

## Improved Pecans

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### Introduction

Texas is situated in the center of the native host range for pecan trees. Native American Indians used pecans for food, as have much of Texas' fauna, including deer, turkey, squirrels, raccoons, and crows. Pecan trees can still be found today growing wild in river bottoms, pastures, parks, courthouse lawns and thousands of residential landscapes throughout Texas.

Pecan trees are also grown for commercial trade in Texas, with the state usually ranking second or third nationally in total pecan production of approximately 60 million pounds. Texas commercial pecans fall into two categories of management: "native groves", wherein

man. While native nuts or trees will occasionally be planted in orchards, most commercial planted orchards in the U.S. are comprised of improved varieties. Originally referred to as "papershell pecans", improved varieties of pecans are selected for superior traits of nut size,



ease of shelling, production habit, and resistance to certain insects and diseases.

***Pecan trees are slow to begin bearing, grow to large size, and require specialized equipment for spraying, harvesting and processing. Therefore, site selection, orchard design, and selection of varieties are critical decisions that must be made cautiously to insure long-term profitability.***

Research into the health benefits of pecans has uncovered many positive reasons for pecans to be integrated into a healthy diet. Pecans are beneficial for correcting blood cholesterol profiles, are rich in vitamins, and contain high levels of antioxidants. Increased awareness of pecans as a health food has increased consumption of pecans and created a favorable economic outlook for commercial orchards.



pecans are harvested from natural stands of trees (See "Native Pecan Production" publication). and "improved orchards", which generally refers to trees planted intentionally by

## Orchard Size

Establishing an orchard that is either too big or too small can result in economic failure. A single pecan tree is capable of producing 50 lbs of nuts per tree in the 10<sup>th</sup> growing season and 100 pounds in the 15<sup>th</sup> growing season. Pecan trees are most frequently planted at densities ranging from 12 to 48 trees per acre, making it possible to produce over 1,000 pounds per acre per year. With many varieties requiring 50 nuts to make a pound, a single acre of pecans may yield 50,000 nuts which must be harvested. Hobby orchards of one or two acres may be harvested by hand, without equipment, but serious, commercial endeavors will need the following equipment items: 1) tractor, 2) tree sprayer, 3) trunk shaker, 4) harvester, and 5) cleaner. The cost of the specialized pecan equipment is typically the same for an orchard of ten acres or one hundred (100) acres, thus small orchards bear higher equipment costs per acre which may challenge profitability of the venture.

Larger orchards must have a cash flow plan for the establishment phase of the orchard, during which time the trees bear very little crop. The establishment phase of a new pecan orchard ranges from five to seven years, depending on the precocity of the improved varieties that are planted and their vigor on the site. Commercial pecan orchards require approximately \$2,000 per acre to bring into production. Sample pecan budgets, including establishment costs may found at <http://agecoext.tamu.edu>.

Pecans require 2 inches of water per week once in production, so water volume and the cost of delivering suitable quality water need to be considered when determining the size of an orchard. Starting small and expanding in phases is a wise strategy for new pecan growers who are unfamiliar with the nuances of pecan growing.

## Climate

All areas of Texas are climatically suited to pecans. Pecans require 200 or more frost-free days to produce a crop on the earliest maturing varieties. Pecan trees break dormancy late in

the spring, and it is unusual, although not unthinkable for the flower crop to be damaged by



Air-blast type pecan tree sprayer

late spring freezes. Cold pockets that place plants at higher risk for freeze damage should be avoided for young trees and reduced spring frost damage. The Texas panhandle, and other northern counties of the state should consider early-harvest varieties to avoid fall freeze damage to maturing nuts.

Counties that generally lie east of Interstate 35 are considered part of the East, humid pecan growing region (Fig. 1). Rainfall in the East region decreases irrigation water pumping requirements, but also has higher incidence of diseases (Pecan Scab, Downy Spot) and greater difficulty harvesting in rainy years. Pecan growers in the West region have little concerns with diseases, but must plan to supply almost all of the annual 55 inches of water per acre that pecan trees require for good growth and production.

An irrigation system is recommended for all commercial pecan orchards in Texas. Rainfall, even in the most humid areas, is erratic in distribution, and there are critical times in the season each year when trees must receive enough water to grow and fill out the nut. Mature bearing trees require 2 inches per week, and should ideally be irrigated every week or



Solid set- type sprinkler irrigation

at least never be allowed to go longer than 21 days without water. Salts in the soil and/or water can significantly reduce growth or kill the trees in extreme cases. Potential pecan orchard sites or problem orchards need to have their irrigation wells tested for water volume, quality, and the cost of electricity for pumping the water. A good rule of thumb is to have a well capacity of 10 gallons of water per minute for each acre of trees.

### Soil

Pecan orchards should be established on deep and well drained soils that contain proper amounts of air, water and nutrients. Poor soil drainage is one of the most serious limiting factors in pecan orchards. More orchards fail in Texas because of undesirable soil than from any other factor, and unfortunately, management cannot correct or substitute for soil limitation. Pecan trees can grow on very shallow soil, but for commercial production of more than 1,000 pounds per acre, the soil should be 32 inches deep or more.

### Varieties

Figure 1. displays the recommended improved varieties for four production regions of Texas. The *Texas Pecan Handbook* (SP-445) discusses each variety thoroughly. A major consideration in variety selection is how pecans harvested from the orchard will be marketed. Large nut size and bright kernel color is important to retail marketing, while kernel percentage and acceptability to shellers is important for wholesale marketing. Pecan varieties fall

into one of two flowering categories: Type I or “protandrous” (male catkins appearing first); and Type II or “protgynous” (female flowers appearing first). Each pecan orchard should contain both flowering types to insure adequate pollination. The ratio of the two types does not have to be equal. Approximately 15%



pollenizers in the orchards should provide adequate pollination of a main variety, provided that they are uniformly distributed throughout the orchard. Other variety characteristics to study carefully include date of nut maturity, alternate bearing

tendency and Scab resistance in humid regions.

### Spacing

Space and ample sunlight are essential for maintaining productivity and profitability. Crowding in pecan orchards is defined as limbs of adjacent trees touching and/or less than 50% of the orchard floor receiving sunlight at mid-day in summertime. Crowding causes nut production to decline, nut size to decrease, and alternate bearing to be more severe. Crowding should be prevented rather than corrected, by tree removal or canopy hedging. Canopy hedging requires very expensive equipment and thus must be contracted annually by small orchards that cannot afford to purchase equipment. Whereas hedging must be performed annually to prevent crowding, tree removal prevents crowding for several years, if not permanently.

The initial tree spacing determines how soon crowding will occur in a pecan orchard. Many pecan orchards in Texas are planted at a spacing of 30 to 35 feet between trees (30 x 30; 35 x 35). Trees at such spacing crowd in 12 to 18 years after planting, depending on site, water and management inputs. Closer spacing is uncommon in Texas due to the fast rate of crowd-

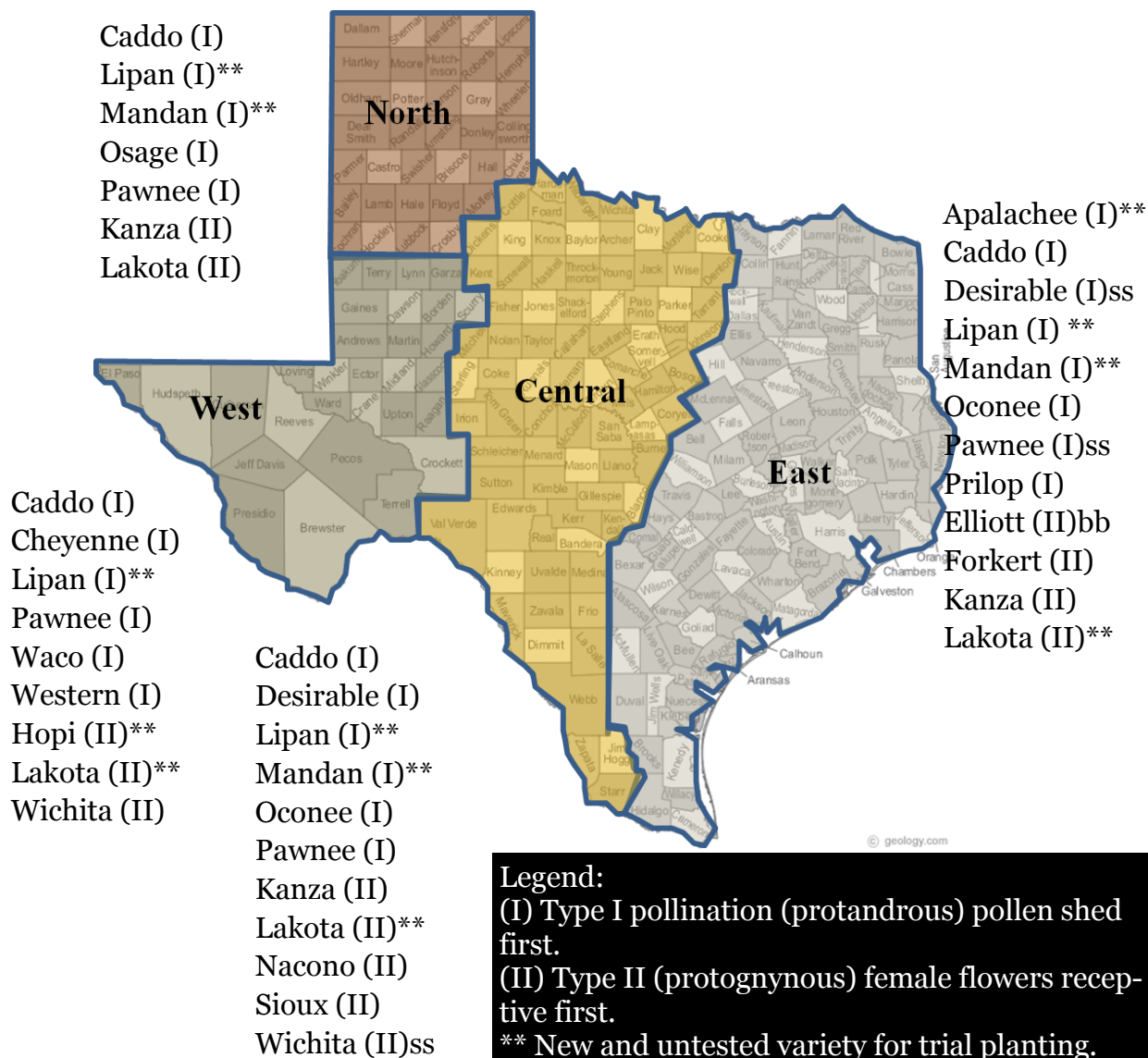
**Regional Factors to Consider:**

**North:** Shorter growing season; low disease pressure; irrigation required, calcareous soils requiring foliar zinc sprays.

**West:** Low disease pressure; high heat stress; irrigation required, calcareous soils requiring foliar zinc sprays.

**Central:** Variable disease pressure (usually light); variable soils, supplemental irrigation.

**East:** Moderate to high disease pressure; variable soils, supplemental irrigation.



ing that occurs. Wider spacing (50 x 50; 60 x 60) is recommended for growers who want to extend the time when crowding prevention methods will be needed. Where there is a desire for pecan trees to never crowd, they should be planted 75 to 100 feet apart or further.



Well spaced young pecan orchard

Future tree removal operations should be considered in the designed layout of main varieties, temporary varieties (if any) and pollenizers. Pollenizers should be located so that they will be present in the orchard after trees are strategically removed.



Mature, 30x30 spaced orchard hedged annually to maintain sunlight.

Square, rectangle, and diagonal orchard designs offer different tree removal strategies. These should be considered carefully in planning to prevent crowding.

Where soils are similar and a large volume of water is available, bearing trees up to approximately 8 inches trunk diameter can be moved with large tree transplanting equipment.

### **Orchard Floor Management**

Weeds must be controlled in young and mature pecan orchards to prevent reduced growth



“Sod and Strip” orchard floor

or kernel development from competition for water and nutrients. A “Sod and Strip” system that combines herbicide use with mowing of

grass is the most practical and widely used system of orchard floor management. Herbicides must be used effectively and properly to kill the weeds, to reduce chemical costs, and to protect the applicator and the environment. Routine cultivation is practiced in western portions of the state where orchards are flood irrigated. Compaction and erosion are potential problems from frequent disking or other cultivation practices.

Grazing livestock in improved orchard is practiced in Texas, but it is generally not recommended because of the potential damage to young trees, compaction of soil, and interfer-

ence with irrigation, spraying and harvesting practices.

### Fertilizer

Nitrogen is essential for good pecan growth. The first application should be at bud break in April with additional applications in May and June. When extremely heavy crops are set, nitrogen should also be applied in July and August. As a rule, 10 pounds of actual nitrogen are needed for 100 pounds of pecans set per acre in June. The number of nitrogen applications should be consistent with crop size. Young trees should receive very small but frequent applications of nitrogen in response to growth. When fast growth occurs, add additional applications until early June. Potassium fertilizer may be needed once every five years on deep sandy soil if leaf levels fall below 1% potassium content. Phosphorous fertilizer is typically not needed in Texas.

**Foliar Zinc Sprays** are essential for pecan growth in Texas. Soil or drip system applications of zinc are not effective. Zinc is needed for leaf expansion, so applications should be made frequently in the early portion of the growing season for maximum growth. Two products, zinc sulfate wettable powder or liquid zinc nitrate, are used with equal success. Liquid nitrogen (32% urea ammonium nitrate) can be added to either zinc



Pecan tree exhibiting severe zinc deficiency ; bunched canopy , small leaves , & limb dieback

type to improve uptake into the foliage. Very fast growing young non-bearing trees need zinc sprays at least every 14 days from bud break in April to early June. Mature bearing pecan trees respond best to 5 applications of zinc. The first 3 applications should be made one week apart beginning at bud break. A 4th application should then be made 2 weeks later followed by a 5th application 3 weeks later. Zinc sulfate will kill most other plants if the spray contacts their foliage; consequently, zinc nitrate is preferred for urban or landscape use.

### Diseases

Pecans are susceptible to a number of foliage, fruit and root diseases in Texas. Pecan Scab is the most important fungal disease in Eastern Texas. Control may require multiple fungicide applications to the tree canopy each season if rainfall is

prevalent. All growers may encounter Downy Spot, Powdery Mildew, Shuck Dieback, Stem-End Blight, Bacterial Leaf Scorch, among others. Root-knot nema-



Pecan scab on pecan shuck

todes, Cotton Root Rot, and Crown Gall are potential problems in some regions of Texas.



Damage from pecan nut casebearer larvae

## Insects

Insects are an expected occurrence in Texas pecan orchards. Pecan growers must become familiar with the control strategies for four serious fruit-attacking pests, as well as numerous foliage feeders. Borers may attack trunks, limbs and roots of pecan trees as well.

Integrated Pest Management for pecans is described in the Texas Pecan Handbook, and on the following websites.

<http://pecankernel.tamu.edu>

<http://pecanipmpipe.org>

<http://pncforecast.tamu.edu>

## Harvesting

Harvesting pecans in Texas must be done expediently to overcome expected delays from inclement weather and minimize depredation from varmints and birds (squirrels, bluejays, crows, turkeys). Pecan is very slowly perishable, but sprouting, embryo rot, darkening of kernels, and other problems develop as pecans remain in the field for many days. Traditionally, the pecan market prices become more volatile and may decline as the season extends, giving growers added incentive to harvest quickly. 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 pecans and associated sticks, leaves and other trash.
  - 3) Cleaners separate good pecans from trash.
- An intermediate step of sweeping or wind-rowing is performed for certain types of harvesters that are less maneuverable in the orchard.

**Processing** pecans immediately after harvest is needed to obtain a good early season price and



PTO –powered trunk shaker

to prevent kernel darkening, embryo rot, vivipary (sprouting), mycotoxins such as aflatoxin, and other problems related to moist pecans. Shucks not removed in the orchard by nature or the harvesting equipment are removed with dehulling equipment. In south Texas, where harvest is begun before the shucks are fully open to prevent vivipary, the shucks must be ground off in water with special equipment. Once de-shucked, poorly filled pecans are vacuum sepa-



PTO—powered pecan harvester



Machine-harvested pecans and trash before processing



Pecan cleaner and sacking operation

rated with a pop remover. Good pecans are dried from 15% moisture to only 4% as soon as possible using forced air. This can be in special drying boxes, false bottom peanut trailers, open-weave sacks, or on concrete floors. Drying time is greatly reduced by moving as much dry air over the pecans as possible.

### **Marketing**

Many pecan growers, particularly smaller producers, direct-market their pecans to the consumer in a retail store, in a catalog, on the internet, through fund-raising organizations etc. For these growers, pecan prices are set based on consumer demand for a fresh product

A wholesale market for pecans, based around approximately 25 major shelling companies is available to all growers. Price is affected by a number of global economic factors as well as the alternate bearing habit of pecan trees, supply and demand, supply and cost of competing nuts (walnuts, almonds) etc. Wholesale prices are often lowest when the national crop is large.

Wholesale market price is additionally affected by variety being sold and the sizing of the nuts, quality of the lot being sold, and presence of defects.

Commercial growers should learn how to conduct their own "hand test", which computes percent kernel by weight, percent fancy grade, and other price-affecting factors. The hand test procedure is demonstrated in many Texas counties annually as part of the Texas Pecan Show and Grading Demonstration, which culminates in a state show of the top pecans in Texas, displayed at the Texas Pecan Growers Association Annual Conference (<http://www.tpga.org>)

**Costs and Returns** for pecans in Texas vary greatly. Of the 67,500 acres of planted orchards, many seldom realize a profit because one or several orchard management factors critical to success is deficient. Approximately \$2,000 are required to bring one acre of pecans into production, not including the cost of the land, irrigation well, or special needs, such as wildlife-proof fencing. Once bearing, \$600 per acre are required for operating costs; therefore, production needs to exceed 600 pounds per acre if the pecan market price is at least \$1.00 per pound. This a reasonable target, since orchards can

produce from 1,000 to 2,000 pounds per acre per year in well managed orchards on good sites. The pecan market is currently strong and paying above \$1.00 per pound wholesale. However this is a market with a history of volatility and new growers should proceed with caution, investigating the market outlook for commercial pecans.

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

**Information** on pecan production can be obtained from the "Texas Pecan Handbook" which is available for a fee at the Texas AgriLife Bookstore (<http://agrilifebookstore.org>). The Texas Pecan Orchard Management Shortcourse is taught annually the last week of January at Texas A&M University in College Station. For registration information, contact Texas A&M University Conference Services.

### **Acknowledgments**

This document is adapted from "Commercial Pecan Orchards in Texas", (1997) authors George Ray McEachern, Larry A. Stein and Julian W. Sauls.