



Texas Fruit and Nut Production

Improved Pecans

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Pecan trees grow in many settings, including woodlands, parks, urban greenbelts, courthouse lawns, and thousands of home landscapes. The pecan is the state tree of Texas and has an important place in the state's history.

Native and improved pecan trees are grown commercially on about 70,000 acres in Texas. The improved varieties were originally called papershell pecans because of their thinner shells (Fig. 1). The trees are large and long-lived; they bear larger crops than do the natives; and they can be resistant to some insects and diseases.

For information about growing native pecans, see *Texas Fruit and Nut Production: Native Pecans*, which is available at <https://agrilifebookstore.org/>.

Commercial production of improved pecans involves many factors. Growers must determine the right orchard size, select a suitable growing site, design the orchard well, select the best varieties for the location and market, fertilize appropriately, control pests economically, and harvest and process the nuts efficiently.

Orchard size

A pecan enterprise may fail if the orchard is too big or too small. For new pecan growers, a wise strategy is to start small and expand in phases. Considerations for determining the size



Figure 1. Improved pecan nuts are also called papershell pecans because of their thinner shells.

of the orchard include cash flow, equipment costs, and water availability.

Cash flow: Establishing a commercial pecan orchard requires a significant capital investment for the land, equipment, irrigation well, water delivery system, and other special needs like wildlife-proof fencing. Growers must have a cash flow plan for the 5- to 7-year establishment phase, when the trees bear very few pecans.



Figure 2. A powered trunk shaker.



Figure 3. A powered pecan harvester.



Figure 4. An air-blast pecan tree sprayer.

Equipment costs: Although hobby orchards of 1 or 2 acres may be harvested expediently enough by hand, larger endeavors need specialized harvest equipment. Commercial equipment includes tractors, shakers, harvesters, cleaners, and airblast tree sprayers (Figs. 2, 3, and 4).

Because the commercial equipment needed for a 10-acre pecan orchard is generally the same as for a 100- or 200-acre orchard, small orchards (less than 50 acres) bear higher per-acre equipment costs, which may reduce their profitability.

Water availability and quality: Mature pecan trees bearing a crop need 1 to 2 inches of water per acre per week during the hottest times of the growing season. Growers must consider the quantity, quality, and delivery cost of the water available at the orchard site.

In general, a water well should be able to produce 10 gallons of water per minute for each acre of trees. Before planting, have the water tested to determine total salinity and the level of potentially damaging elements such as sodium, chloride, and boron.

Water quality analysis is available from the Texas A&M AgriLife Extension Service Plant, Soil and Water Testing Laboratory (<http://soiltesting.tamu.edu>).

Commercial pecan orchards can claim agricultural land tax exemptions. However, since 1986, there are few tax advantages for pecans, and profits need to be determined on a true cash basis.

For sample pecan budgets, including establishment costs, see the AgriLife Extension Agricultural Economics website at <http://agecoext.tamu.edu>.

Climate

The climate in all areas of Texas is suitable for pecans. However, crops can be damaged by early fall

freezes and late spring frosts. In the Panhandle and other northern Texas areas, growers should plant early-harvest varieties to avoid fall freeze injury to maturing nuts.

Freezing weather can also damage young pecan trees. Avoid planting young pecan trees in low-lying topography, or “frost pockets,” which increase the potential for cold injury. Mature trees that have developed thick bark are much less likely to be damaged in these areas.

Water and disease concerns differ across the state. In general, less irrigation is needed for orchards that are east of Interstate 35 and receive at least 35 inches of rainfall per year. However, these orchards have more disease problems and a greater potential for rainy conditions during harvest.

Orchards receiving less than 35 inches of rainfall a year have fewer disease concerns but depend more on irrigation systems to supply the 55 inches of rainfall per acre needed for good tree growth and crop production.

Even in the wettest areas of Texas, rainfall is unpredictable, and irrigation is recommended for producing good-quality pecans (Fig. 5).

Soil

Pecans grow best on deep, well-drained soils that contain adequate oxygen, nutrients, and water. Although trees can grow on shallow soil, commercial orchards are most likely to be successful if the soils are 32 inches deep or deeper. Study the site’s drainage and soil depth carefully before planting, because many soils in Texas are either shallow or poorly drained and do not support profitable production.

Varieties

Improved pecan varieties are recommended for each pecan production region in Texas (Fig. 6). Considerations for choosing varieties include pollination, nut maturity date, resistance to pecan scab, and market preferences.

Pollination: Pecan trees are pollinated by wind. The pollen is blown from male flowers called catkins to female flowers called



Figure 5. Solid set sprinkler irrigation.

Regional factors

North: Shorter growing season; low disease pressure; irrigation required; calcareous soils require foliar zinc sprays

West: Low disease pressure; high heat stress; irrigation required; calcareous soils require foliar zinc sprays

Central: Variable (usually light) disease pressure; variable soils; supplemental irrigation needed

East: Moderate to high disease pressure

Legend

- (I) Type I pollination (protandrous) pollen shed first
- (II) Type II (protogynous) female flowers receptive first
- ** New and untested variety for trial planting
- ss Scab susceptibility risk elevated in this region
- bb Breaks dormancy early and should not be planted in northernmost areas of region

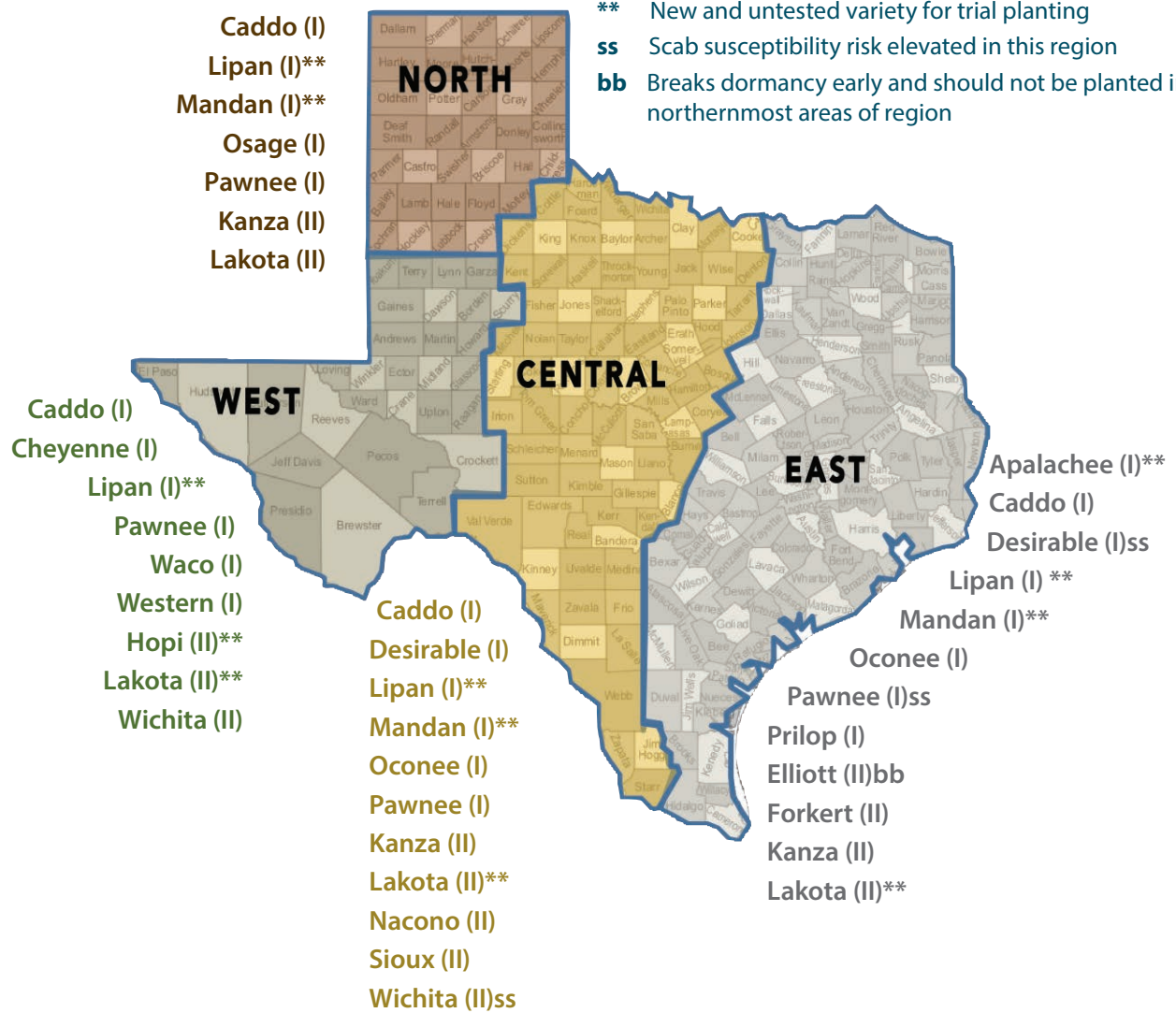


Figure 6. Pecan regions of Texas.

nutlets. On most varieties, the pollen is not dispersed (shed) at the same time that the nutlets become receptive.

To overcome this problem, each pecan orchard should contain two flowering types:

- **Type I**, or protandrous, pecans are those in which the catkins appear first. Catkins are commonly called tassels because their golden strands hang in clumps throughout the tree.
- **Type II**, or protogynous, pecans are those in which the female nutlets become receptive before the catkins begin to shed pollen.

The ratio of the two types in an orchard need not be equal: Only 15 percent of the trees need to be pollenizers for the main variety, as long as they are distributed uniformly throughout the planting. Small orchards may not need pollenizers if native or seedling trees are within sight of the new planting; however, large commercial plantings should include pollenizers within the orchard.

Early nut maturity: Because fall freezes occur earlier in North Texas, growers there should choose varieties that produce early-maturing nuts. This trait is also important for growers in other production areas who want to get the nuts to market early in the harvest season.

Scab susceptibility: Central and East Texas growers should be aware of the risk for scab disease with certain varieties (noted “ss” on the map). Varieties like ‘Wichita’ and ‘Hopi’, cannot be grown successfully in rainy conditions without fungicide sprays to prevent fungal infections, and fungicide treatment may not be enough to prevent crop loss on scab-susceptible varieties in years with abnormally high rainfall.

Marketing outlets: Choose varieties that will best meet the needs of your intended market. Retail markets prefer large nuts with bright-colored kernels (Fig. 7). Wholesale markets look for shelling ease and high percent kernel. Orchards should be designed to allow trees of the same variety to be harvested together, because buyers prefer uniform lots of pecans, rather than blended lots of more than one variety.

For more information about pecan varieties, see the *Texas Pecan Handbook*, which is available from the Texas A&M AgriLife Bookstore at <https://agrilifebookstore.org/>.



Figure 7. Nuts from three pecan varieties. From the top down: Lipan, Pawnee, and Kanza.



Figure 8. A well-spaced young pecan orchard.

Spacing

To be productive, pecan trees must have ample sunlight. At least 50 percent of the orchard floor should receive sunlight at mid-day during the summer throughout the life of the orchard.

Inadequate sunlight hinders pecan production even before the limbs of adjacent trees touch one another. Problems include smaller nuts, lower production, reduced percent kernel, increased insect and disease pressure, and intensified alternate bearing, which is the tendency to bear nuts in 2-year cycles, with a large crop followed by a small or no crop.

The initial tree spacing determines how soon an orchard will become crowded (Fig. 8). To delay crowding, plant the trees 50 or 60 feet apart. To prevent it altogether, space them 75 to 100 feet or farther apart. Although high-density plantings of 35 feet or less can produce more nuts early, they become crowded earlier.

Options to reduce crowding include canopy hedging, transplanting, and tree removal.

Canopy hedging is pruning back the limbs in the outer canopy of the trees. To be effective, the canopies must be hedged every year using a sickle-bar or rotary blade-type hedging machine (Fig. 9), which is very expensive. Because of the cost and scarcity of custom contractors, hedging is usually not feasible for small orchards.

Growers in Far West Texas plan for annual hedging and plant the trees 30 feet apart (30 x 30). Orchards in other regions of the state are commonly planted 35 x 35 or 40 x 40 and are either hedge pruned or thinned by tree removal.

Some growers have used tree spades to move pecan trees. The most successful transplants have trunks that are 10 inches or less in diameter. To survive, transplanted trees must be watered carefully and pruned severely.

Tree removal strategies differ somewhat for square, rectangular, and diamond orchard planting designs. For planting designs and



Figure 9. A mature orchard spaced at 30x30 feet, hedged annually to maintain sunlight.

thinning strategies, see the *Texas Pecan Handbook*. The orchard plan should also ensure that pollenizers remain in the orchard after tree removal.

Orchard floor management

Weeds compete with pecans for water and nutrients and can reduce growth and kernel development. The most practical and widely used system of orchard floor management is the sod and strip system, in which a herbicide-treated, weed-free band is left down the tree row; sod is grown between the bands and maintained by mowing (Fig. 10).

The soil is broken up in pecan orchards by different means across the state. Shallow, clean cultivation (clearing out all plants except the pecan trees) with a disk harrow (disking) is practiced in Far West Texas, where orchards are flood-irrigated with river or reservoir water. It is also used in other parts of the state. However, this practice contributes to erosion and compaction and is impractical in rainy areas because it makes moving the equipment difficult.

Although some Texas growers graze sheep, cattle, goats, and other animals in improved orchards, it is generally not recommended because livestock can compact the soil, damage young trees, and interfere with irrigation, spraying, and harvesting.



Figure 10. A “sod and strip” orchard floor.

Fertilizer

Pecan orchards need applications of nitrogen and zinc every year. Depending on soil test results, they may also need to be fertilized to correct pH problems as well as other macro- and micronutrient deficiencies.

Nitrogen: Pecans must have nitrogen to grow well. Apply nitrogen at bud break in April and again in May and June. As a rule, 10 pounds of actual nitrogen is needed in June to produce 100 pounds of pecans per acre. For heavy crops, apply it in July and August also.

Young trees should receive small, frequent applications in response to growth from budbreak to late July. Later applications will expose young trees to greater risk of freeze injury.



Figure 11. Severe zinc deficiency symptoms in pecan: bunched canopy, small leaves, and limb dieback.

Zinc: Foliar zinc sprays are essential for maximum leaf expansion and pecan growth (Fig. 11). Applying zinc to the soil or via drip systems is ineffective unless the soil pH is 6.0 or less and no limestone has been applied.

Apply zinc frequently in the early part of the growing season. Liquid zinc nitrate and zinc sulfate wettable powder are equally effective. To improve zinc uptake into the foliage, add liquid nitrogen (32 percent urea ammonium nitrate, called UAN) to either type of zinc.

Trees that are young, non-bearing, and growing fast need zinc sprays every 14 to 21 days from bud break in April until July. Mature bearing pecan trees respond best to five applications of zinc:

the first three applied 1 week apart beginning at bud break, the fourth application 2 weeks after the third, and the fifth 3 weeks after the fourth.

Because zinc sulfate can seriously damage the leaves of many types of plants, use zinc nitrate on pecan trees in urban landscapes to reduce the risk of damaging overspray.

pH: Have the soil tested periodically to monitor pH and nutrient levels. If the pH is less than 6.0, you may need to add limestone; soil with a pH of more than 7.5 may require micronutrients.

Potassium and phosphorus: Potassium fertilizer may be needed every 1 to 3 years, especially on sandy soils. Phosphorous fertilizer is seldom needed in Texas, and applying it can aggravate other micronutrient deficiencies. Monitor both elements regularly through soil and leaf analysis.



Figure 12. Pecan scab on pecan shuck.

Diseases

Pecans are susceptible to several foliage, fruit, and root diseases in Texas. The most damaging fungal disease in the Central and East regions is pecan scab (Fig. 12). To control pecan scab on susceptible varieties, spray a fungicide on foliage and the developing nuts multiple times during spring and summer, depending on the frequency of rainfall.

Other common diseases are downy spot, powdery mildew, shuck dieback, stem-end blight, and bacterial leaf scorch. In some regions of the state, pecans are also attacked by soil-borne diseases, including cotton root rot, crown gall, and root-knot nematodes.

Insects

Pecan growers must also know how to control the serious insect pests that attack the nuts—pecan nut casebearer (Fig. 13), pecan weevil, and hickory shuckworm—as well as the many insects that feed on the leaves. Also, borer insects may attack the trunks, limbs, and roots of pecan trees.

For more information on pecan insects, see the *Field Guide to Insects and Mites of Pecan* (<http://agrilifebookstore.org>).

An effective and economical strategy for pecan pest control is integrated pest management (IPM). IPM uses a combination of practices that control pests while posing the least risk to people and the environment.

IPM practices for pecans are described in the *Texas Pecan Handbook* and on the following websites:

- <http://pecankernel.tamu.edu>
- <http://pecan.ipmpipe.org>
- <http://pncforecast.tamu.edu>



Photo by Bill Ree

Figure 13. Damage from pecan nut casebearer larvae.

Harvesting

Pecans in Texas must be harvested expediently to overcome delays from bad weather and to minimize losses from blue-jays, crows, squirrels, and turkeys. Although pecans are very slowly perishable, they can develop problems such as sprouting, embryo rot, and darkening of kernels if left for weeks in warm, damp fields.

An added incentive to harvest quickly is that pecan market prices traditionally become more volatile and may decline as the season progresses from October to January.

Mechanical harvest in commercial orchards is a three- or four-step process:

1. Trunk shakers put the crop on the ground.
2. Harvesters pick up the pecans and associated sticks, leaves, and other trash.

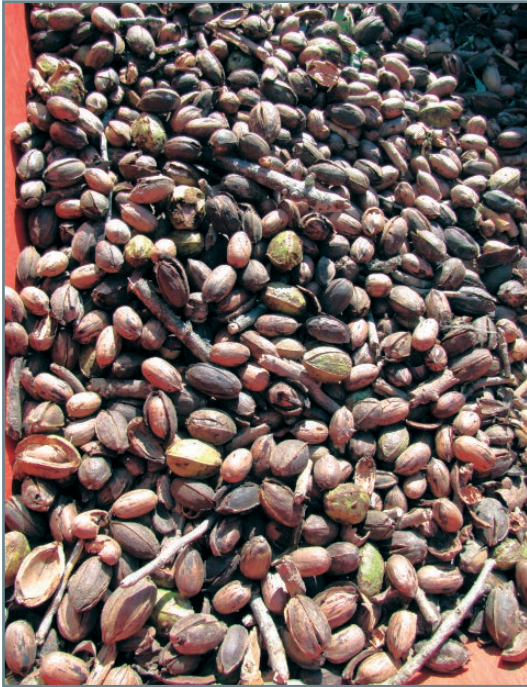


Figure 14. Machine-harvested pecans and trash before processing.



Figure 15. A pecan cleaner and sacking operation.

3. Cleaners separate the good pecans from the trash (Figs.14 and 15).

An intermediate step of sweeping or wind-rowing the fallen nuts into narrow linear piles is needed for harvesters that do not maneuver well in the orchard.

Processing

Pecans should be processed immediately after harvest to obtain a good early-season price and to prevent kernel darkening, embryo rot, vivipary (premature sprouting), the development of toxins such as aflatoxin, and other problems related to moist pecans. Pecans are processed in three steps:

1. Dehulling equipment removes the shucks that were not pulled off in the orchard by nature or by harvesting equipment. In South Texas, harvest begins before the shucks are fully open to prevent vivipary. There, the shucks must be ground off in water with special equipment.
2. A pop remover vacuum-separates the poorly filled pecans from the good ones.
3. As soon as possible, forced air is used to dry the good pecans, reducing the moisture content from 15 to 4 percent. Pecans can be dried on concrete floors or in open-weave sacks, special drying boxes, or false-bottom peanut trailers. To greatly reduce drying time, move as much dry air as possible over the pecans. Heated air can shorten drying times, but the temperature used for drying pecans should not exceed 95°F.

Marketing

Many pecan growers, particularly smaller producers, market their pecans directly to consumers via catalogs, retail stores, the Internet, and fund-raising organizations. For these outlets, pecan prices are based on local consumer demand for fresh pecans.

Growers may also sell to the wholesale market, which is organized around shelling companies and their subsidiaries. Wholesale prices are affected by supply and demand, global economic factors, the cost of competing nuts (walnuts, almonds), and the alternate bearing habit of pecan trees. Prices are often lowest when the national crop is large, and vice versa.

Commercial growers should learn how to evaluate nut quality. Called a hand test, this evaluation is used to estimate the number of nuts per pound, percent kernel by weight, percent fancy grade, and the presence of defects that affect the price negotiated with a wholesale buyer.

The hand test is demonstrated annually in many Texas counties as part of the Texas Pecan Show and Grading Demonstration. Growers who want to attend a county pecan show should contact the county Extension agent.

The demonstration culminates in a display of the state's top pecans at the Texas Pecan Growers Association's annual conference in July (<http://www.tpga.org>).

Costs and returns

Many pecan orchards in Texas seldom make a profit because they lack one or more of the orchard management factors that are critical to success. A producing orchard requires about \$600 per acre in annual operating expenses. Fixed costs and recovery of establishment costs must also be recaptured.

Well-managed orchards on good sites can produce from 1,000 to 2,000 pounds per acre per year (Fig. 16). Pecan production



Figure 16. Well-managed pecan orchards on good sites can produce from 1,000 to 2,000 pounds of nuts per acre per year.

can be profitable when market prices are favorable and crop failures are avoided.

In 2012, the pecan market was strong and paying more than \$2 per pound wholesale. In the United States, consumption is rising as Americans learn about the research confirming the nut's health benefits. Pecans are rich in vitamins, contain high levels of antioxidants, and have been proven to help correct blood cholesterol profiles. The international market for pecans is also growing, as the nuts are gaining in popularity in China.

However, the pecan market has a history of price volatility. Prospective growers should thoroughly investigate the outlook for commercial pecans before proceeding with this long-term agricultural venture.

For more information

These publications are available from the Texas A&M AgriLife Bookstore at <http://agrilifebookstore.org>.

- *Field Guide to Insects and Mites of Pecans*
- *Texas Pecan Handbook*

The Texas Pecan Orchard Management Shortcourse is presented annually during the last week of January at Texas A&M University in College Station. For registration information, contact Texas A&M AgriLife Conference Services at <https://agriliferegister.tamu.edu/>.

Acknowledgments

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