



Texas Fruit and Nut Production

Olives

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The olive is an exotic fruit crop in Texas. Olives are native to the Mediterranean Basin, which usually has mild, rainy winters and hot, dry summers. In contrast, Texas sometimes has severe winter freezes that can kill olives to the ground.

The best area in Texas to attempt commercial olive production is in the southwest region north of Laredo and southwest of San Antonio (known as the Winter Garden). The late Earnest Mortensen of the Texas Agricultural Experiment Station brought olive trees to the Winter Garden in the 1930s. Some of Mortensen's trees survive today.

Although research by Texas A&M University has indicated that olives could be grown for fruit production in large parts of East, Central, and South Texas, those studies also found that growers should expect severe winter freezes to kill trees to the ground about 3 years of every 10.

Over the past 10 to 15 years, olive plantings have increased in Texas, primarily southwest of San Antonio and in the Hill Country. Not all of these plantings have been successful. In North and West Texas and the Hill Country, freezing temperatures occur too often to allow for olive cultivation. Extreme South Texas does not typically experience enough cool weather for the olive to set fruit. There, it may be grown as an ornamental.

Most of the olives grown commercially in Texas have been pressed for oil (Fig. 1). Some growers and hobbyists have also



Figure 1. In Texas, 'Manzanilla' olives are primarily pressed for oil.

successfully produced table olives, which must be brined to remove the fruit's natural bitterness.

The olive is related to the desert olive (*Forestiera sp.*) and the American wild olive (*Osmanthus sp.*), which are not edible. It should not be confused with the Russian olive (*Elaeagnus angustifolia*) or the anacahuita (*Cordia boissieri*), which is sometimes called the Texas or Mexican olive. These plants belong to different botanical families.

Climate

The best olive production and quality occur where conditions are similar to those in the Mediterranean: mild winters and long, warm, dry summers. The tree's growth begins in the spring after average temperatures rise to 70°F and continues until temperatures drop below that point in the fall. Unlike many other temperate fruits, olives are evergreen trees that do not experience a winter dormancy period.



Figure 2. Young trees severely damaged by cold.

Olive trees freeze in extreme cold (Figs. 2 and 3). For the above-ground portions of trees to survive, they must be protected, especially during the first 3 years of establishment (Fig. 4). Their cold hardiness is like that of citrus, improving with tree age and increased trunk size:

- Young trees may be killed when the temperature drops below 25°F.
- The leaves and small stems on mature trees can be damaged at 17°F; more severe damage occurs at 12°F.
- Mature trees can be killed to the ground when the temperature drops below 12°F.

Freezes in Texas are unpredictable—they can occur unexpectedly in the fall, spring, and winter. The survival and extent of freeze damage of olives depend on several factors, including seasonal timing, warm versus cool day/night temperatures before the freeze, and the depth and duration of low temperatures experienced. Less damage occurs when the temperature decline is gradual rather than sudden and steep.

The tree's winter survival can be affected by late-summer and fall growing conditions. Trees may be more likely to sustain freeze damage if they were



Figure 3. Bark splitting from freeze injury.

given too much water and fertilizer late in the growing season, causing them to continue growing too long.

Mature trees can regrow from the underground crown after a severe freeze.

Once established for 3 to 5 years, olive trees become more resistant to freeze damage. However, they can lose their cold hardiness when temperatures fluctuate in the winter. Texas climatic conditions are erratic, particularly in midwinter. In many areas of Texas, temperatures can rise to the 60s in January and upper 80s to 90s in February, only to be followed by severe cold in March. This pattern may result in severe tree damage or death.

Fruit set can be seriously hampered by rain, near-freezing temperatures, very high humidity, and/or hot, dry winds during bloom in the spring.

Unlike most fruit trees in Texas, the olive does not set fruiting buds in the fall.

Instead, the tree sets flower buds during the winter only after being exposed to cool nights (35 to 50°F) and mildly warm days (less than 80°F). This warm day/cool night exposure is called *vernalization*; varieties differ in the temperature ranges required.

Olive trees bear two types of flowers: staminate and perfect. Staminate flowers contain only male parts. Only perfect flowers can become fruits.

Bees and other insects play a minor role in olive pollination; wind moves most of the pollen from tree to tree. Although most olive varieties are self-fertile, some varieties are naturally self-incompatible, requiring cross pollination with another variety to set fruit. Self-incompatibility can also occur in some varieties as a result of high air temperatures.

Soil

Olive trees grow in a wide variety of soils, from sands to clays, and the pH ranges from 5.5 to 8.5. They also have better tolerance to soil and water salinity than many commercial fruit crops.

Because olive trees have fairly shallow root systems, the soil need not be deep. However, it must be well drained. For opti-



Figure 4. A 3-year old olive tree.

mum production, the site should have 3 to 4 feet of unstratified (unlayered) soil.

Clay or rock layers and/or different soil textures can hinder water drainage and cause the olive trees to drown out. Of concern are not the dry periods, but rather those when the area gets an abundance of water from either irrigation or rainfall. If the groves remain saturated for an extended period, the trees may die.

Varieties

Many olive varieties have been tried in the state, with cold hardiness being the key selection factor. Table 1 lists the varieties that have exhibited better survival and production in Texas.

TABLE 1: Olive varieties that survive and produce best in Texas.

Variety	Height at maturity	Cold hardiness	Pollinizer	Uses	Notes
'Arberquina'	12–15 ft	Very good	Self	Oil is very sweet with a delicate almond overtone; the fruit can be brined also	The cultivar planted most in Texas to date; small fruit; from Spain
'Arbosana'	12–15 ft	Moderate	'Arberquina'	Oil or table olive	Spanish variety; good quality
'Frantoio'	20+ ft	Low	Self	Oil	Has grown well in many areas of Texas; productive in some areas; in others, only a handful of olives produced per tree; from Italy
'Manzanilla'	<20 ft	Moderate	'Pendolino' or other pollinizer	Primarily a table olive; in Texas, fruit are usually pressed for oil	Most canned black olives are of this variety; widely planted in the United States, Spain, and the Middle East
'Mission'	<20 ft	Good	Self	Oil or table olive	Developed in California
'Pendolino'	20+ ft	Moderate	N/A	Oil	Has performed poorly in many areas; the only reason to plant this variety is solely as a pollinizer for 'Manzanilla'; from Italy
'Picual'	20+ ft	Moderate	'Manzanilla'	Oil tends to be pungent and has a long shelf life	Yields in Texas have been disappointing; the No. 1 variety in Spain for oil

Of the varieties listed, not all perform equally well at all locations. Cases of very different variety performance even among orchards of close proximity have been noted.

Site preparation

Prepare the orchard site 12 to 18 months before planting the trees. Kill perennial weeds and grasses, and break up any hard layers by deep chiseling or ripping down (using a long shank pulled by a tractor) the planting rows.

Have the soil tested, and apply any needed amendments before planting so you can incorporate them more easily in the planting site.

Install an irrigation system. Although the trees should be watered with a tank and hose at planting, it is impractical for ongoing establishment and maintenance of the orchard.

Planting

The amount of space needed between olive trees depends on the variety and the anticipated harvest method—hand versus machine. Traditional spacing for most varieties where row harvesters are not used is 30 feet by 30 feet, or 48 trees per acre (Fig. 5).

Varieties with more compact growth, such as ‘Arberquina’ (Fig. 6) and ‘Arbosana’, could be spaced at 25 feet by 25 feet, or 70 trees per acre. Where over-the-row harvesting is planned, plant hedgerow trees 5 to 11 feet apart in the row, with 13 to 22 feet between rows. Mechanical harvesting equipment for olives is expensive and requires higher tree density and fruit production per acre.

Space the trees to ensure that each gets adequate sunlight—they bear fruit only on 1-year-old wood on the outer periphery of the trees. Shoots in full shade will not flower or produce fruit. Crowding leads to shading and poor production.



Figure 5. A mature, bearing olive grove.



Figure 6. ‘Arberquina’ is the cultivar planted most in Texas.

Growers often plant trees closer than normal, with plans to remove temporary trees as the permanent trees mature.

The ideal time to plant olive trees is in early spring after the danger of frost has passed. Make the hole large enough to accommodate the root ball and at the same depth that the tree grew in the container.

At planting, cut the tips off the branches at 30 inches to stimulate the tree to produce lateral, or secondary, branches. Water the trees thoroughly at planting and regularly afterward.

Protect the trunks of young trees from sunburn; many growers use tree shelters or grow tubes.

Irrigation

Although the olive is drought tolerant, it grows best when irrigated. Mature olive groves should be irrigated at a rate of about 1 acre-inch per week.

To mature properly, olive fruit need water, and the tree needs water to store reserves for a potential crop next year. Some growers cut back on water at this time hoping to improve oil quality. However, if water is curtailed and then a deluge of rain falls, the quality will be lower than if the trees had received regular irrigation throughout this period.

Avoid overwatering and waterlogging the roots.

Fertilization

Olives are tolerant of low soil nutrition and can grow well in infertile soils. Nitrogen is needed annually to support growth and fruit production. Depending on their size, mature trees need $\frac{1}{2}$ to 2 pounds of actual nitrogen per year. Rare but possible are deficiencies of potassium and boron.

Fertilize in the spring when new growth begins. If growth is poor, more fertilizer may be applied in the summer. Excessive nitrogen will stimulate growth at the expense of fruiting (both the amount and quality of fruit), and luxuriant late season growth is more susceptible to freeze damage.

Training and pruning

Olive trees require little training. During the first growing season, tip-prune any long, whiplike trunks at 30 to 36 inches in height to encourage the formation of lateral-growing scaffold branches on the main trunk.

To prune standard (non-hedged) olive trees, thin out dead wood and dense areas that may have become unproductive.

High-density orchards that are hedge-pruned are pruned annually beginning in Year 4 or 5 to provide access for over-the-row harvesters.

To reduce the risk of freeze damage, delay all training or pruning until early spring. Pruning can stimulate growth of olive trees, which do not go dormant but instead stop growing actively in the winter.

Freeze protection

Most commercial olive trees are grown from cuttings rather than from grafting onto seedling rootstocks. This provides an advantage in climates that have harsh freezes. Trees grown from cuttings that are frozen to the ground usually grow back from the ground and will be true-to-type, provided that the crown of the tree does not also freeze.

Mound, or “bank,” additional soil around the base of the tree to ensure the survival of the crown and any above-ground portions of the trunk or lower limbs that are covered in soil. Create these soil banks in late November; allow them to stay in place through the winter; and remove them by shoveling or raking in early to late March, once threat of serious freezes has passed.

Mounding with hay, straw, mulch, or fabrics is not as effective as with soil because soil conducts heat better.

Soil banks are usually not needed for crown protection once the trees have reached 4 or 5 years old and have made good trunk caliper (diameter at 12 inches above the ground) growth. However, growers who wish to continue protecting the trunks may continue to bank them with soil or use commercial trunk wraps made from Styrofoam or other insulating materials.

Irrigation water can be used to protect olives from freeze damage where growers have microsprinklers and ample water available. Water must be applied continually with sprinklers during a night when freeze damage is anticipated. However, if the right amount of water is not provided continually to each tree, serious injury will occur. If you are considering using irrigation for freeze protection, consult your county AgriLife agent or a licensed irrigator with experience in freeze protection of plants.

Weeds

Use mulch and/or herbicides to prevent competition from weeds and grass. Because of the shallow growth habit of olive feeder roots, do not plow or cultivate the soil to remove weeds.

Diseases

Although stress from cold or heat has been the main cause of tree death in Texas, many diseases also attack olives. One of the most damaging is cotton root rot (*Phymatotricopsis omnivora*), a soilborne fungus that is prevalent in the high-pH soils of southwest Texas.

To help protect against cotton root rot, keep the trees healthy and provide good growing conditions. This fungus more readily affects plants that are weakened from water stress or other deficiencies. Control weeds around the trees to reduce the competition for water and nutrients and to minimize additional food supply for the fungus, which has many alternate hosts.

Texas olive trees have not been affected by two diseases that commonly attack olives in other parts of the world: *Verticillium* wilt and olive knot. Olive knot has been found on other plant species in Texas but not on olive.



Figure 7. Coloration in maturing olive fruit.

Fruit and foliage diseases have been minimal in Texas as well, but wet springs and summers can hinder fruit set and lead to foliage and fruit issues.

Mechanical damage from string trimmers has led to girdling and death of trees.

Insects and vertebrate pests

The main insect injuries to olive fruit in Texas have been caused by leaffooted bugs and/or stinkbugs. Spray insecticide directly on the trees or protect them indirectly by spraying on “trap crops,” which are plants that attract agricultural pests, usually insects, away from nearby crops.

Examples of trap crop plants for olives in Texas include black-eyed peas, pearl millet, and sunflower. Plant them in time to attract inspect pests during the critical fruit-development period.

Even though the most damaging olive insect worldwide is scale, it has not been a serious problem so far in Texas. Lesser problems here have been associated with nematodes, borers, and thrips.

Deer have been a serious deterrent to tree growth in many areas, making high fences a necessity for commercial production.

Harvest

Under the proper conditions, an olive tree will begin bearing a harvestable amount of fruit at about 4 or 5 years old. The fruit is borne on panicles, or fruiting branches, that grow from buds above the point where the leaves join the stem on the previous season's growth.

Olive harvest typically begins in mid to late September or early October. A mature olive at harvest can be completely green to totally black, depending on the variety. Most fruit are harvested as they begin to color (Fig. 7).

Some growers delay harvest to allow the crop to reach the desired size and weight; however, if harvest is postponed too long, the crop value will be reduced by poor fruit quality.

In most cases, olive crops are removed from the trees by hand. A harvester moves a cupped, gloved hand down the limb in a milking action. The olives drop either into a bag or onto a sheet spread on the ground around the tree.

If you will be using hand harvesters, you must have a well-trained labor force available to remove the fruit within a 2-week period. This method harvests about 95 percent of the fruit, with about 5 percent cullage.

Larger operations must harvest the fruit mechanically, using a shaker that vibrates the tree and dislodges the fruit. The challenge is to remove the fruit without damaging it or the tree. Shakers harvest only about 75 percent of the fruit, with up to 20 percent cullage.

Regardless of how the fruit is removed from the tree, it must be processed promptly because the fruit deteriorates fast.

When fresh, the fruit is not palatable because it contains phenolic compounds and oleuropein, a bitter glycoside. To be used as food, olives must be processed—either pressed for the oil or treated with lye and salt to produce the canned or preserved table fruit.

The fruit processed in California has almost all of the bitterness removed; that processed in the Mediterranean basin area may be left somewhat bitter.

Economic considerations

The high cost of olive oil in grocery stores and the health benefits associated with eating olive oil have led many to believe that producing Texas extra-virgin olive oil is lucrative. However, the costs to produce olive oil are high and the competition fierce. Depending on the cultivar, it takes from 75 to 125 pounds of olives to produce 1 gallon of oil.

Olive oil marketing is complicated. The use of the term *extra virgin*—which is generally assumed to be pure, high quality, and mechanically, rather than chemically extracted—is not legally enforced globally.

Olive oil producers/retailers in the United States may certify their olive oil through the U.S. Department of Agriculture (USDA). The USDA Standards for Grades of Olive Oil and Olive-Pomace Oil, passed in 2010, defines *extra virgin olive oil* as having excellent flavor and odor and free fatty acid content of not more than 0.8 grams per 100 grams (0.8 percent).

U.S. Customs laws do not prevent an oil product sold in the United States from saying “imported from Italy (or any other country)” on the bottle, regardless of where it was produced, as long as the real country of origin of the product is also shown somewhere on the same side of the bottle.

For more information

Ferguson, L, G. S. Sibbett, and G. C. Martin. 1994. *Olive Production Manual*, University of California, Oakland, CA

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