

TEXAS FRUIT & NUT PRODUCTION

Apples

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Introduction

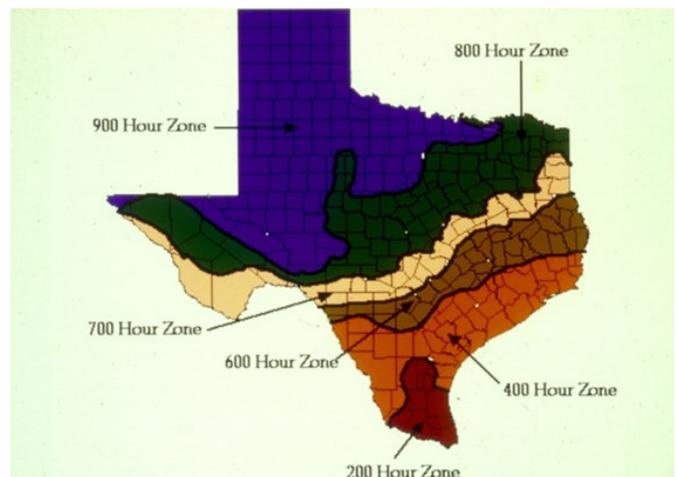
Although there have been numerous attempts to grow apples commercially in several parts of Texas, today, most successful production is centered in the Davis Mountains and the High Plains region near Lubbock. Ample winter chilling and a relatively dry growing season allow for a greater number of varieties to be



grown with less fungal and bacterial disease pressure. Apple trees prefer deep, well drained soil with a pH between 6.5 and 7.0. In north central Texas and the Hill Country, alkaline soils are prone to having apple production limited from Cotton Root Rot (*Phymatotrichopsis omnivora*). Other soil borne pathogens such as Collar Rot (*Phytophthora cactorum*) can also be problematic, but site selection, fungicides and rootstock selection can help overcome this disease. Because temperatures during fruit ripening are quite warm in Texas, poor fruit color on red varieties can be a prob-

lem for commercial producers in the wholesale market, but has no effect on in-hand eating quality for homeowner and local sales.

The major factor that limits selection of apple varieties is chilling requirement. Temperate fruit trees need a certain amount of winter chilling (traditionally, temperatures $<45^{\circ}\text{F}$) to break down internal growth inhibitors and allow for normal bloom and leaf emergence in the spring. Many commercial apple varieties grown in traditional commercial growing areas such as the Pacific Northwest, along the Great Lakes and New England, have chilling requirements between 1000-1600 hours with some varieties approaching 2200 hours. The highest chill hour zone in Texas receives from 800 to 1000 hours



Chill hour zones in Texas.

Like most temperate fruit crops, flower buds in apples are initiated the previous growing season, but finish fully differentiating in late winter in response to receiving sufficient winter chilling. Numerous ways of calculating chilling have been devised, but the old standard method is to measure the number of hours of winter chilling a specific location receives at or below 45° F. Once the chilling requirements is satisfied, warm weather triggers an increase in plant growth promoters and triggers normal bloom and leaf canopy development.

When chilling requirements are too low for a given area, bloom can occur too early in late winter or early spring and subsequent spring freezes and frosts can result in crop loss. In years where accumulated chilling is not enough to adequately break dormancy, buds fail to fully develop and bloom over a late and protracted period. Leaf buds have chilling requirements as well, and low chilling years result in late canopy development. Insufficient chilling is very stressful on trees and the stress can be cumulative. Back-to-back low chilling years can actually kill un-adapted apple trees. Consequently, choosing varieties with appropriate chilling requirements is essential for long term tree health and productivity.

Apples are strongly cross pollinated, so more than one variety with overlapping bloom dates (similar chilling requirements) are necessary for good fruit production. Although some apple varieties can grow and produce with a moderate amount of chilling, all moderate chilling varieties perform best in years with greater than average chilling accumulation. In high chilling years, bloom is less protracted and fruit set is more uniform. This is important in optimizing a grower's ability to appropriately thin fruit to prevent over-cropping and to optimize disease control efforts.

Varieties for Medium and High Chill Areas in Texas

'Gala'- Originated in 1965 and is across between 'Golden Delicious' x 'Cox's Orange Pippin'. The fruit has red striping on golden skin



'Gala'

which gives the fruit a red-orange color. The flesh is crisp, dense, and aromatic with excellent quality

that stores well. Large, vigorous tree which shows some self-fertile characteristics, but should be pollinated with other varieties with similar chilling requirements. Ripens about 140-160 days from bloom and requires at least 600 hours of chilling. Many growers in Texas struggle to consistently produce large fruit from 'Gala' or any of its sports. It appears that water is the key to sizing these varieties and high rainfall seasons produce good sized apples without compromising in-hand eating quality.

'Imperial Gala'- Medium sized sport of Gala, oval to round bright scarlet over yellow ground colored fruit. Extremely firm, very juicy and distinctly aromatic with yellow, creamy flesh.

'Royal Gala'- Developed in New Zealand. Matures to a bright overall red color rather than the orange red blush of 'Gala'. Medium size, conical to round fruit with bold red stripes over a yellow background. Firm, juicy, fine textured, yellow-white flesh with sweet, slightly tart flavor. Compact growth habit, prolific bearer which requires heavy thinning to maintain fruit size and prevent biennial bearing.

*Note, Gala, Imperial Gala and Royal Gala will not serve as adequate pollinizers for each other.

'Mollie's Delicious'- Introduced in 1966. Summer apple not to be confused with 'Red Delicious' strains. Attractive, large fruit with unique, slightly conic shape. Light yellow background about half covered with a red blush and high quality flesh with good flavor that stores for about 10 weeks in refrigerator-



'Mollie's Delicious'

tion. Vigorous, productive tree and the fruit tends to set in clusters, requiring 2-3 pickings. Excellent pollinator with a protracted bloom period. and some disease resistance It requires 450-500 hours of chilling.

'Pink Lady'- A cross between 'Golden Delicious' and 'Lady Williams' from the Western Australian apple-breeding program. Oblong, green fruit turns yellow at maturity and is overlaid with pink or light red. Fine-grained, white flesh with thin skin, that bruises easily. Hard to train and prone to producing blind wood. Ripens in October and has a chilling requirement similar to Granny Smith (500-600).

'Fuji'- Developed in Japan and introduced in 1962. Cross between 'Ralls Janet' x'Red Delicious'. High quality apple with a marginal commercially acceptable appearance.



'Fuji'

Medium sized fruit with a tall, rectangular shape, yellow-green skin with orange to red stripes. Crisp, juicy, white flesh with good texture that requires about 140-160 days from bloom to harvest. Ripens mid-summer and has good shelf life in cold storage. Vigorous, productive, somewhat bushy tree that needs some annual detailed pruning. It is susceptible to Bitter rot and red mites, but is heat resistant and requires approximately 600 hours of chilling.

'Mutsu' ('Crispin')- Developed in Japan in 1948 and is a cross between 'Golden Delicious' x' Indo'. Large, round, yellow fruit with crunchy flesh and good juice and tartness with a distinctive, delicate, spicy flavor. Good dessert and processing apple, also excellent for applesauce and cider. Large, spreading, vigorous and reliable tree. Resistant to powdery mildew but susceptible to scab, blister spot,



'Mutsu'

and bitter rot. It requires approximately 600 hours of winter chilling.

Varieties for Lower Chill Areas of Texas

For areas receiving approximately 400 hours of winter chilling there are two varieties that will grow and fruit reliably.

'Anna'- is an Israeli selection with a chilling requirement of approximately 400 hours. It has relatively large fruit with a light greenish-



'Anna'

yellow skin with a slight red blush. The fruit is sweet, slightly tart, crisp with a creamy white flesh. Anna Apples are a good southern choice for fresh eating, apple sauce, or homemade pies. The trees produce at an early age, stores very well and typically ripens in late June.

'Dorsett Golden'- produces a medium size fruit that is firm, smooth, has crisp flesh and has a sweet and tart flavor. The fruit has yellow skin with an orange-red blush and ripens in early July. 'Dorsett Golden' has a chilling requirement of approximately 350 hours and serves as a reliable pollinizer for 'Anna'.

Selecting a Rootstock

Many years ago, most apple orchards were planted on seedling 'Red Delicious' root systems. The trees were tall, inefficient yielders and very slow to come into production. Rootstocks were first used in apples to overcome wooly apple aphid, a soil-borne insect that kills the roots of susceptible apple root systems. The insect has an above-ground form that is readily identified and controlled, but damage done to the root system is difficult to diagnose



until the damage has been done. In the development of rootstocks in the mid-20th century some of the hybrids also were found to dwarf the scion or fruiting variety which made trees more efficient at intercepting sunlight and producing high quality fruit.

In most cases, the degree of dwarfing a specific

rootstock imparts is positively correlated with precocity, or the ability of a tree to come into production at a younger age. Decisions on tree spacing and trellising are based largely on the degree of dwarfing caused by the rootstock.

Primarily as a means of combating a soil-borne insect pest, wooly apple aphid, a series of rootstocks have been developed that impart varying degrees of dwarfing to apple trees. The advantages of dwarfing stocks are that they are much more space efficient, dwarfing stocks tend to come into production much earlier than standard size trees, and that fruit can be easily harvested.

Extremely dwarfing stocks such as EM 26 and M9 require a support structure such as a trellis because of shallow rooting characteristics. In areas where space is limited, the expense of a small trellis may be justified when including apples in a home planting. MM106, an intermediate dwarfing stock should generally be avoided because of susceptibility to poorly drained soils and the soil-borne fungal pathogen, *Phytophthora cactorum*, or Collar Rot.

Rootstocks that are somewhat dwarfing such as M7 or MM111 are more efficient and precocious than standard seedling stock and do not need a support system. For these reasons, these two stocks are common among both commercial and home plantings.

Pruning & Training

Apples have a naturally erect growth habit and are traditionally trained in a central leader system. The central leader system resembles a Christmas tree shape with a dominant central trunk and an array of scaffold limbs every four to five feet. As with any fruit training system, the goal is to minimize shade and effectively

Rootstock	Size (% of Standard)	Remarks
EM 26	40% to 50%	Semi-dwarf rootstock. Not as precocious as, but more well anchored than M9. More cold hardy than other dwarfing stocks but susceptible to collar rot
EM 7	50%	One of the most popular free-standing stocks in the commercial industry. Tolerates a wide range of well drained soils and is moderately resistant to collar rot. Tends to be somewhat prone to suckering (producing shoots from the ground or below graft union.)
MM 106	60% to 70%	Well anchored and deep rooted stock. Does not sucker but is very susceptible to collar rot.
MM 111	75%	Better adapted to heavy soils and resistant to collar rot. Considered by some to be a standard sized tree but is more precocious than seedling Delicious stock. Rather tolerant of wetter soils and is commonly used in re-plant situations.

intercept sunlight to manage vigor, minimize disease pressure and produce high quality fruit. Scaffold limbs are strongest when they are trained to a 90° angle. In some cases, spreaders or limb weights are used to achieve



these ideal angles. Some apple varieties produce spurs or specialized lateral fruiting branches that serve as perennial fruiting sites. Spur type trees tend to be more compact and easier to train and bring into production than non-spur types.

Numerous younger Hill Country apple orchards are trellised, but trellising is an option, not a necessity. Trellis support is needed for severely dwarfing rootstocks like M 9 because of shallow, brittle, poorly anchored root systems. Trees on less dwarfing rootstocks such as MM 111, M 7 and MM 106 are best grown freestanding.

Nutritional Considerations

Soil samples should be collected and analyzed prior to orchard establishment. If soil pH is too low, lime can be applied to make the soil more neutral in its acidity and alkalinity. If elements that move very slowly in the soil such as potassium and phosphorous are needed, they should be applied and incorporated prior to planting. Nitrogen is the element that will most probably be needed every year. Although high nitrogen inputs are probably not necessary, small, frequent applications will promote early canopy development and maintain leaf

health throughout the fall. Nitrogen applications should probably end no later than August 1 of each year to enable vegetative tissue to properly mature and become hardy for winter. Even on soils with abundant calcium, calcium deficiency is common on the fruit of apple trees grown in Texas. It appears that developing leaf tissue is an extremely strong photosynthetic "sink" and little calcium taken up by trees from the soil is transported to the fruit. The resulting calcium deficiency in fruit can cause a number of different maladies all of which affect the integrity and storage quality of apples.

Bitter Pit- Areas of brown, dry tissue developing initially in fruit flesh are characteristic of



Bitter pit disorder

bitter pit. The disorder often results in discoloration and browning of accompanying peel and the formation of a surface pit. Affected areas are usually most numerous toward the calyx end of the fruit and symptoms typically appear prior to and following harvest.

Lenticel Blotch Pit- Small, dark, necrotic areas



surrounding fruit lenticels that subsequently develop slight pits are characteristic of this nutritional disorder. Onset usually appears after storage begins,

but may occur on mature fruit just prior to harvest.

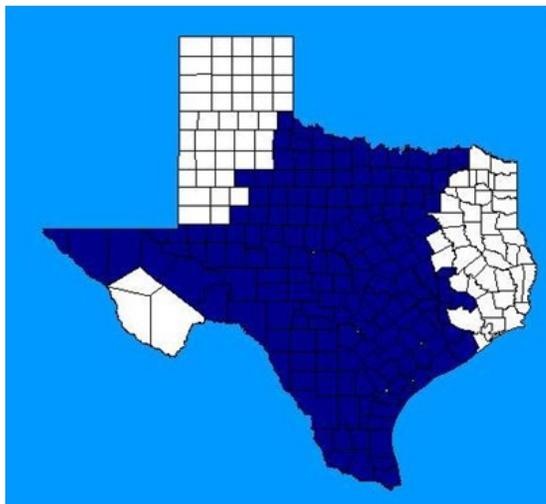
Calcium deficiencies are more severe when trees are under environmental stresses such as high heat or drought. Calcium sprays during fruit development and proper maturity at harvest can reduce the incidence of both of these disorders. Calcium nitrate and calcium chloride can be used to supply needed calcium, but check with your local extension horticulturist to determine the timing, rate and risks associated with these sprays under some environmental conditions.

Managing Cotton Root Rot

There is no diagnostic test to let a grower know if there is Cotton Root Rot present on their site. Having cotton previously planted on that site likewise has no bearing on whether the disease may be problematic or not. There are no known resistant rootstocks and to



Pulling up trees killed by Cotton root rot.



Counties with probable occurrence of Cotton Root Rot in Texas (S.D. Lyda).

date, no fungicides have proven effective in preventing losses from Cotton Root Rot in apple orchards. The best management tactic is to choose sites in areas where the pathogen is not

known to occur or to choose slightly acidic new orchard sites. Neutral or acidic soils severely limit the potential losses from this pathogen.

Because of the high calcium bicarbonate exchange capacity of most high pH soils, attempts to acidify these sites with high application rates of sulfur have largely been unsuccessful. Likewise, biological agents or organic supplements which are sold as "natural" solutions to Cotton Root Rot may work on shallow rooted annual crops, but delivering and maintaining sufficient levels of these agents deep in the soil profile is virtually impossible.

In all susceptible fruit crops there is strong movement of this pathogen from tree to tree or vine to vine. Having apple trees in high density plantings exacerbates the problem within an orchard once infection begins. This has especially been true on very dwarfing stocks where trees are commonly planted four or five feet apart within the row. Some apple growers have transitioned toward less dense plantings, even on dwarfing stocks, as a way of keeping the root systems of trees separated and managing Cotton Root Rot

Insect & Other Disease Problems

Among deciduous fruit crops grown in North America, apples are perhaps the most pesticide spray-intensive of any orchard crop. A multitude of fungal pathogens such as powdery mildew, bitter rot, black rot, and apple scab (to name a few) can cause injury to foliage, fruit and woody tissue. Application of conventional fungicides and insecticides is common among commercial growers, and non-commercial growers in more humid regions of Texas will struggle to grow clean fruit without spraying.

Fireblight, caused by the bacterial pathogen, *Erwinia amylovora* is problematic in Texas, causing twig and limb dieback or even death of entire trees. Humid portions of the state are more prone to have serious fireblight damage on apples. Varieties differ in their resistance to the disease, and susceptible varieties should be avoided. The disease is managed by application of agricultural streptomycin during flowering, pruning of infected limbs, reduced

nitrogen fertilization to slow vegetative growth, and growing resistant varieties.

Numerous insect pests including codling moth, several stink bug species, tarnished plant bugs, apple maggot, flat-headed apple tree borer and scale insects can also cause severe damage to trees and fruit.

Bees and other beneficial are important pollinators and growers need to be extremely cautious about applying insecticides, especially during bloom. Because pesticide products and their labeling change frequently, contact your county AgriLife Extension Office for current recommended pest management suggestions.

Orchard Floor Management

Like all other perennial crops, apples compete with native vegetation for sunlight, nutrients and water. Failure to control weeds in new apple orchards is the single greatest limiting factor to orchard establishment. While cultivation has long been thought to be the most cost-effective and environmentally sound way of managing weeds, potential losses of soil, and the detrimental effects on tree roots leaves cultivation as the method of last resort. The majority of a tree's feeder roots are in the top six inches of soil. Cultivating weeds also cuts feeder roots leaving trees unable to absorb either water or nutrients. Erosion of soil from a cultivated orchard results in the loss of a valuable environmental resource.

There are numerous non-restricted, contact herbicides labeled for weed control in apple orchards. Some of these are selective against only grasses while other manage both grasses and broadleaved weeds. Unlike many of the chemical herbicides used in the past, these newer chemistries are relatively safe to apply and have nominal impact on the environment.

Organic and inorganic weed barriers are popular today for weed control around fruit trees, especially in landscapes or small home orchards. Weed barriers do an acceptable job of controlling competitive vegetation, but organic mulches have many added benefits. In addi-



Inadequate weed control in apple tree rows.

tion to managing competition, organic mulches moderate soil temperatures, conserve moisture, and improve soil structure. To be effective, organic mulches need to be approximately six inches thick and reapplied regularly as breakdown and natural erosion dictates. To help prevent infection from collar rot, organic mulches should be no closer than one foot from the trunk.

For More Information

<http://aggie-horticulture.tamu.edu/fruit-nut>