

Pecan Production Pamphlet for Arkansas

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Pecan Soil Selection

Pecans are native to the United States and have grown along the rivers of the central part of the pecan belt for thousands and possibly millions of years. Soils adjacent to these rivers are usually deep, fertile and well drained but not all river bottom soils are ideal for pecans because some drain poorly. Pecan soils have a high water and mineral holding capacity in combination with a high level of soil air from rapid drainage.

Selecting a soil that is well suited to strong tree growth and production is the key to success in growing commercial pecans.

DEPTH: The greater the root system depth, the better the tree can tolerate climatic stress extremes such as heat, drought, wind and high light intensity. Deep soil also provides essential nutrient elements for good shoot growth and catkin (pollen carrier) formation in the spring.

Checking Soil Depth: The soil depth is best determined by digging straight down with a hand held posthole digger or backhoe. If the soil is easy to dig, it is good. A very shallow 12 inch or less soil can produce a nice yard tree, but it should not be expected to produce commercial pecans.

Shallow soil (24 inches) can be managed with seasonal rainfall and weekly irrigation. Shallow soils should not be expected to bear the same as deeper soils. Soils over 36 inches can be productive, while soils over 72 inches in depth will produce the highest yields of pecans with fewer problems and reduce alternate bearing.

Internal Drainage: A soil with slow internal drainage is a serious problem in pecan orchards. The USDA/NRCS County Soil map is a good source of information on soil internal drainage water infiltration rates, soil depth, and pH. You can access this map via the internet.

Texture: A clay loam soil is mostly clay, but has some sand and silt in it. Loam soils are always better than clay. Sandy soils drains too fast but have a very low water-holding capacity. Clays have high water and nutrient holding capacities, but drain very slowly.

Structure: Good soil structure can be called soft soil, while the absence of good structure is hard soil. Good soil structure results from soil chemical activity, where ions on clay particles push each other apart. This pushing apart of clay particles results in adequate soil drainage and air. Clay soils demand good structure; otherwise, they do not drain.

Sodium: If there is the presence of Sodium in soil or water, it kills soil structure. An important part of pecan orchard site evaluation is the determination of soil and irrigation water sodium. This is reported as the sodium absorption ratio, or SAR. If the SAR is over 10 and rainfall is less than 30 inches annually, pecans should not be planted.

Compacted Soil Structure: Repeated use of heavy equipment on orchard rows can result in a very serious soil compaction problem. Sprayers filled with water and heavy tractors compact the soil, this is easy to happen when the soil is moist – after a good rain fall.

Color: Deep well-drained, red sandy loam soils are the best soils. The red color is from iron oxidation, a good indicator of both the presence of iron and oxygen in the soil. Gray soil with good internal drainage and good depth can be very good too for pecans but gray soil needs to be tested for both depth and good drainage. Black soil is mostly clay and has very poor drainage. However, black soil can have high calcium content and in some cases has adequate soil structure.

Soil pH: Take a Soil sample to determine the soil pH.

Pecan Soil Drainage

Pecan growers frequently experience growth problems with young trees and far too many mature orchards never produce an economic crop, because of poor soil drainage.

Good soil aeration is essential for root health, mineral absorption and water uptake. In well-drained, well-structured soil, oxygen can easily diffuse from the air into the soil supply all the root requirements.

Oxygen Requirement: The pecan root system can function at its peak only when the soil oxygen concentration is high. As soil temperature increases, the soil oxygen requirement increases greatly. Soil that contains 50 percent particles, 25 percent water and 25 percent air is ideal.

Soil Compaction: When heavy tractors and orchard equipment move over the soil, their tires compact the pores.

Recommended Pecan Trees Soil Drainage Test:

Dig hole 32” deep, 8” wide, fill with water [usually about 7 gallons]. Check in 1 hour, if empty there is at least 32” of soil above the water table. ***Pecans trees do not like wet feet!***

Pecan Varieties

Since over 1,000 different pecans named varieties have been propagated, it is very possible to plant a variety which will not be successful. It takes pecan scientists up to 20 years to thoroughly evaluate varieties for commercial production; therefore, variety recommendations are difficult. Some varieties do not have good resistance to pecan scab disease, and therefore should not be planted in a humid area of the state. Other varieties do not ripen their nuts early enough in fall and should be avoided.

Recommended Pecan Varieties and Types:

Type I	Type II	
Desirable – (I)ss*	Candy – (II)	
Caddo – (I)	Choctaw – (II)	
Lakota – (I)	Elliott– (II) bb*	
Oconee – (I)	Forkert – (II)	

Pawnee – (I)	Kanza – (II)	
	Kiowa – (II)	
	Melrose – (II)	
	Moreland – (II)	

– Type 1 pollination (protandrous) pollen shed first.

– Type II (protogynous) female flowers receptive first.

*ss – Scab susceptibility risk elevated in this region.

*bb – Breaks dormancy early and should not be planted in northern most areas of region.

Pecan Pollination Types

Type I – Protandrous

(male pollen 1st, female flower 2nd)

Type II – Protogynous

(female flower 1st, male pollen 2nd)

Caddo

Desirable

Desirable

Oconee

Pawnee

Elliott

Forkert

Kanza

Lakota

Nacono

Pecan Pollination

The flowering system of the pecan tree is complex and requires specialized terminology. Understanding the flowering system is needed for choosing appropriate Cultivars in the design of productive orchards.

Mature pecan trees are monoecious, and bear male and female flowers at different locations and different time on the same tree.

A pecan tree has dichogamous flowering (dicho=2-part; gamy=sexual union) since male and female flowers on a tree mature at different times. If male flowers dehisce pollen before pistillate flowers are receptive, the tree is protandrous (protos = first; andro = male) and is classified as type I. If female flowers are receptive before pollen is shed, the tree is protogynous (protos = first; gyne = female) and is classified as type II.

When a tree has complete separation of male and female bloom, it must be cross pollinated by another tree type. If the tree has incomplete dichogamy, it may be partially self-pollinated, allowing for some nut set. Self-pollination is generally undesirable, since it has been shown to reduce nut quality.

Pecan Rootstock

The performance of pecan trees is greatly influenced by the seed planted to produce the tree. If the seedlings are left ungrafted, the influence of the seedstock* can be seen in their level of disease, in their patterns of seasonal growth (that influences climatic adaptation), and in the quality of the nuts they produce. If the trees are grafted with improved cultivars, the seedstock influences patterns of growth and nutrient uptake in the grafted top.

*A seedstock is the source of seed planted to produce seedling rootstocks. Riverside is a seed stock. The seedlings grown from that seedstock are Riverside seedling rootstocks.

Pecan Orchard Design

Over the last 25 years, there have been more cultural practices adapted or rejected in this period than the entire first 100 years. It would be hard to consider growing pecans today without systemic fungicides, insecticides, herbicide, drip or micro-sprinkler irrigation, sprayers, portable cleaners, mechanical tree trunk shakers, numerous mechanical harvesters and more.

No phase of pecan culture has experienced more field experimentation, sometimes with extremely large acreage, than that of tree spacing. Over the last 25 years there has been a wide range of opinions throughout the industry on what is the optimum pecan tree spacing.

The primary objective of the ultra-high density concept was to plant the trees as close as possible to increase the per-acre yields in the early life of the orchard. This spacing failed to be profitable because of two major problems; first – lack of effective tree size control techniques, second – once trees crowded economic production stopped for an extended number of years.

There are additional factors against the ultra-high density concept – trapped humidity and increased pecan scab disease, increased establishment costs, and probably the most important problem of all, the difficult task of deciding when to remove trees. It is extremely hard for growers to cut down young, fast growing trees in what seems to be their most productive stage.

Light Absorption: Sunlight is captured by chlorophyll in leaves and combined with air and water forms sugars. When shade exists, photosynthesis slows down, less sugar accumulates, growth slows, the limbs are less healthy, fewer nutlets form in spring and eventually the shaded limb dies. Sunlight is only effective two or so feet into the canopy; therefore, the production canopy of the tree is simply the outer layer of shoots and leaves. As crowding occurs, we first recognize shading; second, we see limbs growing into the canopy of the neighboring trees; and finally, we see dead limbs, therefore it is essential to reduce tree crowding and shading by removing trees and they touch in the row middle.

Water Absorption: Pecan tree roots are as essential for tree health and economic production as the limbs and leaves. Over 90 percent of the tree's water is absorbed from the top 36 inches of soil. However we do know that orchards on shallow soil cannot produce the same yields as trees on deep well-drained soil.

Tree Crowding: The pecan, when managed to its full potential on good soil in an ideal climate, is a very large, fast-growing tree. As the trees increase in size, lower limbs can begin to touch as early as the eighth year. Experience has shown that trees need to be

thinned as soon as the lower limbs begin to shade. An initial sign of crowding is a reduction in the percent kernel. A more significant sign of crowding is when alternate bearing begins.

Orchard Design: The most common two designs are the rectangle and the diagonal. These designs were used to obtain the optimum use of orchard space without early crowding. The spacing should allow 12 – 15 years of growth and production before limbs touch. Plant trees 35'X35' if you plan to thin later.

Square System: Many orchards are planted on the square system simply because no plans are made for optimum space utilization or eventual tree thinning.

Diagonal System: This is a popular system today; it gives maximum use of orchard space and is designed for early tree thinning. The trees are intended to be in place for a long period of time, are designated as permanent trees and are planted on the square, usually 50 x 50.

FORMULA FOR CALCULATING NUMBER OF PECAN TREES PER ACRE

Number of pecan trees per acre equals length times width divided into 43460 (square feet per acre).

Example: $50 \times 50 = 2500$

$43560 \text{ divided by } 2500 = 17.42 \text{ trees}$

Pecan Nitrogen and Alternate Bearing

Nitrogen fertilization of pecans is a critical component in the production of annual crops of high quality nuts. The goal of pecan production is not necessarily to produce more pecans, but rather produce moderate crops of high quality nuts every year. The success of a pecan nitrogen program is dependent on a combination of many, rather than one single component. Climate, soil, spacing, pruning, training, tree age, variety, individual tree variability and more play a role in tree growth and nut production. Irrigation, zinc, and weed management have a direct influence on nitrogen absorption and utilization. Therefore, it is important to know increasing nitrogen alone will not help trees if water is lacking or excessive; or if weeds consume available water and nutrients.

Nitrogen Physiology: No element is more essential for pecans than nitrogen. Too little nitrogen results in limited growth and poor tree health. Too much nitrogen stimulates excess growth, shade, and in some instances lower yield. The key to nitrogen management is to balance applications according to tree needs.

The nitrogen program discussed here is for mature bearing trees, 12-15 years of age and producing at least 800 pounds of nuts per acre. It is for trees beyond the high vigor years of grand growth. Mature pecan trees, like all fruit trees, have three physiological needs: spring growth, fruit development, and storage for next year. Each has a need for nitrogen.

Alternate Bearing as A Guide for When to Apply Nitrogen: It was first described by Cabeza de Vaca in 1541. In recent years, crop reduction via mechanical hedging or trunk shaking has helped many growers reduce alternate bearing.

Typically alternate bearing occurs when trees are “on” with a heavy crop followed by an “off” year with a poor crop. On very large trees, one can have “on” and “off” limbs on the

same tree. Growers need to manage nitrogen based on where the trees are in the alternate bearing cycle and not simply apply the same amount year after year.

The key is to develop a nitrogen program which maintains the leaves in the late summer of the big “on” years, but does not stimulate excess growth in the spring of the “off” years. Working these two objectives together can reduce the up and down cycle of production. Once out of the cycle, the applications of nitrogen become more straight forward.

As a general rule, mature trees bearing 800 lbs. or more per acre require 100 to 150 lbs. (units) of actual nitrogen per acre each year. Pecan nutrition scientists have never shown pecans use more than 100 lbs. of actual nitrogen per year. Nitrogen in the soil and tree moves fast, thus it can be applied when most needed by the tree. The problem is that nitrogen is frequently lost or is applied at the wrong time.

There are two critical nitrogen need periods during the season; first early season foliage growth and second, kernel filling and food storage. Crop load and the alternate bearing cycle should now be used to help growers determine if, when, and how much nitrogen is applied.

1st Spring Nitrogen Following an “OFF” Year: Trees beginning growth after an “off” year start the year with a full supply of stored food in the stems, trunk, and roots and they do not take up nitrogen at this time. Therefore, delay spring nitrogen until the leaves and shoots are 75% expanded. This is later than normal with a rate of 50 lb. nitrogen per acre. This recommendation is drastically different because, in the past, most fertilizers applications were made at budbreak.

1st Spring Nitrogen Following an “ON” Year: Trees starting growth after a heavy “on” year have few stored reserves and must have nitrogen at bud break. Such trees need nitrogen right away to stimulate good growth, catkin development, and nut set. These need 50 lbs. of nitrogen at bud break in late March or early April.

2nd Spring Nitrogen Application: A second application is made in May following nut set but before the month of June is over. It would be 50 lbs. of nitrogen if the crop is large and 20 to 30 lbs. if moderate. If the crop is low or zero, there is no second spring application. If you look closely during the month of May, you will see nut set on improved varieties.

Trees in the “off” year cycle of alternate bearing will have sufficient nitrogen and will not need fertilization.

Nitrogen fertilization is extremely important and recommendations have evolved greatly over time. These guidelines should help replace alternate bearing with the regular production of quality pecans.

Zinc Nutrition

Zinc is a major essential element responsible for pecan tree growth and nut production. It is a natural plant hormone responsible for inducing cell elongation and cell division with all subsequent results for plant growth and development.

Over 40 years of pecan zinc research confirms that the pecan tree is a poor accumulator and transporter of zinc, especially when grown in high pH soils, which are typical of much of the pecan belt. Trees that have adequate zinc with resulting good growth and nut yields exhibit long, thick shoots with large dark flattened leaflets. Symptoms of zinc deficiencies

include small, narrow, crinkled leaves growing on thin shoots with shortened internodes, which results in low nut yields and poor quality. Prolonged zinc deficiencies and bunch terminal growth lead to shoot, branch and canopy die-back.

The most effective method of providing zinc to pecans is through foliar spray application applied to young developing buds, leaves, and shoots. These young plant tissues have not yet developed thickened cells or cuticles which can retard or prevent absorption of zinc.

High humidity during spray applications slow evaporation and can increase absorption. Foliar zinc sprays have become the standard application method in most pecan orchards.

Soil pH has to be 5.5 or below for pecan trees to take up zinc through the soil, but this is not very effective. Most recommendations are to raise the pH of acidic soil for zinc to be taken up through the foliage. Pecans like a pH range of 6.5 to 7. It has been found that foliar zinc applications are more effective.

Foliar zinc treatment recommendation:

Two pounds of zinc sulphate (ZnSO₄) per 100 gallons of water plus one quart of 32% liquid nitrogen or one pint of zinc nitrate plus one quart of liquid nitrogen Zn (NO₃)₂.

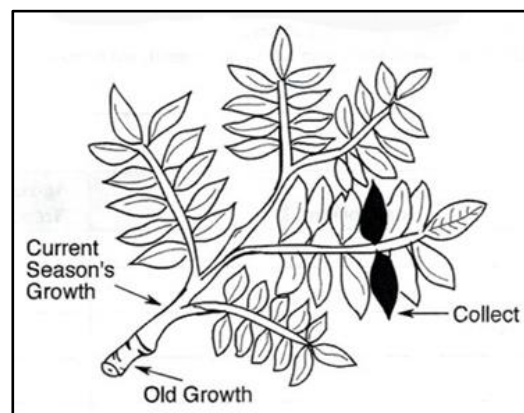
Zinc Spay Schedule:

First Spray	Green Tip
Second Spray	1 week after green tip
Third Spray	3 weeks after green tip
Fourth Spray	With Casebearer Spray
Fifth Spray	Eight weeks after green tip
Young Trees	Every 2 weeks from April to August

Pecan Leaf Sampling

When collecting pecan leaf samples, take leaflets from the middle of the compound leaf. You should collect leaflets from each pecan tree variety and keep them separate. DO NOT MIX leaflets from different pecan varieties. You should collect 60 leaflets from 30 shoots.

Nutrients content is high in the early part of the season; it levels off in July, followed by gradual drop in August till the leaves falls. Therefore, July is the best time to sample leaves for nutrient content. Leaflets should be collected half-way up the tree as possible.



Pecan Leaf Nutrient Levels

Table 1: Acceptable and optimum ranges for nutrient elements in pecan leaves.

Element:	Acceptable	Optimum	Deficiency Symptoms
N	2.5 – 4.0%	3.0%	Pale yellow: trees defoliate pre-maturely; common
P	0.12 - 0.3%	0.2%	Chlorotic young leaves, thin stems, leaf scorch and defoliation; rare
K	0.75 – 1.25%	1.1%	Irregular interveinal chlorosis than leaf bronzing; rare; problem is N scorch induced by high N and low K
Ca	0.7 – 1.5%	1.1%	Leaf margin burn; very rare
Mg	0.3 – 0.6%	0.5%	Gold chlorosis in a Christmas tree pattern; middle of leaf green; rare
Fe	100 – 300 ppm	200 ppm	Interveinal chlorosis; rootstock problem
Mn	40 – 300 ppm	100 ppm	Pale leaves, but no discernible chlorosis or necrosis; lack vigor
Zn	80 – 500 ppm	100 ppm	Rosette; chlorosis, curling leaves with wavy margins; shoot dieback; common
B	20 – 45 ppm		Toxicity usually the problem; chlorosis and leaf burn

Pecan Insect Pests

Hickory Shuckworm: Are active mostly at night during growing season and overwinters as a larva in the shucks of nuts. They begin attacking nuts in early June and continue until harvest, possibly three to four generations per year.

Control: Emergence of the shuckworm varies from year to year and orchard to orchard.

Spraying should be timed depending on shuckworm activity. Activity should be monitored with black light traps. In the absence of a light trap, start scouting for activity in July.

Insecticides: Consult your County Extension Agent and refer to MP-144.

Pecan Nut Casebearer: This gray moth is active at night time only and is the most damaging insect pest in Arkansas. Females lay eggs on the tip end of young developing nuts. Females lay 50-150 eggs during her five to eight day life span. Eggs are white when laid, but will turn pink or red prior to hatching. Eggs hatch in four to five days. Insecticides should be applied two to three days after the first eggs hatch. The casebearer may have one to four generations. By carefully monitoring egg hatch and control of the first generation, the second, third or fourth generation will be controlled. Warm spring temperatures influence casebearer development. Cool rainy weather can delay moth activity and egg laying. Thus, the period of egg laying can vary as much as two weeks from year to year.

Control: Mother's Day is usually a designated time to start scouting for casebearer eggs.

Insecticides: Consult your County Extension Agent and refer to MP-144.

Pecan Weevils: The pecan weevil attacks pecans and hickory prior to shell hardening. Adults will feed on pecans usually causing immature pecan to fall from the tree. After the shell hardens, females will lay eggs in the pecans and grubs will feed on developing kernel.

Control: Control should be aimed at the adult in August. Usually after the first significant rain occurs (1 to 1 ½ inches), adults will emerge from the soil. Emergence can be determined by shaking lower limbs of tree, setting weevil traps in orchard under trees, or attaching circle trap to tree.

Insecticides: Consult your County Extension Agent and refer to MP-144.

Black Pecan Aphids: Black aphids are more destructive than the yellow aphids. It feeds on the underside of leaves and injects a toxin that causes the leaf tissue between major veins to turn bright yellow. The black pecan aphid also reduces nut fill and lowers production the following year.

It is very active in August and September. Treat when aphids average three or more per compound leaf.

Phylloxera: Pecan leaf phylloxera form galls on *leaves only*; extensive infestations may cause some defoliation. The pecan phylloxera is the most damaging species because it attacks *shoots and nuts*.

Biology: Both species of Phylloxera survive the winter as eggs in bark crevices. In spring, tin nymphs emerge during bud break and feed on new growth. As they feed, nymphs secrete a substance that stimulates plant tissue to develop abnormally, creating galls. The young phylloxera is soon completely enclosed in the galls which range from 1/10 to 1 inch in diameter.

Control: Native trees and improved varieties vary in susceptibility to phylloxera. Because phylloxera cannot fly far, infestations move slowly from tree to tree. You can often control them by treating only those trees with phylloxera galls. Survey the orchard in May and mark trees with galls to treat the next spring.

Insecticides for phylloxera must be applied after egg hatch in the spring but before nymphs are protected inside galls. Treat after bud break when growth is 1 – 2 inches long. A dormant oil spray applied to tree trunks and limbs in the dormant season also reduces phylloxera infestations. Thorough coverage is essential to ensure that eggs are killed.

Stink Bugs/Leaf-Footed Bugs: There are three primary types of these bugs – Leaf-footed bugs, Brown Stink bugs, and the Green Stink Bugs. Adult stink bugs and leaf-footed bugs prey on pecans both before and after shell hardening. They are seen on pecan trees late in August and September. Adults overwinter in bark crevices, fence rows, and debris. They puncture the shuck and nut shell, and feed on the inner material. Before shell hardening, the nuts bleed and abort. After shell hardening, the nuts stay on the tree but there will be small dark spots on kernel.

Control: Stink bugs and leaf-footed bugs like legumes (beans and peas, etc.) better than pecans. Plant legumes as a trap close to pecan trees and when the bugs invade, control them with a labeled insecticide after the shell hardening stage in September.

Insecticides: Consult your County Extension Agent and refer to MP-144.

Pecan Diseases

Pecan Scab: Leaves can be infected from bud break until June. Nuts can be infected from May to late September. Lesions are brown and later become black. Lesions reduce photosynthetic activity and cause early leaf loss. Shucks stick to nuts and nuts can become undersized. Nuts may stick to tree or drop prematurely.

Environmental Influences: Frequent rains, high humidity, heavy dew, and cloudy days.

Factors that influence the development of scab are resistant varieties, plant spacing, orchard design, orchards overcrowded, clean up in orchard and type of irrigation.

Control - Fungicide spray should begin as soon as bud break.

Fungicides: Consult your County Extension Agent and refer to MP-154.

Shuck Decline: (Shuck Dieback, Shuck Disease, Tulip Disease, etc.) Pecan shuck decline is the collective name of a rash of problems involving the thick outer husk that surrounds a pecan shell. The condition causes the shucks to shrink, blacken and fall before the nuts can fully form.

It can cause no kernel, small kernel, blacken kernel, small nuts, or stick-tight (shucks stick to shell, etc.). The cause has long been attributed to a fungus, but production stress is apparently responsible. The pecan tree under great production pressure responds by opening its shucks; the tree realizes it's in trouble and tries to drop pecans to ensure its survival. The condition is worse in prolific varieties, such as *Success*, *Cherokee*, *Cape Fear* and *Choctaw*.

Control: Provide tree with plenty of water in late August to September during kernel filling stage.

Preparation of this pamphlet was taken directly from the Texas Pecan Handbook, March 2012 edition.