



Southeastern Pecan Growers' Handbook

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Pecan Propagation

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Pecans grown from seed are not true to type. This means that a nut produced by a given variety will not, when planted, produce a tree identical to the parent. In fact, each seedling tree is unique and will have extremely variable nut quality. Therefore, in order to propagate a tree of a given variety, buds or shoots from the parent tree, must be grafted onto seedling rootstock.

In order to fully understand the processes discussed in this chapter, one should be familiar with the following terms:

Budding – a form of grafting in which a single scion bud is joined with the rootstock to form the graft union.

Cambium – Thin layer of cells between the bark and wood capable of forming new cells.

Grafting – The process of joining the scion with the rootstock.

Scion (Graftwood) – Mature dormant shoot of a known variety to be used for grafting or budding. The scion usually comes from the previous season’s growth and measure five to six inches in length and 1/4 inch to 5/8 inch in diameter.

Rootstock (Understock) – The root, trunk, or limb, to which the scion is grafted.

Topworking – Replacement of the top of a tree with a desired variety by budding or grafting.

The proper budding or grafting technique may vary with size of the rootstock/understock, experience of the worker, climate, and time of year. Often, individuals who graft trees have their own personal preferences with regard to grafting methods. As with many practices related to pecan production, timing is very important for successful grafting (Table 1).

Table 1 Pecan Propagation Timetable.

Pecan Propagation Timetable.												
	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC
	1 10 20	1 10 20	1 10 20	1 10 20	1 10 20	1 10 20	1 10 20	1 10 20	1 10 20	1 10 20	1 10 20	1 10 20
Collect Nuts for Planting									//////////		
Stratify Nuts	//////////										
Plant Nuts				//////////								
Summer Budding ²							//////////			
Collect Graftwood	//////////									
Whip Graft		//////////								
4-Flap Graft				//////////						
Bark Graft				//////////						
Dig Trees	//////////

.....May be done during this time
 //////////Preferred time

Growth of the Rootstock

Most commercial nurseries use open-pollinated seeds from domestic and/or native varieties that perform well in a given region. In Georgia, the most commonly used rootstock seed is Elliott or Curtis. Elliott normally has good germination and develops good caliper relatively quickly. Curtis is similar to Elliott but is more cold tolerant and should be used for pecan rootstock in the northern part of the state. Regardless of the variety used, be sure that nuts are from the current season and free of insects and disease.

Nuts should be soaked for 2 to 3 days in a container of water in order to activate enzymes that stimulate growth. A hose left dribbling into the container provides oxygen, which helps to prevent the growth of fungi. Additional measures to protect against infection with seed-rotting pathogens include keeping the soaking nuts in 35-40 degree Fahrenheit temperatures and changing the water daily. If nuts are soaked at room temperature, the water should be changed every few hours.

Pecan nuts should be stratified for 6 to 8 weeks prior to planting. This can be done by placing the nuts in a container of peat moss or layering them with sand and peat moss. Stratified seed should be kept moist at a temperature of 35 degrees Fahrenheit. Stratification does not hasten germination once the nuts are planted, but helps the seedlings to emerge more uniformly, facilitating the ease of weed control in the nursery.

Pecan seeds should be planted before the soil warms up enough to prevent germination and after danger of frost has passed. This can be done in Georgia from mid March to early April. Seeds can be planted in a seedbed or in containers. There are advantages and disadvantages to both methods.

Just as each seed from an individual tree is not identical to the parent, there is a considerable amount of variation in rootstock, even from seed arising from the same parent tree. This accounts for much of the variation in tree performance as the grafted tree develops and comes into full production.

Planting in the Seedbed

Seedbeds (Figure 1) provide easier planting but more difficult harvest of the trees. Fertility of the seedbed should be determined before planting based on soil test recommendations. Seeds should be planted 4 to 6 inches apart in the row and 3 to 4 inches deep. Planting depth should be more shallow



Figure 1. Pecan nursery trees growing from a seed bed.

in clay soils than in sandy soils. Round-shaped nut varieties such as Elliott and Curtis can be planted easily with a mechanical planter. Large or oblong nut varieties tend to hang up in the planter and therefore, must be planted by hand.

Container Grown Seedlings

Pecan seedlings also grow well in a variety of container shapes and sizes. A container with an open bottom should be used. Roots should be air pruned by placing the pots on a screen wire bench. By using this method, the roots will grow no farther than the bottom of the pot before being air pruned. This prevents circling of the taproot in the container and promotes a fibrous root system.

A potting soil mixture which allows free movement of water through the pot should be utilized. A mix of three parts ground pine bark, one part peat moss, and one part coarse sand works well. All potting mix should be sterile. Amend potting media by incorporation of 15 lbs of slow release 17-7-12, 4 lbs of dolomitic lime, and 1.5 lbs of Micromax micronutrients into the media. This should provide all the required nutrients for the first year and early into the second year. In the second year, additional slow release fertilizer may be needed, but there is no need for lime or micronutrients.

Containerized trees should develop a small, dense, fibrous root. They require frequent irrigation and optimal nutrition.

Graftwood Collection and Storage

Stored graftwood is required for several grafting methods. Unless the wood is collected and

stored properly, the grafting endeavor is destined for failure. A variety of problems may occur in the collection and storage process, including drying out or freezing of the wood, immature buds, old shoots, insect and/or disease damage. Therefore, care should be taken when proceeding with these steps.

Scions should be cut from the previous season's growth of a productive tree. Scions should be straight and smooth, measuring $\frac{1}{4}$ to $\frac{5}{8}$ inches in diameter. They should be long enough (6-8 inches) for three to four healthy buds and should be insect and disease free. Scions from older wood may be used, but are generally less successful.

Scions cut from the end of the shoot should be avoided because the buds are often immature and may be damaged by cold, have pithy wood, and a concentration of insects and disease. The terminal end of the shoot should be cut off where it reaches about $\frac{3}{8}$ inch in diameter or at the point where the wood no longer has a pithy appearance.

When whip grafting, graftwood can be used immediately and storage may not be necessary. When using the 4-flap or bark graft techniques, graftwood should be cut when the trees are completely dormant (January-February). Budwood used for spring budding should be collected in early to mid March.

Scions should be packed in moist sawdust or peat moss in garbage bags, which are then boxed (Figure 2). For smaller scale bundling, wrap a bundle of scions in wet newspaper and place them in a plastic bag (bread wrapper). Do not allow water to accumulate in the storage container. All bundles should be labeled with respect to pecan variety using a waterproof marker to ensure grafting of the desired variety.



Figure 2. Packed scions in garbage bags before they are boxed up.

Graftwood can be stored for up to six months at temperatures between 30 and 38 degrees Fahrenheit. The wood should not freeze, yet remain dormant. Pecan buds may swell when stored at 35 degrees for a prolonged period of time.

Budding Pecans

Patch or ring budding may be used to propagate nursery stock or top-work larger pecan trees. Budding simply involves removal of a portion of the bark along with a single dormant bud from scionwood. The bark and bud from the scionwood are fitted into a space cut into the bark of the understock. After the bud begins to grow, the shoot above the bud is pruned away and the grafted bud becomes the primary shoot.

Budding can be done by patch budding or ring budding. These methods are essentially the same, the real difference being the amount of bark removed with the bud. Two separate knives are used for each method. The patch knife has four blades, while the ring budding knife consists of two blades. The ring budding knife removes a complete ring of bark for the scion stick. Ring budding is not as popular as patch budding because it has been shown that it is best to leave a strip of bark intact on the stock opposite the bud. This ensures that the limb will remain alive beyond the budding operation.

Scionwood should be selected before the buds begin to swell (mid to late February in Georgia). Scions should be cut as indicated above. You can determine when a bud is mature by the color of the underside of the bark on the bud patch. If it is white, the buds are mature. If green, the buds are immature. Buds at the base of the shoot are usually the first to mature. If buds do not slip easily, it is too late in the season or conditions are not right for budding. If bark has difficulty slipping due to drought stress, trees should be watered for 2-3 weeks before budding.

Budding should begin 2-3 weeks after trees begin to grow (mid April). This allows for a reduction in sap pressure as the sap begins to flow. Budding may be done as late as June or July; however, earlier buds will have more time to produce a stronger union with the rootstock and will produce more vegetative growth during the first year. Budding can also be done in late July and August using matured wood from the current year's growth without storing; however, this is often a less successful method.

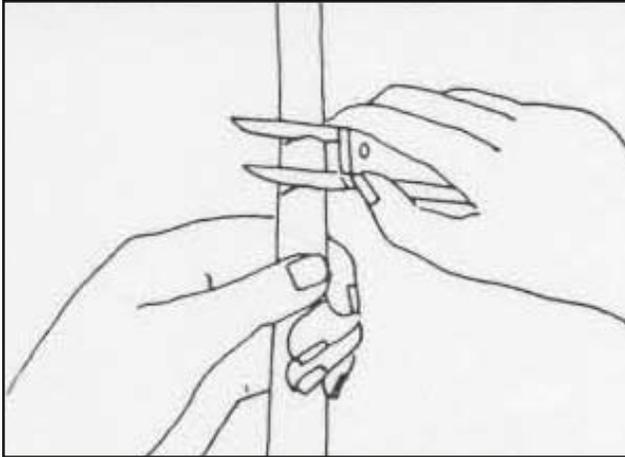


Figure 3. Cutting the stock with a budding knife.

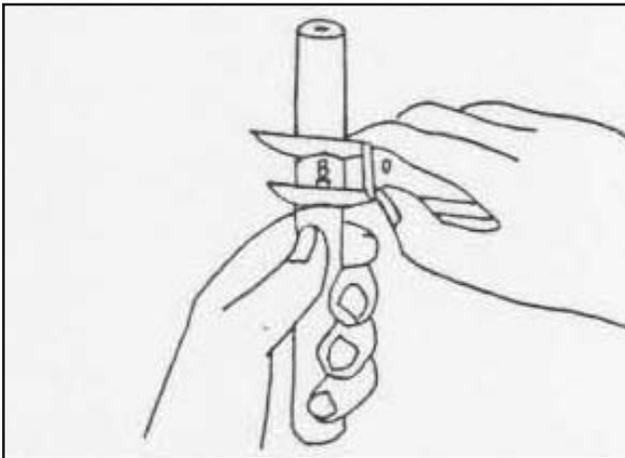


Figure 4. Cutting the scion.

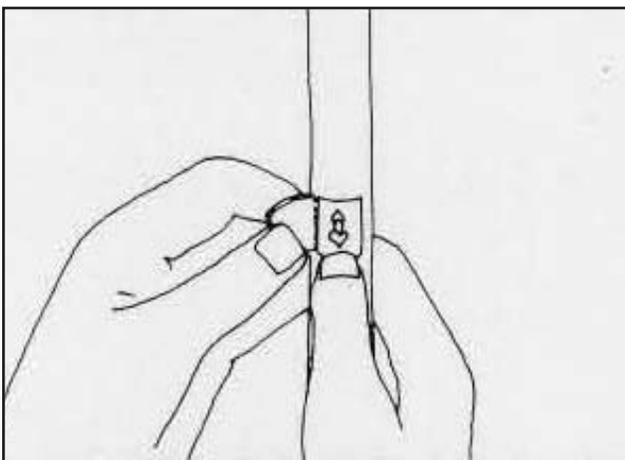


Figure 5. Placing bud patch onto stock.

No preparation of the understock is necessary on nursery stock and young trees where branching limbs are less than 1 1/2 inches in diameter. Larger trees should be de-horned in the winter months to allow new growth to develop along the large limbs. Budding can be accomplished on this new growth in July and August of the year they were de-horned or in the spring of the following year.

Scionwood should be removed from storage 4-6 days prior to use and placed in a room at about 80 degrees Fahrenheit, which will stimulate the bark to slip and allow buds to be removed from the sticks. This usually takes 4-5 days. Wood should be kept moist during this time.

Using a budding knife, the bark should be cut and removed on the stock between existing buds (Figure 3). A bud and bark strip should be removed from the bud stick using the same knife (Figure 4). Patches must be cut to fit very precisely for pecan. Protect all wounds and strips from sunlight and wind. Handle the budwood carefully and do not bruise, split, or rub the budded patch on the tree.

Place the strip and bud from the scionwood onto the stock (Figure 5). Secure the stock with rubber bands, grafting tape, or masking tape and wax over to make it air tight (figure 6). Cover over all exposed areas, but allow the bud to show through the wrap.

Spring buds should be forced to grow by cutting off the stock about 3 inches above the bud 2-3 weeks after budding. Before doing so, you can determine if the patch is alive by lightly knicking the bark with a pocket knife. If the tissue under the bark is green, it is still alive. Durable wrapping materials may need to be loosened after the budding wound has healed.

Bark Grafting

Bark grafting is often used to graft a relatively small scion onto rootstock that is too large for the four flap graft or whip graft. Bark grafting should be done in the spring, usually late April to early May, about 2 to 3 weeks after growth begins in the spring. The primary rule for bark grafting is that the bark on the scions should be tight, while that of the rootstock must slip.

The rootstock should be sawed off smoothly, leaving one or two side branches below the cut to keep the tree actively growing and to later regulate growth. Using a sharp knife, remove the rough, outer portion of the bark to the point where the scion will be inserted (Figure 7). Leave as much of the

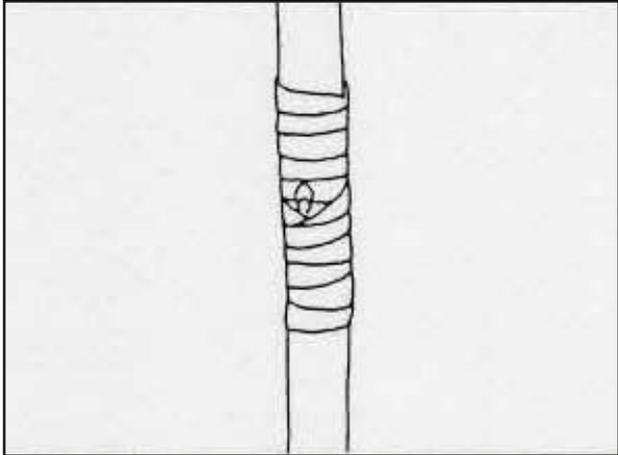


Figure 6. The completed budding process.

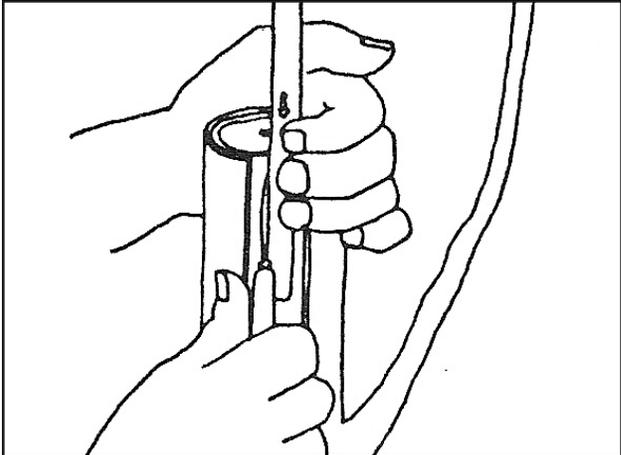


Figure 9. Fitting the scion.

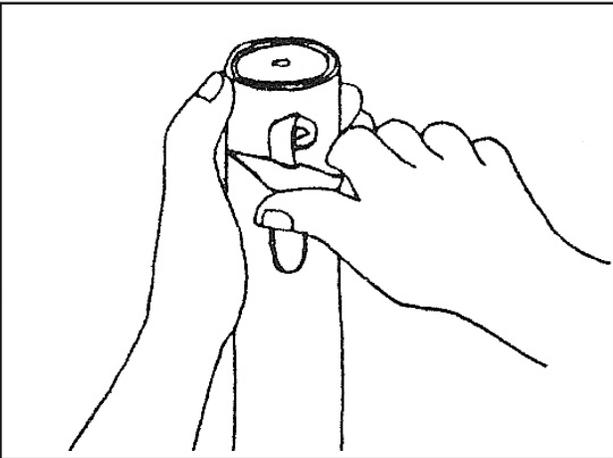


Figure 7. Removing the rough, outer portion of the bark where the scion will be inserted using the bark graft.

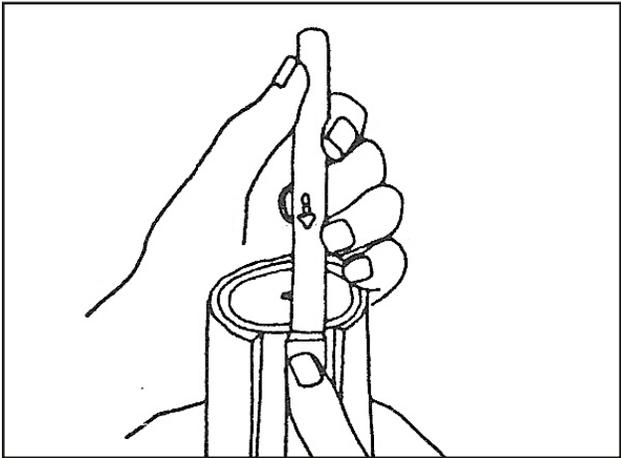


Figure 10. Inserting the scion.

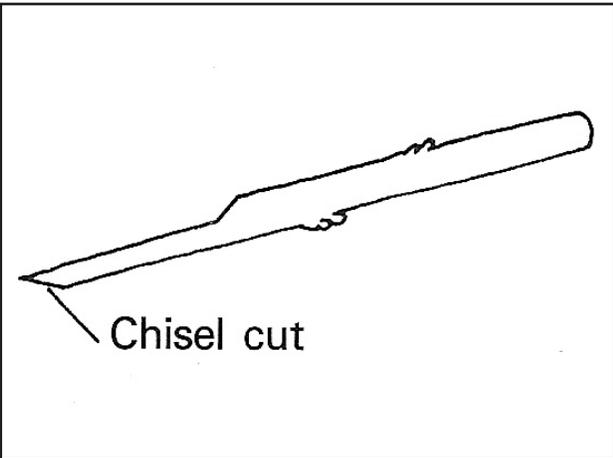


Figure 8. Scion prepared for bark grafting.

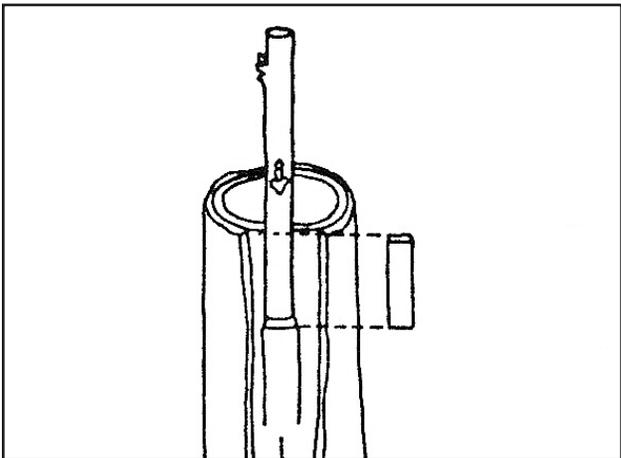


Figure 11. Removing the bark strip.

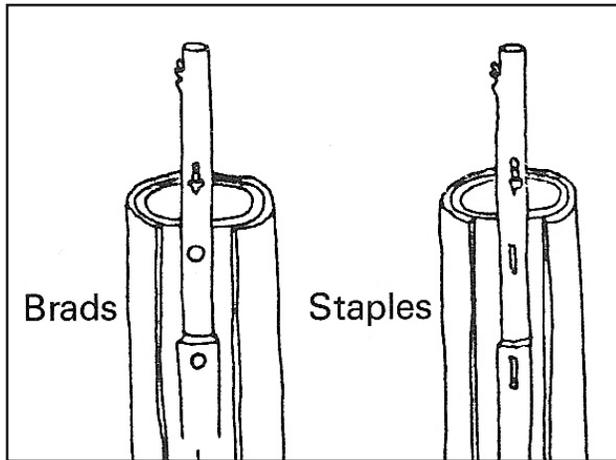


Figure 12. Attaching the scion with brads (left) and staples (right).

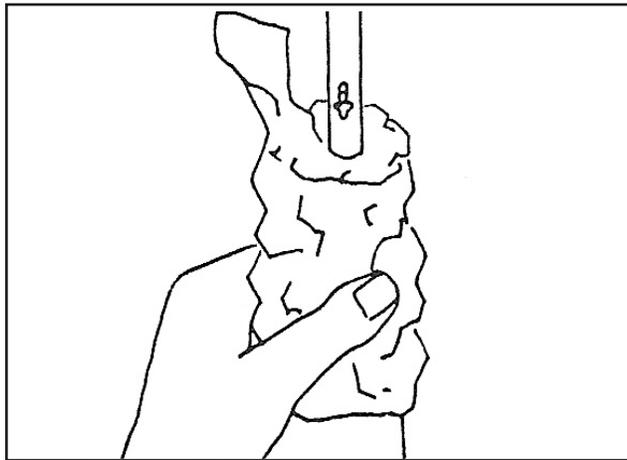


Figure 13. Wrapping with aluminum foil.

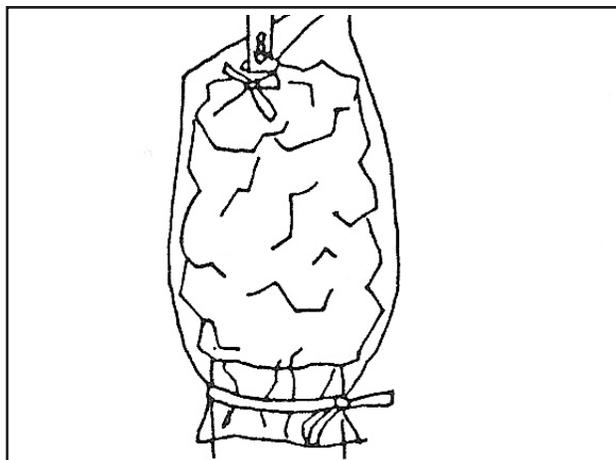


Figure 14. Plastic bag placed over bark grafted scion.

flexible inner bark as possible since the scion will later be fitted beneath this inner bark layer.

Choose a scion with at least three buds. Make a sloping cut through the scion about 1 1/2 -3 inches from the lower end. This cut should be as flat as possible since it forms the seat of the graft against the stock. On the opposite side, make a sloping cut about 1/2 to 3/4 inch long to form a slight wedge (Figure 8). This cut provides additional contact between the cambium of the scion and the stock.

Place the scion against the stock. With a sharp knife, cut through the bark of the stock along each side of the scion (Figure 9). Loosen this strip of bark with the point of the knife and peel it back as deeply as the long cut on the scion. Slip the scion under this strip of bark and gently push downward to the bottom of the loosened bark (Figure 10). Cut the strip of bark, leaving a flap, about 3/4 inch long (Figure 11).

Hold the scion in place and carefully nail the scion to the stock with two brads. Drive one brad through the flap of bark and into the scion just above the chiseled cut at the bottom of the scion. The remaining brad should be driven into the scion near the top of the stock. A heavy duty staple gun may be used instead of brads. Use 9/16 inch staples placed vertically to prevent girdling of the scion (Figure 12).

Two scions may be grafted to increase the chances of a successful graft. If both survive, keep the second scion pruned back during the time that the grafting cut scabs over and heals, then remove it.

Seal the graft by covering it with a 8-12 inch square of household aluminum foil. Cut or tear the foil to its center, fold it with the bright side out, around the stock and scion. Cover the top six inches of the stock, the top of the grafting cut, and the lower 1/2 inch of the scion, leaving the lowest bud on the scion exposed. Crimp the foil, forming a loose mold over the stock (Figure 13).

Cut off 1/4 of a pint or quart plastic bag, slipping the bag over the scion, and down to the stock. Tie the bag just below the lowest bud on the scion with rubber bands, strips, or grafting tape. The bag should reach about 1 inch below the foil (Figure 14). Coat the top and sides of the scion with shellac to prevent drying (Figure 15).

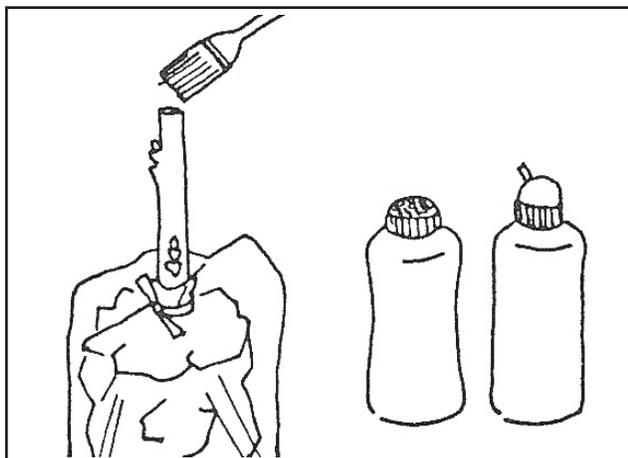


Figure 15. Sealing the scion with shellac.



Figure 16. Initial slicing of the stock for four flap or banana grafting.



Figure 17. Cutting the scion.

Four Flap or Banana Grafting

The four flap or banana graft is one of the easiest grafts to use, even for the novice. It is ideal for small caliper trees up to 1 inch in diameter. This graft is most successful when the scion and rootstock are of similar size. For the best fit, the scion should be slightly larger than the stock.

The high degree of success with the four flap graft can be attributed to the large amount of contact between the cambium of the rootstock and scion. Whereas most grafting techniques only allow for the cambiums to connect at two locations, the four flap allows eight opportunities for cambium contact with each graft. Therefore, a precise cut and fit is less critical with the four flap graft.

Scion wood for the desired cultivar should be collected while dormant in late February or early March. Diameter of the scion wood should be from a minimum of 3/8 inch to 1 inch at maximum. Use healthy, 1 year old wood with well developed buds for the scion. The four flap graft can also be used on older trees. When this is done, use limbs less than one inch in diameter. Large limbs should be de-horned, allowing new growth to develop for one year.

The four flap graft should be made in early spring after the bark begins to slip (April and May). Remove all lateral growth on the stock to about 6 inches. This keeps the tree vigorous, protects it from sunscald, and keeps the scion from becoming too tall or whip-like and breaking out. Cut the stock straight across with sharp pruning shears at a comfortable working height with a trunk or limb diameter of 1/2 to 1 inch. Place a small rubber band around the stock and place it 3 to 4 inches below the cut. This should fit snugly around the stock.

Place the knife blade straight across the cut surface of the stock and slice down through the center about 3/4 inch (Figure 16). After this cut is made, make a second cut perpendicular to the first.

Choose a smooth, straight piece of scion wood approximately 6 inches long and approximately the same diameter as the stock. Each scion stick should have 2 to 3 plump, healthy buds. With a sharp knife, make a flat cut through the bark on three to four sides of the scion, beginning 1 to 2 inches from the bottom end (Figure 17). Gradually increase pressure on the knife so that the cuts taper to join in a square at the base (Figure 18). These cuts should expose a long line of cambium around the edges of the bark.

Pull down four flaps of bark on the stock to expose 2 -2 ½ inches of bare wood (Figure 19). Carefully cut and remove the plug of exposed stock so as not to damage the four flaps (Figure 20). Insert the scion upright on the stock and pull up on the four flaps to cover the cut surface of the scion. Push the rubber band up near the ends of the flaps to hold them in place (Figure 21). Wrap the cut areas with a ¾ inch rubber band or grafting tape (Figure 22).

Wrap the cut areas and the scion with Parafilm strips to seal the cuts and scion (Figure 23). Buds will grow through the Parafilm as they develop. Parafilm allows for the free exchange of air and moisture so that moisture does not build up inside the protective covering. Successful grafts will begin growing in 3 to 4 weeks.

Whip Grafting

Seedling trees and nursery stock of 1, 2 and 3 years of age with a diameter up to 1 inch may be grafted by the “whip” method. Whip grafting may be done in February and March when the buds are dormant.

Young trees of less than an inch in diameter should be whip grafted at or near the soil line. Four to six inches of soil should be removed from the base of the tree so that the graft can be placed below ground where they will be slow to dry out and require less care and wrapping. As an alternative, the graft can be placed close to the ground and the soil mounded around the tree afterwards.

The whip graft can also be used on older trees. When this is done, use limbs less than one inch in diameter. Large limbs should be de-horned, leaving only the smaller ones or allowing new growth to develop for one year.

Select one year old wood, the same day the grafts are to be established. Use 4 to 10 inch pieces of wood approximately the same size as the scion. The best size to graft is ¼ to ¾ inch in diameter. Use 4-6 inch scion wood on older trees and 7-10 inch wood on small seedling trees.

Using a sharp knife, make a cut 1 to ½ long at the top of the stock with one smooth slice (Figure 24). Make the same cut at the top of the scion. Cuts should be made at an angle. Make a ½ to ¾ inch reverse cut nearly parallel to the first on each of the cut surfaces (Figure 25). Fit the scion on the stock so that the two are face to face (Figure 26). The tongues made by the reverse cuts on the stock and

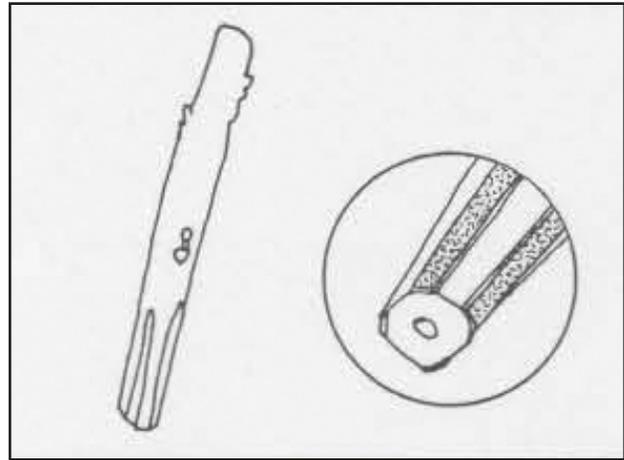


Figure 18. Scion prepared for four-flap graft.



Figure 19. Peeling back of the four flaps.



Figure 20. Cutting the stock for four-flap grafting.



Figure 21. Rubber band holding scion in place.

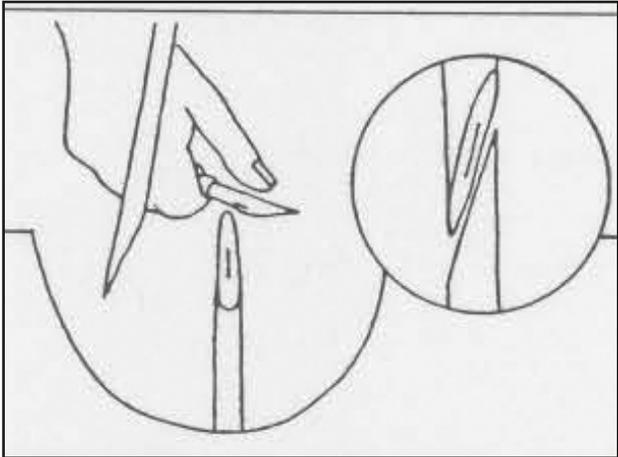


Figure 24. Cutting the seedling stock for whip grafting.



Figure 22. Wrapping scion.

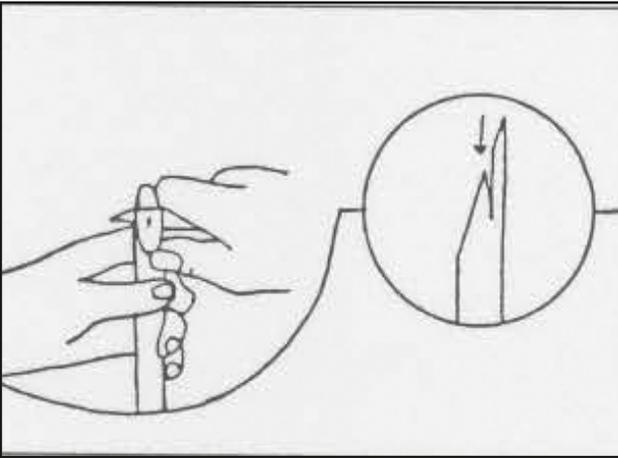


Figure 25a. Cutting tongues on the stock.



Figure 23. Completed four flap graft wrapped with Parafilm.

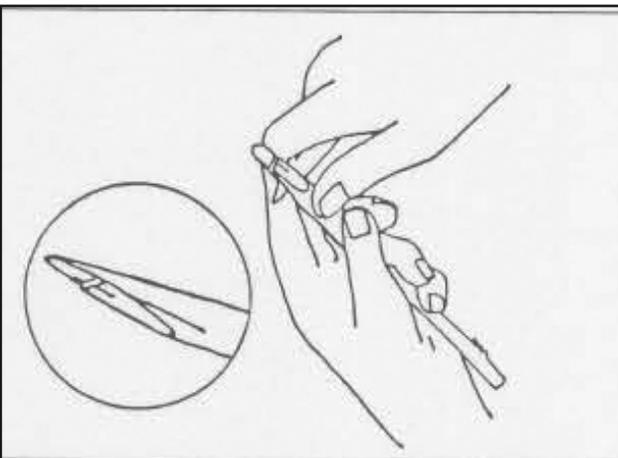


Figure 25b. Cutting tongues on the scion.

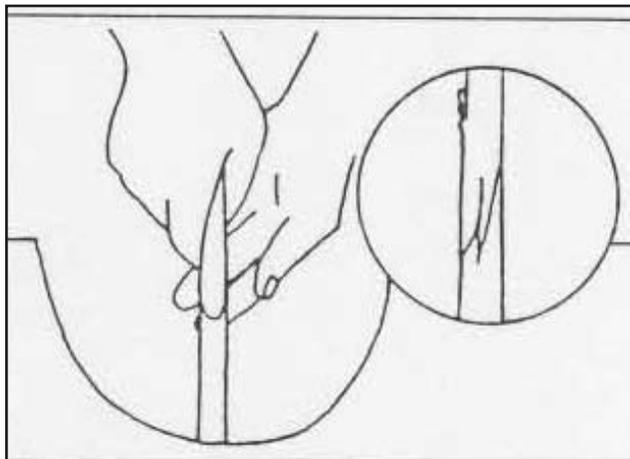


Figure 26. Fitting the scion and stock.

scion are inserted into grooves made by the reverse cuts on the opposite piece of wood.

Immediately after making the graft, wrap it with plastic grafting tape, string, or rubber band so that the scion will be held in proper position with the stock (Figure 27). Bank soil around the scion and stock, leaving one or two buds exposed on the scion (Figure 28). Remove soil after 5 to 8 inches of new growth has developed. For older trees, wax or seal the wrapped cut area with Parafilm.

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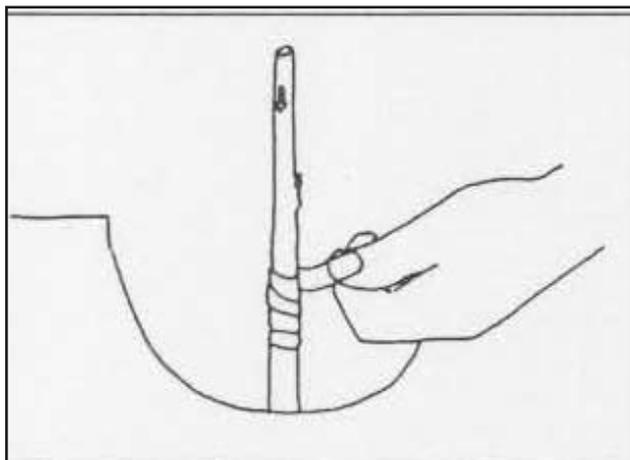


Figure 27. Taping the graft.

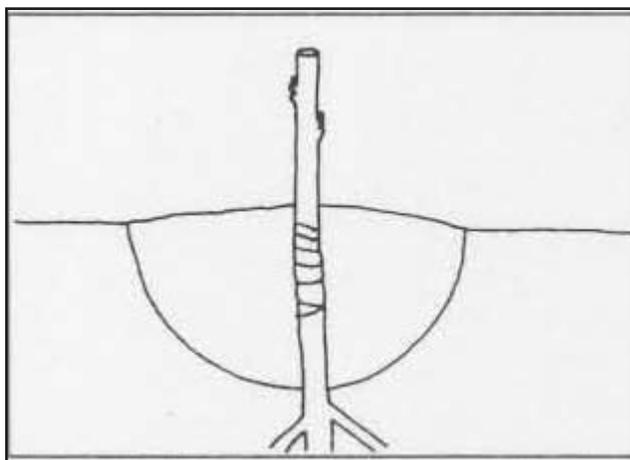


Figure 28. The completed whip graft.