Botany

The pecan (Carya illinoensis) is a native species found along the lower Mississippi River Valley and the river bottoms of Texas and northern Mexico. This is a large deciduous tree also cultivated extensively throughout the south.

The tree produces both pistillate (female) and staminate (male) flowers (Figure 1). Pistillate flowers are borne terminal on growth of the current season and nuts normally appear in clusters of 2 to 8. Staminate flowers in catkins (Figure 2) are borne on wood of the previous season, at the base of new shoots and sometimes on 2 year-old shoots.

Adaptation

Pecan trees are found in practically every county in Florida. The major production areas are the north and northwestern parts of the state. Tree growth is often satisfactory in the southern half of the peninsula but nut production is relatively low because of higher winter temperatures, higher rainfall and increased disease problems.

Planting the Orchard

Varieties

More than 175 varieties have been named of which only a few are commercially acceptable (Table 1). A pecan variety should come into bearing early, be prolific, produce consistently and be at least
moderately resistant to scab to be commercially acceptable. Nuts should be medium to large in size with shells that crack easily and plump straw-colored kernels of good flavor and quality.

Most varieties require 4 to 7 years under good orchard management to begin bearing and 7 to 12 years to produce a commercial crop.

Higher market prices are obtained for large thin-shelled nuts with high-quality kernels. Large nuts are in particular demand for the in-shell trade. However, most pecans go to shelling plants. Consequently, heavy bearing varieties which produce small to medium sized nuts of good quality are in demand. Poor-quality nuts, regardless of size, bring low prices and may be difficult to sell in years of heavy production.

All of the varieties described below as well as many others are being grown in some parts of Florida. Commercial growers should select those which give best results in their immediate localities and not plant more than 3 or 4 varieties. Notably scab-resistant varieties should be selected for dooryard or small orchard culture, since these trees are likely to receive less attention as to disease control.

Pecan varieties, in general, are designated as Western, those having their origin in the western part of the pecan belt and Eastern, those originating from eastern Texas eastward. It is not advisable to plant varieties of the Western group in humid areas, as most are highly susceptible to pecan scab. However, most of the Western varieties produce nuts at an early age and may be planted where a rigorous spray program to combat scab is followed.

Stuart is probably the most widely distributed variety throughout the pecan belt. It is one of the most resistant to scab, although trees in certain areas have been severely infected in recent years. The tree is upright, often attaining considerable height with only a slight spread of branches. The twigs are light gray. The leaves are firm and not very dense. Growth is moderate except on fertile locations where annual twig growth may be two or three feet. Trees are often quite delayed in quantity production but produce rather consistently in later years. They are moderately productive and fairly regular in bearing on the clay soils in northwestern Florida with adequate nutrition.

The nuts are medium to large, very attractive with well-defined markings, oblong to slightly obovate, and regular in shape. They show up well in commercial packages. The shell is moderately thick but cracks easily. The kernel is plump and has good quality and flavor, but breaks easily when removed from the shell (Figure 3). Stuart is planted extensively over northern and western Florida. It originated in Jackson County, Mississippi.

Curtis is highly prized in the eastern part of the pecan belt. The tree begins to bear at a fairly early age and is moderately resistant to scab. Crops in heavy ("on") years are sufficient to give a good average yearly production. The tree is somewhat dwarf, with a slight spreading upright growth and the upper parts of the branches bend outward.

The nut is small to medium, larger at the base and tapering to the apex, with a slight curve to one side (Figure 3). The shell is thin, cracks easily, and yields a plump kernel of high quality and excellent flavor but sprinkled with dark specks, which do not affect the quality on the surface. Curtis originated in Alachua County, Florida.

Desirable originated at Ocean Springs, Mississippi and has been quite widely disseminated by the U. S. Department of Agriculture. It has had only limited tests in Florida but appears promising. The tree is rounded with a moderately open type of growth and begins to bear at an early age, is prolific, and produces quite regularly. The nuts are large, crack easily and usually fill well. The sides of the nuts are slightly depressed and uneven (Figure 4).

Figure 3.

Figure 4.
Elliott has been propagated for more than 20 years but never widely disseminated. It has been grown in a few orchards in the northern part of Walton County, where it is prized highly, and is now being planted across the pecan belt and in Mexico. The tree is vigorous but slow to attain large size. It has a rounded symmetrical top with numerous terminal twigs, medium size leaves with thin leaflets which are decidedly curved and apparently resistant to scab. The tree is fairly precocious, prolific and generally a consistent bearer. The nut is small with a rounded base, pointed apex, partial markings, plump, smooth straw color and a medium thick shell. It is of excellent flavor and quality and very good for cracking purposes (Figure 4). Elliott originated in Santa Rosa County, Florida.

Success is subject to scab and requires a spray program to insure production. It should be planted only on the heavier soils, with an adequate supply of plant food and moisture, as production is variable when these requirements are not met. It has been planted extensively in northern and western Florida. The tree is moderately vigorous, with a funnel-shaped top and branches coming out uniformly around the trunk. It begins to produce nuts at a moderately early age and is fairly regular and consistent in bearing but tends to overbear at times. The nut is large, wedge-shaped, with one lobe at the apex slightly depressed and moderately thick shelled. It cracks well and the kernel is plump, of satisfactory color, and good quality and flavor when grown under proper conditions (Figure 5). Success originated in Jackson County, Mississippi.

Mahan has been widely disseminated throughout the pecan belt since 1926. The tree is vigorous with a symmetrical, well shaped top and thick heavy foliage. The leaves have unusually large leaflets. The tree is fairly precocious and a consistent producer when grown under suitable conditions. It is susceptible to scab, which may become severe when the weather is favorable for scab development, and will require spraying. The nut is very large (Figure 5), with general shape and markings somewhat similar to Schley. The shell is thin so that the nut cracks easily. The kernel is fairly plump and of good flavor and quality. Mahan originated in Attala County, Mississippi.

Moneymaker is popular because generally it is quite prolific. It is planted in all parts of the state. It is susceptible to scab and requires spraying. The tree has an upright, open, spreading type of growth and usually begins to bear at an early age, but it is not consistent unless soil fertility is high and the foliage is maintained. The nut is medium in size, slightly wedge-shaped, rounded with a medium thick shell that cracks satisfactorily (Figure 6). The kernel is usually plump and of good flavor and quality. Moneymaker originated in Madison Parish, Louisiana.

Schley is an outstanding variety and probably would be the most generally grown variety east of the Mississippi River, if it were not so highly susceptible to scab. However, scab can be controlled with sprays and the nuts usually bring a price sufficient to justify the extra expense when trees are maintained in a productive condition. The tree is rather vigorous with thick foliage made up of closely set leaves with large leaflets. The twigs are grayish in color and smooth, turning rough with age. The buds are pointed and brown. The tree is round-topped with branches growing upward and outward. It is considered by many as the most beautiful of all pecan varieties. The tree begins to bear fairly early and is moderately prolific and a regular bearer under good management. Nuts are medium to large, oblong, obovate or irregular in outline, with opposite sides slightly depressed. The apex is sharp-pointed and flat. The base is blunt. The shell is very thin, cracking easily. The kernel is plump, straw-colored, rich in oil and of excellent quality and flavor (Figure 6). Schley originated in Jackson County, Mississippi.

Moore is grown extensively in Jefferson and Duval counties and planted to a limited extent in other
counties. The tree begins to bear at an early age and is prolific, generally being consistent in annual production. It is not very large and inclined to produce willowy twigs which often grow out and downward, especially on the lower branches. It requires spraying to control scab. The nut is small to medium, elongated and brownish with distinct dark markings at the apex reaching about 1/3 of its length (Figure 7). The shell is of medium thickness, but cracks easily. The kernel is easily removed whole, fairly plump and of good quality and flavor. Moore originated in Jefferson County, Florida.

Figure 7.

Kennedy is widely known in Alachua and Bradford counties. It is similar to Curtis, although the tree has slightly heavier foliage and the nut is larger and more pointed. It produces fairly well and is susceptible to scab. The tree is upright and of medium size, begins to bear at a comparatively early age, but often is inclined to bear irregularly. Limbs often break badly with heavy crops. The nut is medium in size, decidedly pointed at the apex, straw-colored set off by distinct markings at the apex, moderately thin shelled, and cracks easily. The kernel is firm, easily removed whole from the shell, fairly plump and of good quality (Figure 7). Kennedy originated in Alachua County, Florida.

Site Selection

Selection of soil is of major importance in planting a commercial pecan orchard. The best soil under Florida conditions is a sandy loam which is well-drained to a depth of 60 to 72 inches. Soils with less than 36 inches of well-drained soil should be avoided. Trees growing on shallow soils may be damaged by drought or excessive moisture and thus prove to be uneconomical.

Time of Planting

Pecan trees are planted as soon as possible after they become dormant, preferably in late December and January. Young trees should be set early in the dormant season so the root system will become established before the trees leaf in the spring. Growth will then be more vigorous than with later plantings.

Selecting Trees

Select varieties which are capable of producing good yields of high quality nuts and will require a minimum of disease control. Nursery trees should be in good condition and vigorous.

Trees 4 to 7 feet tall are probably the best size to transplant. They cost less than larger ones and are less apt to die. Larger trees take more labor to transplant and require more post-planting care. Older trees are often purchased by homeowners for dooryard planting, where the increased expense can be justified because of their ornamental value.

Soil Preparation and Tree Spacing

Soil should be well prepared by plowing under all vegetation and thoroughly disk ing. Stake off the field prior to planting. A common spacing in Florida is 60 feet apart each way (12 trees per acre). Closer spacings of 30 X 30 (48 trees per acre) or 40 X 40 (27 trees per acre) are being tried, however, on an experimental basis. Removal of selected trees or pruning will be necessary when the trees reach maturity if closer spacings are used. The orchard is generally laid out in a square pattern with plantings on the contour on terraced slopes.

Pre-planting Care

Trees should be purchased from a reliable nursery. Trees from nearby nurseries are usually better adapted to local soil and climatic conditions. Arrange with the nurseryman to have trees dug and delivered on the same day they are to be transplanted. Heel trees in wet sawdust or soil if they cannot be transplanted soon after arrival. NEVER expose the roots to the sun and wind even for short periods. Be sure all roots of heeled-in trees are well covered and apply water as needed.

Transplanting

Holes 20 to 30 inches in diameter and 24 to 36 inches deep are necessary to accommodate the root systems. Mixtures of peat or top soil may prove beneficial for better moisture-holding capacity and
root growth. Remove trees from their bales or boxes in the field. Protect the roots from drying out. Use care in setting and placing the roots and filling in the hole with soil. Place the roots in as near a normal position and at the same depth as in the nursery as possible. DO NOT PLANT TOO DEEP. Prune broken and damaged roots and remove 1/3 to 1/2 of the top of the tree at the time of planting. This provides a balance between the top and roots and simplifies the problem of proper heading later.

Press the soil firmly as the hole is filled with soil and water, leaving it about as it was when the trees were growing in the nursery. Use about 5 gallons of water around each tree when the hole is 3/4 full of soil. Make a basin about 5 feet across around the base of the tree to serve as a water reservoir. Water the trees several times if rainfall is insufficient.

**Care of Young Trees**

The highest percentage of young tree losses is during the first summer, usually from failure to water adequately or to control weeds and grass. Watering 2 or 3 times during the spring may be sufficient but much more frequent watering may be required. Young trees should be well enough established after the first year to withstand a moderate drought but may require watering in a long dry period.

Overfertilization is a common fault in the management of young pecan trees. NO FERTILIZER SHOULD BE USED AT THE TIME OF PLANTING. Young trees may be fertilized between June 1 and July 1 with up to 1 pound of 8-8-8 plus minor elements. Fertilizer is spread evenly over the soil in a circle about 7 feet in diameter. Fertilize the trees the second year with 1 pound of 8-8-8 in February and another pound of 8-8-8 in early July. Increase applications by 1 pound for each additional year of tree age. Avoid late summer fertilizing since it may stimulate a late flush of growth which could result in serious freeze damage.

**Managing the Bearing Orchard**

Pecans are borne on the current season's growth, thus it is desirable to manage the trees to obtain vigorous twig growth. Production of such growth requires a high level of soil fertility. Costs of maintaining adequate fertility over a period of years are more than justified in a good pecan orchard.

Three rather distinct forms of management have been developed for pecan orchards in Florida: (1) pecans alone, (2) intercrops and (3) pasture. The key to successful operation of each of these is to maintain soil fertility high enough to encourage good nut yields.

**Management for Pecans Alone**

This system of management may consist of simply fertilizing the trees as required and controlling native cover as necessary for harvest and spray operations. Most growers mow the entire orchard, but herbicides may be used to keep areas under the trees clean. Normally, a sod strip would be left between the rows.

**Management for Production of an Intercrop**

This system was originally recommended as an economical way to utilize orchard space while bringing the pecan trees into production. They are planted as close to the trees as it is possible to operate the farm equipment without damaging the trunks. This practice apparently has had no adverse effect upon the trees where the soil is worked to a depth of not more than 5 to 7 inches. Production of cash intercrops in mature orchards is limited largely to beans, sweet corn and other vegetables which can be grown in the early spring before the trees leaf out. Some grove owners lease their orchards to other farmers for the production of such intercrops. The quantity of fertilizer the vegetable grower guarantees to use is an important consideration in a lease arrangement. Usually, the amount used is adequate for both the vegetable crop and the trees.

Peaches may also be intercropped with pecans since the pecans usually start bearing about the eighth year when the peaches are decreasing in productivity. Caution must be used however in choice of spray materials. For example, basic copper is a recommended fungicide for pecans but copper sprays are toxic to peaches.
Management for Pasture

Pecan groves have long been used as supplementary pastures, but this has detrimental results to the trees when fertility requirements are neglected. Pastures in pecan orchards can be a profitable enterprise with proper management practices, which includes growing legumes and adequate fertilization for both pasture and trees. A few pecan orchards have been planted to grass pasture without legumes. This practice is usually highly detrimental to tree development because the usual rate of fertilization is not high enough. A minimum fertilizer program to keep the trees reasonably productive with grass pasture would be annual application of 600 pounds of 10-10-10 per acre plus 100 pounds of nitrogen per acre as a supplemental top dressing.

Fertilizer Requirements

Fertilization of pecans may vary widely, depending upon the general system of management selected. Mature trees may be fertilized with 10-10-10 or similar mixed fertilizers at rates of 1000 to 1500 pounds per acre. Two-thirds of this amount should be applied in February and the remainder in late June. Additional elements should be added to the fertilizer when soil analysis indicates potential deficiency (see section on Care of Young Trees for fertilization recommendations for young trees).

Nitrogen

Deficiency of nitrogen causes light green foliage, weak shoot growth and earlier fall defoliation. Many orchards are far below their potential yielding capacity because they are deficient in this element. An annual nitrogen supply of 150 pounds of N per acre (approximately 450 pounds of ammonium nitrate) will meet the requirements of the tree as long as the trees do not have to compete heavily with grasses or non-leguminous weeds. Additional nitrogen will be needed when a heavy grass is present to keep both the trees and grass adequately supplied with this nutrient.

Potassium

An annual application of 80 pounds per acre of potash (K₂O) will normally supply the potassium requirements of pecan trees. The deficiency rarely becomes so severe that typical leaf scorch symptoms appear, but it does weaken the trees so that severe winter killing may take place.

Phosphorus

Deficiency of this element has been described as causing weak growth and leaf chlorosis in pot cultures. Deficiency patterns have never been observed in Florida pecan orchards. Significant increases in yields have not been obtained in recent years from phosphate applications in mature groves.

Lime, Calcium and Magnesium

Pecan growers in Florida and other Southeastern states have avoided the use of lime for many years because they feared an increase in pecan rosette (zinc deficiency). Proper precautions should be taken to guard against the development of rosette but the lack of zinc should not be used as an excuse to permit general deterioration of other factors important to maintaining soil fertility. Orchard soils should be limed to the range of pH 5.5 to 6.0 if no leguminous cover crop is grown and from pH 6.0 to 6.5 when such a cover crop is used. The pecan grower should arrange through his county agent for a soil test so that the proper quantity of liming material can be applied. Dolomite rather than high calcic limestone should generally be used on sandy soils because many of these orchards are low in magnesium.

Magnesium deficiency has been observed frequently in pecans growing on the sandy soils and occasionally it becomes severe enough to cause defoliation with subsequent reduction in yield. Magnesium deficiency is characterized by marginal yellowing of leaves with interveinal chlorosis and necrosis becoming more severe in late summer.

Zinc

Most Florida pecan orchards will need zinc sulfate on a regular basis either as annual sprays or 1 unit of zinc oxide (ZnO) in the fertilizer. Rosette is a physiological disorder of pecan trees caused by a lack
of sufficient zinc to produce normal growth. It is manifested by a bronzing and crinkling of the leaflets, which may become greatly reduced in size and a shortening of the internodes, which gives the effect of multiple bud development and thus causing the appearance of a rosette of leaves on the twigs. It may cause twigs and eventually branches to die back in severe cases.

This condition is corrected by the application of zinc in some form that will become available to the tree. Two or 3 pounds of zinc sulfate per tree spread evenly under the branches is usually sufficient to correct rosette or zinc deficiency in mature trees on sandy soils. As much as 10 pounds per tree may be required on soils of heavier texture. Two to 4 ounces will be sufficient for very young trees.

Rosette may also be corrected by direct sprays on the foliage. Since trees respond more rapidly to zinc when it is sprayed on the leaves than when it is applied to the soil, the use of a spray is particularly desirable in the case of severe rosette. Foliage sprays should contain 2 pounds of neutral zinc per 100 gallons of water. Spray applications of zinc should be made between May 25 and June 15 for best results, although fair results can be obtained later in the season.

**Manganese**

A leaf deformity known as "mouse ear" observed primarily in dooryard plantings and in coastal areas has been identified as manganese deficiency (Figure 8). It has little economic importance but may be of considerable concern to homeowners whose trees occasionally are severely injured. It is usually found when leaf manganese levels are less than 100 ppm. Manganese levels in normal pecan leaves in Florida range from 300 to over 2,000 ppm. "Mouse eared" trees are often found near limerock driveways, waste building materials or growing in soils that naturally contain shell or marl, all situations with very high soil pH values.

"Mouse ear" can be corrected by a soil application of from 2 to 10 pounds of manganese sulfate per tree depending on tree size and severity of symptoms. Sulfur can be used at the rate of 1 to 5 pounds per tree to lower the soil pH and increase availability of the manganese. All of these materials should be broadcast evenly to the tree drip line.

**Boron**

Deficiency of boron on pecans has not been recognized in Florida and no significant responses to boron have been obtained. Normal boron content of leaves seems to range from 10 to 90 ppm. It should be pointed out, however, that the leguminous cover crops have a relatively high boron requirement. Hence, it is often necessary to include boron in fertilizer for pecans to insure a good cover crop. Fertilizers which contain sufficient boron to provide the equivalent of 10 to 15 pounds per acre of borax will provide adequate boron in most areas where a deficiency might be encountered.

**Herbicides**

NOTE: The current recommendations are given in the Florida Weed Control Guide. Please contact your local county extension office for this information.

**Rejuvenation of Neglected Orchards**

A number of orchards in the pecan belt of Florida have been neglected to such an extent that they are liabilities rather than assets. Some of them can be reclaimed for profitable production by proper fertilization and management. Selection of an orchard for rejuvenation implies that the grower will first determine whether there is a reasonable chance that it can be made productive. The soil must be examined to determine that there is ample light-textured soil above the clay and that hardpans, claypans or high water table are not present. Trees should be checked to be certain that they are of varieties known to produce satisfactory crops in the area. Varieties and
soil are the two most important factors in determining whether rejuvenation will be successful.

Trees can be rejuvenated by initiating a regular orchard management program but it must be remembered that soils in a neglected orchard may be far below a productive level of fertility. It may be desirable to use extra fertilizer to overcome the deficiency in fertility and re-establish rapid vigorous growth as quickly as possible. Neglected trees with a trunk circumference of 2 to 3 feet should be fertilized the first year with 8 to 10 pounds of nitrogen (24 to 30 pounds of ammonium nitrate) and 4 or 5 pounds of potash (7 to 10 pounds of muriate of potash) per tree. This should be broadcast under the branch spread of the tree. The best time for this application is between December 15 and February 1. Neglected orchards are often zinc deficient, thus it would be well-advised to apply 3 pounds of zinc sulfate per tree at the same time. Trees of larger or smaller trunk circumference should be fertilized at proportionately heavier or lighter rates. Standard management and fertilization practices may usually be followed after the first year in an orchard undergoing rejuvenation. Above average rates of fertilization may be continued in some orchards, however, through the second and possibly the third years.

Dead branches should be pruned out as far as feasible together with other branches as necessary to aid in the development of well-branched symmetrical trees. Steps should also be taken early in the rejuvenation program to free the tree of excessive quantities of moss or mistletoe.

Trees of unproductive varieties may be cut out to provide more space for remaining trees or top-worked to better varieties. Top-working should be delayed until growth becomes vigorous because the percentage of success from grafts or buds is quite low on trees in poor condition.

**Spanish Moss In Pecan Trees**

Spanish moss shades and retards growth when trees become heavily laden. Moss is commonly killed during the dormant period by a thorough wetting with a spray of 4 to 6 pounds of neutral copper in 100 gallons of water. The dead moss will hang in the trees for some time but will eventually be blown out. If the moss is hanging in heavy, thick masses, a second application may be required for a complete kill.

**Thinning and Pruning**

Growth and production will be reduced and disease and insect problems will increase when trees have attained large size and are crowding each other in the orchard. It is advisable to provide more space under such conditions by cutting out trees in alternate diagonal rows or by reducing the size of the tops of the trees. This can be done by cutting back trees in alternate rows by the same method that would be used in top-working. After a new top has been grown sufficiently to bear nuts on these cut back trees, the remaining trees can be cut back in the same manner. This will not eliminate any of the trees, but will reduce the size of the top to a point where there is room for further development. It will require 10 to 15 years for the new tops to attain size that will cause any serious crowding.

Pecan trees normally require little pruning, except to thin, rejuvenate or remove crossed-over, broken or dead branches. Some growers are rather severely pruning large mature trees to rejuvenate them.

Undesirable branches should be cut close to laterals or to the main trunk to eliminate projecting stubs. It is important that branches be cut properly, so wounds will callus rapidly and thus reducing infection by wood-decaying organisms.

**Propagation**

**Top-working Mature Trees**

Trees of undesirable seedlings and varieties can be changed to a desired type by top-working. Either budding or grafting can be employed, but patch budding is used by most growers. Cleft grafting is done during the dormant season, usually from late December to the middle of February. Bark grafting is done in April and patch budding in the summer months when the trees are in growth.
Cleft Grafting

Branches should be cut back to 4 inches in diameter or a little less. The entire cut surface should be covered with grafting wax after scions have been inserted. It is often advisable to tie in the scion with cord or budding tape so there will be no danger of the stock pulling away and preventing a union. It is important that the cambial layers of both stock and scion match. Trees which were grafted can be budded during the summer if the former scions fail to live.

Inlay Bark Graft Method

Scionwood for inlay bark grafts should be cut in late February from strong 1 or 2-year-old shoots in 12-inch lengths and stored at 32° to 40° F in moist sawdust, peat or sphagnum to keep it from drying out. Grafts are placed in 2 to 4 inch diameter limbs during April using the methods illustrated in Figure 9. Grafting should be delayed until about the time pollen sheds if limbs bleed badly. Scions are usually cut 5 to 6 inches long with a sloping cut about 1 3/4 inches long at the basal end. This is placed against the limb and outline cuts are made through the bark or the stock. The bark is then removed and the scion fitted snugly into the groove. Two small nails (3/4 to 7/8 inch long) are driven through the grafts to hold them firmly in place in the limb with care not to split or injure the scion. All cut surfaces are coated with grafting wax. Alternatively, the graft and stock may be covered with highly reflective aluminum foil which greatly reduces the temperature around the graft with a slit to let the scions protrude. A plastic bag is then pulled down over the stock covering the foil and tied in place to maintain high humidity.

Figure 9.

After-care is similar to that for other methods of grafting. Suckers are rubbed off and undesirable limbs of the stock gradually removed over a 1 or 2 year period. One scion should be cut back about 1/2 the way the following winter if both scions on a limb grow.

Budding

Trees to be budded are cut back during the dormant season, leaving several of the branches intact to insure proper growth until the new buds are established. Small trees not more than 4 to 6 inches in trunk diameter may be safely trimmed to a single stub. Trees larger than 6 inches in diameter are pruned to leave branches 4 to 6 inches in diameter.

Shoots will grow in the spring where the branches have been cut off. These will be large enough to bud by July but the work can be done up to the first of September. Ring and patch methods are used (Details are given in the following section on Nursery Propagation). It will be necessary to thin out unbudded shoots after scion growth starts. Part of these may be left for protection but they should be cut back to about 1/2 of their length during the year following budding. Most of the scions will not begin growth until the spring following their insertion but some type of support to prevent breakage later may be necessary. Shoots with live scions are cut back to just above the bud before growth starts and the wrap may then be removed. However, the wrap may be removed earlier if the tie binds the stock so tightly as to create a constriction and prevent normal growth. This will be indicated by a swelling which will develop on the stock above the bud. Part of the original branches that were left on the trees can be removed by the end of the second year and the remainder removed the third year if a good proportion of the scions grow well. The same procedure should be followed when trees are top-worked by grafting. Well developed tops can be developed by top-working if care is exercised in properly distributing the scions over the tree. The new top develops rapidly and will produce nuts in 2 to 4 years, depending upon the variety. However, quantity production should not be expected before the scions are 5 to 7 years old.
Nursery Propagation

Production of pecan trees for planting orchards is a highly specialized business which requires capital and skill. Pecan seedlings are the stock on which varieties are worked in the nursery. The stock is generally grown from small to medium-sized nuts produced by vigorous, thrifty trees which may be seedlings or varieties.

Seedlings grown from nuts of scab-susceptible varieties or from nuts of seedling trees from the West often will themselves be highly susceptible to scab. Nuts from trees of Curtis are preferred by a number of Florida nurserymen because they germinate well and produce uniform stocks.

Soils with a sandy to sandy loam texture are preferred for growth of nursery stock. However, deep, well-aerated soils are not as important as for trees being set in the permanent orchard. In fact, some nurserymen claim that soils with a mottled heavy-textured layer at a depth of 18 to 24 inches are particularly desirable for nursery trees since such soil conditions prevent the development of a deep tap root and encourage the development of extensive lateral roots. It is easier to dig a higher percentage of roots in such soils and the chance of tree survival after transplanting will be improved.

Planting The Nuts

Nuts should be planted in the fall as soon after maturity as possible. Nuts may be stratified and planted in the field later if losses from rodents are likely to be excessive. Stratification may be done in a well-drained location under a shed or in the open by spreading nuts and sand in alternate layers about 2 inches thick, with a top covering of about 8 inches of sand or soil. Nuts generally are sown in the field, however, without stratification. Sowing should be completed by December 15 if possible. Nuts kept at room temperature until January or February should be soaked for 36 to 72 hours before sowing. Soil in the seedbed is worked into a good state of cultivation, after which furrows about 3 1/2 to 4 feet apart are opened with a narrow plow to a depth of 4 to 6 inches. Nuts are then dropped 4 to 6 inches apart in each furrow and covered with a plow to a depth of about 4 inches. The crust of the soil should be broken in the early spring as the small seedlings begin to emerge. Planting machines are available but are not generally used.

Fertilization of Nursery Stock

Well-developed, vigorous seedlings which will result in a higher percentage of success from the budding or grafting operation and a higher percentage of marketable trees are produced with a well-defined and maintained fertilizer program. A heavy tonnage of summer leguminous cover crop worked into the soil prior to sowing will prove profitable. New land or land that has not been fertilized in recent years should have 500 to 800 lbs. per acre of 6-6-6 or 8-8-8 broadcast over it and worked thoroughly into the soil before nuts are sown. This may not be necessary on land that had been previously fertilized for other crops. A 6-6-6 or 8-8-8 fertilizer applied at the rate of about 500 lbs. per acre in bands at the time of sowing or in the spring shortly after the young shoots appear will supply the young seedlings with adequate nutrition for their early stages of growth. The application may be repeated in June or July, or ammonium nitrate at 100 to 150 lbs. per acre may be used if additional growth stimulation seems desirable the first year. Two applications of 6-6-6 or 8-8-8 at 500 lbs. per acre should be made in February, and in June or July of the second year. Ammonium nitrate may be substituted for the June or July application. Seedlings are usually grafted at the end of the second year. A fertilizer program similar to that recommended for the two-year-old seedlings should be sufficient to produce a good size grafted tree. More growth can be encouraged if necessary by increasing the amount of fertilizer, especially nitrogen, the third year. Application of fertilizer after the end of July is not recommended, as the stimulation of late growth may result in formation of wood immature at digging time.

Budding

Annular, ring, and patch are the methods of budding used. Seedlings are large enough to bud the second year. Budding is begun just as early as mature buds are present, which is about June 15 to July 1, and may continue to September. The bark of buds and stocks generally unite in 3 or 4 weeks, at which time the wrap may be removed. The wraps can be left on if
they are not binding until late winter when the stocks are cut back to just above the scion. Seedling shoots will grow along with the scion and these must be removed. Scions will require staking for several months to give them support.

**Ring Budding** was formerly the principal method used but has been largely superseded by the patch bud. It can be done any time during the growing season when the bark will slip freely.

A similar ring of bark containing the bud is cut with the same knife from a budstick of the same diameter and is placed where the ring was removed from the stock. The scion must not be removed after it has been set in place. It is bound firmly in place with plastic budding tape wound to cover all cuts. Tying is important and must be done properly, as carelessness in this operation is often the cause of failure.

**Patch Budding** is a modified form of ring budding which is also done when the bark will slip. The details in making the cut and inserting the bud are similar (Figure 10). The main difference is that a square or rectangular patch of bark is removed from the stock and an identical patch with a bud in the center is removed from the stick of budwood. Sticks of budwood smaller than the stocks can be utilized. The work should be done rapidly to prevent drying out of the tissues. The patch is wrapped as described for ring budding.

**Grafting**

Seedlings too small to bud during the second summer are grafted the following winter, although some year-old seedlings may be large enough to graft at the end of the first season. The whip and tongue graft (Figure 11) is used almost exclusively, the scions inserted just below soil surface. A cleft or side graft is used when old stocks an inch or more in diameter are to be worked. The seedlings are barred off with a small turn plow and the remaining soil removed from the stock with hand rakes. The part to receive the scions is then rubbed with a piece of burlap. January and February are generally the best months for grafting. Scions are inserted and tied in place with wax cord after which the soil is pulled up around the grafts as soon as possible for protection and to prevent drying out. The furrows are leveled to leave only the top bud of the scion showing above ground level. Fertilizers, if needed, are applied just before the seedlings are grafted. It is not necessary to unwrap the grafts. In the spring there will be numerous shoots forced from the stock and these will have to be removed, leaving only the scions. Most of the trees should be well developed by fall and ready for digging.
<table>
<thead>
<tr>
<th>Variety</th>
<th>Harvest season</th>
<th>Scab Resistance</th>
<th>Precocity*</th>
<th>Ease of cracking</th>
<th>% Kernel</th>
<th>Kernel quality</th>
<th>Pollination**</th>
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Table 1.

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*Precocity refers to the age when a tree begins to bear. A good precocious variety will normally bear a few nuts the fourth year.**With a protandrous variety, the pollen (male) is mature most years before the stigma (female) is receptive. With a protogynous variety, the stigma is receptive most years before the pollen is mature. It is desirable to interplant protandrous and protogynous varieties.