



GROWING PECANS IN MISSOURI

by
William Reid

Pecan is a large, beautiful tree that produces bountiful crops of delicious nuts. The largest member of the hickory family, pecan trees often grow to a height of over 70 feet with a spread of greater than 80 feet. Pecans have large, pinnately compound leaves with each leaf bearing 7 to 13 leaflets. Nuts are borne on branch terminals in clusters of two to five. A fleshy green husk surrounds the nut during the growing season but



Pecan is an attractive tree both in the orchard and in the home landscape.



In the fall of the year, the husk enclosing the pecan will split open and allow the nut to fall freely to the ground.

splits open in October to reveal a light brown nut that is streaked with black mottles. As husks dry and wither, nuts fall freely from the tree. Pecan nuts vary widely in size, shape, and shell thickness. Seedling pecan trees often produce small, thick-shelled nuts while trees grafted to improved cultivars produce large, thin-shelled nuts.

Pecans are truly multipurpose trees. In the home landscape, these long-lived and sturdy trees provide ample shade and bright yellow fall color. Wildlife conservationists appreciate the food and cover pecan trees produce for squirrels, turkeys, and deer. In many areas of Missouri, wild pecan trees have been brought under cultivation to provide farmers with an additional source of income. And finally, pecans are a low-input orchard tree.

A successful pecan planting requires:

- good soils
- adequate water
- prudent cultivar selection

Failure to provide all the proper conditions for pecan tree growth often leads to poor tree growth and sparse nut production.

Soil Requirements

Plant pecan trees in deep, well-drained soils. Native pecans grow primarily in the deep alluvial soils found along major rivers and streams. These soils are characterized by a clay loam to sandy loam texture, good internal drainage, and a static water table that ranges from 10 to 25 feet below the soil surface. Upland soils are suitable for pecan trees if they have at least 3 feet of friable (easily crumbled; light, sandy) topsoil and a sandy-clay or gravelly-clay subsoil that allows free penetration of both water and air. In good upland soils, pecan roots grow throughout both topsoil and subsoil. Pecan trees will not perform well if planted on upland soils having a subsoil impervious to root growth or frequently droughty soils.

Pecan trees will grow and thrive in soils that range from slightly acid to slightly basic (pH 6.0 to 7.5). If trees are grown in sandy soils, or soils with a basic pH (7.0 and above), zinc foliar sprays are often necessary to prevent zinc deficiency.

Water Requirements

Pecan trees will grow without irrigation in most areas of Missouri, but ample water throughout the growing season is necessary for good tree growth and regular nut production. Even mild drought conditions affect nut quality. A shortage of water early in the season causes nuts to be small, while a lack of water in August and September leads to poor kernel filling. Severe drought will cause nut abortion, premature defoliation, and a decrease in the subsequent year's nut crop. To ensure annual crops of high quality nuts, supplemental irrigation should be considered.

Pecan trees growing in the major floodplains of Missouri are frequently subjected to seasonal flooding. Although pecan is widely known as a flood-tolerant species, trees can not endure water-saturated soils for an extended period of time. Leaves yellow and fall prematurely from flood stressed trees.

Cultivar Selection

Selecting the proper cultivars for your particular locality will help ensure that your pecan tree planting will be successful. When choosing pecan cultivars several key characteristics should be considered. These include:

- length of growing season
- winter hardiness
- productivity
- flowering and pollination
- nut size and quality

Length of Growing Season. Pecan trees utilize the entire growing season to develop and mature their nut crop. To be successful in Missouri, a pecan cultivar must produce plump, well-filled nuts before the first fall freeze. Nut maturity in pecan is indicated by the splitting of the shuck and separation of nut from shuck. Freezing temperatures before shuck split cause the shuck to remain firmly attached to the nut, so that it never opens. The kernels inside these "sticktights" are usually shriveled and not fully formed.

The rate of kernel development in pecan is controlled genetically, but is also influenced by temperatures during the growing season. Summer heat, especially high nighttime temperatures, is necessary for proper nut development. Unusually cool summers will result in a delay of nut maturity. Variation in weather patterns will cause a pecan cultivar to mature on slightly different dates from year to year. To avoid losing a crop to fall freeze damage, it is best to choose cultivars that mature at least one week before the average date of first fall freeze.



Pecan cultivars should be chosen carefully. The 'Maramec' pecan on the left was grown in a suitable climate. The poorly filled 'Maramec' pecan on the right was grown in a climate that did not provide a long enough growing season.

Winter Hardiness. Pecan trees growing in Missouri are often exposed to severe winter temperatures. "Northern" pecan cultivars have proven cold hardiness and are best adapted for growth in Missouri. These cultivars are termed "Northern" because they originated in the northern most reaches of the pecan tree's natural range. Only a few "Southern" pecan cultivars are adapted for growth in the 'bootheel' of Missouri.



Southern pecan cultivars often suffer severe cold injury when grown in Missouri.

Productivity. The nut-producing capacity of a cultivar is very important. A cultivar able to produce a nut crop every year is far more desirable than an alternate-year bearing cultivar. In addition, a cultivar that produces a large crop of medium-sized nuts will yield more nutmeat than a cultivar that produces only a few "jumbo" nuts.

Flowering and Pollination. Pecans have separate male and female flowers, which are located on different parts of the same tree (Figure 1). Male flowers or catkins develop along one-year-old wood soon after budbreak. The 3- to 4-inch long catkins first appear green, then turn yellow when shedding pollen. After all pollen is released, catkins turn brown and fall from the tree. Female flowers look like miniature pecans and develop on the end of the current season's growth. On the tip of the pistillate flower is the stigma, which may be red, orange or green in color. The stigma becomes glossy with stigmatal fluid when receptive to pollen. Pollination occurs when pollen is transported by wind to the stigmatal surface.

Periods of pollen-shed and stigma receptivity for a single pecan cultivar usually occur at different times. Cultivars that shed their pollen before their stigmas become receptive are called protandrous. Cultivars with stigmas that become receptive before pollen shedding are called protogynous. A protandrous cultivar should be planted within 250 feet from a protogynous cultivar to ensure pollination of both cultivars. In areas where native pecan trees are abundant, the pollination requirements can be met with pollen from surrounding native trees.

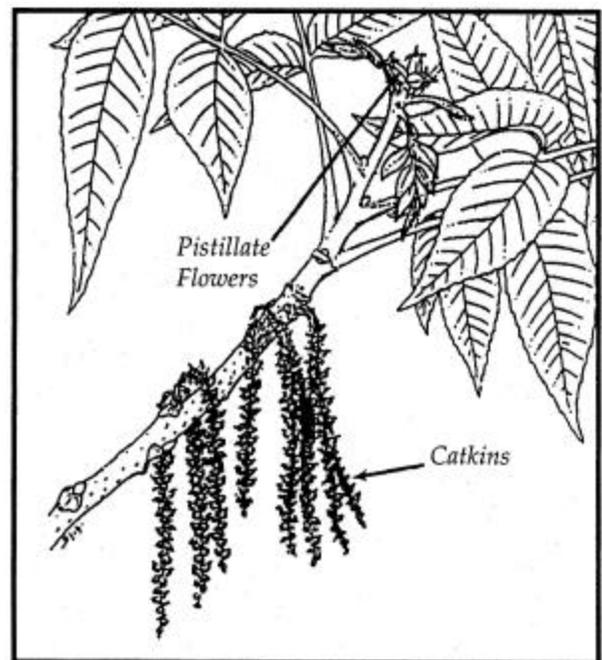


Figure 1. Catkins are borne on one-year-old wood while pistillate flowers form at the terminals of new shoots

Table 1. Recommended pecan cultivars for Missouri.

Cultivar	Nut wt.	Percent Kernel	Maturity Date ^z	Flowering Type ^y	Adaptation Zone
Warren 346	4.78	49.28	-24	II	1
Lucas	3.98	56.84	-10	II	1,2
Wiese	4.40	52.30	-8		1,2
Norton	6.67	43.55	-6	II	1,2
Canton	7.86	47.95	-4	I	1,2
Witte	6.64	51.31	-4	I	2,3
Peruque	6.24	59.28	-2	I	2,3,4
Colby	7.02	44.15	0	II	2,3
Shepherd	5.53	51.18	1		2
Pawnee	8.40	57.12	3	I	3,4,5
Hirschi	6.43	49.81	4	I	3,4
Posey	6.79	53.26	4	II	2,3
Goosepond	6.65	49.80	6	II	2,3
Kanza	6.47	51.82	7	II	3,4,5
Major	6.21	49.35	9	I	3
Caddo	6.48	54.78	18	I	4,5
Giles	6.48	52.65	18	I	4,5
Chetopa	7.43	55.11	20	II	4,5
Greenriver	6.75	49.36	20	II	4,5
GraTex	7.48	58.83	24	II	5
Maramec	8.40	55.92	29	II	5

^z Days before (-) or after (+) 'Colby'. The average ripening date for 'Colby' is 25 Sept. in Chetopa, Kan. and 28 Sept. in Columbia, Mo.

^y I = protandrous, II = protogynous

Methods For Establishing Pecan Trees

Pecans should be given plenty of room to grow. Plant trees 30 to 35 feet apart. Pecans can be established by planting grafted trees, by planting seedling trees then grafting 2-3 years later, or by planting nuts then grafting 3-4 years later. Each of these methods offers advantages and disadvantages. Prospective pecan growers should choose the method suited to their skills and economic situation.

Grafted Trees. Transplanting grafted trees of desired cultivars is the simplest way to establish a pecan orchard. Trees should start to bear nuts within 5 to 7 years after transplanting. Unfortunately, many of the cultivars recommended for Missouri are not widely available from commercial nurseries making it difficult to obtain grafted trees.



The three-flap graft is a popular method used for propagating pecans.

Seedlings. Seedling pecan trees are widely available and can be purchased from seedling nurseries or from the Missouri Department of Conservation. Desired cultivars should be grafted to seedling trees 2 to 3 years after establishment.

Nut production should begin 4 to 6 years after grafting. Starting a pecan planting with seedlings offers the advantages of low initial costs and the opportunity to establish cultivars not available from commercial nurseries. Disadvantages include a delay in the onset of nut production and the expense of grafting your trees.

Nuts. Pecan trees are easily grown from properly stratified nuts. To start your own trees, choose nuts that are medium sized and well filled. Nuts from early-maturing northern cultivars make good cold-hardy seedlings. Stratify nuts in moist sand by placing them in layers about 3 inches deep and holding them in a cool room or refrigerator (35° to 40°F) for 90 to 120 days. Be sure the nuts are kept moist throughout the stratification process to ensure uniform germination after planting.

Plant stratified seeds in the spring after the danger of frost passes. Seedlings can be grown in a nursery row and transplanted the following year or planted directly in the final tree location. Homegrown seedlings require 2 to 3 years to grow large enough for grafting. Starting an orchard from seed has the same advantages and disadvantages as starting with seedlings.

Transplanting Pecan Trees

Bareroot stock. Transplant both grafted trees and seedling trees in March as soon as the soil can be easily dug. After receiving your trees, plant bareroot trees as soon as possible to prevent roots from drying. Prune each tree before planting by trimming off about 1/3 of the top growth. Prune off broken or rotten roots and cut the tap root back to 24 inches. Taproot pruning of one-year-old seedlings is unnecessary.

Dig your planting hole large enough and deep enough to fit the entire root system. Hold the tree in position and fill soil in around the roots making sure the fibrous roots are spread out in their natural positions. The tree should be planted at the same depth as it was in the nursery. Water the tree after transplanting. Do not place soil amendments or fertilizers in the planting hole.

Container grown stock. Transplant container grown pecan trees in early October or in March. Dig your planting hole twice as wide as the container but no deeper than the depth of the pot.

After removing the tree from the container, check for an encircling taproot. Use a pair of pruning shears to cut off the taproot at the point the root starts to circle. Next, use a hay hook to gently pull out the smaller roots that are circling around the outside of the root ball. Place the tree in the planting hole and spread out the fine roots. Fill in the planting hole with topsoil. The tree should be planted at the same depth as it was in the container. However, be sure to cover the root ball and associated potting soil with about one inch of soil to keep the root ball from drying out.

Weed control. Weeds must be controlled in a 5-foot area around the newly transplanted tree. For large plantings, the entire orchard should be kept free of competing vegetation during the establishment year. Complete vegetation control can be achieved by shallow cultivation, application of herbicides, or by mulching.

If the transplanted tree makes 8 to 10 inches of new growth by early June, spread a half-cup of ammonium nitrate fertilizer around the tree over the entire weed free area. Nitrogen applications to trees slow to establish themselves (less than 8 inches of new growth) can cause a leaf burn and should be avoided. To ensure survival, keep the tree well watered throughout the growing season and especially during droughty periods.

Care of Non-bearing Trees

The goal of training a young pecan tree is to develop a strong trunk and healthy root system. Adequate soil moisture throughout the growing season and proper fertilization are keys to strong, vigorous tree growth. Water young pecan trees when conditions become dry by soaking the entire rooting zone deeply once a week. Apply nitrogen fertilizer twice a year, in March and in June, at the rate of one-cup ammonium nitrate per inch of trunk diameter. Spread the fertilizer over the entire rooting area. Keep the area around the tree weed-free to ensure maximum benefit from water and fertilizer applications.

Tip pruning of branches helps shape the young pecan tree and promotes the formation of a strong trunk. Tip prune in early March by clipping off 3 to 4 inches from all terminal growth. When the tree starts its growth in early spring, these cuts force buds along the entire branch to break. This gives the tree a more dense appearance and

greater leaf area. Tip prune again in mid-summer, but this time do not prune the central leader. Cutting all lateral branches back stops their growth and channels their photosynthetic energy into strengthening the trunk. Lower lateral branches should be left on the tree until they are 1 inch in diameter. Remove these lower laterals as the tree grows until you have a tree with 8 feet of clear trunk.

Care of Bearing Trees

Healthy, vigorous trees produce the highest quantity and quality of pecans. Maintaining a strong growing tree is also the best defense against attacks from insects and diseases. Water, fertilizer, and pest control are all important for healthy tree growth.

The importance of providing adequate soil moisture throughout the growing season has been discussed. Pecans require 1 inch of water each week from budbreak to nut maturity. Two inches per week may be closer to optimum during the heat of the summer months. Natural rainfall can be supplemented by flood, sprinkler, or trickle irrigation.

Annual nut production relies on annual applications of nitrogen fertilizer. Apply nitrogen just before bud-swell at the rate of 100 pounds actual nitrogen per acre. Pecans grown on upland soils require slightly higher nitrogen rates.

Rosette, a disorder caused by zinc deficiency, is a common problem if pecans are grown in soils with a pH above 7.0. Symptoms include a rosetting of the terminal growth and small, misshapen leaves. Zinc deficiency is easily corrected with 4 foliar applications of zinc at two-week intervals starting at leaf burst.

Insect and disease problems can severely limit the nut production of a pecan tree although no pests are serious enough to cause tree death. In Missouri, three insects pose the most serious threat to the pecan crop--pecan nut casebearer, hickory shuckworm and pecan weevil. Pecan growers must learn how to identify the symptoms of pest damage and be able to take effective steps to control important pecan pests. Use the identification keys in this bulletin to help you identify common pecan pests and problems (Table 2).

Table 2. A field key for identifying common pests and problems of pecan trees in Missouri.

Time Damage Observed	Time Damage Initiated	Damage Symptoms and Signs	Pest or Problem
April	April	New growth suddenly turns black	Spring frost damage
April	Previous years	Witches-broom type growth that breaks bud a week before healthy branches	Bunch disease
May	April	New leaves have shot-hole appearance	Sawflies
May	April	Galls on leaves and stems. Gall filled with small aphid-like insects	Pecan phylloxera
May	April	Terminal of new growth wilts. Olive-green caterpillar tunneling in pith of new shoot	Pecan Nut Casebearer
June	May	Nuts abort shortly after pollination	Lack of Pollination
June	June	Olive-green caterpillar tunneling into the base of nuts. Webbing and insect frass (debris or excrement resembling sawdust) at the base of infested nuts.	Pecan Nut Casebearer
June	April	Leaflets yellowish, mottled, narrowed, and crinkled. Reddish-brown spots may appear then later drop out to give leaves shot-hole appearance.	Zinc Deficiency
July and Sept.	June and August	Large white webs encasing branches and filled with brownish-yellow caterpillars.	Fall Webworm
July and Sept.	June and August	Entire branches defoliated by a large colony of caterpillars. Young larvae are dark red while mature larvae are black. All larvae have long white hairs.	Walnut Caterpillar
July or August	July or August	Honeydew covering the surface of leaves. Small, yellow insects feeding on the underside of the leaves.	Yellow or Black Margined Aphids
August	August	Yellow blotches on leaves. Small, black insects feeding on the underside of leaves.	Black Pecan Aphids
July	May	Black lesions on leaves and nuts. Lesions may coalesce to cover entire nut. Kernel quality severely reduced.	Pecan Scab
September	August	Small cream-colored caterpillars with red heads tunneling in nut shucks. Kernel quality reduced.	Hickory Shuckworm
October	October	Shucks turns black suddenly and stick to nuts.	Fall Freeze Damage
Harvest	August	Nut kernels have black, bitter-tasting spots.	Stink Bugs and Plant Bugs
Harvest	August	White, legless grubs feeding inside nuts. Grubs exit nut through small round hole in shell after completely devouring nut kernel.	Pecan Weevil

A permanent groundcover of cool-season grasses and legumes should be established in the bearing pecan orchard. Once the trees start to bear, the shading of the tree canopy helps reduce the competitiveness of a groundcover. Keep this permanent ground cover mowed throughout the growing season. In the home orchard, a well-kept lawn grass serves as the groundcover.

The only pruning needed on bearing pecan trees is the removal of dead or injured limbs. In addition, remove low hanging branches to allow free movement of people and machinery around the tree. If a pecan orchard is established at a 35-foot spacing, tree thinning will become necessary 25 to 30 years after grafting. Remove one half of

the trees when the branches of adjacent trees begin to overlap.

A pecan management schedule for Missouri can be found in Table 4.

Equipment for the Pecan Orchard

As with all agricultural endeavors, the proper equipment can make pecan growing easier and more efficient. The type of equipment purchased for maintaining a pecan orchard should be proportional to the size and age of the orchard. Suggestions for the types of equipment needed for pecan orchard management are given in Table 3.

Table 3. Equipment needed to manage pecan plantings in Missouri.

Orchard Operation	Size of Pecan Planting			
	2 to 25 Trees	1 to 3 Acres	3 to 40 Acres	More than 100 Acres
General use horsepower	lawn & garden power tools	12 hp garden tractor	25 to 50 hp tractor	70 to 85 hp tractor
Planting Trees	shovel	shovel	pto driven soil auger	pto driven soil auger
Weed Control	hand sprayer	back-pack sprayer	14 gal., battery powered sprayer	14 gal., battery powered sprayer
Orchard Floor Management - New Orchard	lawn mower, tiller	garden tractor mower and tiller	disc, harrow	disc, harrow
Orchard Floor Management - Mature Orchard	lawn mower	garden tractor mower	5 or 6 ft. rotary mower	10 to 15 ft. rotary mower
Pest Control - Non-bearing Trees	hand sprayer	back-pack sprayer	12 to 15 hp high pressure sprayer	100 gal., pto driven mist sprayer
Pest Control - Bearing Trees	5 hp garden sprayer	12 to 15 hp high pressure sprayer	100 gal., pto driven mist sprayer	500 gal., pto driven air-blast sprayer
Nut harvest	Poles to shake, hand gather nuts	Poles to shake, tarps to gather nuts	pto driven trunk shaker, tarps to gather nuts	pto driven trunk shaker, nut harvester, nut cleaner

Table 4. Pecan management schedule for Missouri.

Pecan Growers Calendar				
Month	Non-bearing Orchard	Bearing Orchard	Native Grove	Pest Management
January				
February	Collect scionwood. Prune trees to central leader.	Prune orchard to remove low limbs and/or narrow crotches.	Prune off low limbs. Thin out unproductive trees. Market wood products.	
March	Fertilize trees. Prune and train last year's grafts. Plant bare root trees.	Fertilize trees.	Fertilize trees.	Control pecan phylloxera on previously marked trees.
April	Apply weed control. Plant stratified pecan seed.			Apply foliar zinc sprays to zinc deficient trees.
May	Graft trees to recommended cultivars.			Monitor casebearer populations with pheromone traps. Continue zinc sprays.
June	Tip prune trees.	Keep groundcover mowed.	Keep groundcover mowed.	Control pecan nut casebearer and pecan scab. Apply final zinc spray.
July	Prune off suckers below new grafts. Support new grafts by tying to stakes.	Collect leaf samples for nutrient analysis.	Collect leaf samples for nutrient analysis. Clean drainage ditches.	Set out pecan weevil traps. Mark trees with significant phylloxera populations.
August	Make sure newly planted trees have adequate water.	Keep groundcover mowed.	Keep groundcover mowed.	Monitor weevils. Spray orchard when weevils emerge.
September	Establish cool season cover crops.	Prepare orchard for harvest.	Prepare orchard for harvest. Remove cattle by month's end.	Control squirrels and crows with firearms and traps. Encourage hunting.
October	Plant container grown trees.		Mark weak and unproductive trees for removal.	
November	Collect nuts for stratification and planting next year.			Collect harvest samples to determine weevil damage.
December		Harvest promptly, clean and market nuts.	Harvest promptly, clean and market nuts.	

Harvest and Storage

Well-adapted pecan cultivars begin splitting their shucks in late September or early October. Although the nut is fully mature at this time, it is still "green" and needs to dry further before being gathered. As the nut dries, the shucks will turn brownish-black and curl away from the nut, exposing the pecan. Pecans will fall from the tree when they are fully dry. Begin harvesting when the first nuts drop to the ground. At this point you can hasten the natural drop by shaking the tree or limbs. Pick pecans off the ground as soon as possible and store in a cool, dry place.

Over 70% of the pecan kernel is composed of unsaturated fats which can become rancid in room temperature storage. To maintain highest nut quality, shell out all your pecans and store the kernels in the freezer. Kept frozen, pecan kernels remain fresh for 2 years or more.



A three-point hitch pecan shaker facilitates the prompt harvest of the pecan crop.

Additional Information on Pecan Pest Management:

The University of Missouri Extension *Pecan Pest Management: Insects and Diseases* guide (number MP711) provides additional information on pest management for pecan. Copies are available for a small fee from Extension Publications. To order contact Extension Publications, University of Missouri, 2800 Maguire Blvd., Columbia, MO 65211, (573) 882-7216 or toll-free 1-800-292-0969. The guide is available on the internet at <http://muextension.missouri.edu/xplor/miscpubs/mp0711.htm> and can be downloaded for no charge.

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Design and layout by Sara M. Peters.



Produced by the
University of Missouri Center for Agroforestry

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This work was funded under cooperative agreement C R 826704-01-0 with the US EPA. The results presented are the sole responsibility of the P.I. and/or MU and may not represent the policies or positions of the EPA.

Pecan Tree Source List

Pecan trees can be established by planting seed nuts, planting seedling trees, or planting grafted trees. Both seedling trees and grafted trees can be purchased as either bareroot trees or container grown trees. Given proper tree care, all tree establishment methods can result in a healthy, vigorous orchard. Orchards established by seed or seedling trees should be grafted one to three years after establishment. Vendors of plant materials and grafting supplies are listed below.

Pecan Seed Nuts

HarperHill Farm
Larry Harper
908 Danforth Drive
Columbia, MO 65201
573-442-5326

Lovelace Seeds
Rob Lovelace
1187 Brownsmill Rd.
Elsberry, MO 63343
573-898-2103

Kansas Nut Growers
Association
PO Box 247
Chetopa, KS 67336
316-597-2972

Jim Wilson
Rt. 2, Box 115
Nevada, MO 64772
417-667-8115

Pecan Scionwood

HarperHill Farm
Larry Harper
908 Danforth Drive
Columbia, MO 65201
573-442-5326

Nebraska Nut Growers
Assoc.
122 Mussehl Hall
East Campus - UNL
Lincoln, NE 68583
402-472-3674

Kansas Nut Growers
Association
PO Box 247
Chetopa, KS 67336
316-597-2972

PecanQuest
Wes Rice
9704 Braden School Rd.
Ponca City, OK 74604

King Hill Farms
Paul Manson
RR 3, Box 66
Brunswick, MO 65236
660-548-3972

Seedling Trees

Cascade Forestry
Nursery
Route 2
Cascade, IA 52033
319-852-3042
Bareroot seedlings

Forrest Keeling Nursery
PO Box 135
Elsberry, MO 63343
1-800-256-2401
Container grown
seedlings of northern
pecan cultivars.

Missouri Dept. of Conservation (MDC)
George O. White State Forest Nursery
573-674-3229

[www.conservation.state.mo.us/forestry/nursery/
index.htm](http://www.conservation.state.mo.us/forestry/nursery/index.htm)

Applications for seedling trees are available at all
MDC offices and all University of Missouri County
Extension Offices.

Grafted Trees

Forrest Keeling Nursery
PO Box 135
Elsberry, MO 63343
1-800-256-2401
Container grown.
Grafted on to Colby
rootstock.

Texas Pecan Nursery
PO Box 306
Chandler, TX 75758
903-849-6203
Bare root trees. Request
Giles rootstock.

Nolin River Nut Tree
Nursery
John Brittain
797 Port Wooden Rd.
Upton, Ky 42784
502-369-8551

Womack Nuresry
RR 1, Box 80
DeLeon, TX 76444
817-893-6497
Bare root trees. Request
Giles rootstock.

Stark Bro's Nurseries
PO Box 10
Louisiana, MO 63353
573-754-5511
Bareroot trees. Grafted
on northern rootstock

Grafting Supplies

Forestry Suppliers, Inc.
PO Box 8397
Jackson, MS 39284-
8397
1-800-647-5368

A.M. Leonard
PO Box 816
Piqua, OH 45356
1-800-543-8955

Hummert International
4500 Earth City Expwy.
Earth City, MO 63045
314-739-4500