

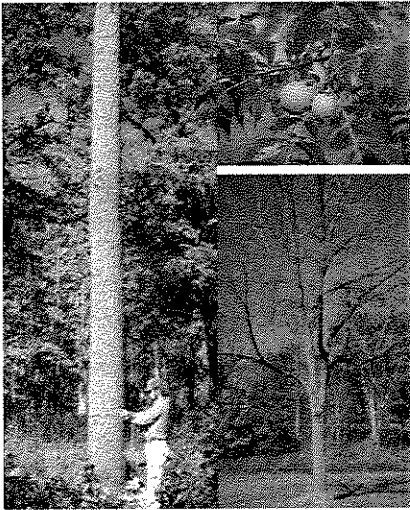


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Growing Black Walnut

Melvin J. Baughman and Carl Vogt

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This bulletin will help woodland owners grow black walnut trees in natural stands and plantations for timber, nuts, and agroforestry. It combines sound research with practical applications. To get the most out of your woodland, ask a forester experienced in black walnut management to help you develop a management plan and monitor your progress.



WHY GROW WALNUT?

Black walnut is one of the Midwest's most valuable tree species based on price per board foot. It has long been in high demand throughout the world for wood products because of its beautiful color, strength, durability, dimensional stability after drying, and excellent machining qualities. Besides wood products, walnut trees produce edible nuts, wildlife food, and beauty, while protecting soil and water resources. When

you plant and care for black walnut trees, you are making an investment that may pay off handsomely in future years.



USES FOR WALNUT

Top-quality logs are sliced into veneer, which then is glued to wall panels, doors, furniture, and cabinets. Standards for veneer trees vary with market demand, but veneer most often is cut from the first log on trees at least 16 inches in diameter and 8 ½ feet long with very few defects (e.g., small limbs, knots, bird peck).

Logs with more significant defects (e.g., large limbs, knots, decay, crook, sweep) often can be sawn into lumber and gunstock blanks. Sawlogs usually are at least 12 inches in diameter* and 8 ½ feet long.

*All tree diameters in this publication are measured at 4 ½ feet above ground, following standard practice.

Portions of trees that are not suitable for lumber may be cut for novelty items. Figured wood from the stump, large branch crotches, and burls is especially desirable. However, specialty markets are limited.

Prices for standing timber vary greatly depending on log quality and size. The size at which a walnut tree should be harvested depends on its log quality and growing site quality. A high-quality tree on a good site may be left to grow larger than 24 inches in diameter. A low-quality tree or one on a poor-quality site may be harvested when it's less than 16 inches in diameter. Contact a forester for advice before harvesting or marketing walnut trees!

Figure 1. Tree defects influence wood use and value.

1a. Defects that reduce the total volume of usable wood.

1b. Defects that reduce wood quality.

Rich nut meats of the black walnut are used primarily in commercial baking, ice cream, candy, and retail sale. Shells are ground and used as a polishing abrasive, as an additive to well-drilling mud, and in dozens of other products.

Walnuts are an important food for squirrels, white-tailed deer, and woodpeckers.

As a landscape tree, walnut provides light shade and bright yellow fall foliage, although its nuts can be a nuisance in some landscape settings. A chemical found in the tree's roots, leaves, trunk, and nut husks can inhibit the growth of tomatoes, potatoes, alfalfa, blackberry, domestic grape, lilac, hydrangea, chrysanthemum, paper birch, red (Norway) pine, Scotch pine, hackberry, basswood, apple, and other plants grown too close to a walnut tree. This effect remains long after a walnut tree has been removed.



WHERE WALNUT GROWS

Black walnut is a long-lived tree, sometimes exceeding 200 years in age. Trees 3 to 4 feet in diameter were fairly common at the turn of the century in the Upper Midwest.

Black walnut (*Juglans nigra*) is one of six walnut species found in the United States; about 15 species are found worldwide. While black walnut grows throughout the United States and southern Canada, its natural range is in the central and eastern states (Figure 2).

Figure 2. Natural range of black walnut.

In Minnesota its primary commercial range is in the southeast. Here on the northern edge of its range, walnut grows more slowly, but is often worth more because of its closely spaced annual growth rings, rich color, and figure.

Although walnut trees grow in yards in almost every Minnesota county, large-scale plantings for timber production are discouraged beyond the recognized commercial range.

In natural woodlands, walnut trees grow primarily in small groups or as scattered specimens mixed with American elm, hackberry, boxelder, sugar maple, green and white ash, basswood, red oak, and hickory.

Walnut requires at least 25 inches of precipitation (35+ inches is optimum) and 140 frost-free days (170+ days is optimum) per year.

It grows best in soil that is deep, fertile, and moist but well-drained. Soil should be at least 30 inches deep before bedrock, gravel, or hardpan restricts root growth. Soil texture should be sandy loam, loam, silt loam, or silty clay loam. Avoid shallow, dry, sandy, gravelly, or rocky soils. Walnuts are often found along streams where periodic flooding occurs in the dormant season. Do not try to grow walnut where soils are poorly drained or wet during the growing season or where flooding or ice damage is frequent. Examine soil survey maps and written soil descriptions to identify soil types suitable for walnut. When walnut or other trees are not present to allow you to judge site quality, dig several pits or cores to evaluate soil depth, texture, drainage, and fertility.

Walnut grows well on river terraces and hillside benches, and in coves in hilly terrain facing north or east. It will not grow well on steep slopes facing south or west—such sites are too hot and dry.

TO AVOID FROST DAMAGE, DO NOT PLANT WALNUT

- in narrow valleys with steep adjacent side slopes,
- on bottomland sites (frost pockets) that are lower than the surrounding landscape, or
- where airflow is minimal and cold air could settle undisturbed.

When planting walnut, choose sites with good airflow, but not windy sites. Exposed upland sites can be used if walnut is interplanted with another species for wind protection.

Since walnut does not tolerate shade, plant it only in forest openings or open fields.



PLANTING WALNUT

Walnut reproduces naturally from seeds (nuts) and stump sprouts, but both methods are unreliable. Nut crops are small and most nuts are eaten by animals or damaged by insects. Stump sprouting vigor declines greatly when trees are more than 30 years old. Planting nuts or seedlings is the most reliable way to start walnut trees. Walnut plantations can produce high-quality crop trees in 35 to 50 years. This is half the time natural stands take to mature.

Designing Plantations

Tree spacing and the mix of tree species or other crops grown in association with walnut depend on your objectives and site conditions. Walnut trees may be grown primarily for timber, nuts, or agroforestry purposes.

TIMBER PRODUCTION

When your objective is timber, space trees relatively closely, allowing 50 to 100 square feet around each tree (Table 1) at the time of establishment. This encourages trees to grow straight and self-prune as lower branches become shaded and die. It also allows you to be more selective about which trees to let grow and which to remove during thinnings. Trees grow more slowly in dense stands, but they have denser wood and more dark-colored heartwood, increasing wood value.

Walnut may be planted in pure or mixed species stands. There is a tendency to plant pure stands to maximize tree value and simplify planting and management, but over the life of a plantation, unexpected pest or environmental problems could damage a high percentage of trees. For example, unusually cold winter temperatures recently damaged or killed many walnuts in southeastern Minnesota. Mixed stands reduce such risks, have more aesthetic appeal, support a wider variety of plants and animals, and may have less expensive seedling costs.

When white pines are mixed with walnuts, the pines help control weeds by shading the ground, and they improve walnut stem form. Walnuts also can be mixed with hardwood trees that have a similar growth rate, such as red oak and white or green ash. Nitrogen-fixing shrubs, notably autumn olive, can stimulate growth of walnut trees. Different tree species may be planted in alternate rows or mixed within a row; pines often are planted in two out of every three rows.

The disadvantage of mixed species stands is that other species usually have less economic value than walnut. However, other species can be eliminated through thinnings if desired.

NUT PRODUCTION

Walnut trees begin producing nuts when they are about 10 years old, but the best nut production begins when trees are 30 years old. Good nut crops occur in about two out of five years. Open-grown trees with large crowns produce more nuts than woods-grown trees with small crowns, but the number of nuts, frequency of nut crops, and quality of nuts (percentage of kernel to shell, by weight) vary greatly from tree to tree.

The timber value of good nut trees usually is low because of their short butt logs, numerous knots, wide growth rings, and high percentage of light-colored sapwood. However, nut plantations can be grown on poorer quality sites than timber plantations.

Allow 200 to 300 square feet of growing space around each tree at the time of establishment (Table 1). Gradually thin to about half this density as trees mature. Keep other trees and shrubs from invading. Sod reduces nut production, but also reduces soil erosion and may discourage other plants from invading that would make nut collection difficult.

Table 1. Suggested spacing and numbers of tree to plant per acre by type of plantation.

Type of Plantation	Spacing Within and Between Rows (Feet)	Trees per Acre
Timber production	7 x 7	889
	8 x 8	681
	9 x 9	538
	10 x 10	436
	12 x 12	303
Timber & Nut Production	12 x 12	303
	15 x 15	194
	17 x 17	151
Agroforestry	6 x 30	242
	6 x 40	182
	8 x 30	182
	8 x 40	136
	10 x 30	145
	10 x 40	109

To determine the number of trees to plant at other spacings, multiply your proposed spacing in feet within rows by the spacing in feet between rows and divide into 43,560 square feet per acre:

$$\frac{43,560 \text{ square feet per acre}}{(\text{spacing in feet within rows}) \times (\text{spacing in feet between rows})} = \text{trees per acre}$$

AGROFORESTRY

Agroforestry generally refers to growing trees at a wide spacing with agricultural crops or shrubs between tree rows or beneath the trees. Trees usually are grown for nuts because wide spacing can lead to poor timber quality. Agricultural crops grown between tree rows provide annual income while nut trees mature. Crops that have been grown with walnut include corn, soybeans, winter wheat, forage, vegetables, berries, and Christmas trees. Over time the nut trees may take over the site and other agricultural activities cease. Agroforest plantations are not easy to manage because the cultivation, harvest, and pest-control activities needed to grow agricultural crops often damage tree roots, stems, or leaves. As a rule of thumb, space trees relatively close together within a tree row (6 to 10 feet), but space rows far apart (40 feet or at least 4 feet wider than the equipment used to maintain annual crops) (Table 1).

Site Preparation and Weed Control

Site preparation before planting is bound to increase tree survival, growth rate, and quality. Begin controlling weeds, grasses, and brush before planting and continue at least three years after planting. The longer competing vegetation is controlled, the better the walnuts will grow.

OLD FIELDS AND CROPLAND

Leave crop stubble for moisture retention, weed suppression, and erosion control. Remove excess stubble that will interfere with machine planting of walnuts. Chisel-plow the planting site if there is a plow pan, or disk to loosen compacted soil.

Sod strongly competes with walnut trees. Mowing will not adequately control grass. Before planting, remove sod in strips or patches by rototilling, disking, or using herbicides. Clear at least a 7- to 12-square-foot area around each planting spot (1 ½- to 2-foot radius around each seedling).

Continue cultivation, chemicals, or mulch to maintain sod-free conditions around individual trees for at least three years or until tree crown closure occurs. If you cultivate, keep rototillers and disks away from tree stems and till no more than 6 inches deep. Where chemicals are used, always read and follow label directions. Preemergent chemicals are less likely to damage walnut seedlings than foliar applied chemicals. Keep mulches 1 to 2 inches away from tree stems to avoid heat buildup. Wood chips, sawdust, bark, shredded corn cobs, plastic sheets, or fabric weed barrier mats can be used. Because organic mulches use nitrogen when they decompose, you may need to add nitrogen fertilizer around trees to maintain vigorous growth. Yellowish walnut leaves during the growing season may indicate a nutrient deficiency. Some mulches may attract small rodents that build nests and then feed on tree seedlings in fall and winter.

FOREST OPENINGS AND CLEARCUTS

Forest openings and clearcuts provide an excellent environment for walnut, but brush, broad-leaved weeds, and grasses must be controlled in a 12- to 28-square-foot area around each planting spot

(2- to 3-foot radius around each seedling) prior to planting. Plant walnuts where natural regeneration of other desirable tree species is not adequate.

If the site has not yet been harvested:

1. Spray small understory trees and shrubs with a herbicide in late summer.
2. Harvest merchantable trees during winter.
3. Cut down or girdle all nonmerchantable trees and spray herbicide on their stumps or girdles to prevent resprouting.

4. Plant walnuts in spring.

If the planting site has been harvested and is stump-free:

1. Rototill or disk to uproot small woody stems, herbaceous plants, and grasses, or (for more reliable results) apply herbicides late in the growing season.
2. Plant the following spring.

If the site has been harvested but has too many stumps for mechanical site preparation:

1. Let woody and herbaceous plants resprout.
2. Spray them with a herbicide in late summer.
3. Plant walnuts in spring.

Be very cautious when using herbicides where walnut trees grow or will be planted. Walnuts are easily damaged when some herbicides are applied nearby and drift through the air or wash onto the ground where walnuts can absorb them.

Mulches can be used instead of herbicides to control grasses and broad-leaved weeds around walnut seedlings. However, they will not suppress sprouting from woody plants and are difficult to apply in wooded environments.

Mark each seedling with a wire flag or ribbon to help you relocate it for follow-up weed control.

Planting Nuts and Seedlings

Walnut trees can be grown from nuts, but planting seedlings is more reliable. The planting stock (nuts or seedlings) source should be not more than 200 miles south or 50 miles north of the planting site.

PLANTING NUTS

A forester in southeastern Minnesota once said, "If you want to plant walnuts, take two bushels of nuts into the forest—one for the squirrels to bury and eat later, and one bushel for them to bury, forget about, and let grow."

Nuts generally fall from trees in September and October. When possible, collect nuts from trees with good stem form (for timber production) or large nuts with a high percentage of kernel (for nut production).

Nuts can be planted with husks, but are easier to handle and sort for viability if husks are removed. Collect nuts as soon as they fall and immediately remove husks using one of these methods:

- Place nuts in a bucket of water to soften and then peel the husks by hand.
- Place nuts in a hand-operated corn sheller.
- Place nuts in a small cement mixer along with gravel, cover with water, and rotate for 20 to 30 minutes.

Wear clothing and gloves for protection from stain in the husks. After removing husks, rinse nuts in water. Discard nuts that float; nuts that sink have full kernels and are more likely to germinate.

Walnut seeds require stratification (cold treatment) before they will germinate. Small quantities of nuts can be stratified in a plastic bag in a refrigerator at 34 to 41° Fahrenheit for 90 to 120 days. To stratify large numbers of walnuts for spring planting, dig a pit, spread out the nuts, and cover them with 1 to 2 feet of sand, leaves, or mulch. Cover the pit with screening to keep out rodents.

When the ground thaws in spring, dig up the nuts and plant 1 to 2 inches deep in the prepared site. Plant two nuts at each planting spot. About half the nuts will germinate in four to five weeks. Additional nuts may germinate the following year. Remove excess seedlings to allow adequate growing space.

To reduce predation by squirrels and other rodents, plant nuts in the spring in an open field at least 330 feet from a woodland. When nuts will be planted within 330 feet of a woodlot with squirrels, some form of protection may be needed. Tin (not aluminum) food cans, such as soup cans, may be used to protect small plantings. Burn the cans so they will rust and disintegrate within a few years. Remove one end of each can and cut an X into the other using a chisel. Pry up the cut ends as shown in Figure 3.

Figure 3. Tin can seed protector.

Figure 3a

Figure 3b (Be careful—the ends and edges are very sharp!)

Grasping the can with the open end up, place 1 to 2 inches of soil into the can, drop in a walnut, then fill the can with soil. Plant the entire can with the sharp points facing up and buried about 1 inch below the soil surface. A seedling will grow out of the can.

PLANTING SEEDLINGS

A more reliable way to start walnut trees is to plant seedlings. One-year-old seedlings usually are adequate, but they should be at least ¼-inch and preferably 3/8-inch in diameter 1 inch above the root collar. Seedling age and height are less important than stem diameter. Investing in high-quality seedlings can save money and time in the long run.

Bareroot seedlings are adequate for most planting sites. Plant them before bud-break. Containerized seedlings are much more expensive, but they can be planted later in the growing season and when soil is drier.

Figure 4. Tree shelters reduce animal damage and accelerate height growth.

Tree shelters increase planting costs, but they also protect trees from animal damage (deer and rodents) and herbicides and encourage rapid height growth by serving as mini-greenhouses (Figure 4). Tree shelters are held in place by stakes. They must be raised slightly in the fall to allow air flow that helps "harden off" the trees. Remove shelters after seedlings emerge from the top.

Seedling survival begins with good planting techniques. Make a hole deep enough to hold the root system without significant bending. Use a planting bar, shovel, or auger depending on seedling size and soil texture (Figure 5). A tree-planting machine pulled by a tractor can be used for large open-field plantings (Figure 6). Use a machine with a planting shoe that can be adjusted to accommodate the entire walnut root system. Be sure to press soil firmly around roots after planting to eliminate air pockets. If feasible, water trees after planting.

Figure 5. Hand-planting a seedling.

Figure 6. Machine-planting seedlings.

THINNING WALNUT STANDS

When trees are spaced close together, their stems grow straighter and their lower limbs become shaded, die, and fall off, creating a clear stem. Dense stands need to be thinned, however, to maintain a desirable diameter growth rate. Thinning also lets you remove undesirable tree species and poorly formed trees, providing more growing space to trees with greater potential value (Figure 7).

Figure 7. Thinning a walnut stand.

As a general rule, thin stands when crowns are slightly overlapping. Dense stands as young as 10 years old may benefit from thinning, but commercial wood products (mainly fuelwood) cannot be harvested until stems are at least 4 inches in diameter. Stands may need thinning at roughly 10-year intervals.

Begin thinning by locating a potential crop tree—straight stem, dominant leader, average or larger stem diameter, small lateral branches, and no significant stem or branch damage. Cut or deaden trees around that crop tree to provide at least 5 feet of clear space around three-fourths of its crown, when adjacent trees are no taller than the crop tree. The crop tree's crown should be at least 10 feet from the crowns of taller trees. Then find another crop tree and release it in the same manner (Figure 8). Do not over-thin a stand; heavy thinning may stimulate sprouting from tree stems.

Contact a forester before thinning. Foresters have more sophisticated formulas to determine optimum tree spacing.

Figure 8. Crown release will stimulate crop-tree Growth. (CT= crop tree)

PRUNING

Pruning walnut trees yields high-quality, knot-free veneer and lumber logs at an earlier age. Use corrective and clear-stem pruning on both timber and nut trees. Most nut trees eventually will be harvested and they'll be more valuable with a veneer-quality butt log. Prune during the dormant season. Do not apply paint or other sealants to pruning cuts.

Corrective Pruning

Corrective pruning on seedlings and saplings encourages straight stems, but do this only on potential timber crop trees. Many trees will straighten on their own and others will be removed during early thinnings. Follow instructions in Figure 9.

Figure 9. Corrective pruning improves seedling and sapling form.

Clear-stem Pruning

Clear-stem pruning (Figure 10) develops knot-free lumber and veneer. Although some landowners begin clear-stem pruning when trees are only 12 feet tall, it may be more efficient to wait until trees are 3 to 4 inches in diameter. Trees up to 10 inches in diameter may benefit from clear-stem pruning.

Figure 10. Clear-stem pruning leads to more valuable, knot-free wood.

Figure 10a. Do not prune higher than 50 percent of total tree height or remove more than 25 percent of live crown.

Figure 10b. Do not cut into branch collar or branch bark ridge. Minimize size of cut surface.

Figure 10c. When removing a dead limb, leave callus ridge intact.

Prune only 25 to 150 potential crop trees per acre. Select crop trees with straight stems, dominant leaders, average or larger stem diameters, small lateral branches, and no significant stem or branch damage.

Do not remove more than 25 percent of the live crown in a single pruning or prune higher than 50 percent of total tree height. Prune only branches less than 2 inches in diameter, preferably less than 1 inch. Larger pruning cuts heal slowly and may lead to decay and ring shake. Prune up to 9 feet high; if possible, prune timber trees up to 17 feet in two or more pruning operations. Stem forks, crooks, or large branches may restrict pruning height.



PEST AND ENVIRONMENTAL PROBLEMS

There are no major insect or disease problems on walnut trees in Minnesota. However, extreme cold can severely damage branches and kill trees. Damaged trees then can be infected by fusarium canker. To reduce freeze injury and related problems, do not plant walnuts in narrow valleys or low-lying frost pockets,

plant mixed species plantations, plant only in areas where black walnut grows naturally, and do not wound or prune trees during the growing season.

Walnut foliage, twigs, or nuts may be damaged by insects such as fall webworm, walnut caterpillar, walnut lace bug, aphids, husk fly, black walnut curculio, walnut shoot moth, pecan leaf casebearer, and plant hoppers. Leaf feeders on this list are active late in the growing season, causing little damage. Gypsy moths rarely feed on walnut leaves.

Keep livestock out of woodlands. They compact soil, rub bark, break branches, and eat twigs and foliage. Such damage can severely reduce growth of seedlings and saplings and reduce wood quality of larger trees. Wounded trees become stressed and susceptible to diseases, including heart rot. Wood that becomes stained or decayed as a result of injury is practically worthless.



FUTURE OF BLACK WALNUT

Growing trees requires energy, enthusiasm, money, and a long time commitment. Although walnut timber value has increased over time, changes in supply and demand, land prices, and tax consequences of growing trees make it difficult to predict the long-term financial outlook. However, black walnut has been and continues to be a premier hardwood that is marketed throughout the world. Some uses of black walnut have decreased, while new uses for the wood, nuts, and by-products continue to expand. Walnuts also provide benefits to wildlife, nuts for human consumption, aesthetic qualities, improved biodiversity, and much more. Whether you plant just a few trees or many acres, the rewards can be very satisfying.

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Authors: Melvin J. Baughman and Carl Vogt, Department of Forest Resources, University of Minnesota

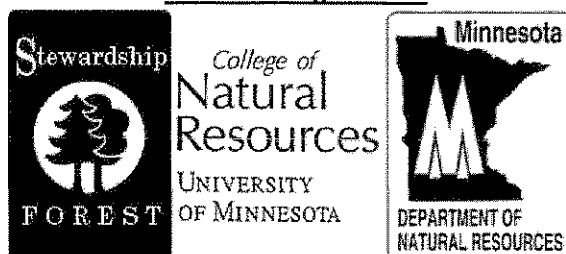
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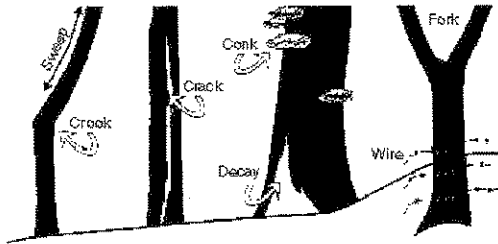
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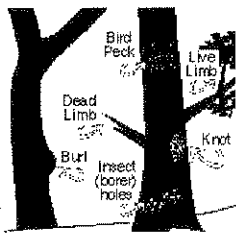


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Figure 2. Natural range of black walnut.

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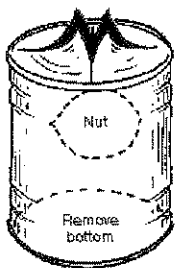


Figure 3a

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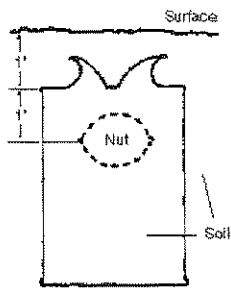


Figure 3b

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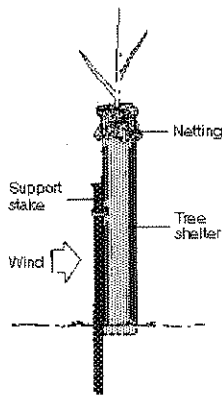


Figure 4. Tree shelters reduce animal damage and accelerate height growth.

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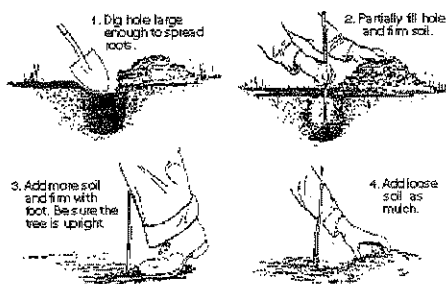


Figure 5. Hand-planting a seedling.

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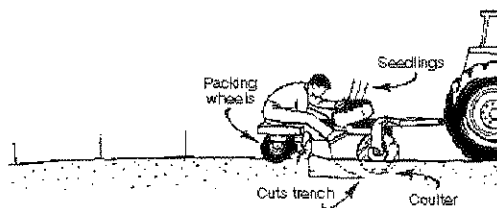


Figure 6. Machine-planting seedlings.

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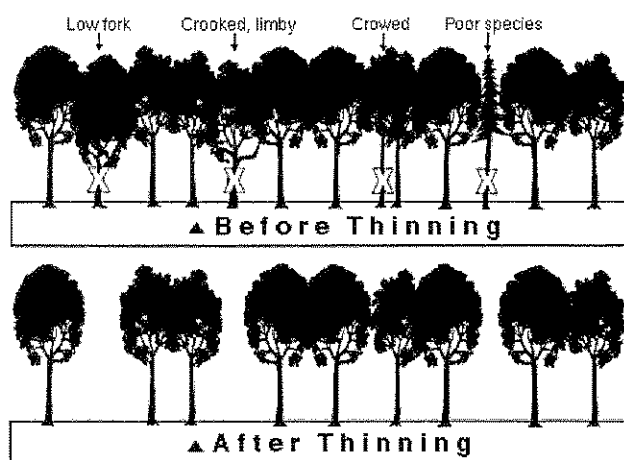


Figure 7. Thinning a walnut stand.

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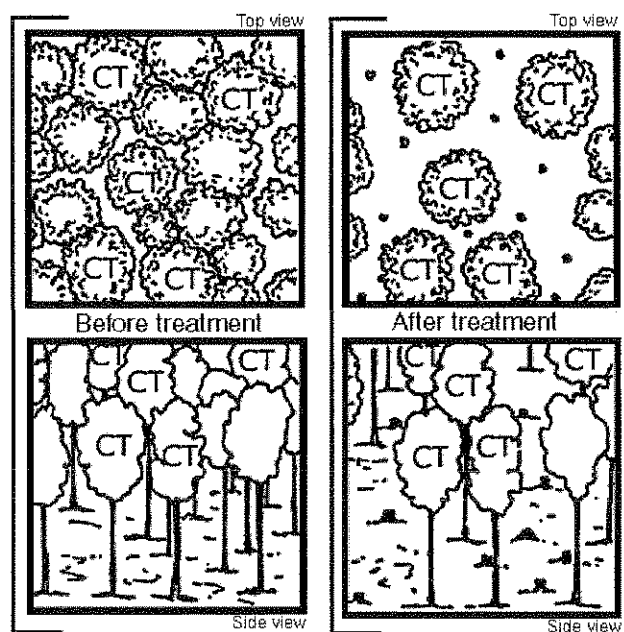


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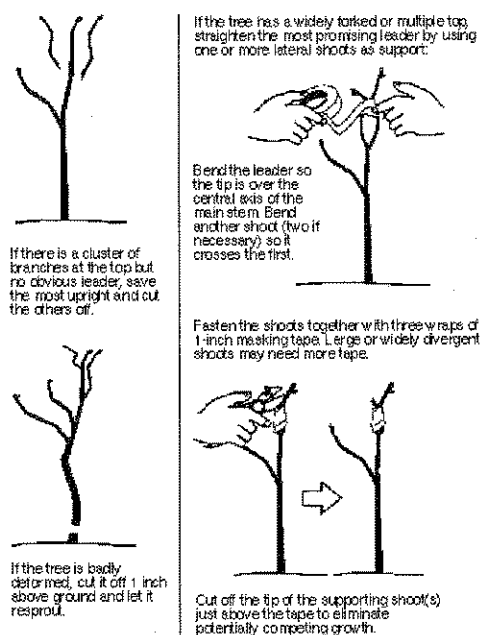


Figure 9. Corrective pruning improves seedling and sapling form.

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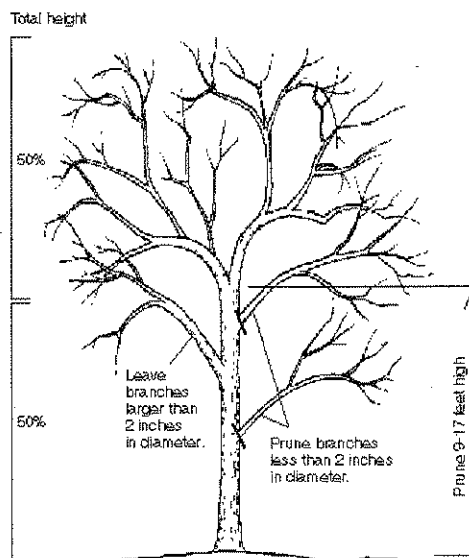


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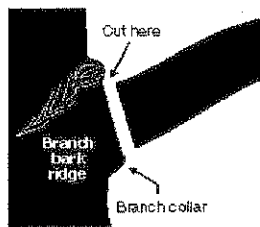


Figure 10b. Do not cut into branch collar or branch bark ridge. Minimize size of cut surface.

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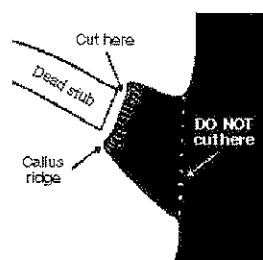


Figure 10c. When removing a dead limb, leave callus ridge intact.

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