

Grass Hay & Pasture Herbicide Guide



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The herbicide recommendations in this guide were generated using Virginia Cooperative Extension's 'Pest Management Guide', local herbicide trials, label recommendations, and local experience. At the time of printing, the products listed in this guide were labeled for use in Virginia.

There may be instances where herbicides other than those mentioned may be legal and effective. Virginia Cooperative Extension does not endorse any specific company or product; product names are used when a product represents a unique combination of active ingredients not found elsewhere on the market, or if use of a product name clarifies the recommendation.

In many cases generic herbicides with active ingredients identical to branded products exist, and this guide attempts to highlight some of those options. Be sure to read all labels, since generics may differ in concentration from the products listed in this guide.

Please note that all example applications are calculated using label specifications for mid to high application rates. "Doubling up" on the rate can often result in reduced control by promoting top-kill before herbicide translocation occurs to roots and underground organs.

Thank you to Doug Horn, Augusta County Extension Agent, and Dr. Michael Flessner, Virginia Tech Extension Weed Specialist, for their periodic review of this guide.

How to use this guide

Boom Sprayers

Calibrated equipment such as truck or tractor boom sprayers. “Per gallon” rates in this guide were calculated under the assumption that the total spray volume is 30 gal/ac for boom sprayers.



Boomless Sprayers

Calibrated boomless sprayers, such as those commonly used on 4-wheelers or ATVs. “Per gallon” rates in this guide were calculated under the assumption that the total spray volume is 10 gal/ac for boomless sprayers.



Handgun & Wand Sprayers

Spot-spraying equipment such as backpack or handgun sprayers. “Per gallon” rates were calculated under the assumption that most people will apply somewhere around 75 gallons/acre (thoroughly wet, but not to the point of runoff) when hand-spraying.



Basal Bark Application

To control trees less than 6 inches in diameter. Wet the root collar area, any exposed roots, and the lower 15 inches of the trunk around the entire circumference of the tree. An oil carrier (commercial basal oil, diesel fuel, fuel oil, or kerosene) is used to penetrate bark.



Cut-Stump Application

Used to prevent stump-sprouting of cut trees. Herbicide with oil carrier (commercial basal oil, diesel fuel, fuel oil, or kerosene) is sprayed or painted onto the cut stump around the entire circumference of the tree. Only the area of live vascular tissue (just inside the bark) need be treated.



Herbicide Timing for *Summer Annual Weeds*

**Optimal stage
to spray**



Seedling through vegetative stages

*Occurring through spring & summer
depending on species*



Flowering & seeding

Summer/fall

Annuals are relatively simple to kill during the seedling and early vegetative stages. Increased size and age result in significantly reduced control.

Herbicide Timing for *Biennial Weeds*

**Optimal stage
to spray**



Seedling
Typically summer or fall



Rosette
Target in fall through
early spring.



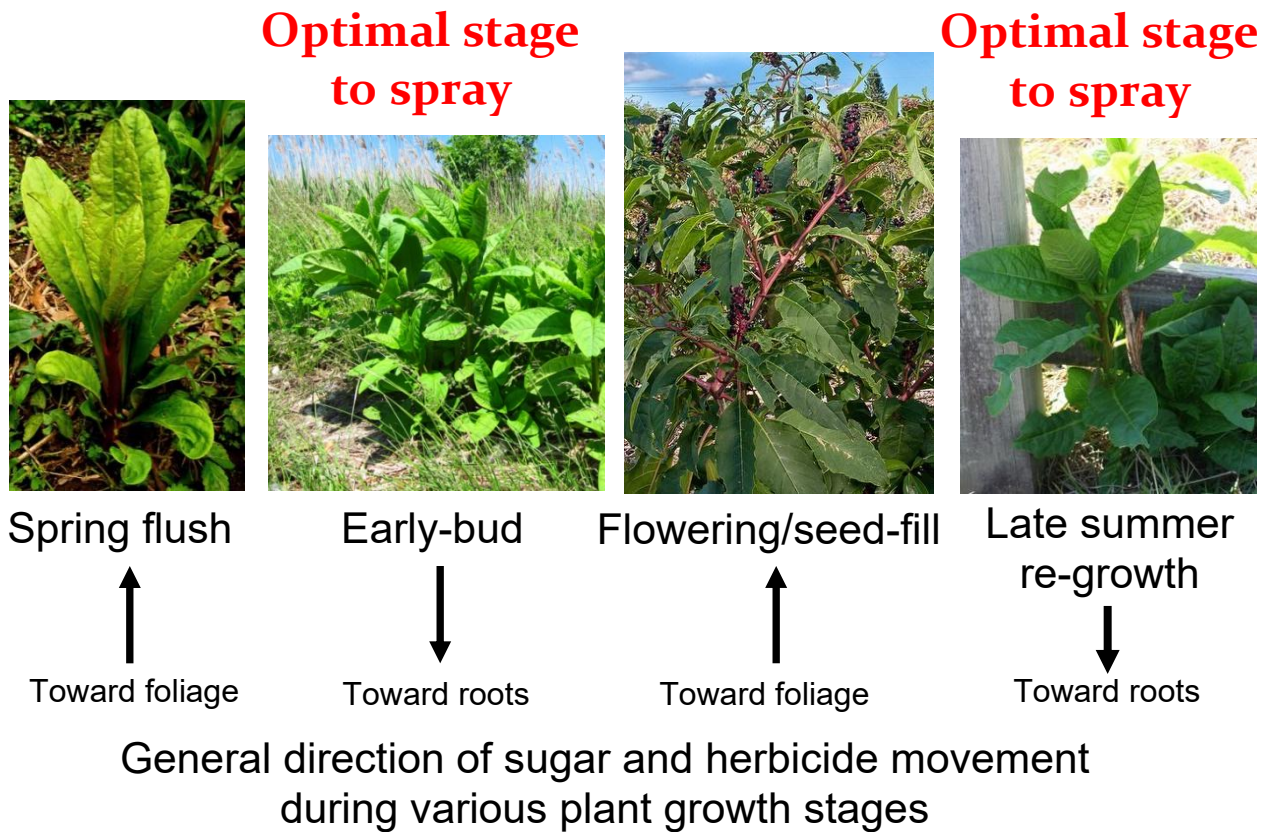
Bolting
Late spring/summer of year 2



Flowering
Summer of year 2

Biennials are relatively simple to kill during the seedling and rosette stage with most broadleaf herbicides. Once biennials begin to bolt in spring, control is significantly reduced.

Herbicide Timing for *Perennial Weeds*



Why are the early-bud stage (just prior to flowering) and late-summer time periods good times to spray?

1. Sugars are directed toward underground perennial structures
2. Plenty of leaf area to take in herbicide
3. Perennial structures may be at relatively lower energy levels

Herbicides & Active Ingredients

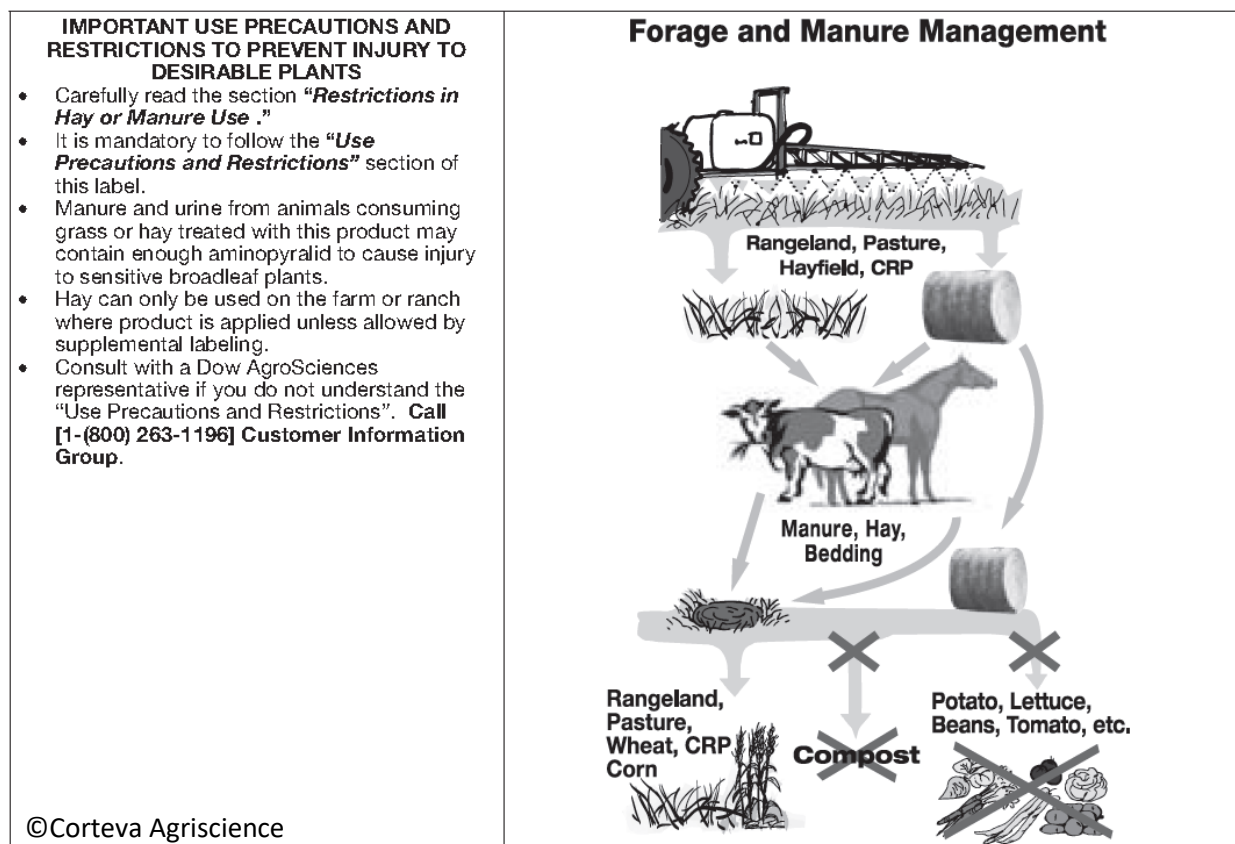
Commonly Available Trade Names	Active Ingredient(s)	Active Ingredient	Acid Equivalents	General- or Restricted-use	Residual activity?
		%	lbs a.i.		
2,4-D LV4	2,4-D (ester)	63.70%	3.8/gal	General	No
Clarity®	dicamba (amine)	48.20%	4/gal	General	No
Weedmaster®	2,4-D (amine)	35.70%	2.87/gal	General	No
	dicamba (amine)	12.40%	1/gal		No
Chaparral®	aminopyralid	62.13%	0.525/lb	General	Yes
	metsulfuron methyl	9.45%	0.095/lb		
Cimarron Plus®, Chisum™	metsulfuron methyl	48.00%	0.48/lb	General	No
	chlorsulfuron	15.00%	0.15/lb		
Crossbow®, Crossroad®	triclopyr (ester)	16.50%	1/gal	General	No
	2,4-D (ester)	34.40%	2/gal		
DuraCor®	aminopyralid	8.95%	0.67/gal	General	Yes
	florpyrauxifen-benzyl	0.76%	0.067/gal		
Facet L®	quinclorac	18.92%	1.5/gal	General	Yes
Glyphsate 4 Plus™, many generics	glyphosate	41.00%	3/gal	General	No
Grazon P+D®, Gunslinger P+D®	picloram	10.20%	0.54/gal	Restricted	Yes
	2,4-D (amine)	39.60%	2/gal		
GrazonNext HL®, Gunslinger AMP®	aminopyralid	8.24%	0.41/gal	General	Yes
	2,4-D (amine)	41.26%	3.33/gal		
Milestone®, Whetstone™	aminopyralid	40.60%	2/gal	General	Yes
PastureGard HL®, Cleargraze™	triclopyr (ester)	45.07%	3/gal	General	No
	fluroxypyr	15.56%	1/gal		
Prowl H20®	pendimethalin	38.70%	3.8/gal	General	Yes
Quinstar 4L®	quinclorac	40.00%	3.8/gal	General	Yes
Remedy Ultra®, Garlon 4 Ultra®	triclopyr (ester)	60.45%	4/gal	General	No
Stinger®	clopyralid	40.90%	3/gal	General	Yes
Surmount®	picloram	13.20%	0.67/gal	Restricted	Yes
	fluroxypyr	10.60%	0.67/gal		
NovaGraz®	2,4-D (amine)	35.11%	2.67/gal	General	No
	florpyrauxifen-benzyl	0.49%	0.45/gal		

Precautions with Residual Herbicides

While all herbicides have some persistence in the environment, some active ingredients have a relatively long persistence and are often referred to as “residual” herbicides. This can be good, as it allows for extended control of weeds as plants take up residual chemical over time. It also poses a risk that chemicals could move off site through animal manures or hay. There have been cases where manure from animals grazing or consuming hay from treated fields was used in gardens or commercial vegetable fields, causing catastrophic losses of high-value crops. Lawsuits and bad publicity related to these cases threaten our ability to use these products in the future, so it is critical to follow the precautions and restrictions outline by the manufacturer.

The specific active ingredients mentioned in this guide that pose a risk are picloram, aminopyralid, and clopyralid, which belong to a class of herbicides known as “pyridines”. You will most likely encounter these active ingredients in the products *Milestone*®, *GrazonNext HL*®, *Grazon P+D*®, *Chaparral*®, *Surmount*®, and *DuraCor*®. These products should only be used on sites where manure or hay will be several months or more in an open field setting where chemicals are subject to breakdown by ultraviolet light and microbial organisms. In a closed setting such as stockpiled manure or stored hay, chemicals can retain their integrity for years.

The following illustration is taken from a label, and outlines forage and manure management when using residual herbicides.



Notes on NovaGraz® Herbicide

NovaGraz® herbicide became commercially available in 2025. It is a non-residual herbicide that preserves grasses, white clover, and annual lespedeza while controlling broadleaf weeds. Note that red clover, alfalfa, and other legumes are not tolerant to NovaGraz. Upon application, white clover and annual lespedeza typically show injury symptoms that can persist for several weeks or more before full recovery occurs. NovaGraz is effective on many annual and broadleaf weeds but is usually not the best option when targeting hard-to-kill perennials. Notable exceptions include ironweed, wingstem, perennial buttercup, and plantain. NovaGraz is not currently included elsewhere in this guide. However, producers wanting to preserve white clover or annual lespedeza in their pasture should consider its use and seek more species-specific guidance.

Bladder Champion (*Silene alba*)



Bladder champion is a perennial that sprouts from a creeping underground stem (rhizome). It is mainly a problem in hayfields, as livestock eat it readily in pasture. Target the plant during the bud stage to maximize delivery of herbicide to roots and rhizomes. Research has shown good results with metsulfuron methyl, which is an active ingredient in *Cimarron Plus*®, *Chisum*™, and *Chaparral*®. You can also purchase metsulfuron methyl as generic *metsulfuron*. All of these products can cause grass injury in fescue, and especially in Timothy. It may be a good idea to tank-mix metsulfuron-containing products with either dicamba or 2,4-D to increase the spectrum of weeds controlled; *Chaparral*® already contains an additional active ingredient for this purpose.

Cimarron Plus®		
	<i>Per Acre</i>	<i>Per Gal of Water</i>
Boom Sprayer	0.5 oz Cimarron Plus ® 9.6 oz non-ionic surfactant	Low use-rate makes measuring herbicide for small batches difficult
Boomless Sprayer	0.5 oz Cimarron Plus ® 3.2 oz non-ionic surfactant	
Handgun/ Wand Sprayer	N/A	
Chaparral®		
	<i>Per Acre</i>	<i>Per Gal of Water</i>
Boom Sprayer	2.5 oz Chaparral ® 9.6 oz non-ionic surfactant	Low use-rate makes measuring herbicide for small batches difficult
Boomless Sprayer	2.5 oz Chaparral ® 3.2 oz non-ionic surfactant	
Handgun/ Wand Sprayer	N/A	

Horsenettle, Sand Briar (*Solanum carolinense*)



Horsenettle sprouts from creeping roots or rhizomes. Spray at early-flowering, typically July or August. *GrazonNext HL*®, *DuraCor*®, *Chaparral*®, and *Surmount*® provide around 90% control. 2,4-D tankmixed with dicamba or *Remedy*®, or *Cimarron Plus*® are less expensive and acceptable for use in hay, however, control would only be around 70%.

GrazonNext HL®		
	<i>Per Acre</i>	<i>Per Gal of Water</i>
Boom Sprayer	2.1 pints <i>GrazonNext HL</i> ®	1.1 oz. <i>GrazonNext HL</i> ®
	9.6 oz. non-ionic surfactant	0.3 oz. non-ionic surfactant
Boomless Sprayer	2.1 pints <i>GrazonNext HL</i> ®	3.4 oz. <i>GrazonNext HL</i> ®
	3.2 oz. non-ionic surfactant	0.3 oz. non-ionic surfactant
Handgun/ Wand Sprayer	N/A	0.5 oz. <i>GrazonNext HL</i> ®
		0.3 oz. non-ionic surfactant
2,4-D + dicamba		
	<i>Per Acre</i>	<i>Per Gal of Water</i>
Boom Sprayer	2.5 pints 2,4-D	1.3 oz. 2,4-D
	8 oz. dicamba	0.3 oz. dicamba
	9.6 oz. non-ionic surfactant	0.3 oz. non-ionic surfactant
Boomless Sprayer	2.5 pints 2,4-D	4 oz. 2,4-D
	8 oz dicamba	0.8 oz. dicamba
	3.2 oz. non-ionic surfactant	0.3 oz. non-ionic surfactant
Handgun/ Wand Sprayer	N/A	0.5 oz. 2,4-D
		0.1 oz. dicamba
		0.3 oz. non-ionic surfactant

Pokeweed, pokeberry (*Phytolacca americana*)



Steve Brill



Pokeweed is a perennial that sprouts from a large fleshy taproot. Target herbicide applications at the bud stage (early summer through late summer). In university testing, 80-90% control was obtained with *Crossbow*® (or an equivalent tankmix of triclopyr + 2,4-D), *GrazonNext HL*®, and *Surmount*®.

GrazonNext HL®		
	<i>Per Acre</i>	<i>Per Gal of Water</i>
Boom Sprayer	2.1 pints GrazonNext HL®	1.1 oz. GrazonNext HL®
	9.6 oz. non-ionic surfactant	0.3 oz. non-ionic surfactant
Boomless Sprayer	2.1 pints GrazonNext HL®	3.4 oz. GrazonNext HL®
	3.2 oz. non-ionic surfactant	0.3 oz. non-ionic surfactant
Handgun/ Wand Sprayer	N/A	0.5 oz. GrazonNext HL®
		0.3 oz. non-ionic surfactant
2,4-D + dicamba		
	<i>Per Acre</i>	<i>Per Gal of Water</i>
Boom Sprayer	2.5 pints 2,4-D	1.3 oz. 2,4-D
	8 oz. dicamba	0.3 oz. dicamba
	9.6 oz. non-ionic surfactant	0.3 oz. non-ionic surfactant
Boomless Sprayer	2.5 pints 2,4-D	4 oz. 2,4-D
	8 oz dicamba	0.8 oz. dicamba
	3.2 oz. non-ionic surfactant	0.3 oz. non-ionic surfactant
Handgun/ Wand Sprayer	N/A	0.5 oz. 2,4-D
		0.1 oz. dicamba
		0.3 oz. non-ionic surfactant

Milkweed (*Asclepias syriaca*)



Milkweed is a perennial that sprouts from large, fleshy roots and deep rhizomes. It is the only feed source for monarch butterfly caterpillars. With monarch populations in decline, landowners are encouraged to weigh carefully the decision to spray. The most effective spray timing is at the early-bud stage, from early summer through late summer. Best results are obtained with *Surmount* (80% control). Both *Crossbow* (or homemade equivalent of 2,4-D+ Remedy Ultra®) and *GrazonNext HL* provide about 70% control.

GrazonNext HL®		
	<i>Per Acre</i>	<i>Per Gal of Water</i>
Boom Sprayer	2.1 pints GrazonNext HL®	1.1 oz. GrazonNext HL®
	9.6 oz. non-ionic surfactant	0.3 oz. non-ionic surfactant
Boomless Sprayer	2.1 pints GrazonNext HL®	3.4 oz. GrazonNext HL®
	3.2 oz. non-ionic surfactant	0.3 oz. non-ionic surfactant
Handgun/ Wand Sprayer	N/A	0.5 oz. GrazonNext HL®
		0.3 oz. non-ionic surfactant
2,4-D + Remedy Ultra®		
	<i>Per Acre</i>	<i>Per Gal of Water</i>
Boom Sprayer	3 pints 2,4-D	1.6 oz. 2,4-D
	1.5 pint Remedy Ultra®	0.8 oz. Remedy Ultra®
	9.6 oz non-ionic surfactant	0.3 oz non-ionic surfactant
Boomless Sprayer	3 pints 2,4-D	4.8 oz. 2,4-D
	1.5 pint Remedy Ultra®	2.4 oz. Remedy Ultra®
	3.2 oz non-ionic surfactant	0.3 oz non-ionic surfactant
Handgun/ Wand Sprayer	N/A	0.5 oz. 2,4-D
		0.3 oz. Remedy Ultra®
		0.3 oz. non-ionic surfactant

Hemp Dogbane (*Apocynum cannabinum*)



University of Illinois Crop Science



Dogbane is a perennial that sprouts from a large taproot and spreading root system. While dogbane contains toxic glycosides, poisoning is extremely rare, and many producers report that their livestock graze it readily. When spraying, target the plant, taproot, and root system through herbicide application at the early-bud stage in early summer or on late summer re-growth. *Surmount*, *Crossbow*, and *Remedy Ultra* have been effective (around 80% control) on dogbane in university trials. When considering price, the spectrum of weeds controlled, and the persistence of weed control, *Surmount*® is probably the best fit. The presence of fluroxypyr also makes *Surmount* strong on other woody species, so its suitability for fencerow applications is on par with *Crossbow*®.

Surmount®		
	<i>Per Acre</i>	<i>Per Gal of Water</i>
Boom Sprayer	3 pints Surmount®	1.6 oz. Surmount®
	9.6 oz non-ionic surfactant	0.3 oz non-ionic surfactant
Boomless Sprayer	3 pints Surmount®	4.8 oz. Surmount®
	3.2 oz non-ionic surfactant	0.3 oz non-ionic surfactant
Handgun/ Wand Sprayer	N/A	0.6 oz. Surmount®
		0.3 oz. non-ionic surfactant
2,4-D + Remedy Ultra®		
	<i>Per Acre</i>	<i>Per Gal of Water</i>
Boom Sprayer	3 pints 2,4-D	1.6 oz. 2,4-D
	1.5 pint Remedy Ultra®	0.8 oz. Remedy Ultra®
	9.6 oz non-ionic surfactant	0.3 oz non-ionic surfactant
Boomless Sprayer	3 pints 2,4-D	4.8 oz. 2,4-D
	1.5 pint Remedy Ultra®	2.4 oz. Remedy Ultra®
	3.2 oz non-ionic surfactant	0.3 oz non-ionic surfactant
Handgun/ Wand Sprayer	N/A	0.5 oz. 2,4-D
		0.3 oz. Remedy Ultra®
		0.3 oz. non-ionic surfactant

Eastern Red Cedar (*Juniperus virginiana*)



Cedar proliferates in pastures with poor fertility; therefore, long-term management of cedar is dependent on proper soil pH (>6.0) and adequate soil phosphorus. Target foliar herbicide applications in late-spring/early-summer or early-fall. The rate of control decreases as the size of the tree increases; at 10 inches tall or larger, 50-75% of trees will be controlled at best. Rather than spraying, trees in this size range should be cut at ground level; when cut below the lowest branch they will not re-sprout. For trees smaller than 10 inches tall, the following herbicide recipe using 3 pints/acre of either *Surmount*® or *Grazon P+D*® tankmixed with *Remedy Ultra*® is likely the best option. If you do not have a private pesticide applicator's license, *Cimarron Plus*® is the next best option. Anecdotal observations have suggested that control of cedar is more effective when using 30+ gallons water/acre and extra surfactant, with the goal of penetrating cedar's dense foliage.

Cimarron Plus®		
	<i>Per Acre</i>	<i>Per Gal of Water</i>
Boom Sprayer	0.5 oz Cimarron Plus ®	Low use-rate makes measuring herbicide for small batches difficult
	11.5 oz non-ionic surfactant	
Boomless Sprayer	0.5 oz Cimarron Plus ®	
	11.5 oz non-ionic surfactant	
Handgun/ Wand Sprayer	N/A	
Surmount®		
	<i>Per Acre</i>	<i>Per Gal of Water</i>
Boom Sprayer	3 pints Surmount®	1.6 oz. Surmount®
	11.5 oz non-ionic surfactant	0.4 oz non-ionic surfactant
Boomless Sprayer	3 pints Surmount®	4.8 oz. Surmount®
	11.5 oz non-ionic surfactant	0.4 oz non-ionic surfactant
Handgun/ Wand Sprayer	N/A	0.6 oz. Surmount®
		0.4 oz. non-ionic surfactant

Osage orange, Hedge Apple (*Maclura pomifera*)



Osage orange can reproduce by seed or by stump and root suckers. Cutting is the most effective control method for mature trees. Sprouting may be prevented at time of cutting using a cut-stump herbicide treatment with triclopyr (*Remedy Ultra* or *Garlon 4 Ultra*). Application of these herbicides to trunks that have been girdled have shown some success, as have basal bark application on small trees. Foliar herbicide applications of *PastureGard HL* or *Remedy Ultra* (triclopyr) at a high rate are labeled for Osage orange and can be effective as an individual plant treatment on small trees. Explore tank-mixing options if spraying additional species. Total coverage of foliage is essential.

Remedy Ultra®		
	<i>Per Acre</i>	<i>Per Gal of Mix</i>
Cut Stump/Basal Bark	N/A	1 quart Remedy Ultra®
		3 quarts diesel fuel or fuel oil
	<i>Per Acre</i>	<i>Per Gal of Water</i>
Foliar with Handgun or Wand	N/A	0.6 oz. Remedy Ultra®
		0.3 oz. non-ionic surfactant

Sumac
(*Russ spp.*)



Ailanthus (tree-of-heaven)
(*Ailanthus altissima*)



Although often confused, sumac species and ailanthus are separate species. While sumac only sometimes acts as a weed and is an important species for wildlife, Ailanthus is a well-known invasive. Cutting or mowing alone is not effective on ailanthus, and can increase its spread by promoting suckering.

Remedy Ultra®		
	<i>Per Acre</i>	<i>Per Gal of Mix</i>
Cut Stump/Basal Bark	N/A	1 quart Remedy Ultra®
		3 quarts diesel fuel or fuel oil
	<i>Per Acre</i>	<i>Per Gal of Water</i>
Foliar with Handgun or Wand	N/A	0.6 oz. Remedy Ultra®
		0.3 oz. non-ionic surfactant

Honey locust
(*Gleditsia triacanthos*)



Black locust
(*Robinia pseudoacacia*)



Mature trees should be cut. Sprouting from cut stumps can be prevented by using a cut-stump herbicide treatment with *Remedy Ultra*® or *Garlon 4 Ultra*®. *GrazonNext HL*®, *PastureGard HL*®, or *Surmount*® are labeled for foliar application to small locust trees. Also, a 2,4-D + dicamba mixture can be very effective (80+% control).

GrazonNext HL®		
	<i>Per Acre</i>	<i>Per Gal of Water</i>
Boom Sprayer	2.1 pints GrazonNext HL®	1.1 oz. GrazonNext HL®
	9.6 oz. non-ionic surfactant	0.3 oz. non-ionic surfactant
Boomless Sprayer	2.1 pints GrazonNext HL®	3.4 oz. GrazonNext HL®
	3.2 oz. non-ionic surfactant	0.3 oz. non-ionic surfactant
Handgun/ Wand Sprayer	N/A	0.5 oz. GrazonNext HL®
		0.3 oz. non-ionic surfactant
2,4-D + dicamba		
	<i>Per Acre</i>	<i>Per Gal of Water</i>
Boom Sprayer	2.5 pints 2,4-D	1.3 oz. 2,4-D
	8 oz. dicamba	0.3 oz. dicamba
	9.6 oz. non-ionic surfactant	0.3 oz. non-ionic surfactant
Boomless Sprayer	2.5 pints 2,4-D	4 oz. 2,4-D
	8 oz dicamba	0.8 oz. dicamba
	3.2 oz. non-ionic surfactant	0.3 oz. non-ionic surfactant
Handgun/ Wand Sprayer	N/A	0.5 oz. 2,4-D
		0.1 oz. dicamba
		0.3 oz. non-ionic surfactant
Remedy Ultra®		
	<i>Per Acre</i>	<i>Per Gal of Mix</i>
Cut Stump/Basal Bark	N/A	1 quart Remedy Ultra®
		3 quarts diesel fuel or fuel oil

Multiflora rose (*Rosa multiflora*)



Garv Fewless



Apply herbicide from full leaf emergence through the flowering period. Late-summer can be a good time if disease and insect feeding on leaves is not present. Multiple herbicides provide around 80% control, including *GrazonNext HL*®, *Remedy Ultra*®, *Cimarron Plus*®, *Chaparral*®, and *Crossbow*® (a tank-mix of 2,4-D and *Remedy Ultra*® is a good, economical substitute for *Crossbow*®). Caution: products containing metsulfuron can stunt fescue and Timothy. If the plant has been mown, wait 9-12 months before applying herbicide in order to maximize leaf area exposure to the treatment.

Cimarron Plus®		
	<i>Per Acre</i>	<i>Per Gal of Water</i>
Boom Sprayer	0.5 oz Cimarron Plus ®	Low use-rate makes measuring herbicide for small batches difficult
	9.6 oz non-ionic surfactant	
Boomless Sprayer	0.5 oz Cimarron Plus ®	
	3.2 oz non-ionic surfactant	
Handgun/ Wand Sprayer	N/A	
Remedy Ultra®		
	<i>Per Acre</i>	<i>Per Gal of Water</i>
Foliar with Handgun or Wand	N/A	0.6 oz. Remedy Ultra®
		0.3 oz. non-ionic surfactant
GrazonNext HL®		
	<i>Per Acre</i>	<i>Per Gal of Water</i>
Boom Sprayer	2.1 pints GrazonNext HL®	1.1 oz. GrazonNext HL®
	9.6 oz. non-ionic surfactant	0.3 oz. non-ionic surfactant
Boomless Sprayer	2.1 pints GrazonNext HL®	3.4 oz. GrazonNext HL®
	3.2 oz. non-ionic surfactant	0.3 oz. non-ionic surfactant
Handgun/ Wand Sprayer	N/A	0.5 oz. GrazonNext HL®
		0.3 oz. non-ionic surfactant

Autumn olive (*Elaeagnus umbellate*)



This invasive species is often encountered as large mature plants, and these must be mechanically removed. If cut, a cut stump treatment should be applied. For plants smaller than about 5 feet tall, multiple herbicides provide around 80% control, including 2,4-D + dicamba, *Cimarron*®, *PastureGard HL*®, *Crossbow*® (2,4-D + triclopyr), and *Remedy Ultra*®. However, these will not provide residual control. For broad spectrum weed control and residual soil activity use *GrazonNext HL*® or *Surmount*® tankmixed with *Remedy Ultra*®. Apply herbicide from full leaf emergence through the flowering period. If the plant has been mowed, wait 9-12 months before applying herbicide in order to maximize leaf area exposure to the treatment. Basal treatments can be effective and provide a winter option for hard-to-reach plants.

GrazonNext HL®		
	<i>Per Acre</i>	<i>Per Gal of Water</i>
Boom Sprayer	2.1 pints GrazonNext HL®	1.1 oz. GrazonNext HL®
	9.6 oz. non-ionic surfactant	0.3 oz. non-ionic surfactant
Boomless Sprayer	2.1 pints GrazonNext HL®	3.4 oz. GrazonNext HL®
	3.2 oz. non-ionic surfactant	0.3 oz. non-ionic surfactant
Handgun/ Wand Sprayer	N/A	0.5 oz. GrazonNext HL®
		0.3 oz. non-ionic surfactant
Remedy Ultra®		
	<i>Per Acre</i>	<i>Per Gal of Water</i>
Boom Sprayer	3 pints Remedy Ultra®	1.6 oz. Remedy Ultra®
	9.6 oz non-ionic surfactant	0.3 oz non-ionic surfactant
Boomless Sprayer	3 pints Remedy Ultra®	4.8 oz. Remedy Ultra®
	3.2 oz non-ionic surfactant	0.3 oz non-ionic surfactant
Handgun/ Wand Sprayer	N/A	0.5 oz. Remedy Ultra®
		0.3 oz. non-ionic surfactant
Remedy Ultra®		
	<i>Per Acre</i>	<i>Per Gal of Mix</i>
Cut Stump/Basal Bark	N/A	1 quart Remedy Ultra® 3 quarts diesel fuel or fuel oil

Sericea Lespedeza (*Lespedeza cuneata*)



Sericea lespedeza is an invasive warm-season perennial legume that sprouts in early summer from crown buds. Frequent mowing, especially late in the season, limits carbohydrate storage and reduces stand productivity the next year. Target herbicide applications in early summer at the flower bud stage, or in late summer. Triclopyr (e.g. *Remedy Ultra*®, *PastureGard HL*®, *Surmount*®) is most effective, resulting in around a 75% reduction in weed density one year after treatment. Metsulfuron (e.g. *Cimarron Plus*, *Chisum*, *Chaparral*, generic metsulfuron) has been shown to be equally effective when applied in fall.

Cimarron Plus®		
	<i>Per Acre</i>	<i>Per Gal of Water</i>
Boom Sprayer	0.5 oz Cimarron Plus ®	Low use-rate makes measuring herbicide for small batches difficult
	9.6 oz non-ionic surfactant	
Boomless Sprayer	0.5 oz Cimarron Plus ®	
	3.2 oz non-ionic surfactant	
Handgun/ Wand Sprayer	N/A	
Remedy Ultra®		
	<i>Per Acre</i>	<i>Per Gal of Water</i>
Boom Sprayer	3 pints Remedy Ultra®	1.6 oz. Remedy Ultra®
	9.6 oz non-ionic surfactant	0.3 oz non-ionic surfactant
Boomless Sprayer	3 pints Remedy Ultra®	4.8 oz. Remedy Ultra®
	3.2 oz non-ionic surfactant	0.3 oz non-ionic surfactant
Handgun/ Wand Sprayer	N/A	0.5 oz. Remedy Ultra® 0.3 oz. non-ionic surfactant

Buckbrush, Devil's shoestring (*Symphoricarpos orbiculatus*)



Buckbrush is a perennial bush that sprouts from aggressive rhizomes. Target the plant and rhizomes through an early spring or fall herbicide application, followed by spot herbicide applications or mowing of any regrowth. For spring applications, spray after new leaves and stems emerge, but before new growth becomes woody. Because of its rhizomatous nature, it may take several years to get an infestation under control. In university testing, best results were obtained with high rates of 2,4-D, or with a tankmix of *GrazonNext HL*® + *Remedy Ultra*®. Both options gave over 90% control when assessed 3 months after treatment. Because of the effectiveness of 2,4 D on buckbrush when it is young, many common pasture herbicides should be effective when boosted with 2,4-D.

GrazonNext HL® + Remedy Ultra®		
	<i>Per Acre</i>	<i>Per Gal of Water</i>
Boom Sprayer	2.1 pints GrazonNext HL®	1.1 oz. GrazonNext HL®
	1 pint Remedy Ultra®	0.5 oz. Remedy Ultra®
	9.6 oz. non-ionic surfactant	0.3 oz. non-ionic surfactant
Boomless Sprayer	2.1 pints GrazonNext HL®	3.4 oz. GrazonNext HL®
	1 pint Remedy Ultra®	1.6 oz. Remedy Ultra®
	3.2 oz. non-ionic surfactant	0.3 oz. non-ionic surfactant
Handgun/ Wand Sprayer	N/A	0.5 oz. GrazonNext HL®
		0.2 oz. Remedy Ultra®
		0.3 oz. non-ionic surfactant
2,4-D		
	<i>Per Acre</i>	<i>Per Gal of Water</i>
Boom Sprayer	4 pints 2,4-D	2.2 oz. 2,4-D
	9.6 oz. non-ionic surfactant	0.3 oz. non-ionic surfactant
Boomless Sprayer	4 pints 2,4-D	6.4 oz. 2,4-D
	3.2 oz. non-ionic surfactant	0.3 oz. non-ionic surfactant
Handgun/ Wand Sprayer	N/A	0.9 oz. 2,4-D
		0.3 oz. non-ionic surfactant

Queen Anne's Lace, Wild Carrot (*Daucus carota*)



Queen Anne's Lace is a biennial that develops a rosette and taproot the first year, then flowers the following summer before dying. Spray during the seedling and rosette stages the first year. During the second year it is best to mow-off the flower stalks since there is limited leaf area on mature plants to take in herbicide (you may still apply herbicide to control the next generation of seedling plants). Preventing seed production is an important management tool since each plant can produce around 4,000 seeds. Best results are obtained with 2,4-D + dicamba, *Chaparral*®, *Cimarron Plus*®, and *DuraCor*®, all providing about 90-100% control. For hay use of 2,4-D + triclopyr, or a tankmix of 2,4-D + dicamba would do well also.

2,4-D + dicamba		
	<i>Per Acre</i>	<i>Per Gal of Water</i>
Boom Sprayer	2.5 pints 2,4-D	1.3 oz. 2,4-D
	8 oz. dicamba	0.3 oz. dicamba
	9.6 oz. non-ionic surfactant	0.3 oz. non-ionic surfactant
Boomless Sprayer	2.5 pints 2,4-D	4 oz. 2,4-D
	8 oz dicamba	0.8 oz. dicamba
	3.2 oz. non-ionic surfactant	0.3 oz. non-ionic surfactant
Handgun/ Wand Sprayer	N/A	0.5 oz. 2,4-D
		0.1 oz. dicamba
		0.3 oz. non-ionic surfactant
DuraCor®		
	<i>Per Acre</i>	<i>Per Gal of Water</i>
Boom Sprayer	1 pint DuraCor®	0.5 oz. DuraCor®
	9.6 oz non-ionic surfactant	0.3 oz non-ionic surfactant
Boomless Sprayer	1 pint DuraCor®	1.6 oz. DuraCor®
	3.2 oz non-ionic surfactant	0.3 oz non-ionic surfactant
Handgun/ Wand Sprayer	N/A	0.2 oz. DuraCor®
		0.3 oz. non-ionic surfactant

Wingstem
(*Verbesina alternifolia*)

Yellow Crownbeard/Stickweed
(*Verbesina occidentalis*)



While both species have winged stems, the leaves of wingstem have a lanceolate shape and are alternate on the stem, whereas the leaves of crownbeard have a broadly ovate leaf and are opposite one another on the stem. Additionally, the leaves of wingstem have a sandpaper-like texture unlike crownbeard. Anecdotal reports suggest livestock will more readily graze wingstem versus yellow crownbeard. Both species are rhizomatous perennials, and they are managed similarly from an herbicide standpoint. Target the plant during the early-bud stage in early to mid-summer or following mowing, after the plant has regrown to about 2 feet in height.

2,4-D + dicamba		
	<i>Per Acre</i>	<i>Per Gal of Water</i>
Boom Sprayer	2.5 pints 2,4-D	1.3 oz. 2,4-D
	8 oz. dicamba	0.3 oz. dicamba
	9.6 oz. non-ionic surfactant	0.3 oz. non-ionic surfactant
Boomless Sprayer	2.5 pints 2,4-D	4 oz. 2,4-D
	8 oz dicamba	0.8 oz. dicamba
	3.2 oz. non-ionic surfactant	0.3 oz. non-ionic surfactant
Handgun/ Wand Sprayer	N/A	0.5 oz. 2,4-D
		0.1 oz. dicamba
		0.3 oz. non-ionic surfactant
GrazonNext HL®		
	<i>Per Acre</i>	<i>Per Gal of Water</i>
Boom Sprayer	2.1 pints GrazonNext HL®	1.1 oz. GrazonNext HL®
	9.6 oz. non-ionic surfactant	0.3 oz. non-ionic surfactant
Boomless Sprayer	2.1 pints GrazonNext HL®	3.4 oz. GrazonNext HL®
	3.2 oz. non-ionic surfactant	0.3 oz. non-ionic surfactant
Handgun/ Wand Sprayer	N/A	0.5 oz. GrazonNext HL®
		0.3 oz. non-ionic surfactant

Plantain species

Buckhorn (*Plantago lanceolata*)

Broadleaf (*Plantago major*)



These are perennial species with dense clumps of leaves that grow close to the ground, where they form a taproot. They do well in compacted soils and tolerate close mowing or grazing. Plantain (particularly buckhorn plantain) has good palatability and forage quality and can be an asset in pastures when present in moderation. In fact, forage varieties of buckhorn plantain are now available. Herbicide applications should target the mature plant from spring through fall. Good results can be obtained with many common herbicides including *DuraCor®*, *Cimarron Plus®*, *Chaparral®*, *Surmount®*, and 2,4-D + dicamba.

2,4-D + dicamba		
	<i>Per Acre</i>	<i>Per Gal of Water</i>
Boom Sprayer	2.5 pints 2,4-D	1.3 oz. 2,4-D
	8 oz. dicamba	0.3 oz. dicamba
	9.6 oz. non-ionic surfactant	0.3 oz. non-ionic surfactant
Boomless Sprayer	2.5 pints 2,4-D	4 oz. 2,4-D
	8 oz dicamba	0.8 oz. dicamba
	3.2 oz. non-ionic surfactant	0.3 oz. non-ionic surfactant
Handgun/ Wand Sprayer	N/A	0.5 oz. 2,4-D
		0.1 oz. dicamba
		0.3 oz. non-ionic surfactant
DuraCor®		
	<i>Per Acre</i>	<i>Per Gal of Water</i>
Boom Sprayer	1 pint DuraCor®	0.5 oz. DuraCor®
	9.6 oz non-ionic surfactant	0.3 oz non-ionic surfactant
Boomless Sprayer	1 pint DuraCor®	1.6 oz. DuraCor®
	3.2 oz non-ionic surfactant	0.3 oz non-ionic surfactant
Handgun/ Wand Sprayer	N/A	0.2 oz. DuraCor®
		0.3 oz. non-ionic surfactant

Yucca (*Yucca filamentosa*)



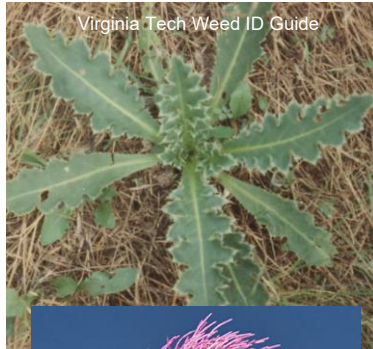
Yucca is a tall perennial weed with thick underground rootstocks. Effective control can be obtained by spot treatment with a triclopyr + diesel fuel mixture.

Remedy Ultra®		
	<i>Per Acre</i>	<i>Per Gal of Mix</i>
Cut Stump/Basal Bark	N/A	1 quart Remedy Ultra®
		3 quarts diesel fuel or fuel oil
	<i>Per Acre</i>	<i>Per Gal of Water</i>
Foliar with Handgun or Wand	N/A	0.6 oz. Remedy Ultra®
		0.3 oz. non-ionic surfactant

Bull thistle
(*Cirsium vulgare*)



Musk thistle
(*Carduus nutans*)



Plumeless thistle
(*Carduus acanthoides*)



Virginia's 3 most common thistle species are biennial and are managed similarly. Biennial thistles spread only by seed, which germinate mainly in late-summer and fall. The 1st year is spent as a seedling that overwinters as a rosette prior to shooting a flowering stalk (bolting) in summer. Target the plant during the seedling or rosette stage in year 1, or up to bolting in its second year. Most broadleaf herbicides are effective on biennial thistles when applied in the rosette stage. Timing is critical as control declines sharply once bolting begins.

GrazonNext HL®		
	<i>Per Acre</i>	<i>Per Gal of Water</i>
Boom Sprayer	2.1 pints GrazonNext HL®	1.1 oz. GrazonNext HL®
	9.6 oz. non-ionic surfactant	0.3 oz. non-ionic surfactant
Boomless Sprayer	2.1 pints GrazonNext HL®	3.4 oz. GrazonNext HL®
	3.2 oz. non-ionic surfactant	0.3 oz. non-ionic surfactant
Handgun/ Wand Sprayer	N/A	0.5 oz. GrazonNext HL®
		0.3 oz. non-ionic surfactant
2,4-D + dicamba		
	<i>Per Acre</i>	<i>Per Gal of Water</i>
Boom Sprayer	2.5 pints 2,4-D	1.3 oz. 2,4-D
	8 oz. dicamba	0.3 oz. dicamba
	9.6 oz. non-ionic surfactant	0.3 oz. non-ionic surfactant
Boomless Sprayer	2.5 pints 2,4-D	4 oz. 2,4-D
	8 oz dicamba	0.8 oz. dicamba
	3.2 oz. non-ionic surfactant	0.3 oz. non-ionic surfactant
Handgun/ Wand Sprayer	N/A	0.5 oz. 2,4-D
		0.1 oz. dicamba
		0.3 oz. non-ionic surfactant

Canada Thistle (*Cirsium arvense*)



Canada thistle is a perennial that sprouts from creeping rhizomes (underground stems) and can form large colonies. One way to differentiate Canada thistle from biennial thistles is that Canada thistle has smooth stems (with spiny leaves). Unlike the biennial thistles, which should be sprayed when small, Canada thistle should be targeted after they have reached about $\frac{3}{4}$ of their maximum height (around the early-bud stage) in order to deliver herbicides to roots and rhizomes. Late summer is a good time to spray re-growth.

GrazonNext HL®		
	<i>Per Acre</i>	<i>Per Gal of Water</i>
Boom Sprayer	2.1 pints GrazonNext HL®	1.1 oz. GrazonNext HL®
	9.6 oz. non-ionic surfactant	0.3 oz. non-ionic surfactant
Boomless Sprayer	2.1 pints GrazonNext HL®	3.4 oz. GrazonNext HL®
	3.2 oz. non-ionic surfactant	0.3 oz. non-ionic surfactant
Handgun/ Wand Sprayer	N/A	0.5 oz. GrazonNext HL®
		0.3 oz. non-ionic surfactant
2,4-D + Remedy Ultra®		
	<i>Per Acre</i>	<i>Per Gal of Water</i>
Boom Sprayer	3 pints 2,4-D	1.6 oz. 2,4-D
	1.5 pint Remedy Ultra®	0.8 oz. Remedy Ultra®
	9.6 oz non-ionic surfactant	0.3 oz non-ionic surfactant
Boomless Sprayer	3 pints 2,4-D	4.8 oz. 2,4-D
	1.5 pint Remedy Ultra®	2.4 oz. Remedy Ultra®
	3.2 oz non-ionic surfactant	0.3 oz non-ionic surfactant
Handgun/ Wand Sprayer	N/A	0.5 oz. 2,4-D
		0.3 oz. Remedy Ultra®
		0.3 oz. non-ionic surfactant

Spiny Amaranth, Spiny pigweed (*Amaranthus spinosus*)



Spiny amaranth is a summer annual that thrives in bare or high traffic areas. Each plant can produce over 100,000 seeds, so preventing seed production is important. Seeds require light to germinate, so maintaining a good grass canopy is also an important management tool. When less than about 4” tall it is easy to kill with most broadleaf herbicides; control becomes difficult as plant size increases. Seeds germinate throughout summer, so the use of a residual chemical can be helpful. 2,4-D + dicamba, *Cimarron Plus*®, *Chaparral*®, *Surmount*®, and *GrazonNext HL*® offer 80-90% control.

GrazonNext HL® + dicamba		
	<i>Per Acre</i>	<i>Per Gal of Water</i>
Boom Sprayer	2.1 pints GrazonNext HL®	1.1 oz. GrazonNext HL®
	8 oz. dicamba	0.3 oz. dicamba
	9.6 oz. non-ionic surfactant	0.3 oz. non-ionic surfactant
Boomless Sprayer	2.1 pints GrazonNext HL®	3.4 oz. GrazonNext HL®
	8 oz dicamba	0.8 oz. dicamba
	3.2 oz. non-ionic surfactant	0.3 oz. non-ionic surfactant
Handgun/ Wand Sprayer	N/A	0.5 oz. GrazonNext HL®
		0.1 oz. dicamba
		0.3 oz. non-ionic surfactant
2,4-D + dicamba		
	<i>Per Acre</i>	<i>Per Gal of Water</i>
Boom Sprayer	2.5 pints 2,4-D	1.3 oz. 2,4-D
	8 oz. dicamba	0.3 oz. dicamba
	9.6 oz. non-ionic surfactant	0.3 oz. non-ionic surfactant
Boomless Sprayer	2.5 pints 2,4-D	4 oz. 2,4-D
	8 oz dicamba	0.8 oz. dicamba
	3.2 oz. non-ionic surfactant	0.3 oz. non-ionic surfactant
Handgun/ Wand Sprayer	N/A	0.5 oz. 2,4-D
		0.1 oz. dicamba
		0.3 oz. non-ionic surfactant

Dock species

Curly (*Rumex crispus*)



Broadleaf (*Rumex obtusifolius*)



These are taprooted perennials that form dense rosettes. Although the plant will send up new shoots every year, it spreads mainly by seed. Anecdotal reports suggest that livestock will graze the young plants but often avoid plants as they age and become tough and bitter. Mature plants can have a broad footprint and displace a significant amount of grass when not consumed. Target the mature plant and seedlings from late spring through fall. 90+% control can be obtained with many herbicides including *GrazonNext HL*®, *Surmount*®, *Chaparral*®, 2,4-D + dicamba, *Cimarron Plus*®, and *Crossbow*®.

GrazonNext HL®		
	<i>Per Acre</i>	<i>Per Gal of Water</i>
Boom Sprayer	2.1 pints GrazonNext HL®	1.1 oz. GrazonNext HL®
	9.6 oz. non-ionic surfactant	0.3 oz. non-ionic surfactant
Boomless Sprayer	2.1 pints GrazonNext HL®	3.4 oz. GrazonNext HL®
	3.2 oz. non-ionic surfactant	0.3 oz. non-ionic surfactant
Handgun/ Wand Sprayer	N/A	0.5 oz. GrazonNext HL®
		0.3 oz. non-ionic surfactant
2,4-D + dicamba		
	<i>Per Acre</i>	<i>Per Gal of Water</i>
Boom Sprayer	2.5 pints 2,4-D	1.3 oz. 2,4-D
	8 oz. dicamba	0.3 oz. dicamba
	9.6 oz. non-ionic surfactant	0.3 oz. non-ionic surfactant
Boomless Sprayer	2.5 pints 2,4-D	4 oz. 2,4-D
	8 oz dicamba	0.8 oz. dicamba
	3.2 oz. non-ionic surfactant	0.3 oz. non-ionic surfactant
Handgun/ Wand Sprayer	N/A	0.5 oz. 2,4-D
		0.1 oz. dicamba
		0.3 oz. non-ionic surfactant

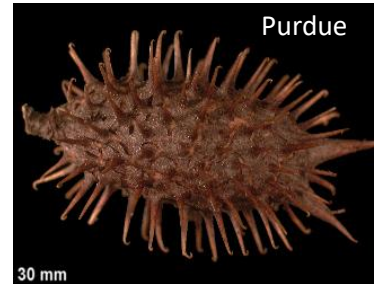
Burdock (*Arcticum minus*)



Burdock is a biennial that forms a large rosette the 1st year and a large upright plant the 2nd year. Reproduction is by seed. Target the plant from the rosette through bolting stages. 90% control can be obtained with *Crossbow*® (or equivalent tankmix of 2,4-D + *Remedy Ultra*®), 2,4-D alone or 2,4-D + dicamba, *Grazon P+D*®, *PastureGard HL*®, and *Chaparral*®.

2,4-D + dicamba		
	<i>Per Acre</i>	<i>Per Gal of Water</i>
Boom Sprayer	2.5 pints 2,4-D	1.3 oz. 2,4-D
	8 oz. dicamba	0.3 oz. dicamba
	9.6 oz. non-ionic surfactant	0.3 oz. non-ionic surfactant
Boomless Sprayer	2.5 pints 2,4-D	4 oz. 2,4-D
	8 oz dicamba	0.8 oz. dicamba
	3.2 oz. non-ionic surfactant	0.3 oz. non-ionic surfactant
Handgun/ Wand Sprayer	N/A	0.5 oz. 2,4-D
		0.1 oz. dicamba
		0.3 oz. non-ionic surfactant
Remedy Ultra®		
	<i>Per Acre</i>	<i>Per Gal of Water</i>
Boom Sprayer	3 pints Remedy Ultra®	1.6 oz. Remedy Ultra®
	9.6 oz non-ionic surfactant	0.3 oz non-ionic surfactant
Boomless Sprayer	3 pints Remedy Ultra®	4.8 oz. Remedy Ultra®
	3.2 oz non-ionic surfactant	0.3 oz non-ionic surfactant
Handgun/ Wand Sprayer	N/A	0.5 oz. Remedy Ultra®
		0.3 oz. non-ionic surfactant

Cocklebur (*Xanthium strumarium*)



Cocklebur is a summer annual with a thick, woody taproot. Reproduction is by seed. Target during the seedling and vegetative stages. Most broadleaf herbicides offer around 90% control. Products with residual activity, such as *GrazonNext HL*® help to prevent future flushes of cocklebur in-season.

2,4-D + dicamba		
	<i>Per Acre</i>	<i>Per Gal of Water</i>
Boom Sprayer	2.5 pints 2,4-D	1.3 oz. 2,4-D
	8 oz. dicamba	0.3 oz. dicamba
	9.6 oz. non-ionic surfactant	0.3 oz. non-ionic surfactant
Boomless Sprayer	2.5 pints 2,4-D	4 oz. 2,4-D
	8 oz dicamba	0.8 oz. dicamba
	3.2 oz. non-ionic surfactant	0.3 oz. non-ionic surfactant
Handgun/ Wand Sprayer	N/A	0.5 oz. 2,4-D
		0.1 oz. dicamba
		0.3 oz. non-ionic surfactant
Remedy Ultra®		
	<i>Per Acre</i>	<i>Per Gal of Water</i>
Boom Sprayer	3 pints Remedy Ultra®	1.6 oz. Remedy Ultra®
	9.6 oz non-ionic surfactant	0.3 oz non-ionic surfactant
Boomless Sprayer	3 pints Remedy Ultra®	4.8 oz. Remedy Ultra®
	3.2 oz non-ionic surfactant	0.3 oz non-ionic surfactant
Handgun/ Wand Sprayer	N/A	0.5 oz. Remedy Ultra®
		0.3 oz. non-ionic surfactant

Common Mullein (*Verbascum thapsus*)



Common mullein is a biennial that forms a large rosette the first year and a tall upright stem the second year. It has a large taproot. Reproduction is by seed that usually germinates in late-summer, early-fall, or spring. Target the plant during the 1st-year rosette stage, or the 2nd year prior to bolting (emergence of reproductive stem). Mullein is difficult to kill. University testing has shown best control with metsulfuron. *Cimarron Plus*® or a generic metsulfuron) provides about 70% control, while Chaparral provides around 90% control plus residual activity.

Cimarron Plus®		
	<i>Per Acre</i>	<i>Per Gal of Water</i>
Boom Sprayer	0.5 oz Cimarron Plus ®	Low use-rate makes measuring herbicide for small batches difficult
	9.6 oz non-ionic surfactant	
Boomless Sprayer	0.5 oz Cimarron Plus ®	
	3.2 oz non-ionic surfactant	
Handgun/ Wand Sprayer	N/A	
Chaparral®		
	<i>Per Acre</i>	<i>Per Gal of Water</i>
Boom Sprayer	2.5 oz Chaparral ®	Low use-rate makes measuring herbicide for small batches difficult
	9.6 oz non-ionic surfactant	
Boomless Sprayer	2.5 oz Chaparral ®	
	3.2 oz non-ionic surfactant	
Handgun/ Wand Sprayer	N/A	

Brambles: dewberries, blackberries, etc. (*Rubrus spp.*)



Assorted species are referred to as brambles. They are perennial, spreading by root sprouts, rhizomes, or rooting aboveground stems, in addition to seed. All species are difficult to control and generally require an herbicide application in 2 consecutive years for eradication. Goats are an effective option but be prepared to graze for 2 to 3 years for complete control. Triclopyr containing herbicides (*Crossbow*®, *Remedy Ultra*®, *PastureGard HL*®) and metsulfuron containing herbicides (metsulfuron, *Cimarron Plus*®, *Chaparral*®) are most effective. Plants can be sprayed in the early-bloom stage in spring, but better control will be obtained with a high-volume foliar treatment in September. Application of metsulfuron in 2 consecutive years is not recommended due to tall fescue injury and stand thinning; if metsulfuron is used in year 1, replace it with another chemical in year 2. Mowing is a waste of time and money and can lead to decreased herbicide efficacy. If you must mow, wait at least 12 months before spraying to allow adequate leaf area for translocating herbicides to belowground structures. After spraying, allow 6 months before mowing to give adequate time for herbicides to translocate.

2,4-D + Remedy Ultra®		
	<i>Per Acre</i>	<i>Per Gal of Water</i>
Boom Sprayer	3 pints 2,4-D	1.6 oz. 2,4-D
	1.5 pint Remedy Ultra®	0.8 oz. Remedy Ultra®
	9.6 oz non-ionic surfactant	0.3 oz non-ionic surfactant
Boomless Sprayer	3 pints 2,4-D	4.8 oz. 2,4-D
	1.5 pint Remedy Ultra®	2.4 oz. Remedy Ultra®
	3.2 oz non-ionic surfactant	0.3 oz non-ionic surfactant
Handgun/ Wand Sprayer	N/A	0.5 oz. 2,4-D
		0.3 oz. Remedy Ultra®
		0.3 oz. non-ionic surfactant
Surmount®		
	<i>Per Acre</i>	<i>Per Gal of Water</i>
Boom Sprayer	3 pints Surmount®	1.6 oz. Surmount®
	9.6 oz non-ionic surfactant	0.3 oz non-ionic surfactant
Boomless Sprayer	3 pints Surmount®	4.8 oz. Surmount®
	3.2 oz non-ionic surfactant	0.3 oz non-ionic surfactant
Handgun/ Wand Sprayer	N/A	0.6 oz. Surmount®
		0.3 oz. non-ionic surfactant

Foxtails species (*Setaria spp.*)



Green foxtail seedhead



Yellow foxtail seedhead



University of Missouri

Giant foxtail seedhead



Iowa State Univ.

Foxtail seedlings

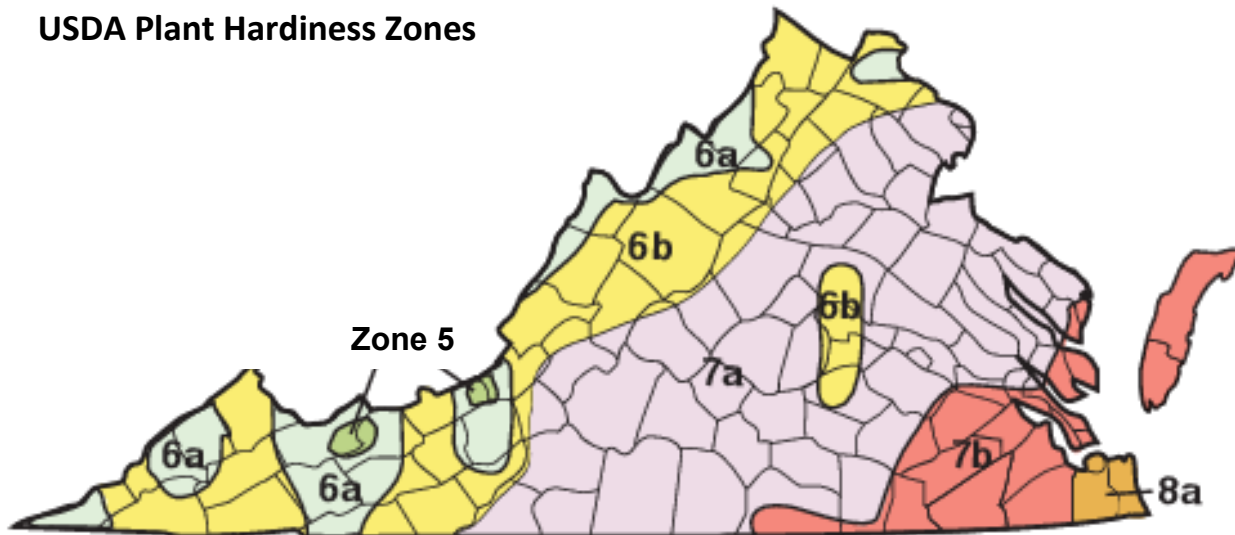
There are three common types of annual foxtail species: yellow, green, and giant. From a biology and control standpoint they are identical, though the plants and seedheads look different. Annual foxtails germinate once the ground temperature reaches about 60°F –around mid-March or later depending on your location. Because there is also a light requirement for germination, the density of the hay or pasture stand will influence germination. Some seeds may not germinate until the first hay cutting is removed.

While germination time may vary, seedheads will not show up until at least mid-summer. Mowing foxtail may make the foxtail head-out shorter, and may reduce seed production some.

There are two herbicides labeled for foxtail control in hay are *pendimethalin* (*Prowl H₂O*®) and *quinclorac* (®*Facet L*® or *QuinStar 4L*®). They work differently and require different control strategies.

Pendimethalin is entirely dependent on preemergence activity to control weeds. It provides about 4-6 weeks of control per quart applied. Not only must it be applied prior to foxtail germination, it must also reach the soil and be watered-in to be effective. A dense canopy of hay can inhibit *pendimethalin* from reaching the ground, a scenario which can make spring applications a challenge. Higher spray volumes and selecting nozzles that produce coarse droplets (such as air-induction tips) should help some with this. Applying *pendimethalin* later in spring (after the first cutting for example) can often fail because foxtail may have already germinated. Lack of rain following first cutting is another cause of concern with late-spring applications. The only strategy which has consistently worked in Virginia Tech trials has been to apply 3-4 quarts/acre *Prowl H₂O*® in early-spring—typically mid-March to early-April in zone 6b of the USDA plant hardiness zone. Other areas of Virginia may be up to several weeks later or earlier.

USDA Plant Hardiness Zones



In

Virginia Tech trials, 4 quarts of *Prowl H₂O*® applied in early-spring provided up to 90% control in late-summer evaluations. Where foxtail pressure was very high, the rate of control has been less (as low as 55%). While other rates and application dates work in theory, they have not worked as well in practice. In central and western Virginia, on-farm demonstrations and discussions with early-adopters of *pendimethalin* have shown mixed results with 2 quarts of *Prowl H₂O*® applied in early-spring. Similarly, *pendimethalin* applied immediately after the first hay cutting either as a standalone application or as part of a split-application have not shown consistent results. *Prowl H₂O*® currently retails for around \$12/quart. A generic, aqueous version of *pendimethalin*, named *Satellite HydroCap*® is also labelled for hay and pasture, and seems to run slightly less expensive than *Prowl H₂O*®.

Quinclorac has both preemergence and postemergence activity to control weeds. It is therefore a good fit for applying after the first cutting of hay, since there may exist foxtail pressure ranging from un-germinated seeds to multiple-leaf seedlings. In both university trials and on-farm demonstrations, quinclorac has shown good results. Virginia Tech trials have shown near 90% control at late-summer evaluations from 1 quart per acre of *Facet L*® applied immediately after the first hay cutting. *Facet L*® is a liquid formulation which retails for about \$30/quart. A generic version of *quinclorac*, named *QuinStar 4L*®, is labelled for use in pasture and hay in Virginia.

Caution should be used when applying *quinclorac* on orchardgrass under stress, as crop injury can occur. Stress is increased by hot, dry weather during or immediately following herbicide application. The risk is inherently intensified by the requirement to add crop oil or MSO to *quinclorac* to achieve the required efficacy on foxtail. A 2017 Virginia Tech research trial looked at orchardgrass stunting by *Facet L*® and found season-long stunting of 10-15% after an herbicide application in late-May. Our recommendation is to use *Facet L*® only after a *true* first cutting taken prior to mid-June, and only if moisture and temperature conditions are favorable for orchardgrass growth and recovery. Do not mix fertilizer with the herbicide. Avoid applying to a new stand of orchardgrass. Lastly, to get optimal postemergence efficacy on foxtail, make sure any quinclorac application is followed by the appropriate rain-fast period specified by the label. In Virginia Tech trials, tankmixing *Prowl H₂O*® with *Facet L*® provided no improvement over *Facet L*® alone.

Because the cost of any of these treatments may approach \$50/acre, they are likely only economical for premium horse hay markets. Even with herbicide treatment, it is very possible that some foxtail will still be present in late-summer hay. Many producers have asked how long it would take to eliminate the foxtail seedbank from a field. Its likely most foxtail seed are viable in the soil for 2-3 years, so controlling seed production for several years will likely be required. Beware that hay equipment can easily carry foxtail seed from field to field.

Facet L® (immediately following 1st cutting)		
	<i>Per Acre</i>	<i>Per Gal of Water</i>
Boom Sprayer	1 quart Facet L®	1.1 oz. Facet L®
	2 pints crop oil concentrate	1.1 oz. crop oil concentrate (COC)
	OR	OR
	1.5 pints methylated seed oil	0.8 oz. methylated seed oil (MSO)
Boomless Sprayer	1 quart Facet L®	3.2 oz. Facet L®
	2 pints crop oil concentrate	3.2 oz. crop oil concentrate (COC)
	OR	OR
	1-2 pints methylated seed oil	2.4 oz. methylated seed oil (MSO)
Handgun/ Wand Sprayer	N/A	0.4 oz. Facet L®
		0.4 oz. crop oil concentrate (COC)
		OR
		0.3 oz. methylated seed oil (MSO)
QuinStar 4L® (immediately following 1st cutting)		
	<i>Per Acre</i>	<i>Per Gal of Water</i>
Boom Sprayer	12.5 oz QuinStar 4L®	0.4 oz. QuinStar 4L®
	2 pints crop oil concentrate	1.1 oz. crop oil concentrate (COC)
	OR	OR
	1.5 pints methylated seed oil	0.8 oz. methylated seed oil (MSO)
Boomless Sprayer	12.5 oz QuinStar 4L®	1.3 oz. QuinStar 4L®
	2 pints crop oil concentrate	3.2 oz. crop oil concentrate (COC)
	OR	OR
	1-2 pints methylated seed oil	2.4 oz. methylated seed oil (MSO)
Handgun/ Wand Sprayer	N/A	0.2 oz QuinStar 4L®
		0.4 oz. crop oil concentrate (COC)
		OR
		0.3 oz. methylated seed oil (MSO)
Prowl H2O® (mid-March/early-April)		
	<i>Per Acre</i>	<i>Per Gal of Water</i>
Boom Sprayer	4 quarts Prowl H2O®	4.3 oz. Prowl H2O®
Boomless Sprayer	4 quarts Prowl H2O®	12.8 oz. Prowl H2O®
Handgun/ Wand Sprayer	N/A	1.7 oz. Prowl H2O®

Perilla Mint (*Perilla frutescens*)



An erect, bushy, annual mint that grows to 2 feet or more at maturity. It grows best in moist shady areas, but is also very capable of growing in the open. Reproduction is by seed only. All stages of both the green and cured plant are toxic to livestock, with the highest concentration of toxins found in flowers and seeds. Cases of poisoning are a concern during the late summer and early fall when forages might be in short supply and perilla mint is prominent and flowering. Perilla mint germination can begin whenever soil temperatures reach 60°F and can persist all summer. While annual weeds are typically easiest to kill in the early vegetative stages of development, the long germination period of perilla mint can result in breakthroughs once residual chemicals disintegrate. Since studies have shown that perilla mint can be effectively killed through the late-vegetative stages with a number of herbicides, it may be best to postpone spraying until mid-summer when more plants have emerged. Prevent grazing fields containing recently-sprayed perilla mint, as wilted plants are often targeted by livestock.

GrazonNext HL®		
	<i>Per Acre</i>	<i>Per Gal of Water</i>
Boom Sprayer	2.1 pints GrazonNext HL®	1.1 oz. GrazonNext HL®
	9.6 oz. non-ionic surfactant	0.3 oz. non-ionic surfactant
Boomless Sprayer	2.1 pints GrazonNext HL®	3.4 oz. GrazonNext HL®
	3.2 oz. non-ionic surfactant	0.3 oz. non-ionic surfactant
Handgun/ Wand Sprayer	N/A	0.5 oz. GrazonNext HL®
		0.3 oz. non-ionic surfactant
2,4-D + dicamba		
	<i>Per Acre</i>	<i>Per Gal of Water</i>
Boom Sprayer	2.5 pints 2,4-D	1.3 oz. 2,4-D
	8 oz. dicamba	0.3 oz. dicamba
	9.6 oz. non-ionic surfactant	0.3 oz. non-ionic surfactant
Boomless Sprayer	2.5 pints 2,4-D	4 oz. 2,4-D
	8 oz dicamba	0.8 oz. dicamba
	3.2 oz. non-ionic surfactant	0.3 oz. non-ionic surfactant
Handgun/ Wand Sprayer	N/A	0.5 oz. 2,4-D
		0.1 oz. dicamba
		0.3 oz. non-ionic surfactant

Japanese stiltgrass (*Microstegium veminium*)



An annual invasive grass found mostly in moist, shady, areas. It grows to 2 feet tall, often falling over and rooting at nodes to form a mat. Seed is dispersed by wildlife and water, and readily spreads into disturbed areas. Keeping a dense canopy of desirable forage is key to preventing invasion in pastures. Spray when the majority of plants are around 12" tall to ensure that most seed germination has occurred by the time of spraying. Presumably, most germination occurs before June. A mid-May application of aminopyralid provides season-long control of around 80%. *Milestone*, *Chaparral*, and *GrazonNext HL* contain aminopyralid and are labelled for use in pasture. Areas that are infested with broadleaf weeds in addition to stiltgrass provide the best return on investment with these chemicals. Glyphosate at even very low rates can be effective, which provides an option in grasslands as long as any chance of temporary damage to desirable grass can be tolerated. If using a low rate of glyphosate, apply 0.9 lbs. glyphosate/acre (2.5 oz/acre of an herbicide containing 41% glyphosate) when stiltgrass is around 18" in height and prior to seedhead emergence.

GrazonNext HL®

	<i>Per Acre</i>	<i>Per Gal of Water</i>
Boom Sprayer	2.1 pints GrazonNext HL®	1.1 oz. GrazonNext HL®
	9.6 oz. non-ionic surfactant	0.3 oz. non-ionic surfactant
Boomless Sprayer	2.1 pints GrazonNext HL®	3.4 oz. GrazonNext HL®
	3.2 oz. non-ionic surfactant	0.3 oz. non-ionic surfactant
Handgun/ Wand Sprayer	N/A	0.5 oz. GrazonNext HL® 0.3 oz. non-ionic surfactant

Low-Rate Application of a 41% glyphosate product

	<i>Per Acre</i>	<i>Per Gal of Water</i>
Boom Sprayer	2.5 oz glyphosate product	2.5 mL (0.5 teaspoon) glyphosate
	9.6 oz non-ionic surfactant	0.3 oz. non-ionic surfactant
Boomless Sprayer	2.5 oz glyphosate product	7.4 mL (1.5 teaspoons) glyphosate
	9.6 oz non-ionic surfactant	0.3 oz non-ionic surfactant
Handgun/ Wand Sprayer	N/A	1 mL (0.2 tsp) glyphosate 0.3 oz. non-ionic surfactant

Jointhead arthraxon or small carpetgrass (*Arthraxon hispidus*)



An annual grass weed that thrives in sunny, moist areas. Identifying features include a smooth hairless stem and clasping leaves with hairy margins. It can form 1 to 2'-tall, carpet-thick stands in pastures and hayfields, choking out desirable plants. Carpetgrass can germinate throughout summer, meaning preemergent herbicide application must provide residual control for several months. Postemergent herbicide applications in mid-to-late summer offer the best chance of controlling emerged plants without subsequent germination occurring. Controlling seed production is important to minimizing future problems. 1.5-2 quarts/ac *Prowl H₂O*® has offered a consistent level of control (>95%). Timing of the *Prowl H₂O*® application is important; please see the section on Foxtail for more information. Aminopyralid (a component of *Milestone*®, *GrazonNextHL*®, & *Chaparral*®) has postemergence activity on carpetgrass, but has not consistently resulted in acceptable control by the end of the season. Glyphosate works well as a postemergent, and even low rates can be effective. Studies using this strategy have shown best results by waiting until carpetgrass is around 18 inches tall.

Prowl H₂O® (mid-March/early-April)

	<i>Per Acre</i>	<i>Per Gal of Water</i>
Boom Sprayer	4 quarts Prowl H ₂ O®	4.3 oz. Prowl H ₂ O®
Boomless Sprayer	4 quarts Prowl H ₂ O®	12.8 oz. Prowl H ₂ O®
Handgun/ Wand Sprayer	N/A	1.7 oz. Prowl H ₂ O®

Low-Rate Application of a 41% glyphosate product

	<i>Per Acre</i>	<i>Per Gal of Water</i>
Boom Sprayer	2.5 oz glyphosate product	2.5 mL (0.5 teaspoon) glyphosate
	9.6 oz non-ionic surfactant	0.3 oz. non-ionic surfactant
Boomless Sprayer	2.5 oz glyphosate product	7.4 mL (1.5 teaspoons) glyphosate
	9.6 oz non-ionic surfactant	0.3 oz non-ionic surfactant
Handgun/ Wand Sprayer	N/A	1 mL (0.2 tsp) glyphosate 0.3 oz. non-ionic surfactant

Tall buttercup
(*Ranunculus acris*)



Bulbous buttercup
(*Ranunculus bulbosus*)



Two main buttercup species are seen in Virginia pastures and hayfields. Both contain toxins, though poisoning is rare since the plant is not palatable. The toxin volatilizes during drying, so hay containing dried buttercup foliage is harmless. Tall buttercup is a winter annual or short-lived perennial that flowers in early spring and is best targeted with a fall herbicide application. Bulbous buttercup is a perennial that flowers from May-August; timing should target actively growing plants throughout spring and summer. Most broadleaf herbicides are very effective.

2,4-D + dicamba		
	<i>Per Acre</i>	<i>Per Gal of Water</i>
Boom Sprayer	2.5 pints 2,4-D	1.3 oz. 2,4-D
	8 oz. dicamba	0.3 oz. dicamba
	9.6 oz. non-ionic surfactant	0.3 oz. non-ionic surfactant
Boomless Sprayer	2.5 pints 2,4-D	4 oz. 2,4-D
	8 oz dicamba	0.8 oz. dicamba
	3.2 oz. non-ionic surfactant	0.3 oz. non-ionic surfactant
Handgun/ Wand Sprayer	N/A	0.5 oz. 2,4-D
		0.1 oz. dicamba
		0.3 oz. non-ionic surfactant
DuraCor®		
	<i>Per Acre</i>	<i>Per Gal of Water</i>
Boom Sprayer	1 pint DuraCor®	0.5 oz. DuraCor®
	9.6 oz non-ionic surfactant	0.3 oz non-ionic surfactant
Boomless Sprayer	1 pint DuraCor®	1.6 oz. DuraCor®
	3.2 oz non-ionic surfactant	0.3 oz non-ionic surfactant
Handgun/ Wand Sprayer	N/A	0.2 oz. DuraCor®
		0.3 oz. non-ionic surfactant

Poison hemlock (*Conium maculatum*)



A biennial in the carrot family that flowers in early- to mid-spring, up to 10 feet tall. It is common in pastures, highways, and ditches. It is toxic, though poisonings are relatively rare. Since it is a biennial, controlling seed production is important to stopping its spread. Spray seedling or first year rosettes, fall through early spring. Herbicide effectiveness goes down quickly once the plant begins to bolt (rapid upright growth) in early spring. Crossbow or an equivalent tankmix of 2,4-D + *Remedy Ultra*® is very effective, as is a tankmix of 2,4-D + dicamba. *DuraCor*® is very effective and would provide additional residual activity. Other residual herbicides, such as *GrazonNext HL*®, have only shown around 80% control.

DuraCor®		
	<i>Per Acre</i>	<i>Per Gal of Water</i>
Boom Sprayer	1 pint DuraCor®	0.5 oz. DuraCor®
	9.6 oz non-ionic surfactant	0.3 oz non-ionic surfactant
Boomless Sprayer	1 pint DuraCor®	1.6 oz. DuraCor®
	3.2 oz non-ionic surfactant	0.3 oz non-ionic surfactant
Handgun/ Wand Sprayer	N/A	0.2 oz. DuraCor®
		0.3 oz. non-ionic surfactant
2,4-D + Remedy Ultra®		
	<i>Per Acre</i>	<i>Per Gal of Water</i>
Boom Sprayer	3 pints 2,4-D	1.6 oz. 2,4-D
	1.5 pint Remedy Ultra®	0.8 oz. Remedy Ultra®
	9.6 oz non-ionic surfactant	0.3 oz non-ionic surfactant
Boomless Sprayer	3 pints 2,4-D	4.8 oz. 2,4-D
	1.5 pint Remedy Ultra®	2.4 oz. Remedy Ultra®
	3.2 oz non-ionic surfactant	0.3 oz non-ionic surfactant
Handgun/ Wand Sprayer	N/A	0.5 oz. 2,4-D
		0.3 oz. Remedy Ultra®
		0.3 oz. non-ionic surfactant

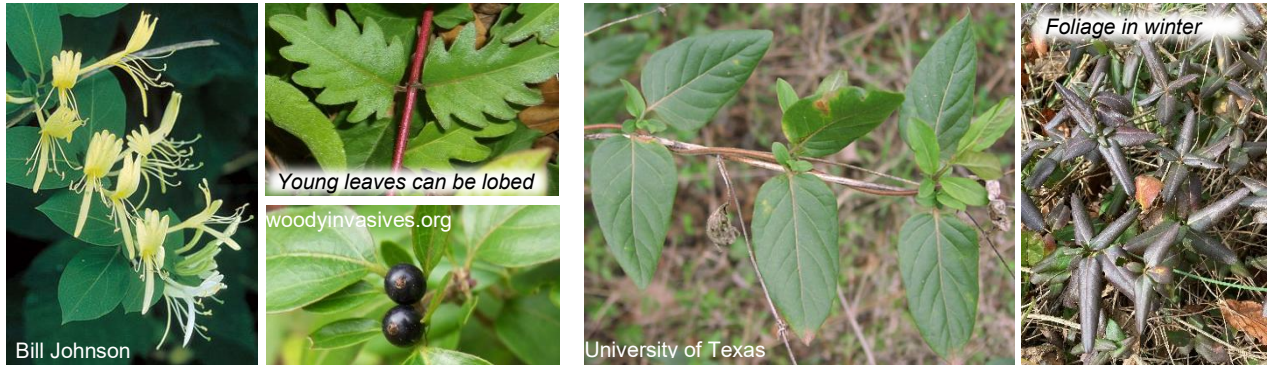
Callery “Bradford” pear (*Pyrus calleryana*)



While horticultural cultivars were bred to produce sterile fruit, cross-pollination between varieties has produced wild trees that grow viable seeds, and are readily spread by birds. Callery pear is also capable of spreading vegetatively through root sprouts. Foliar herbicide applications are effective on trees less than 10' tall as long as good coverage is achieved, but this is difficult. Plants can be mowed or cut with a chainsaw, however, re-sprouting from the roots is likely. An herbicide treatment of the mowed or cut stump using triclopyr (e.g. *Remedy Ultra*® or *Garlon 4 Ultra*®) is necessary for complete control. When a cut stump treatment is not practical, a later foliar herbicide application to sprouts can suffice. The preferred chemical is triclopyr (e.g. *Garlon 4 Ultra*®, *Remedy Ultra*®, or *Crossbow*®).

Remedy Ultra®		
	<i>Per Acre</i>	<i>Per Gal of Water</i>
Boom Sprayer	3 pints Remedy Ultra®	1.6 oz. Remedy Ultra®
	9.6 oz non-ionic surfactant	0.3 oz non-ionic surfactant
Boomless Sprayer	3 pints Remedy Ultra®	4.8 oz. Remedy Ultra®
	3.2 oz non-ionic surfactant	0.3 oz non-ionic surfactant
Handgun/ Wand Sprayer	N/A	0.5 oz. Remedy Ultra®
		0.3 oz. non-ionic surfactant
	<i>Per Acre</i>	<i>Per Gal of Mix</i>
Cut Stump/Basal Bark	N/A	1 quart Remedy Ultra®
		3 quarts diesel fuel or fuel oil
Surmount®		
	<i>Per Acre</i>	<i>Per Gal of Water</i>
Boom Sprayer	3 pints Surmount®	1.6 oz. Surmount®
	9.6 oz non-ionic surfactant	0.3 oz non-ionic surfactant
Boomless Sprayer	3 pints Surmount®	4.8 oz. Surmount®
	3.2 oz non-ionic surfactant	0.3 oz non-ionic surfactant
Handgun/ Wand Sprayer	N/A	0.6 oz. Surmount®
		0.3 oz. non-ionic surfactant

Japanese honeysuckle (*Lonicera japonica*)



Japanese honeysuckle is an invasive, perennial vine that colonizes disturbed areas. It reproduces by seed or by runners. Foliar herbicides can be applied from spring through fall as long as leaves remain green and temperatures are above freezing. Virtually all broadleaf herbicides are effective during the active growing season. Its semi-evergreen nature allows for selective control using glyphosate in mid to late-fall after many desirable plants have dropped their leaves.

41% glyphosate		
	<i>Per Acre</i>	<i>Per Gal of Water</i>
Boom Sprayer	2 quarts glyphosate	2.2 oz. glyphosate
	9.6 oz non-ionic surfactant	0.3 oz. non-ionic surfactant
Boomless Sprayer	2 quarts glyphosate	6.4 oz glyphosate
	9.6 oz non-ionic surfactant	0.3 oz non-ionic surfactant
Handgun/ Wand Sprayer	N/A	0.9 oz. glyphosate
		0.3 oz. non-ionic surfactant
2,4-D + Remedy Ultra®		
	<i>Per Acre</i>	<i>Per Gal of Water</i>
Boom Sprayer	3 pints 2,4-D	1.6 oz. 2,4-D
	1.5 pint Remedy Ultra®	0.8 oz. Remedy Ultra®
	9.6 oz non-ionic surfactant	0.3 oz non-ionic surfactant
Boomless Sprayer	3 pints 2,4-D	4.8 oz. 2,4-D
	1.5 pint Remedy Ultra®	2.4 oz. Remedy Ultra®
	3.2 oz non-ionic surfactant	0.3 oz non-ionic surfactant
Handgun/ Wand Sprayer	N/A	0.5 oz. 2,4-D
		0.3 oz. Remedy Ultra®
		0.3 oz. non-ionic surfactant

Japanese barberry (*Berberis thunbergii*)



Japanese barberry is an invasive thorn bush. Apply foliar herbicides from full leaf emergence through late summer/fall until leaves begin to change color. Glyphosate is very effective but kills nonselectively. Triclopyr-based herbicide products (e.g. *Crossbow*, *Remedy Ultra*, *Garlon 4 Ultra*, *PastureGard*) are effective and will not kill grass. Some universities recommend a tankmix of glyphosate and triclopyr. Basal bark applications can be applied all year, but may require excessive amounts of spray because of barberry's many stems and dense growth habit. A better approach would be to cut out bushes and apply a cut stump treatment to prevent stump sprouts.

41% glyphosate		
	<i>Per Acre</i>	<i>Per Gal of Water</i>
Boom Sprayer	2 quarts glyphosate	2.2 oz. glyphosate
	9.6 oz non-ionic surfactant	0.3 oz. non-ionic surfactant
Boomless Sprayer	2 quarts glyphosate	6.4 oz glyphosate
	9.6 oz non-ionic surfactant	0.3 oz non-ionic surfactant
Handgun/ Wand Sprayer	N/A	0.9 oz. glyphosate
		0.3 oz. non-ionic surfactant
Remedy Ultra®		
	<i>Per Acre</i>	<i>Per Gal of Water</i>
Boom Sprayer	3 pints Remedy Ultra®	1.6 oz. Remedy Ultra®
	9.6 oz non-ionic surfactant	0.3 oz non-ionic surfactant
Boomless Sprayer	3 pints Remedy Ultra®	4.8 oz. Remedy Ultra®
	3.2 oz non-ionic surfactant	0.3 oz non-ionic surfactant
Handgun/ Wand Sprayer	N/A	0.5 oz. Remedy Ultra®
		0.3 oz. non-ionic surfactant
Remedy Ultra®		
	<i>Per Acre</i>	<i>Per Gal of Mix</i>
Cut Stump/Basal Bark	N/A	1 quart Remedy Ultra®
		3 quarts diesel fuel or fuel oil

Chinese fountain grass (*Pennisetum alopecuroides*)



Chinese fountain grass is a perennial warm-season bunchgrass. It can grow to 3 ½ feet in height, with dark green leaves as long as 20 inches. Stems are flat, especially when young. The plant has a fibrous root system as well as short rhizomes. The seed heads have the appearance of a bottle brush, which turn red or purple in late summer. Seed can be spread by wind, wildlife, and equipment.

Research by the University of Missouri indicates that mowing, even repeated close mowing, has very little effect. Several herbicides (e.g. Imazapic, Imazapyr, Clethodim, etc.) typically used on warm-season perennial grass weeds showed initial control, but results do not persist. The best option found by the Missouri trial was to spot-apply a high rate of glyphosate, resulting in 90% or greater control when evaluated at 21 weeks after treatment.

41% glyphosate		
	<i>Per Acre</i>	<i>Per Gal of Water</i>
Boom Sprayer	2 quarts glyphosate	2.2 oz. glyphosate
	9.6 oz non-ionic surfactant	0.3 oz. non-ionic surfactant
Boomless Sprayer	2 quarts glyphosate	6.4 oz glyphosate
	9.6 oz non-ionic surfactant	0.3 oz non-ionic surfactant
Handgun/ Wand Sprayer	N/A	0.9 oz. glyphosate
		0.3 oz. non-ionic surfactant

General Weed Control, Targeting Mainly Annual & Biennial Weeds

2,4-D		
	<i>Per Acre</i>	<i>Per Gal of Water</i>
Boom Sprayer	4 pints 2,4-D	2.2 oz. 2,4-D
	9.6 oz. non-ionic surfactant	0.3 oz. non-ionic surfactant
Boomless Sprayer	4 pints 2,4-D	6.4 oz. 2,4-D
	3.2 oz. non-ionic surfactant	0.3 oz. non-ionic surfactant
Handgun/ Wand Sprayer	N/A	0.9 oz. 2,4-D
		0.3 oz. non-ionic surfactant
2,4-D + dicamba		
	<i>Per Acre</i>	<i>Per Gal of Water</i>
Boom Sprayer	2.5 pints 2,4-D	1.3 oz. 2,4-D
	8 oz. dicamba	0.3 oz. dicamba
	9.6 oz. non-ionic surfactant	0.3 oz. non-ionic surfactant
Boomless Sprayer	2.5 pints 2,4-D	4 oz. 2,4-D
	8 oz dicamba	0.8 oz. dicamba
	3.2 oz. non-ionic surfactant	0.3 oz. non-ionic surfactant
Handgun/ Wand Sprayer	N/A	0.5 oz. 2,4-D
		0.1 oz. dicamba
		0.3 oz. non-ionic surfactant
Cimarron Plus®		
	<i>Per Acre</i>	<i>Per Gal of Water</i>
Boom Sprayer	0.5 oz Cimarron Plus ®	Low use-rate makes measuring herbicide for small batches difficult
	9.6 oz non-ionic surfactant	
Boomless Sprayer	0.5 oz Cimarron Plus ®	
	3.2 oz non-ionic surfactant	
Handgun/ Wand Sprayer	N/A	

General Weed Control with Residual, Targeting Perennials

GrazonNext HL®		
	<i>Per Acre</i>	<i>Per Gal of Water</i>
Boom Sprayer	2.1 pints GrazonNext HL®	1.1 oz. GrazonNext HL®
	9.6 oz. non-ionic surfactant	0.3 oz. non-ionic surfactant
Boomless Sprayer	2.1 pints GrazonNext HL®	3.4 oz. GrazonNext HL®
	3.2 oz. non-ionic surfactant	0.3 oz. non-ionic surfactant
Handgun/ Wand Sprayer	N/A	0.5 oz. GrazonNext HL®
		0.3 oz. non-ionic surfactant
Chaparral®		
	<i>Per Acre</i>	<i>Per Gal of Water</i>
Boom Sprayer	2.5 oz Chaparral ®	Low use-rate makes measuring herbicide for small batches difficult
	9.6 oz non-ionic surfactant	
Boomless Sprayer	2.5 oz Chaparral ®	
	3.2 oz non-ionic surfactant	
Handgun/ Wand Sprayer	N/A	
Surmount®		
	<i>Per Acre</i>	<i>Per Gal of Water</i>
Boom Sprayer	3 pints Surmount®	1.6 oz. Surmount®
	9.6 oz non-ionic surfactant	0.3 oz non-ionic surfactant
Boomless Sprayer	3 pints Surmount®	4.8 oz. Surmount®
	3.2 oz non-ionic surfactant	0.3 oz non-ionic surfactant
Handgun/ Wand Sprayer	N/A	0.6 oz. Surmount®
		0.3 oz. non-ionic surfactant
DuraCor®		
	<i>Per Acre</i>	<i>Per Gal of Water</i>
Boom Sprayer	1 pint DuraCor®	0.5 oz. DuraCor®
	9.6 oz non-ionic surfactant	0.3 oz non-ionic surfactant
Boomless Sprayer	1 pint DuraCor®	1.6 oz. DuraCor®
	3.2 oz non-ionic surfactant	0.3 oz non-ionic surfactant
Handgun/ Wand Sprayer	N/A	0.2 oz. DuraCor®
		0.3 oz. non-ionic surfactant

General Weed Control, Targeting Woody Brush and Trees

2,4-D + Remedy Ultra®		
	<i>Per Acre</i>	<i>Per Gal of Water</i>
Boom Sprayer	3 pints 2,4-D	1.6 oz. 2,4-D
	1.5 pint Remedy Ultra®	0.8 oz. Remedy Ultra®
	9.6 oz non-ionic surfactant	0.3 oz non-ionic surfactant
Boomless Sprayer	3 pints 2,4-D	4.8 oz. GrazonNext HL®
	1.5 pint Remedy Ultra®	2.4 oz. Remedy Ultra®
	3.2 oz non-ionic surfactant	0.3 oz non-ionic surfactant
Handgun/ Wand Sprayer	N/A	0.5 oz. 2,4-D
		0.3 oz. Remedy Ultra®
		0.3 oz. non-ionic surfactant
Crossbow®		
	<i>Per Acre</i>	<i>Per Gal of Water</i>
Handgun/ Wand Sprayer	N/A	1.5 oz. Crossbow®
		0.3 oz. non-ionic surfactant
	<i>Per Acre</i>	<i>Per Gal of Mix</i>
Cut Stump/Basal Bark	N/A	1 quart Crossbow®
		3 quarts diesel fuel or fuel oil
Remedy Ultra®		
	<i>Per Acre</i>	<i>Per Gal of Water</i>
Boom Sprayer	3 pints Remedy Ultra®	1.6 oz. Remedy Ultra®
	9.6 oz non-ionic surfactant	0.3 oz non-ionic surfactant
Boomless Sprayer	3 pints Remedy Ultra®	4.8 oz. Remedy Ultra®
	3.2 oz non-ionic surfactant	0.3 oz non-ionic surfactant
Handgun/ Wand Sprayer	N/A	0.5 oz. Remedy Ultra®
		0.3 oz. non-ionic surfactant
	<i>Per Acre</i>	<i>Per Gal of Mix</i>
Cut Stump/Basal Bark	N/A	1 quart Remedy Ultra®
		3 quarts diesel fuel or fuel oil
GrazonNext HL® + Remedy Ultra®		
	<i>Per Acre</i>	<i>Per Gal of Water</i>
Boom Sprayer	2.1 pints GrazonNext HL®	1.1 oz. GrazonNext HL®
	1 pint Remedy Ultra®	0.5 oz. Remedy Ultra®
	9.6 oz. non-ionic surfactant	0.3 oz. non-ionic surfactant
Boomless Sprayer	2.1 pints GrazonNext HL®	3.4 oz. GrazonNext HL®
	1 pint Remedy Ultra®	1.6 oz. Remedy Ultra®
	3.2 oz. non-ionic surfactant	0.3 oz. non-ionic surfactant
Handgun/ Wand Sprayer	N/A	0.5 oz. GrazonNext HL®
		0.2 oz. Remedy Ultra®
		0.3 oz. non-ionic surfactant