B	grasshoppers, yellow sugar cane aphid and other aphids, greenbug armyworms, chinch bugs, cutworms, European corn borer corn earworm	0.5-1.0 pint per acre 0.5-2.0 pint per acre 1-2 pints per acre 4. 1.5-2.0 pints per acre 5. 2 pints per acre	Do not harvest for grain, forage, fodder, hay or silage within 30 days after application of 1 pint per acre, or within 60 days after application of rates above 1 pint per acre. 24 REI unless PPE for early entry is worn

Grain Sorghum

Seed, Soil and Foliar Insecticides *(continued)*

Insecticide Active ingredient	Mode of Action	Target Pest	Rate	Comments
Lorsban 15G chlorpyrifos	1B	cutworms, chinch bugs (suppression)	8 oz per 1000 row-ft	24 h REI. Do not make more than one application of Lorsban 15G per season. Maximum single application rate is 1.3 lb ai chlorpyrifos in 30-inch row spacing (8 oz of Lorsban 15G per 1000 feet of row). Use proportional amounts for other row spacings not to exceed 1.5 lb ai chlorpyrifos (9.9 lb of Lorsban 15G) per acre. Do not apply more than a total of 1.5 lb ai chlorpyrifos (9.9 lb of Lorsban 15G) per acre per year. Do not make a foliar application of Lorsban-4E or other product containing chlorpyrifos within 10 days of an at-plant application of Lorsban 15G.
Mustang Maxx zeta-cypermethrin	3A	Cutwormspp. fall armyworm, true armyworm, yellow-striped armyworm, European corn borer, corn earworm, flea beetle spp., stink bugspp. aphid spp., beet armyworm, chinch bug, false chinch bug, grasshopper spp.,	1. 1.28 to 4.0 fl oz per acre 2. 1.76 to 4.0 fl oz per acre 3. 3.2-4.0 fl oz per acre	Apply using a min of 10 gal per acre by ground or 2 gal per acre by air. 14 d PHI for grain and stover, 45 d PHI for forage
Poncho 600 clothianidin	4A	Black cutworm, aphids, including greenbug, yellow sugarcane aphid, corn leaf aphid and English grain aphid, chinch bug, white grubs, wireworms	5.1-6.4 fl oz per 100 lb seed	
Prevathon chlorantraniliprole	28	corn earworms, beet armyworm, European corn borer, fallarmyworm, truearmyworm Grasshoppers	14-20 fl oz per acre 8-20 fl oz per acre	4 h REI; 1 d PHI
Sevin 4F carbaryl	1A	Armyworm, fall armyworm, chinch bugs, corn earworm, stink bugs, webworms cutworms	1-2 quarts per acre 2 quarts per acre	Do not apply within 21 d of harvest for grain or fodder, or within 14 d of harvest or grazing of forage or silage. Do not apply more than a total of 6 quarts per acre per crop per year.
Sivanto SL flupyradifurone	4D	sugar cane aphid. Section 2(ee) recommendation	4.0-7.0-fl oz per acre	PHI; 7d forage; 21 d dried grain, stover, or straw. Apply in a min 10 gal per acre by ground; 2 gal per acre byair
Stallion chlorpyrifos + zeta- cypermethrin	1B, 3A	cutworms true armyworm, yellow-striped armyworm, European corn borer, corn earworm, flea beetle spp., stink bugspp. Aphids, chinch bug, false chinch bug, fall armyworm,grasshoppers,	1. 3.75-11.75 oz per acre 2. 5.0-11.75 oz per acre 3. 9.26-11.75 oz per acre	30 d PHI for grain, 45 d PHI for forage 24 h REI Apply using min 15 gal per acre by ground, 2 gal per acre by air
Tracer spinosad	5	armyworms, corn earworms, webworms	1.5-3.0 fl oz per acre	PHI 7 days for grain or fodder, 14 d forage. Do not allow cattle to graze treated area until spray has dried
Transform WG sulfoxaflor	4C	sugarcane aphid. NE Section 18 Emergency Exemption, expires April 8, 2017	0.75-1.5 oz per acre	Apply in min spray volume of 3 gal per acre. Do not apply within 14 d of grain or straw harvest, or within 7 d of grazing, or forage, folder or hay harvest. 24 h REI. Do not apply ≤ 3 d pre-bloom or until after seed set.
Warrior II with Zeon Technology lambda- cyhalothrin	3A	cutworm spp. armyworm, beet armyworm, corn earworm, European corn borer,fall armyworm, flea beetle spp., grasshopper spp., stink bug spp., yellowstripedarmyworm chinchbug,	1. 0.96-1.28 floz per acre 2. 1.28-1.92 floz per acre 3. 1.92 fl oz per acre	Do not apply within 30 d of harvest Apply in a minimum of 2 gal per acre by air

Soybean

Seed and Foliar Insecticides

Insecticide	Bean Leaf Beetle	Soybean Aphid	Grasshopper	Caterpillar
Seed Treatment				
Cruiser (various formulations)	X	X		
Gaucho 600	X	X		
Inovate	X	X		
Poncho/VOTiVO	X	X		
Foliar Treatment				
Alias 4F	X	X		
Ambush 2EC	X		X	X
Arctic 3.2EC	X		X	X
Asana XL	X	X	X	X
<i>Bacillus thuringiensis</i>				X
Baythroid XL	X	X	X	X
Belay	X	X		
Besiege	X	X	X	X
Cobalt/Cobalt Advanced	X	X	X	X
Declare	X	X	X	X
Delta Gold 1.5EC	X	X	X	X
Dimethoate 4E	X	X	X	
Dimilin 2L			X	X
Endigo ZC	X	X		X
Hero	X	X	X	X
Intrepid 2F				X
Justice	X	X		X
Lannate LV	X			X
Leverage 360	X	X	X	X
Methyl 4E	X		X	X
Mustang Maxx	X	X	X	X
Nufos 4E	X	X	X	X
PennCap-M	X		X	X
Pounce 25WP	X	X	X	X
Prevathon			X	X
Proaxis	X		X	X
Radiant SC				X
Respect	X	X	X	X
Sevin XLR Plus	X		X	X
Stallion	X	X	X	X
Steed	X	X	X	X
Steward EC				X
Swagger	X	X	X	X
Tracer				X
Transform WG		X		
Triple Crown	X	X	X	X
Warrior II with Zeon Technology	X	X	X	X

X = insecticide labeled for control against this pest.

Soybean

Seed and Foliar Insecticides

Insecticide Active Ingredient	Mode of Action	Target Pest	Rate	Comments*
Alias 4F imidacloprid	4A	Soybean aphid, bean leaf beetle, Japanese beetle adult	1.5 fl oz / A	REI is 12 hours. PHI is 7 days. Minimum interval between applications is 7 days. Maximum allowed per crop season is 4.5 fl oz per acre.
Ambush 2EC permethrin	3A	1. Green cloverworm, bean leaf beetle, cabbage looper, velvetbean caterpillar, saltmarsh caterpillar, cutworm, thistle caterpillar 2. Corn earworm, beet armyworm, Japanese beetle, soybean looper, webworms	1. 3.2-6.4 fl oz / A 2. 6.4-12.8 fl oz / A	REI is 12 hours. Can be applied up to 60 days before harvest. Do not graze treated areas or harvest for forage or hay.
Arctic 3.2EC permethrin	3A	1. Bean leaf beetle, cabbage looper, corn rootworm beetle, cutworm, green cloverworm, Japanese beetle, saltmarsh caterpillar, woollybear caterpillar, thistle caterpillar, velvetbean caterpillar 2. Beet armyworm, corn earworm, soybean aphid, soybean looper, webworms	1. 2.0-4.0 fl oz / A 2. 4.0-8.0 fl oz / A	REI is 12 hours. Can be applied up to 60 days before harvest. Do not graze treated areas or harvest for forage or hay.
Asana XL esfenvalerate	3A	1. Green cloverworm, saltmarsh caterpillar, velvetbean caterpillar, woollybear caterpillar 2. Bean leaf beetle, cabbage looper, corn earworm, grasshopper, green stink bug, Japanese beetle, southern green stink bug, soybean aphid	1. 2.9-5.8 fl oz / A 2. 5.8-9.6 fl oz / A	REI is 12 hours. PHI is 21 days. Do not feed or graze livestock on treated fields. Do not apply more than 0.2 lb ai per acre per season.
Baythroid XL beta-cyfluthrin	3A	1. Bean leaf beetle, stink bug, cabbage looper, corn earworm, Japanese beetle, saltmarsh caterpillar, velvetbean caterpillar, webworm, woollybear caterpillar 2. Soybean aphid, grasshoppers 3. Bean leaf beetle (growth stage VC- V2), cutworms, green cloverworm	1. 1.6-2.8 fl oz / A 2. 2.0-2.8 fl oz / A 3. 0.8-1.6 fl oz / A	REI is 12 hours. PHI is 21 days.
Belay clothianidin	4A	Aphids, bean leaf beetle, Japanese beetle, stink bugs	3-4 fl oz / A	REI is 12 hours. PHI is 21 days. Do not graze or feed forage and hay to livestock.
Besiege lambda-cyhalothrin chlorantraniliprole	3A, 28	1. Bean leaf beetle, cabbage looper, corn earworm, corn rootworm beetle adults, cutworm spp., green cloverworm, Mexican bean beetle, painted lady (thistle) caterpillar, potato leafhopper, saltmarsh caterpillar, soybean aphid, thrips spp. (except western flower thrips), velvetbean caterpillar, woollybear caterpillar 2. Armyworm, blister beetle spp., fall armyworm, grasshopper spp., Japanese beetle adult, plant bug spp., silverspotted skipper, stink bug spp., tobacco budworm, webworm spp., yellowstriped armyworm 3. Beet armyworm, soybean looper	1. 5.0 - 8.0 fl oz / A 2. 8.0 - 10.0 fl oz / A 3. 10.0 fl oz / A	REI is 24 hours. PHI is 30 days. Do not graze or harvest treated forage, straw, or hay for livestock feed

*REI = Restricted Entry Interval PHI = Preharvest Interval

Soybean

Seed and Foliar Insecticides *(continued)*

Insecticide Active Ingredient	Mode of Action	Target Pest	Rate	Comments*
Cobalt chlorpyrifos + gamma-cyhalothrin	1B, 3A	1. Grasshopper, green cloverworm, velvetbean caterpillar 2. Cabbage looper, cutworm, painted lady caterpillar, saltmarsh caterpillar, soybean aphid, webworm spp., woollybear caterpillar 3. Bean leaf beetle, corn earworm, corn rootworm adult, Japanese beetle, stink bug spp.	1. 7.0-13.0 fl oz/A 2. 13.0-26.0 fl oz/A 3. 19.0-38.0 fl oz/A	REI is 24 hours. Do not apply last treat- ment within 30 days before harvest.
Cobalt Advanced chlorpyrifos, lambda-cyhalothrin	1B, 3A	1. Grasshopper, green cloverworm, velvetbean caterpillar 2. Cabbage looper, cutworm, painted lady caterpillar, saltmarsh caterpillar, soybean aphid, webworm spp., woollybear caterpillar 3. Bean leaf beetle, corn earworm, corn rootworm adult, Japanese beetle, stink bug spp.	1. 6.0-13.0 fl oz/A 2. 11.0-26.0 fl oz/A 3. 16.0-38.0 fl oz/A	REI is 24 hours. Do not apply last treat- ment within 30 days before harvest.
Cruiser thiamethoxam	4A	Aphid, bean leaf beetle, grape colas- pis, seedcorn maggot, thrips, white grub, and wireworm	Available as Cruiser Maxx, Cruiser Maxx Plus, Cruiser Maxx Vibrance, and other formulations. See labels.	See labels.
Delta Gold 1.5 EC deltamethrin	3A	1. Green cloverworm, corn earworm, cutworms 2. Bean leaf beetle, loopers, corn rootworm beetle, grasshoppers, Japanese beetle, saltmarsh caterpillar, soybean aphid, stink bugs, webworm, yellow woollybear	1. 1.0-1.5 fl oz/A 2. 1.5-2.4 fl oz/A	REI is 12 hours. PHI is 21 days. Do not allow livestock to graze treated forage or feed treated hay to livestock.
Dimethoate 4E dimethoate	1B	Mexican bean beetle, spider mites, aphids, bean leaf beetle, leafhoppers	1.0 pt/A	REI is 48 hours. PHI is 21 days.
Dimilin 2L diflubenzuron	15	1. Velvetbean caterpillar, green cloverworms 2. Grasshoppers 3. Beet armyworm, fall armyworm, soybean looper	1. 2.0-4.0 fl oz/A 2. 2.0 fl oz/A 3. 4.0 fl oz/A	DIMILIN is not effective in controlling grasshoppers once they reach the adult stage. Do not enter or allow worker entry into treated areas during the 12-hour REI. Do not make more than 2 applications per season. Do not apply within 21 days of harvest. Do not apply within 25 feet by ground or 150 feet by air of bodies of water. All applications must include a 25-foot vegetative buffer strip within the buffer zone to decrease runoff.
DiPel ES and several others <i>Bacillus thuringiensis</i> Cry toxin	11	Green cloverworm, velvetbean caterpillar, soybean looper, saltmarsh caterpillar	See product label	See product label.

*REI = Restricted Entry Interval PHI = Preharvest Interval

Soybean

Seed and Foliar Insecticides *(continued)*

Insecticide Active Ingredient	Mode of Action	Target Pest	Rate	Comments*
Endigo ZC lambda-cyhalothrin + thiamethoxam	3A, 4A	1. Cabbage looper, corn earworm, corn rootworm beetle adults, cutworm spp., green cloverworm, Mexican bean beetle, painted lady (thistle) caterpillar, potato leafhopper, saltmarsh caterpillar, soybean aphid, thrips spp., velvet bean caterpillar, woollybear caterpillar 2. Armyworm, bean leaf beetle, brown marmorated stink bug, fall armyworm, grasshopper spp., stink bug spp. (except brown and red banded), Japanese beetle adult, sliverspotted skipper, webworm spp., yellowstriped armyworm 3. Brown stink bug, red banded stink bug	1. 3.5-4.0 fl oz / A 2. 4.0-4.5 fl oz / A 3. 4.5 fl oz / A	REI is 24 hours. PHI is 30 days. Allow at least 7 days between applications. Do not graze or harvest treated soybean forage, straw or hay for livestock feed. Do not apply this product within 45 days of planting if soybean seeds were treated with a neonicotinoid product. Do not exceed a total of 9.0 fl. oz of Endigo ZC or 0.06 lb a.i. of lambda-cyhalothrin containing products or 0.125 lb a.i. of foliar applied thiamethoxam containing products per acre per growing season.
Gaucha 600 imidacloprid	4A	Seed corn maggot, soybean aphid, bean leaf beetle	1.6-3.2 fl oz per cwt of seed	Do not graze or feed livestock on soybean forage or hay.
Hero zeta-cypermethrin + bifenthrin	3A	1. Bean leaf beetle, cutworms, grasshoppers, green cloverworm, painted lady caterpillar 2. Armyworm, corn earworm, corn rootworm adult, dectes stem borer, looper, Japanese beetle, saltmarsh caterpillar, soybean aphid, stink bug, thrips, velvetbean caterpillar, webworm, woollybear caterpillar 3. Twospotted spider mite	1. 2.6-6.1 oz / A 2. 4.0-10.3 oz / A 3. 10.3 oz / A	REI is 12 hours. Do not make applications less than 30 days apart. Do not graze or harvest treated soybean forage, straw, or hay for livestock feed. PHI is 21 days.
Inovate clothianidin	4A	1. Aphids, bean leaf beetle, leafhoppers, seed corn maggot, white grubs, wireworm	1. 4.74 fl oz / 100 lb of seed	Do not graze or feed soybean forage and hay to livestock.
Intrepid 2F methoxyfenozide	18	Armyworm, green clover worm, saltmarsh caterpillar, soybean looper, velvet bean caterpillar	4-8 fl oz / A	REI is 4 hours. Do not apply within 7 days of harvest of hay and forage or within 14 days of harvest of seed.
Justice acetamiprid, bifenthrin	3, 4A	1. Aphid species, bean leaf beetle, leafhoppers, loopers (except soybean looper) 2. Armyworm species, soybean looper	1. 2.5-3.0 fl oz / A 2. 3.0-5.0 fl oz / A	REI is 12 hours. PHI is 30 days. No more than 2 applications per season. Do not graze or use cut forage or hay as animal feed.
Lannate LV methomyl	1A	1. Green cloverworm, velvetbean caterpillar 2. Soybean aphid 3. Beet armyworm, saltmarsh caterpillar, bean leaf beetle, fall armyworm, thrips	1. 0.40-0.75 pt / A 2. 0.5-1.0 pt / A 3. 0.75-1.0 pt / A	REI is 48 hours. PHI is 14 days for beans. PHI is 3 days for forage and 12 days for hay.
Leverage 360 imidacloprid + cyfluthrin	3A, 4A	Aphid, bean leaf beetle, cabbage looper, corn rootworm adult, cutworms, grasshopper, green cloverworm, Japanese beetle, saltmarsh caterpillar, corn earworm, stink bug, thrips (foliage feeding thrips only), velvetbean caterpillar, whiteflies (other than sweetpotato whitefly)	2.8 fl oz / A	REI is 12 hours. PHI for seed is 21 days, feeding of dry vines is 15 days. Green forage may be fed 15 days after last application. Minimum interval between applications is 7 days

*REI = Restricted Entry Interval PHI = Preharvest Interval

Soybean

Seed and Foliar Insecticides *(continued)*

Insecticide Active Ingredient	Mode of Action	Target Pest	Rate	Comments*
Methyl EC methyl parathion	1B	1. Climbing cutworm, garden webworm, aphid, stink bug, two-spotted mites, velvet bean caterpillars 2. Fall armyworm, green cloverworms	1. 0.75-1.0 pt/A 2. 1.0 pt/A	Do not apply within 20 days of harvest or grazing. REI is 4 days. Do not make more than 2 applications per year.
Mustang Maxx zeta-cypermethrin	3A	1. Painted lady caterpillar, saltmarsh caterpillar, cutworms 2. Alfalfa caterpillar, armyworm, yellowstriped armyworm, bean leaf beetle, corn earworm, corn rootworm beetle, green cloverworm, Japanese beetle, soybean aphid, velvetbean caterpillar, webworm, woollybear caterpillar 3. Beet armyworm, fall armyworm, grasshopper spp., looper spp., stink bug spp., whitefly spp.	1. 1.28-4.0 fl oz / A 2. 2.8-4.0 fl oz / A 3. 3.2- 4.0 fl oz / A	REI is 12 hours. Do not make applications less than 7 days apart. 21 day preharvest interval. Do not graze or harvest treated soybean forage, straw, or hay for livestock feed.
Nufos 4E chlorpyrifos	1B	1. Grasshopper, green cloverworm, velvetbean caterpillar, spider mites 2. Armyworms, bean leaf beetle, corn earworm, cutworms, saltmarsh caterpillar and other woollybears, soybean aphid, thistle caterpillar	1. 0.5-1.0 pt/A 2. 1.0-2.0 pt/A	REI is 24 hours. PHI is 28 days. 14 days between applications with a 6.0 pt maximum per season, 3 applications maximum per year. Do not allow meat or dairy animals to graze in treated areas or feed treated forage, hay, or straw to meat or dairy animals.
PennCap-M methyl parathion	1B	1. Stink bug, soybean aphids 2. Corn rootworm adults 3. Bean leaf beetle, grasshopper, green cloverworm, Japanese beetle, soybean looper, thrip, velvetbean caterpillar	1. 1.0-3.0 pt/A 2. 1.0-2.0 pt/A 3. 2.0-3.0 pt/A	REI is 11 days. Do not apply within 30 days of harvest or grazing. Do not make more than 2 applications per year. Do not apply more than once every 7 days.
Poncho/VOTiVO	4A	Aphids, bean leaf beetle, seed corn maggot, white grubs, wireworm	0.13 mg/ai/seed	Do not graze or feed forage and hay to livestock.
Pounce 25 WP permethrin	3A	1. Bean leaf beetle, cabbage looper, corn rootworm beetle, green cloverworm, Japanese beetle, saltmarsh caterpillar, woollybear caterpillar, thistle caterpillar, velvetbean caterpillar 2. Beet armyworm, corn earworm, soybean looper, webworms	1. 3.2-6.4 fl oz / A 2. 6.4-12.8 fl oz / A	REI is 12 hours. PHI is 60 days. Do not graze or feed soybean forage or hay.
Proaxis gamma-cyhalothrin	3A	1. Bean leaf beetle, cabbage looper, corn earworm, cutworm spp., green cloverworm, painted lady caterpillar, saltmarsh caterpillar, soybean aphid, velvetbean caterpillar, woollybear caterpillar, corn rootworm beetle 2. Grasshopper, Japanese beetle, stink bug, webworm 3. Beet armyworm	1. 1.92-3.20 fl oz / A 2. 3.20-3.84 fl oz / A 3. 3.84 fl oz / A	REI is 24 hours. PHI is 45 days. Do not graze or harvest treated soybean forage, straw or hay for livestock feed.
Prevathon chlorantraniliprole	28	1. Corn earworm, beet armyworm, fall armyworm, cabbage looper, green cloverworm, southern armyworm, soybean looper, tobacco budworm, velvetbean caterpillar 2. Grasshoppers	1. 14.0 -20.0 fl oz / A 2. 8.0 – 20.0 fl oz / A	REI is 4 hours. PHI is 1 day. Make no more than 4 applications per acre per crop. Do not apply more than 60 fl oz per acre per year. Minimum interval between treatments is 3 days.

*REI = Restricted Entry Interval PHI = Preharvest Interval

Soybean

Seed and Foliar Insecticides *(continued)*

Insecticide Active Ingredient	Mode of Action	Target Pest	Rate	Comments*
Radiant SC spinetoram	5	Corn earworm, cabbage looper, green cloverworm, saltmarsh caterpillar, soybean looper, true armyworm, velvetbean caterpillar	2.0-4.0 fl oz / A	REI is 4 hours. PHI is 28 days.
Respect EC zeta-cypermethrin	3A	1. Cutworm spp., painted lady caterpillar, saltmarsh caterpillar, cutworms 2. Alfalfa caterpillar, armyworm, yellowstriped armyworm, bean leaf beetle, corn earworm, corn rootworm beetle, green cloverworm, Japanese beetle, soybean aphid, velvetbean caterpillar, webworm, woollybear caterpillar 3. Beet armyworm, fall armyworm, grasshopper spp., looper spp., stink bug spp., whitefly spp.	1. 1.28-4.0 fl oz / A 2. 2.8-4.0 fl oz / A 3. 3.2- 4.0 fl oz / A	REI is 12 hours. PHI is 21 days. Do not make applications less than 7 days apart. Do not graze or harvest treated soybean forage, straw, or hay for livestock feed.
Sevin XLR Plus carbaryl	1A	1. Bean leaf beetle, green cloverworm, velvetbean caterpillar 2. Alfalfa caterpillar 3. Armyworm, cutworm, stink bugs, webworms 4. Painted lady caterpillar (thistle caterpillar), saltmarsh caterpillar, yellowstriped armyworm	1. 0.5-1.0 qt / A 2. 1.0 qt / A 3. 1.0-1.5 qt / A 4. 1.5 qt / A	REI is 12 hours. Do not apply within 14 days of grazing or harvest for forage, or within 21 days of harvest of seed or hay. Sevin XLR is registered for grasshopper control on many crops (multiple sites), including soybeans. Check label for more information.
Stallion zeta-cypermethrin chlorpyrifos	3A, 1B	1. Cutworm spp., painted lady (thistle) caterpillar, saltmarsh caterpillar 2. Bean leaf beetle, dectes stem borer, grasshopper spp., green cloverworm, Japanese beetle, soybean aphid, woollybear caterpillar 3. Stink bug spp.	1. 3.75-11.75 fl oz / A 2. 5.0-11.75 fl oz / A 3. 9.25-11.75 fl oz / A	REI is 24 hours. PHI is 28 days. 14 days between applications, with no more than 3 applications per season. Do not allow meat or dairy animals to graze in treated areas or feed treated forage, hay or straw to meat or dairy animals.
Steed zeta-cypermethrin bifenthrin	3A	1. Cutworm spp., green cloverworm, painted lady (thistle) caterpillar 2. Armyworm spp., bean leaf beetle, corn earworm, corn rootworm adult, dectes stem borer adult, grasshopper spp., Japanese beetle adult, looper spp., saltmarsh caterpillar, soybean aphid, stink bug spp., velvetbean caterpillar, webworm	1. 2.5-3.5 fl oz / A 2. 2.5-4.7 fl oz / A	REI is 12 hours. PHI is 21 days. 30 days between applications, with no more than 28.1 fl oz / A per season.
Steward EC indoxacarb	22	Beet armyworm, cabbage looper, corn earworm, fall armyworm, green cloverworm, soybean looper, yellowstriped armyworm	4.6-11.3 fl oz / A	REI is 12 hours. PHI is 21 days. Do not feed or graze livestock on treated fields.
Swagger bifenthrin and imidacloprid	3A, 4A	Aphids, bean leaf beetle, cloverworm, corn earworm, corn rootworm beetle, cutworms, fall armyworm, grasshoppers, Japanese beetle adult, loopers, saltmarsh caterpillar, stink bugs, two-spotted spider mite, western bean cutworm, webworms, whitefly, yellow striped armyworm	7.6-12.2 fl oz / A	REI is 12 hours. Maximum of 2 applications per season. Minimum 30 day interval between applications. PHI is 18 days.

*REI = Restricted Entry Interval PHI = Preharvest Interval

Soybean

Seed and Foliar Insecticides *(continued)*

Insecticide Active Ingredient	Mode of Action	Target Pest	Rate	Comments*
Tracer spinosad	5	1. Green clover worm, soybean looper, true armyworm, velvet bean caterpillar 2. Fall armyworm, yellowstriped armyworm, beet armyworm, corn earworm, saltmarsh caterpillar	1. 1.0-2.0 fl oz / A 2. 1.5-2.0 fl oz / A	REI is 4 hours. PHI is 28 days. Do not apply more than a total of 6 fl oz per acre per year. Do not feed treated forage or hay to meat or dairy animals.
Transform WG sulfoxaflor	4C	Soybean aphid	0.75-1.0 oz / A	REI is 24 hours. PHI is 7 days for grain, forage or hay. Maximum 4 applications per crop. Do not make applications less than 14 days apart. Do not make more than two consecutive applications per crop. Do not apply more than 8.5 oz per acre per year. No more than two applications to forage.
Triple Crown clothianidin, zeta-cypermethrin, and bifenthrin	3, 4A	1. Bean leaf beetle, cutworms, green cloverworm, leafhopper, thistle caterpillar, soybean aphid 2. Dectes stem borer, grasshoppers, Japanese beetle adult, loopers, rootworm adult, stink bugs, woollybear caterpillar	1. 3.5-4.8 fl oz / A 2. 4.8 fl oz / A	REI is 12 hours. PHI is 21 days. Do not graze or harvest treated soybean forage, straw, or hay for livestock feed. Maximum 14.2 fl oz / A per season.
Warrior II with Zeon Technology lambda-cyhalothrin	3A	1. Bean leaf beetle, cabbage looper, corn earworm, corn rootworm beetle, cutworm, green cloverworm, painted lady caterpillar, saltmarsh caterpillar, soybean aphid, thrips (except western flower thrip), velvetbean caterpillar, woollybear caterpillar 2. Fall armyworm, grasshopper, Japanese beetle adult, stink bug, webworm, yellowstriped armyworm	1. 0.96-1.60 fl oz / A 2. 1.60-1.92 oz / A	REI is 24 hours. Do not graze or harvest treated soybean forage, straw or hay for livestock feed. PHI is 30 days.
Zeal SC etoxazole	10B	Two spotted spider mite (and any other Tetranychidae)	2.0-6.0 fl oz / A	Supplemental label expires on July 21, 2019. REI is 12 hours. Maximum 1 application per season. Do not apply after R5 stage. Do not graze treated soybean fields or feed treated forage or hay to livestock.

*REI = Restricted Entry Interval PHI = Preharvest Interval

Wheat

Seed and Foliar Insecticide Efficacy

Insecticide	Aphids	Armyworm	Army Cutworm	Cereal Leaf Beetle	Grasshopper	Pale Western Cutworm	Wireworm
Seed Treatment							
Cruiser 5FS	X				X		X
Gaucho	X				X		X
NipsIt Inside	X				X		X
Foliar-Applied							
Baythroid XL	X	X	X		X	X	
Besiege	X	X	X	X	X	X	
Cobalt Advanced	X	X	X		X	X	
Dimethoate	X						
DiPel		X					
Entrust		X					
Lannate	X	X		X			
Lorsban 4E	X			X	X		
Malathion	X	X			X		
Methyl 4EC	X	X			X		
Mustang Maxx EC	X	X	X		X	X	
PennCap-M	X	X			X		
Proaxis	X	X	X		X	X	
Radiant SC		X		X			
Respect	X	X	X		X	X	
Sevin XLR Plus		X					
Stallion	X	X	X		X	X	
Success		X					
Tracer		X		X			
Warrior	X	X	X		X	X	

X = insecticide labeled for control against this pest.

Wheat

Seed and Foliar Insecticides

Insecticide Active Ingredient	Mode of Action	Target Pest	Rate	Comments*
Baythroid XL beta-cyfluthrin	3A	1. Army cutworm, cutworm 2. Aphids, grasshopper, pale western cutworm	1. 1.0-1.8 oz/A 2. 1.8-2.4 oz/A	The pre-grazing or foraging interval is 3 days. PHI is 30 days. REI is 12 hours. Maximum of 4.8 fl oz/A allowed per crop season. Only effective against small grasshopper nymphs.
Besiege Lambda-cyhalothrin and Chlorantraniliprole	3,28	1. Army cutworm, cutworm species 2. Armyworm, bird cherry-oat aphid, cereal leaf beetle, English grain aphid, fall armyworm, flea beetle species, grasshopper species, Hessian fly, orange blossom wheat midge, Russian wheat aphid, stink bug species, yellowstriped armyworm 3. Grass sawfly 4. Chinch bug, corn leaf aphid, greenbug, mite species	1. 5.0-8.0 fl oz/A 2. 6.0-10.0 fl oz/A 3. 8.0-10.0 fl oz/A 4. 10.0 fl oz/A	PHI is 30 days. REI is 24 hours. Do not exceed a total of 18.0 fl oz of Besiege or 0.06 lb ai of lambda-cyhalothrin products or 0.2 lb ai of chlorantraniliprole products per acre per year.
Cobalt Advanced chlorpyrifos and gamma cyhalothrin	1B, 3A	1. Aphids, grasshopper 2. Army cutworm, cutworm, armyworm	1. 7.0-13.0 fl oz/A 2. 13.0-25.0 fl oz/A	Do not apply within 14 days of harvest for forage and hay, and within 28 days of harvest for grain and straw. Do not allow meat or dairy animals to graze or otherwise feed on treated forage within 7 days after last treatment. Do not feed straw from treated wheat within 30 days of application. REI is 24 hours.
Cruiser 5FS thiamethoxam	4A	1. Bird cherry-oat aphid, English grain aphid, greenbug, Hessian fly, Russian wheat aphid 2. Wireworm 3. Grasshopper	1. 0.75-1.33 fl oz/100 lb seed 2. 0.19 to 0.5 fl oz/100 lb seed 3. 1.33 fl oz/100 lb seed	120 days plant-back interval for non-labeled crops
Dimethoate 4EC dimethoate	1B	1. Aphid 2. Grasshopper	1. 0.5-0.75 pt/A 2. 0.75 pt/A	Do not graze immature plants within 14 days of application. PHI is 35 days. REI is 48 hours. Do not make more than 2 applications per season.
DiPel ES <i>Bacillus thuringiensis</i>	11	Armyworm	2.0-4.0 pt/A	No pre-harvest interval. REI is 4 hours. Only effective against small armyworms.
Entrust spinosad	5	Armyworm, webworm	1.0-2.0 fl oz/A	PHI is 21 days for grain or straw and 14 days for forage or hay. REI is 4 hours. Do not apply more than 5.6 fl oz per acre per year
Gaucha 600 imidacloprid	4A	1. Bird cherry-oat, English grain, greenbug, Russian wheat aphid, Hessian fly 2. Wireworm 3. Grasshopper	1. 0.8-2.4 fl oz/100 lb seed 2. 0.13-0.26 fl oz/100 lb seed 3. 1.2-2.4 fl oz/100 lb seed	Grazing interval is 45 days. 12 month plant-back interval for non-labeled crops. Will suppress grasshopper damage.
Lannate LV methomyl	1A	Armyworm, aphid, cereal leaf beetle	0.75-1.5 pt/A	Do not graze or feed treated forage or hay to livestock within 10 days of last application. PHI is 7 days. REI is 48 hours.
Lorsban Advanced Lorsban 4E chlorpyrifos	1B	1. Aphid, grasshopper 2. Army cutworm, armyworm, cereal leaf beetle	1. 0.5-1.0 pt/A 2. 1.0 pt/A	PHI is 28 days. Do not graze or feed treated forage to livestock within 14 days of application. REI is 24 hours. Effectiveness reduced on adult grasshoppers. Will only give suppression against armyworm.
Malathion 8 malathion	1B	Armyworms, aphids, grasshoppers	1.0-1.25 pt/A	REI is 12 hours. PHI is 7 days.

*REI = Restricted Entry Interval PHI = Preharvest Interval

Wheat

Seed and Foliar Insecticides *(continued)*

Insecticide Active Ingredient	Mode of Action	Target Pest	Rate	Comments*
Methyl 4EC methyl parathion	1B	1. Aphid 2. Grasshopper 3. Armyworm	1. 0.5-1.5 pt/A 2. 0.75-1.0 pt/A 3. 1.5 pt/A	REI is 4 days (5 days where rainfall is less than 25 inches per year). PHI is 15 days
Mustang Maxx zeta-cypermethrin	3A	1. Army cutworm 2. Armyworm, pale western cutworm 3. Aphid, grasshopper	1. 1.28-4.0 oz/A 2. 1.76-4.0 oz/A 3. 3.2-4.0 oz/A	PHI is 14 days for grain, forage and hay. REI is 12 hours. Do not apply more than 20 fl oz per acre per year.
NipsIt Inside clothianidin	4A	1. Aphid 2. Grasshopper	1. 0.75-1.79 fl oz/100 lb seed 2. 1.79 fl oz/100 lb seed	30-day plant back restriction on dry beans.
PennCap-M methyl parathion	1B	Aphid, grasshopper, armyworm	2.0-3.0 pt/A	REI is 31 days. PHI is 14 days. Highly toxic to bees. Do not apply more than 6 pt per acre per year.
Proaxis gamma-cyhalothrin	3A	1. Army cutworm, cutworm 2. Armyworm, grasshopper, Oat bird-cherry aphid, Russian wheat aphid, English grain aphid 3. Greenbug, corn leaf aphid	1. 1.92-3.2 oz/A 2. 2.56-3.84 oz/A 3. 3.84 oz/A	PHI is 30 days. REI is 24 hours. Do not apply more than 0.48 pt per acre per year.
Radiant SC spinetoram	5	1. Cereal leaf beetle 2. Corn earworm, armyworms, webworms	1. 2.0-6.0 fl oz/A 2. 3.0-6.0 fl oz/A	REI is 4 hours. Do not apply within 21 days of grain or straw harvest or within 3 days of fodder, forage or hay harvest.
Sevin XLR PLUS carbaryl	1A	Armyworm, fall armyworm, grasshoppers	1.0-1.5 qt/A	PHI is 21 days for grain or straw. Do not apply within 7 days of harvest or grazing of forage. REI is 12 hours.
Stallion zeta-cypermethrin	3A	1. Army cutworm, pale western cutworm 2. Bird cherry oat aphid, grasshopper spp. 3. Armyworm, grain aphids	1. 3.75-11.75 fl oz/A 2. 5.0-11.75 fl oz/A 3. 9.25-11.75 fl oz/A	REI is 24 hours. PHI is 14 days for forage, 28 days for grain.
Success spinosad	5	Armyworm	3.0-6.0 fl oz/A	Do not enter or allow others to enter the treated area until sprays have dried. Do not apply within 21 days of grain or straw harvest or within 3 days of forage, fodder, or hay harvest. Do not apply more than 19 fl oz per acre per year. Effectiveness reduced on adult grasshoppers.
Tracer spinosad	5	1. Cereal leaf beetle 2. Armyworm	1. 1.0-3.0 fl oz/A 2. 1.5-3.0 fl oz/A	Do not apply within 21 days of grain or straw harvest, or within 3 days of forage or hay harvest. Do not apply more than 9 fl oz per acre per year.
Warrior II with Zeon Technology lambda-cyhalothrin	3A	1. Army cutworm, cutworm 2. Armyworm, grasshopper, Russian wheat aphid, bird cherry-oat aphid, English grain aphid 3. Corn leaf aphid, greenbug	1. 1.92-3.2 oz/A 2. 2.56-3.84 oz/A 3. 3.84 oz/A	Do not graze or harvest forage as feed within 7 days after treatment. Do not feed treated straw within 30 days after treatment. PHI is 30 days. REI is 24 hours. Do not apply more than 3.84 fl oz per acre per year.

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2017 Approximate Retail Price (\$) per Unit of Selected Insecticides for Field Crops

Survey price estimates in September 2016

Product	2017 Price (\$) per Unit
Alias 4F	120.00/gal
Arctic 3.2E	90.00/gal
Asana XL	85.00/gal
Avicta Complete Corn	20.00/unit
Aztec 2.1G	4.00/lb
Aztec 4.67G	9.00/lb
Baythroid XL	370.00/gal
Belt SC	1100.00/gal
Besiege	300.00/gal
Blackhawk	100.00/lb
Brigade	145.00/gal
Capture LFR	360.00/gal
Cobalt Advanced	60.00/gal
Comite II	65.00/gal
Coragen	1140.00/gal
Counter 20G	5.00/lb
Cruiser 5FS Wheat	870.00/gal
Declare	200.00/gal
Dimethoate 4EC	47.00/gal
Dimilin 2L	340.00/gal
DiPel DF	16.00/lb
Endigo ZC	240.00/gal
Entrust	550.00/lb
Fanfare 2EC	62.00/gal
Force 3G	7.00/lb
Force CS	460.00/gal
Fyfanon UNV Ag	55.00/gal

Product	2017 Price (\$) per Unit
Gaucha 600FS	400.00/gal
Hero	230.00/gal
Justice	240.00/gal
Lannate LV	95.00/gal
Leverage 360	300.00/gal
Lorsban Advanced	55.00/gal
Lorsban 4E	55.00/gal
Lorsban 15G	2.65/lb
Malathion 5EC	34.00/gal
Mustang Maxx	190.00/gal
Nufos 4E	37.00/gal
Oberon 4SC	520.00/gal
Onager	360.00/gal
Prevathon	190.00/gal
Radiant SC	930.00/gal
Regent 4SC	9.90/oz
Sevin 4F	55.00/gal
Sevin XLR Plus	60.00/gal
Silencer	65.00/gal
Skyraider	145.00/gal
SmartChoice 5G	5.30/lb
Steward EC	310.00/gal
Thimet 20G	4.30/lb
Thionex 3EC	35.00/gal
Warrior II with Zeon Technology	380.00/gal
Zeal Miticide	250.00/3 oz bag

Insecticide Dictionary

See page 203 for a guide to reading dictionary entries. Number/letters in brackets in the Insecticide Dictionary correspond to the product Mode (s) of Action listed on page 269 and are provided by the Insecticide Resistance Action Committee (IRAC).

Adjourn® [esfenvalerate (0.66 lb ai/gal)]. Makhteshim Agan of North America, Inc. EPA Reg. No. 352-515-66222. 01/2005. RUP. {3A}.

Agri-Mek SC [abamectin (0.7 lb abamectin per gallon)] For control of spider mites in soybean. Syngenta Crop Protection. EPA Reg. No. 100-1351. 5-16. [6]

Alias™ 2F [imidacloprid (2 lb ai/gal)]. For use in pest management and suppression of insect-vectored diseases and maintenance of plant health. Makhteshim Agan of North America, Inc. EPA Reg. No. 264-758-66222. 06/2005. {4A}.

Alias® 4F [imidacloprid (4 lb ai/gal)]. For use in pest management and suppression of insect-vectored diseases and maintenance of plant health. Makhteshim Agan of North America, Inc. EPA Reg. No. 66222-156-12446. 09/2008. {4A}.

Ambush® 2EC [permethrin (2 lb ai/gal)]. Amvac. EPA Reg. No. 5481-549. RUP. {3A}.

Arctic® 3.2EC [permethrin (3.2 lb ai/gal)]. Winfield Solutions, LLC. EPA Reg. No. 1381-187. RUP. {3A}.

Asana® XL – [esfenvalerate (0.66 lb ai/gal)]. For broad spectrum insect control in many field crops and fruit. Valent. EPA Reg. No. 59639-209. RUP. {3}

Aztec® 2.1G [2.0% tebufirimifos, 0.1% cyfluthrin]. For control of corn rootworms, cutworms, and other soil insects in corn. Bayer CropScience. EPA Reg. No. 264-775. 06/2001. RUP. {1B, 3A}.

Aztec® 4.67G [4.45% tebufirimifos, 0.22% cyfluthrin]. For control of corn rootworms, cutworms, and other soil insects in corn. Amvac. EPA Reg. No. 264-811-5481. 6/2001. RUP. {1B, 3A}.

Ballista LFC [lambda-cyhalothrin (1 lb per gallon)] A liquid fertilizer compatible insecticide to control soil insects in corn. Syngenta Crop Protection. EPA Reg. No. 100-1086. 3-15. [3]

Baythroid® XL [Beta-cyfluthrin (1 lb ai/gal)]. For control of certain insect pests on field, vegetable, tree, and vine crops. Bayer CropScience. EPA Reg. No. 264-840. 09/2008. RUP. {3A}.

Belt® SC [flubendiamide (4 lb ai/gal)]. Bayer CropScience. EPA Reg. No. 264-1025. 08/2008 {28}.

Belay® [clothianidin (2.13 lb ai/gal)]. For control of sucking and chewing insects in a wide variety of field crops, fruits, and vegetables. Valent. EPA Ref. No. 59639-150. 04/2012. {4A}.

Besiege® [chorantraniliprole and lambda-cyhalothrin (0.835 lb of chlorantraniliprole and 0.417 lb of lambda-cyhalothrin per gallon)]. For control of insects on field corn, soybeans, alfalfa, sunflower, other field crops. Syngenta. EPA Reg. No. 100-1402. 03/2013. {3A, 28}.

Bifenture® EC [bifenthrin (2 lb ai/gal)]. For control of insects and mites on field corn, soybeans, and various fruit and vegetable crops. United Phosphorus, Inc. EPA Reg. No. 70506-57. 04/2013. {3A}

Bifenture® LFC [bifenthrin (1.5 lb ai per gal)]. For control of labelled insects on field corn, seed corn, popcorn, soybeans and other crops. United Phosphorus, Inc. EPA Reg. No. 70506-305. 11/6/2013. RUP. {3A}.

Blackhawk [spinosad (36% by weight)] For control of lepidopterous larvae, leafminers, beetles, thrips. Dow Agrosciences. EPA Reg. No. 62719-523. 10-11 [5]

Brigade® 2EC [bifenthrin (2 lb ai/gal)]. FMC. EPA Reg. No. 279-3313. 10/2008. RUP. {3A}.

Capture® LFR [bifenthrin (1.5 lb ai/gal)]. For mixing directly with liquid fertilizer to control soil insect pests. FMC. EPA Reg. No. 279-3302. 09/2008. {3A}.

Cobalt® [chlorpyrifos and gamma-cyhalothrin (2.5 lb chlorpyrifos and 0.045 lb gamma-cyhalothrin per gallon)]. For control of various insects infesting listed field, fruit, nut, and vegetable crops. Dow AgroSciences. EPA Reg. No. 62719-575. RUP. 09/2008 {1B, 3A}.

Cobalt® Advanced [chlorpyrifos and lambda-cyhalothrin (2.503 lb chlorpyrifos and 0.129 lb lambda-cyhalothrin per gallon)]. For control of various insects in field, fruit, nut, and vegetable crops. Dow AgroSciences, EPA Reg. No. 62719-615. 07/2012. {1B, 3A}.

Comite® II [propargite (6 lb ai/gal)]. Chemtura USA Corp. EPA Reg. No. 400-154. {12C}.

Coragen [chlorantraniliprole] (1.67 lb ai/gal). For control of insects on corn, soybeans, grass forage, and various fruit and vegetable crops. Dupont. EPA Reg. No. 352-729. 06/2013. {28}.

Counter® 15G Lock 'n Load® [terbufos (15% terbufos)]. For use in field corn, field corn grown for seed, popcorn, sweet corn, sugarbeets, and grain sorghum. Amvac. EPA Reg. No. 5481-545. RUP. {1B}.

Counter® Smartbox® 20G [terbufos (20% terbufos)]. For use in field corn (including field corn containing in-plant corn rootworm protection traits such as YieldGard®, Herculex®, and Agrisure®), field corn grown for seed, popcorn, sweet corn, sugarbeets, and grain sorghum. Amvac. EPA Reg. No. 5481-562. RUP. 03/2009 {1B}.

Cruiser® 5FS [thiamethoxam (5 lb ai/gal)]. A seed treatment product for protection from, or control of, listed insects on barley, corn, cotton, cucurbit vegetables, legume vegetables (including soybean), oilseed crops (black mustard seed, borage seed, crambe seed, field mustard seed, flax seed, Indian mustard seed, Indian rapeseed seed, rapeseed seed, and safflower seed), potatoes, sorghum, sunflower, and wheat. Syngenta. EPA Reg. No. 100-941. 05/2009 {4A}.

Insecticide Dictionary *(continued)*

Declare® [gamma-cyhalothrin (1.25 lb ai/gal)]. For control of insect pests in alfalfa, corn, grass forage, fodder and hay, small grains, sorghum (grain), soybean, sunflower, various fruit and vegetable crops, and non-cropland areas adjacent to crops. Cheminova. EPA Reg. No. 67760-96. {3A}.

Defcon® 2.1G [tebupirimifos, cyfluthrin (2.0% tebupirimifos, 0.1% cyfluthrin)]. For control of corn rootworms, cutworms, and other soil insect pests in corn. Helena Chemical Company. EPA Reg. No. 264-813-5905. 2005. {1B, 3A}.

Delta Gold® 1.5EC [deltamethrin (1.5 lb ai/gal)]. For insect control on bulb vegetables, cucurbit vegetables, fruiting vegetables, root vegetables (except sugarbeets), tuberous and corm vegetables, pome fruits, tree nuts, canola and rapeseed, cotton, field corn, popcorn, sweet corn, soybeans, sorghum and sunflowers. Winfield Solutions, LLC. EPA Reg. No. 264-1011-1381. 11/2008. {3A}.

Diflumax® @L [diflubenzuron (2 lb ai per gal)]

Dimate 4E [dimethoate (4 lb ai/gal)]. For control of insects and mites on field, vegetable, fruit, and nut crops. Winfield Solutions LLC. EPA Reg. No. 9779-273, {1B}

Dimethoate 4E [dimethoate (4 lb ai/gal)]. Cheminova. EPA Reg. No. 34704-207-67760. 02/1998. {1B}.

Dimilin® 25W [diflubenzuron (25% diflubenzuron)]. For use on trees, shrubs, ornamentals, mushrooms, soybeans, cotton, pears, peppers, grassland, and non-crop areas. Chemtura. EPA Reg. No. 400-465. 09/2007. RUP. {15}.

Dimilin® 2L [diflubenzuron (2 lb ai/gal)]. For use on barley, oats, triticale, wheat, cotton, grassland and non-crop areas, leafy brassica and turnip greens, peanuts, pears, peppers, turfgrass, rice, soybeans, stonefruit (excluding cherries), and tree nuts. Chemtura. EPA Reg. No. 400-461. 02/2008. RUP. {15}.

DiPel® ES [*Bacillus thuringiensis*, subsp. *kurstaki*, strain ABTS-351, fermentation solids, spores, and insecticidal toxins (64 billion cabbage looper units per gallon)]. Valent BioSciences Corporation. EPA Reg. No. 73049-17. 8/2007. {11}.

Discipline® 2EC [bifenthrin (2 lb ai/gal)]. For control of insects and mites on field corn and soybeans, and various fruit and vegetable crops. Amvac. EPA Reg. No. 5481-517. {3A}.

Endigo® ZC [lambda-cyhalothrin, thiamethoxam (1.18 pounds thiamethoxam and 0.88 pounds lambda-cyhalothrin per gallon)]. For use on cotton, pecans, soybeans, and tuberous and corm vegetables. Syngenta. EPA Reg. No. 100-1276. RUP. {3A, 4A}.

Entrust® [spinosad (80% spinosad)]. For control of lepidopterous larvae (worms or caterpillars), leafminers, and thrips in asparagus, bushberries, caneberries, cereal grains, citrus, cole crops, corn (field corn, sweet corn, popcorn, and corn grown for seed), cotton, cranberry, cucurbits, fig, fruiting vegetables (okra, tomatoes, peppers and eggplants), grape, herbs, leafy vegetables, leaves of root, tuber, and legume vegetables, peanut, pome fruits, potatoes and tuberous and corm vegetables, root vegetables, soybean, stone fruits, strawberry, succulent and dry beans and peas, tree farms or plantations, tree fruits, and tree nuts and pistachios, and for control of red imported fire ants. Dow AgroSciences. EPA Reg. No. 62719-282 {5}.

Ethos XB [bifenthrin (1.5 lb ai/gal)] For mixing with liquid fertilizer to control listed soil pests. FMC Corporation. EPA Registration No. 279-3473, 07/06/2016. {3A}

Fanfare® 2EC [bifenthrin (2 lb ai/gal)]. MANA, EPA Reg. No. 66222-99. 02/2009. RUP. {3A}.

Force® 3G [tefluthrin (3% tefluthrin)]. For control of insects on field corn, popcorn, seed corn and sweet corn. Syngenta. EPA Reg. No. 100-1075. 9/2008. RUP. {3A}.

Force® CS [tefluthrin (2.1 lb ai/gal)]. For control of insects on field corn, popcorn, seed corn, and sweet corn. Syngenta. EPA Reg. No. 100-1253. 10/2008. RUP. {3A}.

Fortress® 2.5G [chlorethoxyfos (2.5% chlorethoxyfos)]. To control corn rootworms, wireworms, cutworms, seed corn maggots, white grubs, grape colaspis and symphytans on field corn, seed corn, sweet corn, and popcorn. Amvac. EPA Reg. No. 5481-494. 4/2008. RUP. {1B}.

Fyfanon® ULV AG [malathion (9.9 lb ai/gal)]. Cheminova. EPA Reg. No. 67760-35. {1B}.

Gaucha® 600 Flowable [imidacloprid (5 lb ai/gal)]. Bayer CropScience. EPA Reg. No. 264-968. 08/2007. {4A}.

Govern® 4E [chlorpyrifos (4 lb ai/gal)]. For control of insects on alfalfa, field corn, grain sorghum, soybean, sugarbeet, sunflower, wheat, and various fruit and vegetable crops. Tenkoz, Inc. EPA Reg. No. 62719-220-55467. {1B}.

Hatchet® [chlorpyrifos (4 lb ai/gal)]. For control of listed insects infesting certain field, fruit, nut, and vegetable crops. Dow AgroSciences LLC. EPA Reg. No. 62719-220. 06/2012. {1B}.

Hero® [zeta-cypermethrin, bifenthrin (0.31 lb zeta-cypermethrin and 0.93 lb bifenthrin per gallon)]. FMC Corporation. EPA Reg. No. 279-3315. RUP. 09/2008. {3A}.

Imidan® 70-W [phosmet (70% ai)]. Gowan Company. EPA Reg. No. 10163-169. 10/2008. RUP. {1B}.

Inovate® Seed Protectant [clothianidin (1.34 lb/gal), metalaxyl (1.108 lb/gal), ipconazole (0.0675 lb/gal)]. Valent. EPA Reg. No. 59639-176. 08/2011. {4A}.

Intrepid® 2F [methoxyfenozide (2 lb ai/gal)]. Dow AgroSciences. EPA Reg. No. 62719-442. 08/2008. {18}.

Justice® [acetamiprid (1.0 lb/gal), bifenthrin (0.8 lb/gal)]. For control of various soybean insects. Gowan. EPA Reg. No. 8033-116-10163. RUP. 05/2012. {3, 4A}.

Insecticide Dictionary *(continued)*

Lambda-Cy EC [lamda-cyhalothrin (1 lb ai per gal)]. For control of labeled insects on alfalfa, alfalfa grown for seed, field corn, popcorn, seed corn, wheat, soybeans, and other crops. United Phosphorus, Inc. EPA Reg. No. 70506-121. 06/2010. RUP. {3A}.

Lannate® LV [methomyl (2.4 lb ai/ gal)]. Dupont. EPA Reg. No. 352-384. RUP. 03/2008. {1A}.

Lannate® SP [methomyl (90% ai)]. Dupont. EPA Reg. No. 352-342. RUP. 02/2008. {1A}.

Larvin® 3.2 [thiodicarb (3.2 lb ai/ gal)]. Bayer CropScience. EPA Reg. No. 264-379. RUP. 10/2007. {1A}.

Leverage® 360 [imidacloprid, cyfluthrin (2 lb imidacloprid per gallon plus 1 lb cyfluthrin per gallon)]. For protection of listed crops from certain insects and to promote enhanced plant health and yield. Bayer CropScience. EPA Reg. No. 264-1104. RUP. 02/2010. {3A, 4A}.

Lorsban® 4E [chlorpyrifos (4 lb ai/ gal)]. For control of various insects infesting certain field, fruit, nut, and vegetable crops. Dow AgroSciences. EPA Reg. No. 62719-220. RUP. 12/2008. {1B}.

Lorsban® 15G [chlorpyrifos (15% chlorpyrifos)]. For control of various insects infesting certain field and vegetable crops. Dow AgroSciences. EPA Reg. No. 62719-34. RUP. 09/2008. {1B}.

Lorsban® Advanced [chlorpyrifos (3.755 lb ai/ gal)]. For control of listed insects infesting certain field, fruit, nut, and vegetable crops. Dow AgroSciences. EPA Reg. No. 62719-591. RUP. 11/2008. {1B}.

Lumivia [chlorantraniliprole (50% by weight)] Insecticide seed treatment on field corn. E. I. Dupont de Nemours and Company. EPA Reg. No. 352-841. 5-14 [28]

Malathion 8F [malathion (8 lb malathion per gallon)]. Gowan Company. EPA Reg. No. 10163-21. 11/2007. {1B}.

Malathion 57 EC [malathion (5 lb ai per gal)]. For control of labeled insects on alfalfa, field corn, wheat and other crops. Cheminova. EPA Reg. No. 67760-40. 4/2013. RUP. {1B}.

Methyl 4E [methyl parathion (4 lb methyl parathion per gallon)]. Cheminova. EPA Reg. No. 67760-43. RUP. {1B}.

Mustang® Maxx [zeta-cypermethrin (0.8 lb ai/ gal)]. For foliar insect control on field, vegetable, fruit, grass and non-grass animal feeds. FMC Corporation. EPA Reg. No. 279-3426. 05/2012. RUP. {3A}.

Mustang® Max EC [zeta-cypermethrin (0.8 lb ai/ gal)]. FMC Corporation. EPA Reg. No. 279-3327. 10/2008. RUP. {3A}.

Neemix® 4.5 [azadirachtin (0.34 lb ai/ gal)]. For control of a variety of insects on field, vegetable and fruit crops. Certis, USA, LLC. EPA Reg. No. 70051-9. {unknown}.

NUFOS® 4E [chlorpyrifos (4 lb ai/ gal)]. Cheminova, Inc. EPA Reg. No. 67760-28. 06/2009. RUP. {1B}.

Oberon® 45C [spiromesifin (4 lb ai/ gal)]. Bayer CropScience. EPA Reg. No. 264-850. 09/2008. {23}.

Onager® [Hexythiazox (1 lb ai/ gal)]. Gowan Company. EPA Reg. No. 10163-277. 02/2009. {10A}.

Paradigm™ [lambda-cyhalothrin (1 lb ai/ gal)]. For control of insects on cereal grains, soybeans, sunflower, alfalfa, grass forage, fodder and hay, fruit, vegetable and nut crops, and noncropland areas. MANA. EPA Reg. No. 66222-223. 12/2011. RUP. {3}

PennCap-M® [methyl parathion (2 lb ai/ gal)]. United Phosphorus, Inc. EPA Reg. No. 70506-193. RUP. 2008. {1B}.

Poncho™ 600 [clothianidin (5 lb ai/ gal)]. For use on canola, rapeseed, corn, and sorghum for the control of certain insect pests. Bayer CropScience. EPA. Reg. No. 264-789. 08/2007. {4A}.

Pounce® 1.5G [permethrin (1.5% ai)]. FMC Corporation. EPA Reg. No. 279-3059. RUP. 12/2008. {3A}.

Prevathon® [chlorantraniliprole (0.43 ai/ gal)]. For control of caterpillars and grasshoppers on corn, cereals, grass, non-grass forages, legumes, oilseeds, and soybeans. DuPont. EPA Reg. No. 352-844. 03/2011. {28}.

Prey® 1.6 [imidacloprid (1.6 lb ai/ gal)]. For control of listed insects infesting various crops. Loveland Products, Inc. EPA Reg. No. 34704-894. 07/2009. {4A}.

Proaxis™ [gamma-cyhalothrin (0.5 lb ai/ gal)]. For control of insect pests in alfalfa, canola, cole crops, corn, cotton, fruiting vegetables, legume vegetables, lettuce, onion, peanut, pome fruits, rice, sorghum (grain), soybean, stone fruits, sugarcane, sunflower, tree nuts including pecans, wheat, triticale, conifer and deciduous trees (plantations, nurseries and seed orchards) and non-cropland areas adjacent to crops. Loveland Products, Inc. EPA Reg. No. 74921-3-34704. RUP. 03/2004. {3A}.

Radiant™ SC [spinetoram (1 lb ai/ gal)]. For control or suppression of lepidopterous larvae (worms, caterpillars), dipterous leafminers, thrips, and certain psyllids in asparagus, bulb vegetables, cereal grains (except rice), cole crops, corn (field corn, sweet corn, popcorn, and corn grown for seed, cotton, cucurbits, fruiting vegetables (tomato, peppers, and eggplant), and okra, herbs, leafy vegetables and leaves of root and tuber and legume vegetables, legume vegetables (succulent and dried beans and peas), mint, peanut, potatoes and tuberous and corm vegetables, root vegetables, soybean, and strawberry. Dow AgroSciences, EPA Reg. No. 62719-545. 10/2007. {5}.

Renounce 20WP [cyfluthrin (20% ai)]. For control of certain insects on listed field crops, vegetables, and tree and vine crops. Bayer CropScience, EPA Reg. No. 264-784. 09/2008. {3A}.

Respect® [zeta-cypermethrin (0.8 lb ai/ gal)]. BASF Corporation. EPA Reg. No. 279-3249-7969. RUP. 01/2007. {3A}.

Seduce Insect Bait [spinosad (0.07% ai by weight)]. For control of earwigs and cutworms on field, vegetable and fruit crops. Certis, USA, LLC. EPA Reg. No. 67702-25-70051. {5}.

Sevin® Brand XLR Plus [carbaryl (4 lb ai/ gal)]. Bayer CropScience. EPA Reg. No. 264-333. 09/2004. {1A}.

Insecticide Dictionary *(continued)*

Sivanto™ 200 SL [flupyradiflurone (1.67 lb ai/gal)]. For use in pest management suppression of insects which vector diseases and maintenance of plant health. Bayer CropScience. EPA Reg. No. 264-1141. 3/15. {4D}

Silencer®, [lambda-cyhalothrin (1 lb ai/gal)]. For control of insects on cereal grains, soybeans, sunflower, alfalfa, grass forage, fodder and hay, fruit, vegetable and nut crops, and noncropland areas. MANA. EPA Reg. No. 66222-104. 11/2008. RUP. {3}

SmartChoice™ 5G [4.3% chlorethoxyfos, 0.7% bifenthrin]. For control of corn rootworm larvae, wireworms, cutworms, seedcorn maggots, white grubs, grape colaspis, and symphylans on field corn, seed corn, sweet corn, and popcorn. Amvac. EPA Reg. No. 5481-561. RUP. {1B, 3A}.

Sniper® [bifenthrin (2 lb ai/gal)]. For control of insect and mites in field corn, popcorn, soybeans, dry beans and various fruit and vegetable crops. Loveland Products. EPA Reg. No. 34704-858. 07/2011. {3A}.

Stallion™ [zeta-cypermethrin (0.275 lb ai/gal) + chlorpyrifos (2.75 lb ai/gal)]. For foliar and soil insect control in row crops, forage crops, tree nuts, and citrus. FMC Corp. EPA Reg. No. 279-9545. 04/2012. {3A, 1B}.

Steed™ [Zeta-cypermethrin and bifenthrin (1.5 lb ai/gal; 8.2% by weight zeta-cypermethrin, 9.8% by weight bifenthrin)]. For control of insects and mites on field corn, soybeans, dried beans, potato and various vegetable crops. FMC Corporation Ag. Products Group. EPA Reg. No. 279-3380. 03/2010. {3A}.

Steward® EC [indoxacarb (1.25 lb ai/gal)]. Dupont. EPA Reg. No. 352-638. 02/2008. {22}.

Success® [spinosad (2 lb ai/gal)]. For control or suppression of lepidopterous larvae (worms, caterpillars, and peach twig borers), leafminers, and thrips. Dow AgroSciences. EPA Reg. No. 62719-292. 04/2009. {5}.

Swagger™ [bifenthrin and imidacloprid (0.5 lb ai of bifenthrin and imidacloprid each per gallon)]. For control of insects on soybeans, various fruit, vegetable and field crops. Loveland Products, Inc. EPA Reg. No. 34704-1045. 08/2012. {3A, 4A}.

Taiga™ Z [lambda-cyhalothrin (1 lb ai/gal)]. Agrilience LLC. EPA Reg. No. 100-1112-1381. RUP. 05/2009. {3A}.

Thimet® 20-G [phorate (20% ai)]. Amvac. EPA Reg. No. 5481-530. RUP. {1B}.

Thionex® 3EC [endosulfan (3 lb ai/gal)]. MANA. RUP. 11/2002. {2A}.

Tombstone™ Helios [cyfluthrin (2 lb ai/gal)]. For control of certain insect pests on field, vegetable, tree, and vine crops. Loveland Products, Inc. EPA Reg. No. 34704-978. 07/2009. RUP. {3A}.

Tracer® [spinosad (4 lb ai/gal)]. For control of lepidopterous larvae (worms or caterpillars), leafminers, and thrips. Dow AgroSciences. EPA Reg. No. 62719-267. 07/2009. {5}.

Transform WG [sulfoxaflor 50% ai by weight]. For control or suppression of aphids, fleahoppers, plant bugs, stink bugs, whiteflies and certain psyllids, scales, and thrips in barley, canola (rapeseed), cotton, root and tuber vegetables, potatoes, soybean, succulent, edible podded, and dry beans, triticale, and wheat. Dow AgroSciences. EPA Reg. No. 62719-625. 05/2013. {4CX}.

Triple Crown™ [2.7% zeta-cypermethrin, 7.87% bifenthrin, 13.8% imidacloprid (2.25 lb ai/gal SE)]. For broad spectrum control of many insects in corn, soybean, and potato. FMC Corp. EPA Reg. No. 279-3440. RUP. 02/2012. {3A, 4A}.

Tundra® EC [bifenthrin (2 lb ai/gal)]. For control of insects and mites in field corn, popcorn, dry beans, soybeans, and various vegetable and fruit crops. Winfield Solutions, LLC. EPA Reg. No. 1381-196. 01/2003. {3A}.

Tundra® Supreme [chlorpyrifos and bifenthrin (2.41 lb chlorpyrifos per gallon and 0.76 lb bifenthrin per gallon)]. For control of insects and mites in field corn, sweet corn and soybeans. Winfield Solutions, LLC. EPA Reg. No. 1381-243. 01/2007. {1B, 3A}.

Voliam Xpress® [chlorantraniliprole and lambda-cyhalothrin (0.835 lb of chlorantraniliprole and 0.417 lb of lambda-cyhalothrin per gallon)]. For control of insects on vegetable, fruit, and nut crops. Syngenta Crop Protection, LLC. EPA Reg. No. 100-1320. 12/2011. RUP. {3, 28}.

Vulcan™ [chlorpyrifos (3.76 lb of chlorpyrifos per gallon)]. For control of insects infesting field, fruit, nut and vegetable crops. MANA. EPA Reg. No. 66222-233. 12/2011. RUP. {1B}.

Warhawk® [chlorpyrifos (4 lb ai/gal)]. For control of listed insects infesting certain field, fruit, nut, and vegetable crops. Loveland Products. EPA Reg. No. 34704-857. 12/2012. {1B}.

Warrior II with Zeon Technology® [lambda-cyhalothrin (1 lb ai/gal)]. Syngenta. EPA Reg. No. 100-1112. 09/2008. {3A}.

Yuma 4E [chlorpyrifos (4 lb ai/gal)]. For control of listed insects infesting certain field, fruit, nut, and vegetable crops. Winfield Solutions, LLC. EPA Reg. No. 62719-220-1381. {1B}.

Zeal [etoxazole (72% ai by weight)]. For control of spider mites on corn, various fruit, vegetable and other crops. Valent USA Corporation. EPA Reg. No. 59639-138. 04/2012. {10B}.

Zeal SC Miticide [etoxazole 2.88 lb ai/gal]. Supplemental label (Expires July 21, 2019) for control of spider mites on soybean. Valent USA Corporation. EPA Reg. No. 59639-202. 2016. {10B}.

Weights and Measures

Volume

1 bushel = 35.24 liters
 27 cubic feet = 1 cubic yard
 1 cubic foot = 0.028 cubic meters
 1 cubic foot = 1728 cubic inches = 7.48 gallons
 1 gallon = 231 cubic inches
 Volume of spire = $D^3 \times 0.5236$

Weight

16 ounces = 1 pound = 453.6 grams
 1 gallon water = 8.34 pounds = 3.78 liters
 1 pint water = 1.04 lb
 1 short ton = 2,000 lb
 1 long ton = 2,240 lb
 1 cubic foot water = 62.43 lb

Liquid Measure

1 milliliter = 1 cubic centimeter = 0.034 fluid ounces
 1 fluid ounce = 2 tablespoons = 29.58 milliliters
 16 fluid ounces = 1 pint = 2 cups
 1 quart = 2 pints = 32 fluid ounces
 8 pints = 4 quarts = 1 gallon
 1 gallon = 128 ounces = 3785 milliliters = 3.785 liters
 1 cup = 16 tablespoons = 48 teaspoons = 236.5 ml
 2 tablespoons = 1 oz = 29.58 ml
 3 t = 1 T = 14.79 ml
 1 qt = 0.946 liters = 946 milliliters
 1 pt = 0.473 liters = 473 milliliters

Dry Measure

1 ounce = 28.3495 grams

Length

1 inch = 2.54 centimeters 16.5 feet = 1 rod
 3 feet = 1 yard = 91.44 centimeters 5280 feet = 1 mile = 1.61 kilometers
 320 rods = 1 mile

Area

43560 square feet = 1 acre = 160 square rods
 1 acre = 0.405 hectare
 640 acres = 1 square mile
 1 square mile = 2.59 square kilometer
 1 square foot = 0.093 square meters
 1 hectare = 2.47 acres
 9 square feet = 1 square yard

Circles

Circumference = diameter $\times$ 3.1416
 Circle area = radius² $\times$ 3.1416

Speed

88 feet per minute = 1 mph
 1 mph = 0.477 meter/sec
 1 mph = 1.61 km/hour

Spraying Systems Microns

Very fine = 153 and less Coarse = 359 - 451
 Fine = 154 - 241 Very coarse = 452 - 740
 Med = 242 - 358 Extremely coarse = greater than 740

Fertilizer Facts — Weight at 60°F (Pounds per 1 gallon of solution)

10-34-0	11.40 lb	28-0-0	10.65 lb
11-37-0	11.60 lb	32-0-0	11.06 lb
7-21-7	11.00 lb	82-0-0	5.15 lb
28-0-0	10.65 lb	12-0-0-26	11.50 lb

Concentration

1 ppm = 1 sec in 12 days
 0.013 ounces in 100 gallons
 or about 8/10 of 1 teaspoon in 1000 gallons
 1 ppb = 1 sec in 32 years
 0.013 ounces in 100,000 gallons
 or about 8/10 of teaspoon in 1,000,000 gal
 1 ppt = 1 sec in 320 centuries
 452 gpm = 1 inch/1 acre/1 hour

Grain Information

	lb/bu	Moisture %
Corn	56	15.5
Soybeans	60	13.0
Grain sorghum	56	14.0
Wheat	60	13.5
Sunflower	25	10.0
Oats	32	14.0

Cu ft $\times$ 0.8 = bushel of grain
 Cu ft $\times$ 0.4 = bushel of ear corn

1 horsepower = 550 ft lb/sec
 = 33,000 ft lb/min
 = 746 watts

Rate Conversion

1 bu/acre = 62.7 kg/ha @ 56 lb/bu crops
 1 qt/acre = 2.33 l/ha
 1 lb/acre = 1.12 kg/ha
 1 gal/acre = 9.34 l/ha
 1 kg/ha = 0.89 lb/acre
 1 kg/ha = 0.015 bu/acre
 1 l/ha = 0.107 gal/acre

Weights and Measures *(continued)*

Spray Volumes

$$\text{GPM (per nozzle)} = \frac{\text{GPA} \times \text{MPH} \times W^*}{5,940}$$

$$\text{GPA} = \frac{5,940 \times \text{GPM (per nozzle)}}{\text{MPH} \times W^*}$$

W* = Nozzle spacing (in boom spraying) or swath (in boomless spraying) in inches

Length of Row Required For One Acre

Row spacing (inches)	Distance	
	(yards)	(feet)
24	7,260	21,780
30	5,808	17,424
36	4,840	14,520
42	4,149	12,445
48	3,630	10,890

Tractor Speeds

Speed in MPH	Time required in seconds to travel a distance of:		
	100 feet	200 feet	300 feet
3.0	23.0	45.0	68.0
3.5	20.0	39.0	58.0
4.0	17.0	34.0	51.0
4.5	15.0	30.0	45.0
5.0	14.0	27.0	41.0
6.0	11.0	23.0	34.0
7.0	9.7	19.0	29.0
7.5	9.0	18.0	27.0
8.0	8.5	17.0	26.0
9.0	7.6	15.0	23.0
10.0	6.8	14.0	20.0
12.0	5.7	11.0	17.0
15.0	4.5	9.0	13.6
20.0	3.4	6.8	10.2

Rates of Flow For Calibrating Spray Tips

GPM	Seconds to collect 1 qt	GPM	Seconds to collect 1 qt
0.05	300	0.20	75
0.06	250	0.23	67
0.07	214	0.25	60
0.08	188	0.30	50
0.09	167	0.35	43
0.10	150	0.40	38
0.11	136	0.50	30
0.12	125	0.60	25
0.13	115	0.70	21
0.14	107	0.80	19
0.15	100	0.90	17
0.17	88	1.00	15

Converting Rate Per Acre To 1,000 Square Feet

- Known facts and assumptions:
 1 acre = 43,560 sq ft
 2 lb = 32 fl oz; 1 pt = 16 fl oz; 1 qt = 32 fl oz
 1 fl oz = 2 tablespoons = 6 teaspoons
 Herbicide rate per acre from bulletin or label
 Hand sprayers apply about 1 gal per 1,000 sq ft
- Convert herbicide rate per acre to ounces:
 For example, 2 quarts per acre = 64 fl oz
- Convert 64 fl oz per acre to fl oz per 1,000 sq ft
 64 fl oz / 43.56 sq ft = 1.50 fl oz
 or 3 tablespoons per 1,000 sq ft
- Add 3 tablespoons of the product to 1 gal of water and apply uniformly to 1,000 sq ft

Spot Treatment

For hand sprayers used for spot treatments, add 1 1/2 tablespoons of herbicide per gallon of water for each 1 quart per acre required broadcast. Apply to 1,000 sq ft. Application amounts are dependent upon spray pressure, walking speed during treatment and tip size. For powered handgun applications, mix broadcast rate in 100 gallons of water.

NOTE: Wettable powder herbicide rates would be determined by the same procedure; however, since volume or density of wettable powder herbicides varies, the calculated rate per 1,000 sq ft should be carefully measured by weighing on a precision scale.

Weights and Measures *(continued)*

Active Ingredient Per Gallon Conversions

Pounds of active material per gal of commercial product	Pints of commercial product needed per acre to give the following pounds of herbicide per acre		
	1/4 lb	1/2 lb	1 lb
2.00	1	2	4
2.64	3/4	1 1/2	3
3.00	2/3	1 1/3	2 2/3
3.34	3/5	1 1/5	2 2/5
4.00	1/2	1	2
5.00	2/5	4/5	1 2/3
6.00	1/3	2/3	1 1/3

Metric Conversions

Symbol	When you know	Multiply by	To find	Symbol
lb	pounds	0.454	kilograms	kg
pt	pints	0.473	liters	L
qt	quarts	0.946	liters	L
fl oz	fluid ounces	29.57	milliliters	ml
A	acres	0.405	hectares	ha
ha	hectares	2.47	acres	A
gal	gallons	3.785	liters	L
L	liters	0.264	gallons	gal
kg	kilograms	2.205	pounds	lb

Abbreviations

ae — acid equivalent	GPA or gpa — gallons per acre	PRE — preemergence
AF — acre foot	GPH — gallons per hour	PSI — lb/sq inch
ai — active ingredient	GPM — gallons per minute	PT — Poast-tolerant
AMS — ammonium sulfate	IMI — imidazolinone	pt — pint
cc — cubic centimeter	IMR — imidazolinone-resistant	pt/A — pints per acre
COC — crop oil concentrate	IR — imidazolinone-resistant	qt — quart
cu ft — cubic feet	IT — imidazolinone-tolerant	qt/A — quarts per acre, qpa
DAA — days after application	lb — pound	qt/100 — quarts/100 gal of spray solution
DAP — days after planting	lb/A — pounds per acre	REI — re-entry interval
DBP — days before planting	l — liter	RPM — revolutions per minute
DF — dry flowable	LPOST — late postemergence	RR — Roundup Ready®
DG — dispersible granules	LL — Liberty-Link®	RR2 — Roundup Ready 2®
EC — emulsifiable concentrate	ME — micro-encapsulated	SA — surface acres
EPOST — early postemergence	ml — milliliter	SG — soluble granules
EPP — early preplant	mph — miles per hour	SM — surface mix
ESO — esterified seed oil	MSO — methylated seed oil	SP — soluble packet
F — flowable	NIS — nonionic surfactant	STS — soybean tolerance to sulfonylurea
fl oz — fluid ounce	OM — organic matter	T — tablespoon
fb — followed by	OP — organophosphate insecticide	tsp — teaspoon
FPM — feet per minute	OS — organosilicone surfactant	UAN — urea-ammonium nitrate
ft — foot	oz — dry ounce	V/V — volume per volume
G — granules	PHI — pre-harvest interval	WDG — wettable dispensable
gal — gallon	POST — postemergence	WG — wettable granule
gal/A — gallons per acre, gpa, GPA	PP — preplant	WP — wettable powder
gm/A — grams per acre	PPSA — preplant surface-applied	W/V — weight per volume

More abbreviations can be found in the *Herbicide Dictionary Section* starting on page 203.

Nebraska Noxious Weeds



Noxious weeds compete with crops, rangeland, and pastures, reducing yields and quality. Some noxious weeds are directly poisonous or injurious to man, livestock, and wildlife. UNL Extension, in cooperation with the Nebraska Department of Agriculture, offers a series of publications on identifying and controlling Nebraska's noxious weeds. Publications are available for:

- Boheman Knotweed, Giant Knotweed, and Japanese Knotweed
- Canada Thistle
- Leafy Spurge
- Musk Thistle
- Phragmites
- Plumeless Thistle
- Purple Loosestrife
- Saltcedar
- Señeca Lespedeza
- Spotted and Diffuse Knapweed

To access these publications online or order print copies, visit the UNL Extension Publications website at <http://extension.unl.edu/publications>.

CropWatch.unl.edu

UNL Extension's Website for Nebraska Crop Production and Pest Management Information



From the CropWatch home page, view timely articles on crop production and pest management or link to more in-depth information and on-line tools organized by crop.

This website integrates crop specific production agriculture, plant protection, and related agricultural websites into a single resource that can be easily searched and navigated. Each crop section features articles on production; variety selection; soil management and fertility; insect, disease, and weed management; irrigation and water use; and marketing and economics. Additional sections cover organic and value-added products, tillage systems, UNL crops research, youth, and related topics.

The news section on the home page features timely stories from extension specialists and educators, a calendar of ag events, and a weather section with daily GDD, ET, precipitation, and temperature updates.

To learn of new stories when they're posted, visit cropwatch.unl.edu and subscribe to email alerts or an RSS feed. You also can also follow UNL_CropWatch on Twitter.

WEED EMERGENCE PATTERN

Emergence is typically described as the visible appearance of the seedling above the soil surface. However, it is not that easy to describe exact emergence time in weed species, as many have a tendency to emerge over an extended period of time (eg. several months). Most weeds in agronomic crops are either winter or summer annuals. Winter annuals can emerge in the fall or early spring, while summer annuals typically start emerging in late April or during the month of May, primarily affected by heat units and soil moisture.

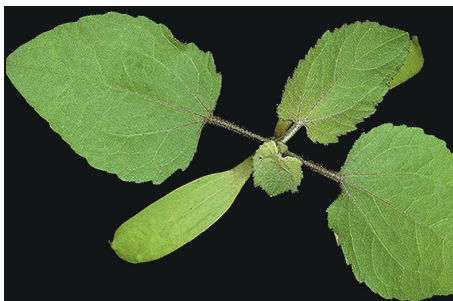
Below is the list of the most common agronomic weeds in Nebraska and their common emergence pattern as indicated by the “X” in a box corresponding to the month. Note that some of these species might deviate from the described pattern due to various dormancy mechanisms. Dormancy is a period during which seeds (or plants) are not active (not growing).

Weed Species	March	April	May	June	July	August	September	October	November
Field Pennycress	X	X	X				X	X	X
Henbit	X	X	X				X	X	X
Marestail	X	X	X				X	X	X
Tansy mustard	X	X	X				X	X	X
Shepherdspurse	X	X	X					X	X
Prickly lettuce	X	X	X	X					
Blue mustard	X	X					X	X	X
Green foxtail			X	X	X	X			
Yellow foxtail			X	X	X	X			
Giant foxtail			X	X	X	X			
Wooly cupgrass			X	X					
Large crabgrass			X	X	X	X			
Barnyardgrass			X	X					
Shattercane			X	X					
Downy brome	X	X				X	X	X	X
Sandbur			X	X	X	X			
Kochia	X	X	X						
Lambsquarter	X	X	X						
Common ragweed		X	x	X					
Giant ragweed		X	X						
Russian thistle	X	X	X	X	X				
Wild sunflower	X	X	X	X					
Velvetleaf		X	X	X					
Redroot pigweed			X	X	X	X			
Palmer amaranth			X	X	X	X			
Waterhemp			X	X	X	X			
Morningglories			X	X	X				
Common Cocklebur			X	X	X				
Smartweeds		X	X	X	X				
Eastern black nightshade		X	X	X					
Dandelion from seed			X	X			X	X	X

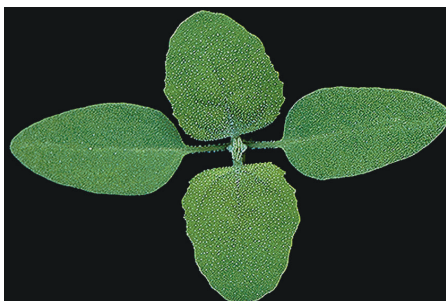
Common Annual Weeds in Nebraska Crops

Broadleaf Weeds

Common cocklebur



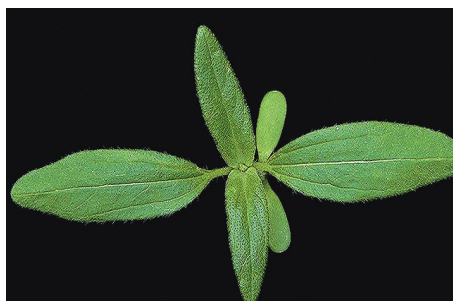
Common lambsquarters



Common ragweed



Common sunflower



Eastern black nightshade



Giant ragweed



Hairy nightshade



Ivyleaf morningglory



Jimsonweed



Kochia



Redroot pigweed



Russian thistle



Common Annual Weeds in Nebraska Crops

Broadleaf Weeds

Velvetleaf



Venice mallow



Wild buckwheat



Waterhemp



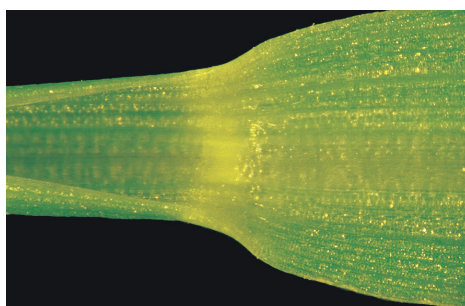
Wild mustard



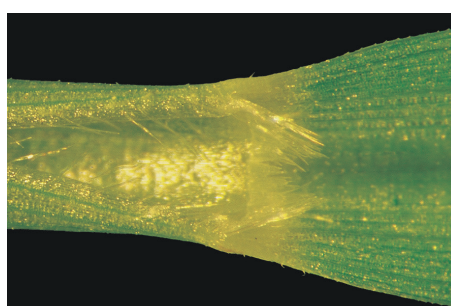
(Source: S. J. Nissen and D. E. Wilson.
Department of Bioagricultural Sciences
and Pest Management, Colorado State
University, Fort Collins, Colo. 80523-1177

Grass Weeds

Barnyardgrass



Green foxtail



Longspine sandbur



Wild oat



Wild proso millet

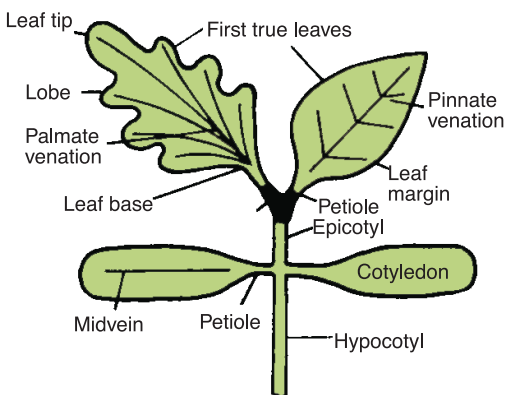


Yellow foxtail



Broadleaf weed seedling identification key

Vegetative broadleaf plant parts



STEP 1 - Identify cotyledon shape.

STEP 2 - Are first true leaves alternate or opposite?

STEP 3 - Answer question yes or no.



Opposite leaves

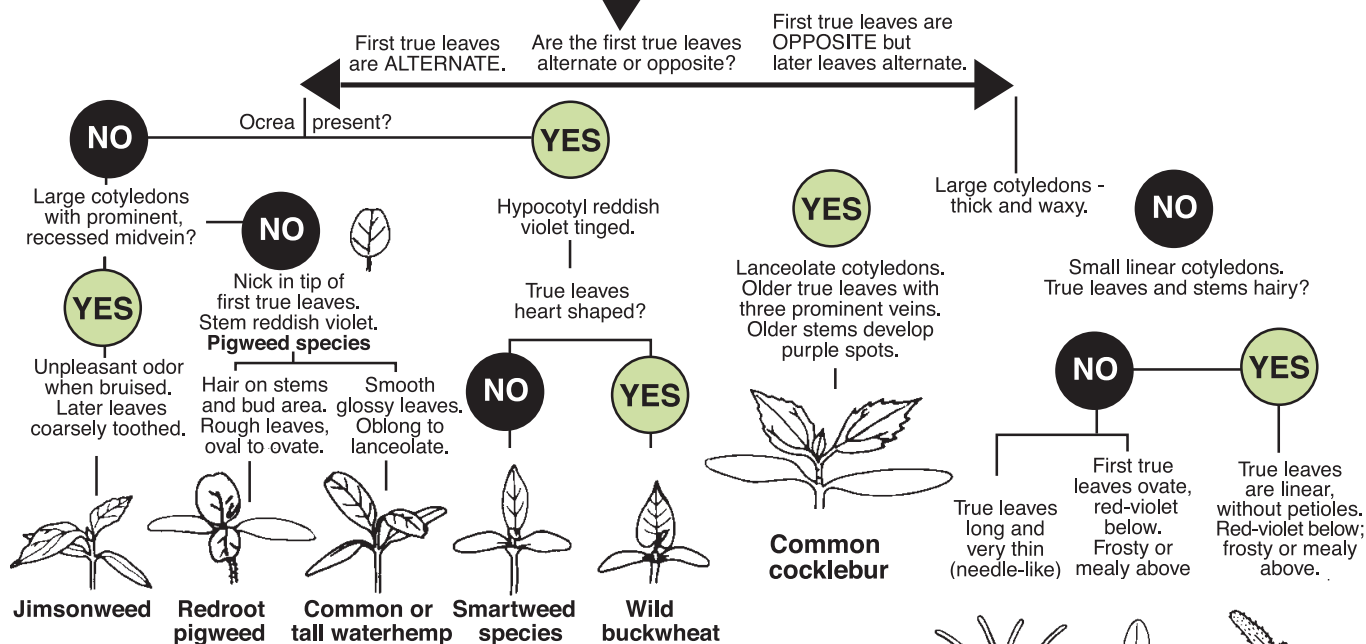
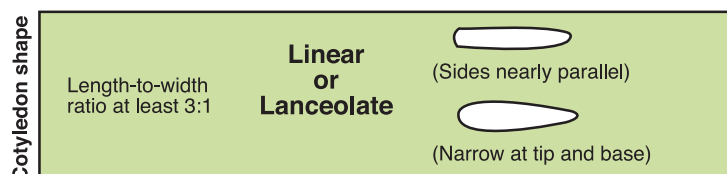
Two leaves attached per node or opposite sides of stem. Leaves at the same node are of similar size.

Often the first true leaves are opposite, but later leaves are alternate.



Alternate leaves

One leaf per node. Newest leaf is smaller than preceding leaf.



Other weeds with linear-lanceolate cotyledons and first true leaves **alternate**:

- Buffalo bur
- Cutleaf nightshade
- Pigweed species with fine hairs on stem: Smooth pigweed, Powell amaranth
- Pigweed species without fine hairs on stem: Palmer amaranth, Prostrate, spiny, and tumble pigweeds

Other weeds with an **ocrea** —membranous, papery sheath encircling nodes and petioles:

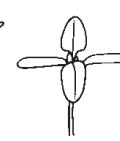
- Swamp smartweed
- Docks
- Knotweeds
- Red sorrel

Other weeds with linear-lanceolate cotyledons and first true leaves **opposite**:

- Purslane
- Puncturevine (may appear alternate)



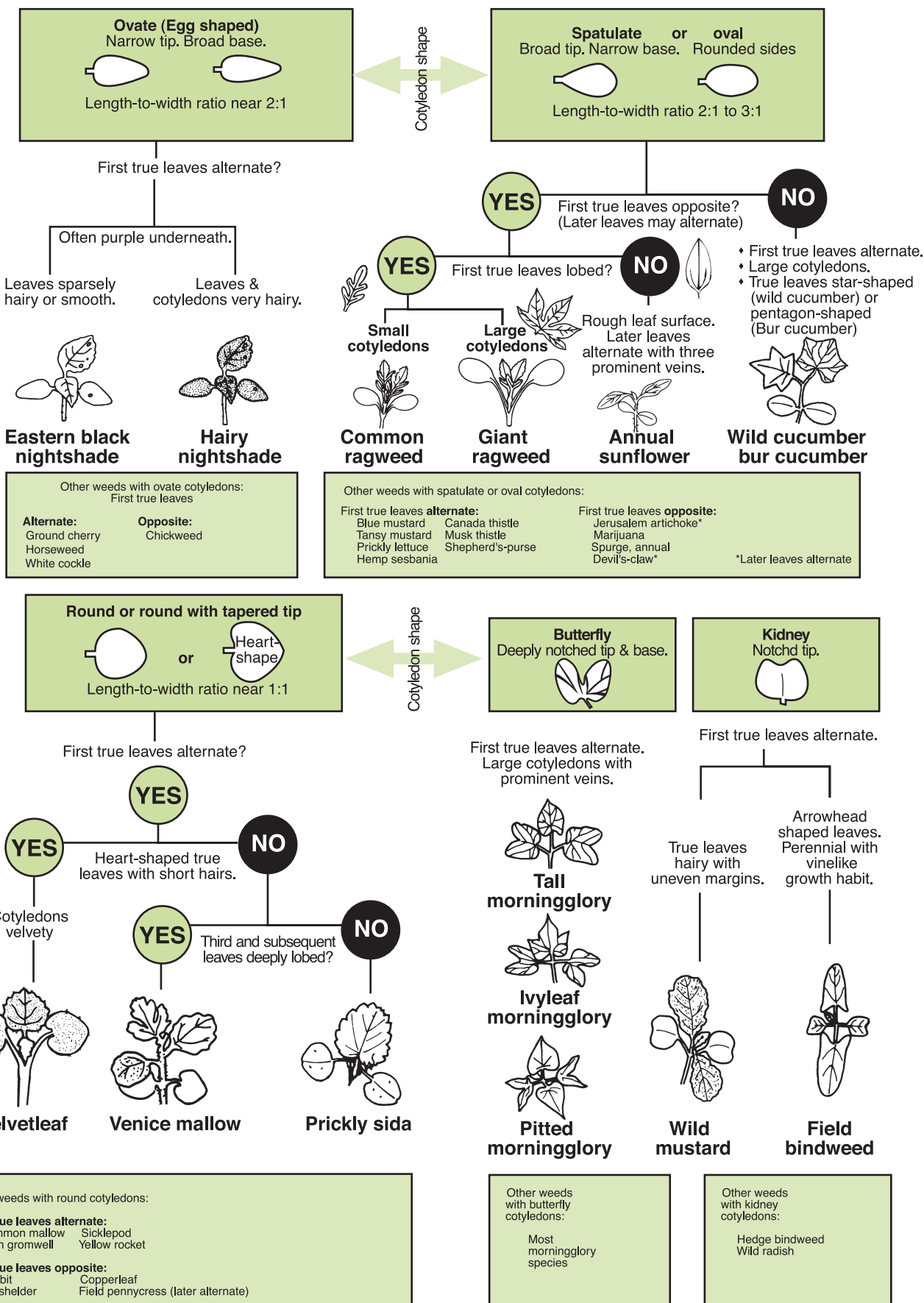
Russian thistle



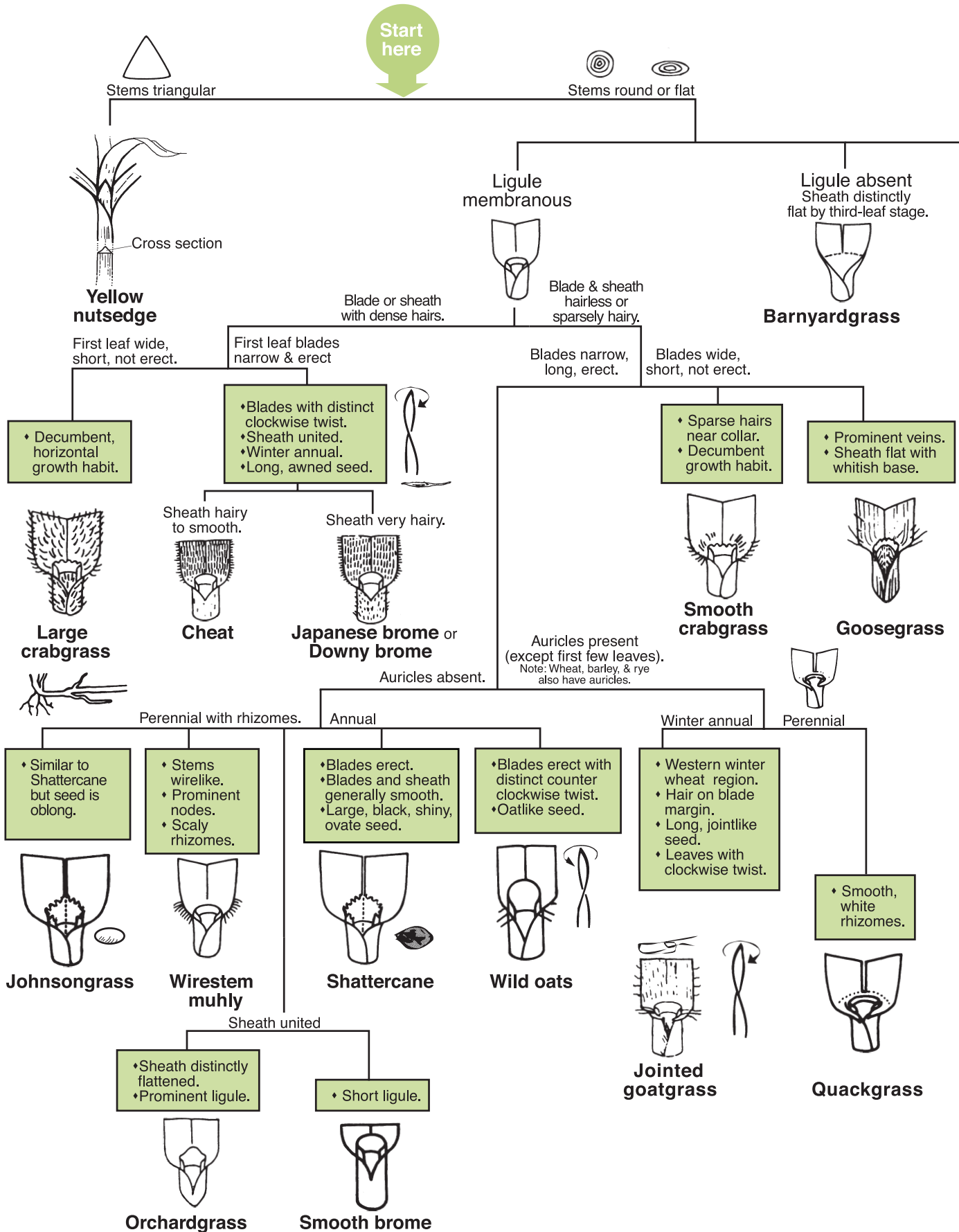
Common lambsquarters

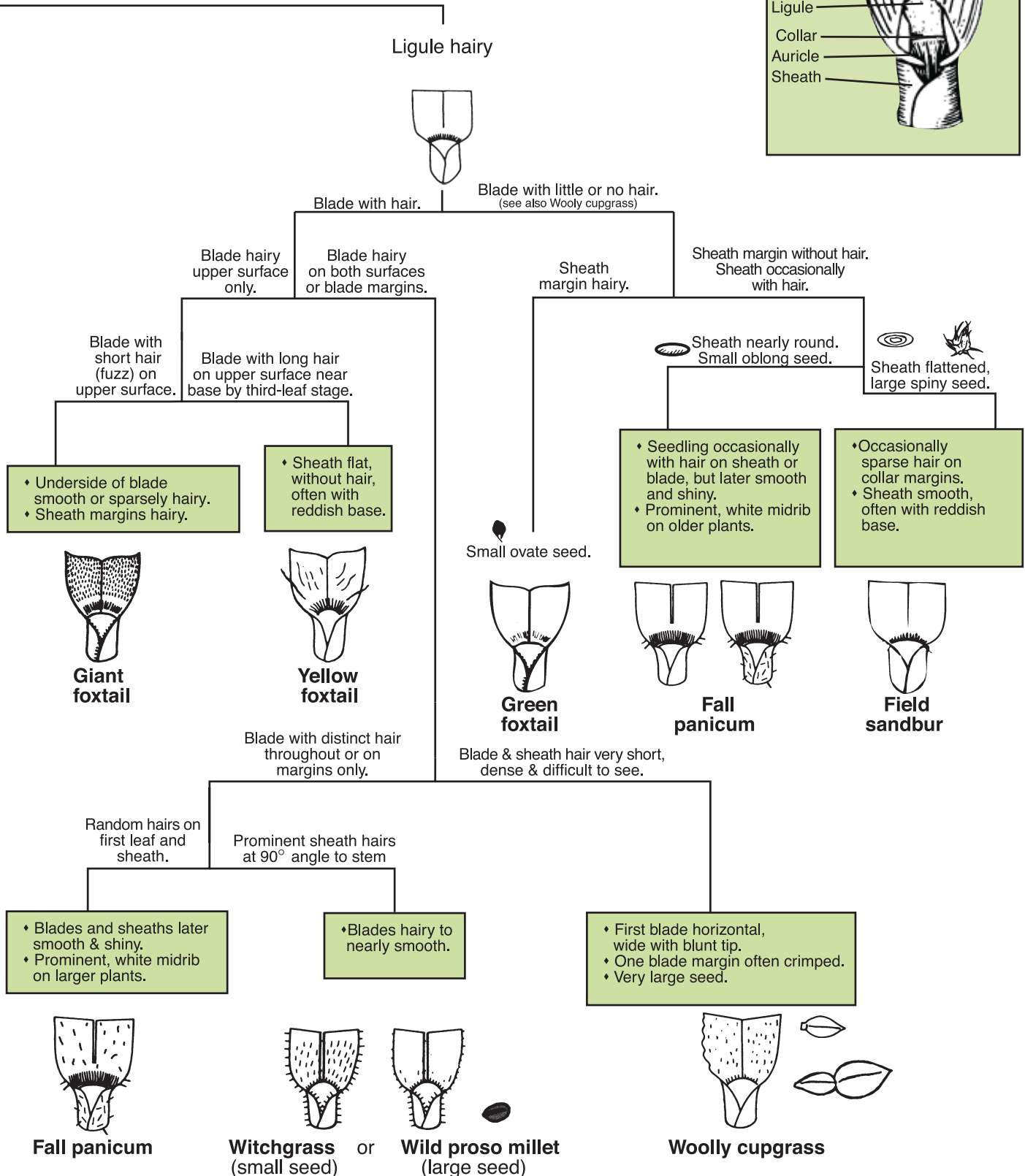
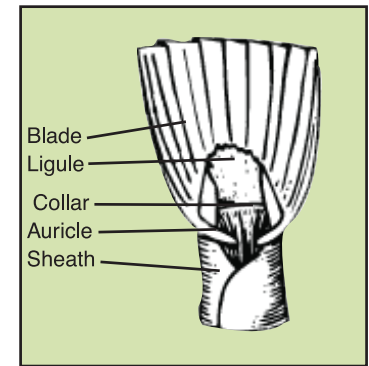


Kochia



Grass weed seedling identification key

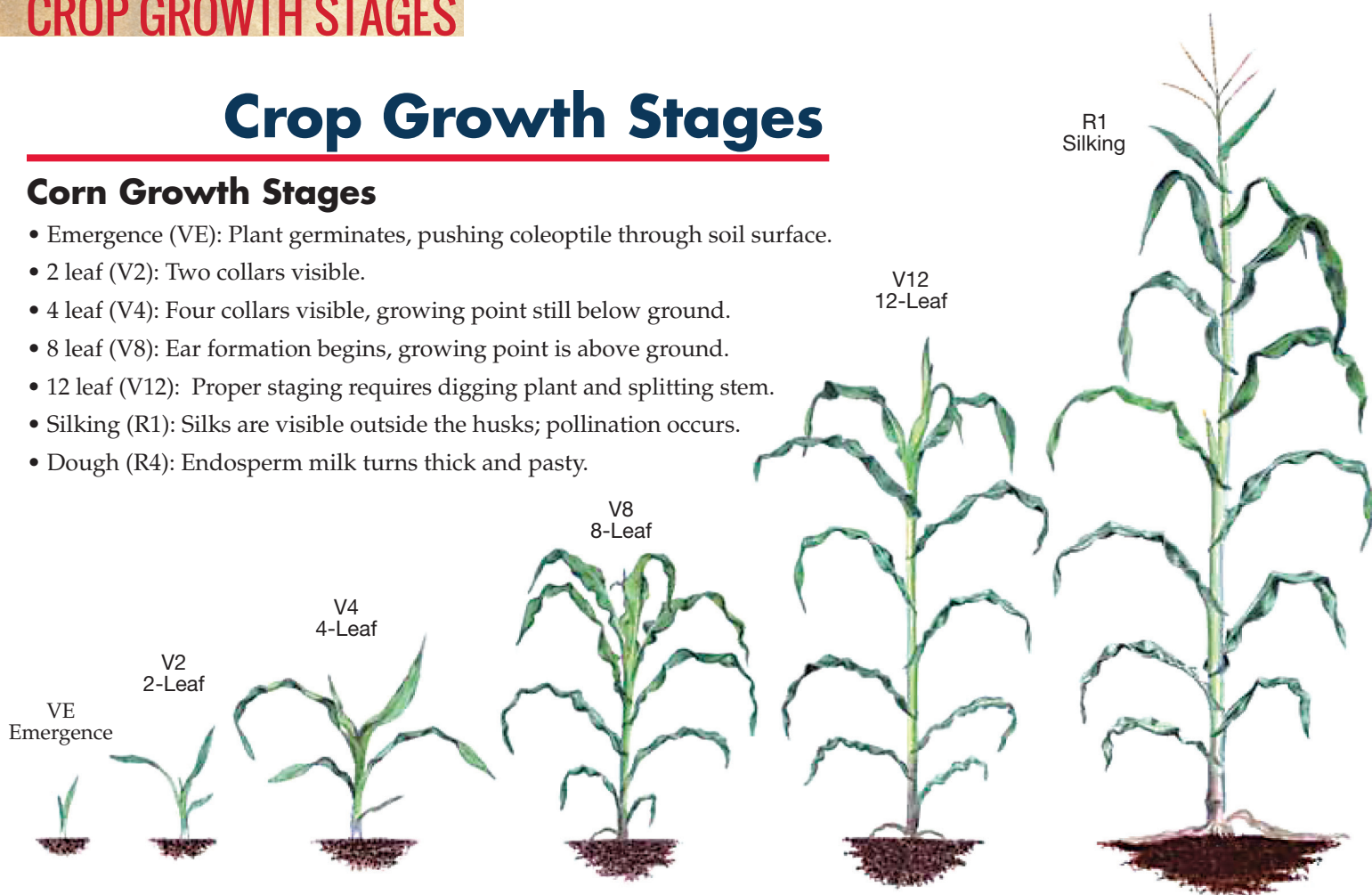




Crop Growth Stages

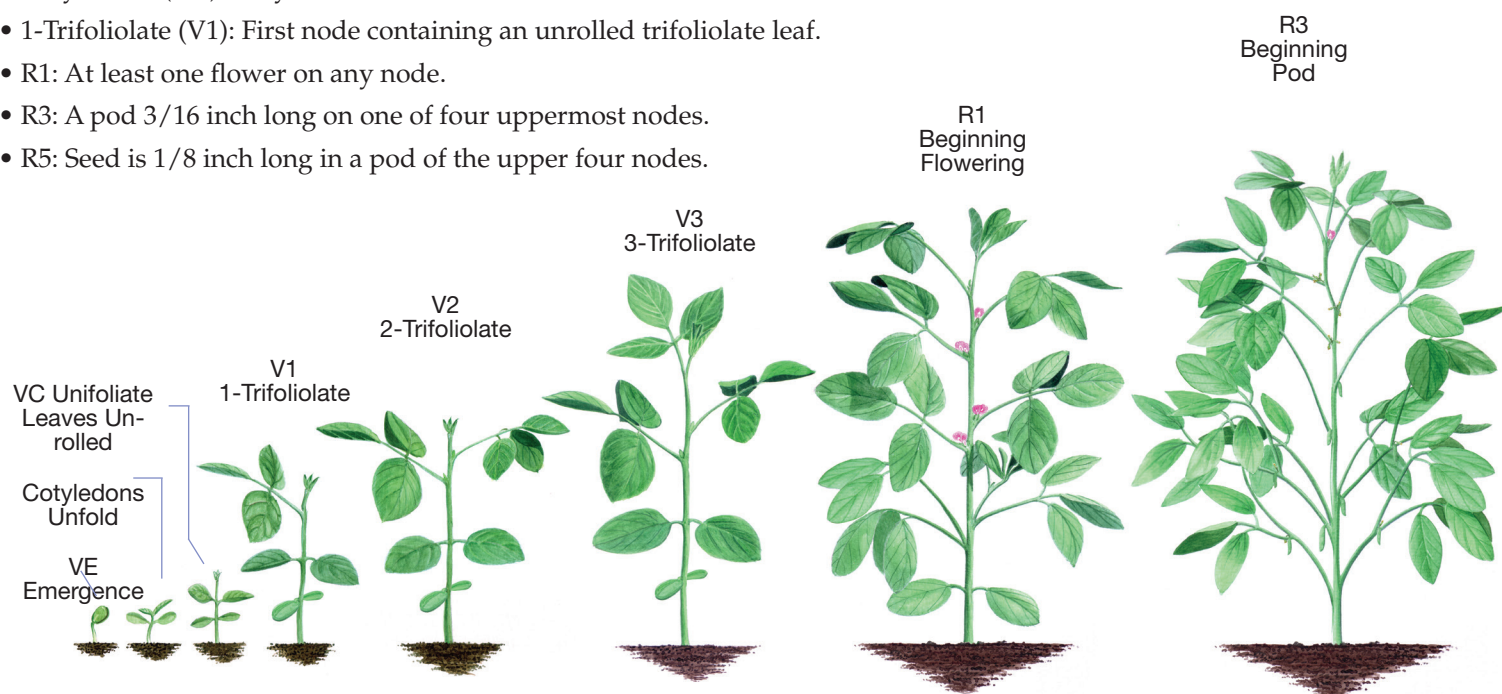
Corn Growth Stages

- Emergence (VE): Plant germinates, pushing coleoptile through soil surface.
- 2 leaf (V2): Two collars visible.
- 4 leaf (V4): Four collars visible, growing point still below ground.
- 8 leaf (V8): Ear formation begins, growing point is above ground.
- 12 leaf (V12): Proper staging requires digging plant and splitting stem.
- Silking (R1): Silks are visible outside the husks; pollination occurs.
- Dough (R4): Endosperm milk turns thick and pasty.



Soybean/Dry Edible Bean Growth Stages

- Emergence (VE): Hypocotyl pulls cotyledons through soil surface, cotyledons provide nutrients and energy.
- Cotyledons (VC): Cotyledon leaves with unifoliate leaves unrolled.
- 1-Trifoliolate (V1): First node containing an unrolled trifoliolate leaf.
- R1: At least one flower on any node.
- R3: A pod 3/16 inch long on one of four uppermost nodes.
- R5: Seed is 1/8 inch long in a pod of the upper four nodes.

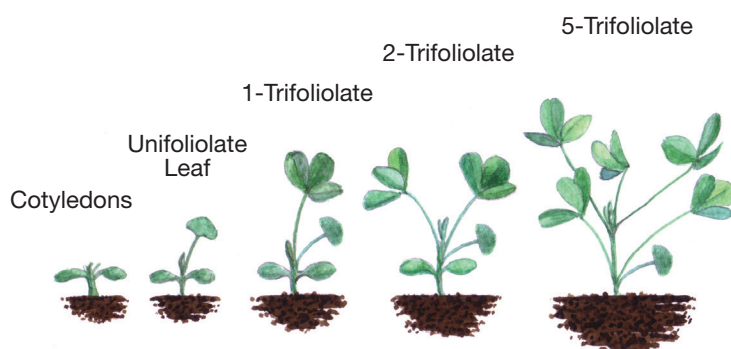


R4
Dough



Alfalfa Growth Stages

- Cotyledons: Provide nutrients and energy for the newly emerged plant.
- Unifoliolate leaf: The first true leaf has only one leaflet.
- 1-Trifoliolate: The second leaf to appear has three leaflets. All subsequent leaves have 3 or more leaflets.
- 5-Trifoliolate: Crown development is underway; lowermost buds pulled below ground.
- Bloom: Plant initiates flower development.
- Maturity: Pods with full seed development.



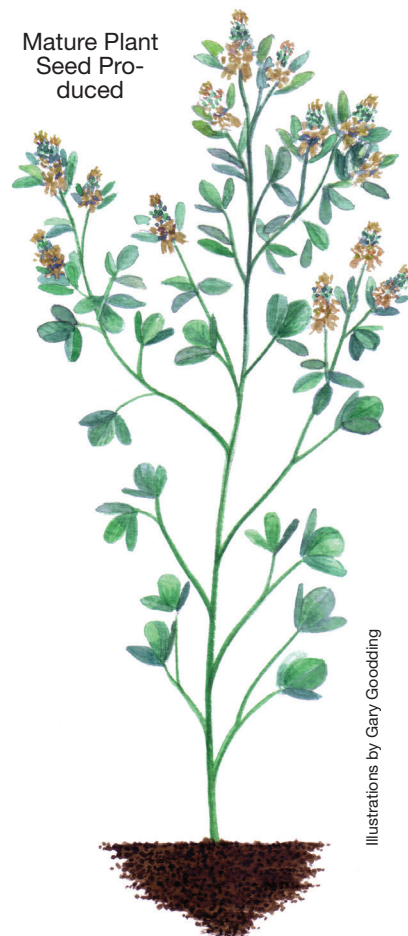
R5
Beginning
Seed



Bloom



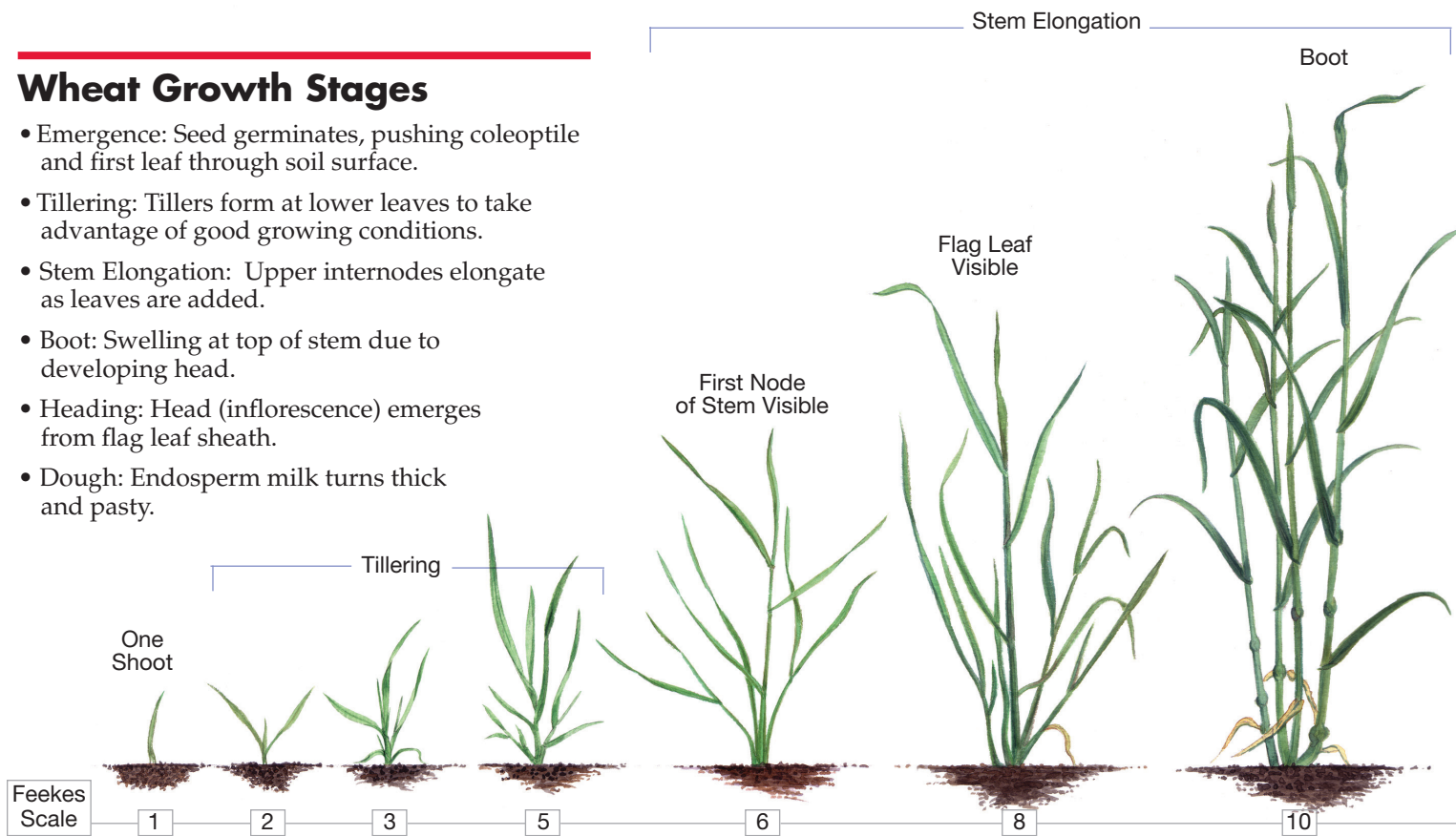
Mature Plant
Seed Pro-
duced



Illustrations by Gary Gooding

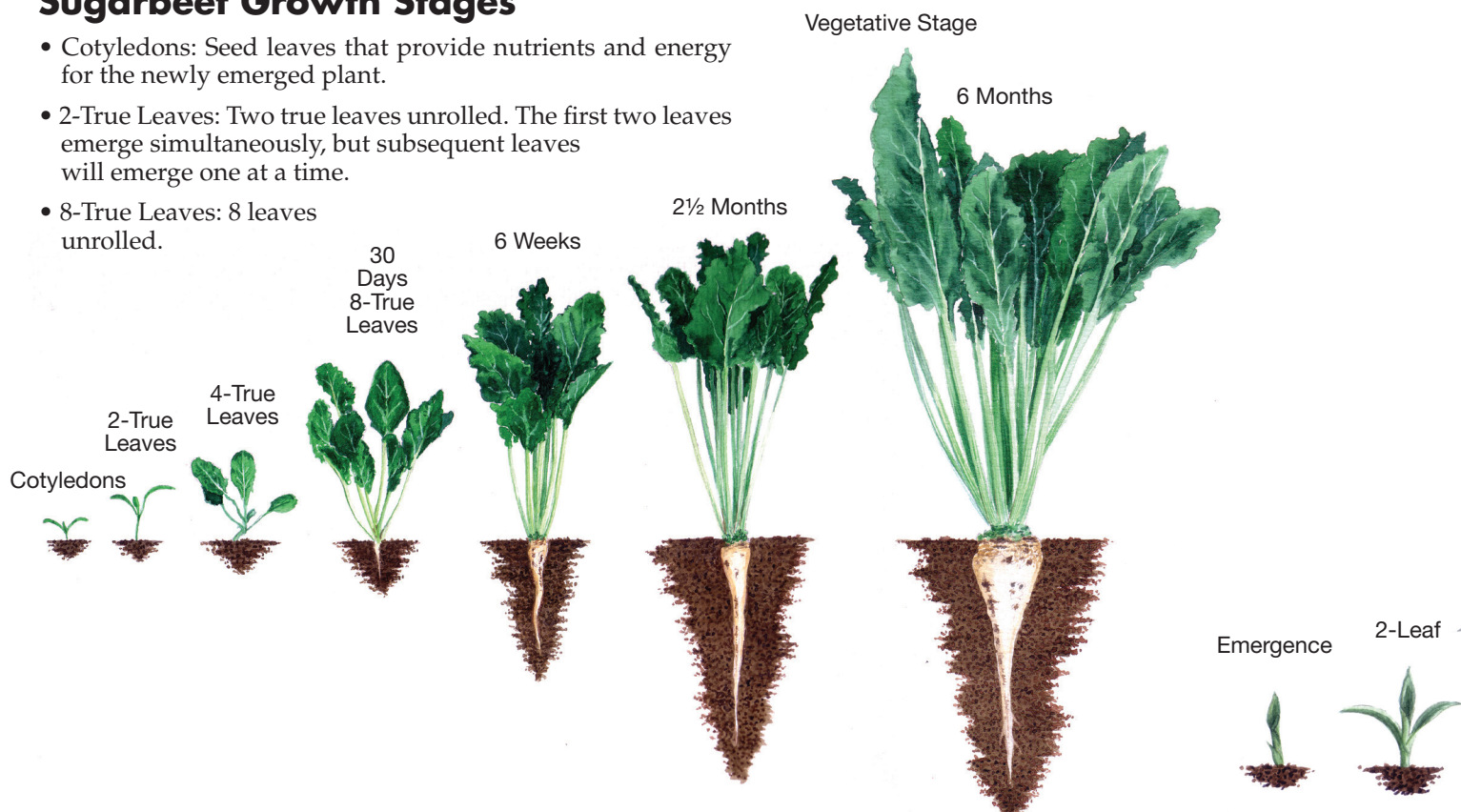
Wheat Growth Stages

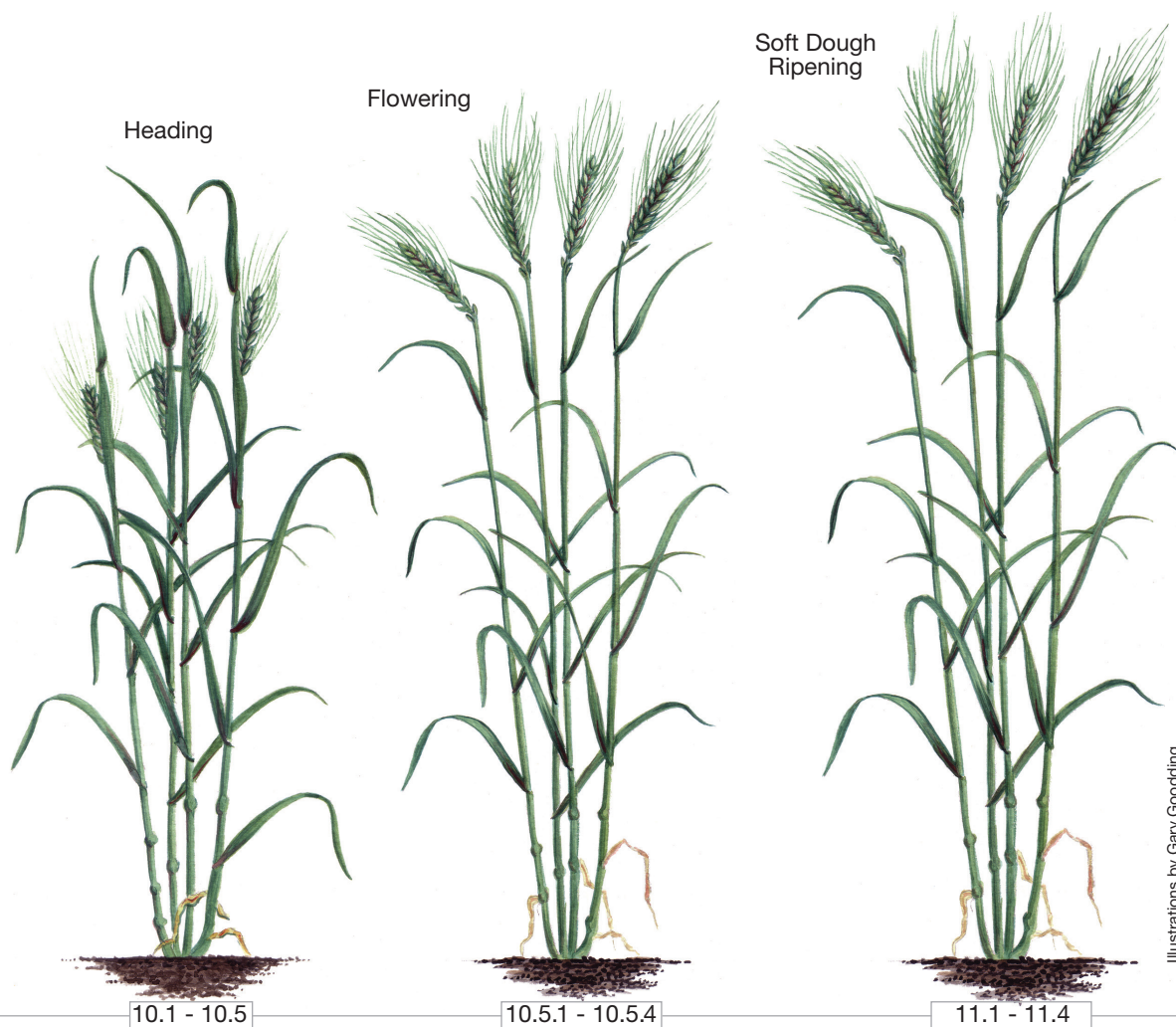
- **Emergence:** Seed germinates, pushing coleoptile and first leaf through soil surface.
- **Tillering:** Tillers form at lower leaves to take advantage of good growing conditions.
- **Stem Elongation:** Upper internodes elongate as leaves are added.
- **Boot:** Swelling at top of stem due to developing head.
- **Heading:** Head (inflorescence) emerges from flag leaf sheath.
- **Dough:** Endosperm milk turns thick and pasty.



Sugarbeet Growth Stages

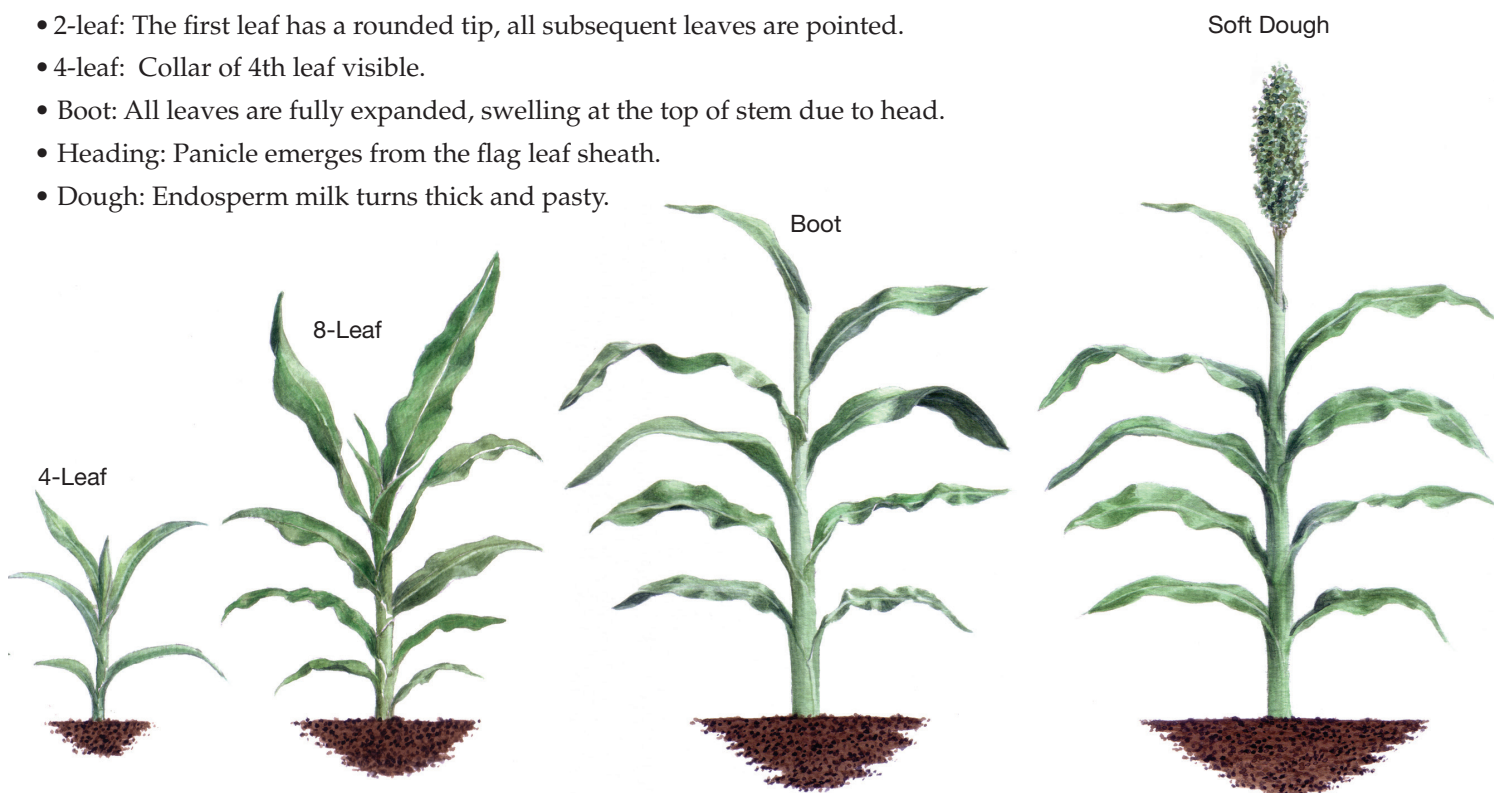
- **Cotyledons:** Seed leaves that provide nutrients and energy for the newly emerged plant.
- **2-True Leaves:** Two true leaves unrolled. The first two leaves emerge simultaneously, but subsequent leaves will emerge one at a time.
- **8-True Leaves:** 8 leaves unrolled.





Sorghum Growth Stages

- Emergence: Plant germinates, pushing coleoptile through soil surface.
- 2-leaf: The first leaf has a rounded tip, all subsequent leaves are pointed.
- 4-leaf: Collar of 4th leaf visible.
- Boot: All leaves are fully expanded, swelling at the top of stem due to head.
- Heading: Panicle emerges from the flag leaf sheath.
- Dough: Endosperm milk turns thick and pasty.



Extension Publications

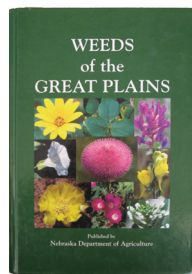
University of Nebraska–Lincoln Extension offers a library of searchable on-line NebGuides and Extension Circulars and continues to add new publications regularly. These research-based publications cover a range of information from family and small business to agricultural topics, including weed management, crop production, soil fertility, insect and disease management, tillage and equipment and farm and ranch economics. Browse by topic or use the search engine to locate the information you need 24/7 on the UNL Extension Publications Web site at <http://extension.unl.edu/publications>.



<http://extension.unl.edu/publications>

Weeds of the Great Plains

Weeds of the Great Plains is a valuable resource for anyone involved in crop or range management in Nebraska. It includes pictures and useful information on many plants common to the Great Plains. Written by James Stubbendieck, Mitchell Coffin, and L.M. Landholt, and published by the Nebraska Department of Agriculture, it is available for only \$25. It may be ordered by calling the State Department of Agriculture at (402) 471-2394 or by downloading a form available at <http://www.agr.ne.gov/forms/nw11.pdf>.



<http://www.agr.ne.gov/forms/nw11.pdf>

WeedSOFT

WeedSOFT is now available at <http://www.weedsoft.org>. Designed to be a valuable resource for both producers and educators, it includes tools to evaluate the impact of weeds on crop yield and selectivity and residual activity of herbicides, and to calculate product amounts for tank-mixtures.



<http://www.weedsoft.org>

CropWatch

For research-based information directly tied to the current crop production season, visit CropWatch on-line. Written by Extension specialists and educators from across the state, CropWatch provides timely information on pest management and crop production for Nebraska as well as indepth information organized by crop. Issued almost weekly during the crop production season, readers can subscribe to an email alert and be notified whenever a new issue is posted. Visit CropWatch at <http://cropwatch.unl.edu> and make it your one-stop resource for farming in Nebraska.



<http://cropwatch.unl.edu>

Glyphosate, Weeds, and Crops

For information to maximize weed control in glyphosate-resistant cropping systems, visit <http://glyphosateweeds crops.org>. Content and publications have been prepared by the Glyphosate Stewardship Working Group, a collaboration of university weed scientists.



<http://glyphosateweeds crops.org/>

Plant and Soil Sciences eLibrary

Visit <http://plantandsoil.unl.edu> to discover the premier on-line library for information and lessons on the science behind crop production. Written by professors and scientists at several universities, the content, illustrations and crop animations present information in an interesting and accessible format.



<http://plantandsoil.unl.edu>

Pesticide Education Resources

The web site <http://pested.unl.edu> is a one-stop resource for all the information you need to know on pesticide safety, applicator training, pesticide labels, IPM and building pest control.



<http://pested.unl.edu>

Crop Production Clinics

UNL's Crop Production Clinics have served Nebraska agriculture for over 30 years. At <http://cpc.unl.edu> you can find information on program locations, topics and registration, as well as research results from irrigation, entomology, plant pathology, soil science and weed science researchers.

<http://cpc.unl.edu>

UNL Weed Science

Go to <http://weedscience.unl.edu> for the latest information on weed control research and news from weed scientists at the University of Nebraska-Lincoln.



<http://weedscience.unl.edu>

Agronomy and Horticulture Department

At <http://agronomy.unl.edu> you will find information for future students, meet UNL agronomy and horticulture faculty, and discover valuable educational programs and materials.

<http://agronomy.unl.edu>

Pesticide Label Resources

Labels for most herbicides registered in Nebraska are available online on the Crop Data Management Systems (CDMS) Web site at <http://www.cdms.net/LabelsMsds/LMDefault.aspx> or on the Greenbook Web site at <http://www.greenbook.net/>. Manufacturer Web sites also may be consulted for label information. For a comprehensive list of pesticides labeled in Nebraska visit <http://www.kellysolutions.com/ne/pesticidindex.htm>



<http://www.cdms.net/LabelsMsds/LMDefault.aspx>



<http://www.greenbook.net/>

COMMON RAGWEED



COMMON WATERHEMP



KOCHIA



PALMER AMARANTH



MARESTAIL



GIANT RAGWEED



Increase in glyphosate resistant weeds (pictured above) across Nebraska due to repeated use of glyphosate based herbicides.

Emergency Contacts

In case of pesticide poisoning contact:
Nebraska Regional Poison Center (800) 222-1222
University of Nebraska Medical Center