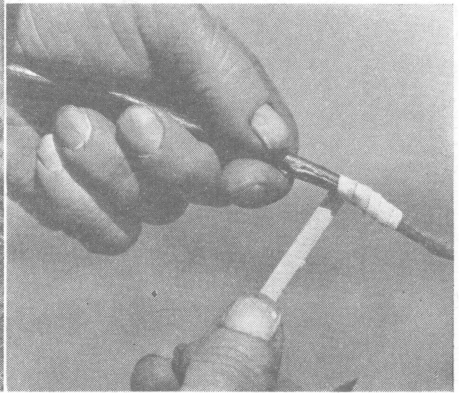


# *Grafting and Budding Fruit Trees*



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## Grafting and Budding Fruit Trees

**M**ANY fruit growers, sooner or later, find it desirable and often necessary to practice some form of grafting and budding.

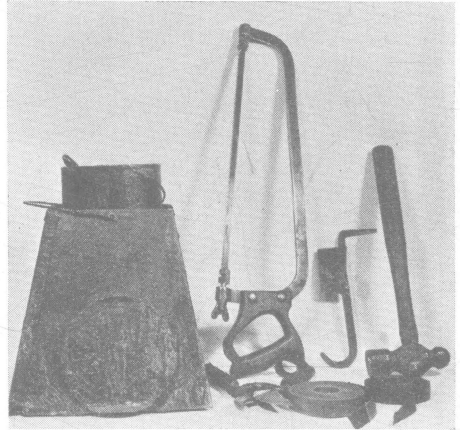
Because fruit varieties do not "come true" from seed, grafting or budding is an absolute necessity at some point in the development of a tree of a particular variety. Usually the nurseryman buds or grafts the desired variety to a rootstock. Occasionally an intermediate stock is used between the rootstock and top to obtain winter hardiness.

Mistakes occasionally occur in the nursery resulting in varieties being untrue to name. This cannot be known until the tree bears fruit. By that time, the grower has time and money invested in the tree. By topworking such trees by grafting or budding, the variety may be changed without sacrificing the original tree.

Growers may also employ the art of budding and grafting to produce their own planting stock. This practice permits growers to use hardy rootstocks such as Haralson, Virginia Crab, Oldenburg, and Transparent on which the desired variety is budded or grafted.

Grafting or budding is also practiced to change a variety that may prove undesirable for ever changing consumer demand.

Repair of injury to trees from rodents is also possible through the use of grafting and budding. Valuable trees that otherwise would be lost can be saved by bridge grafting.



Tools used in grafting, tape for wrapping, and wax melter.

### Time of Grafting

The best time to do grafting is just before and as the buds are starting development in the spring. This period can be lengthened if scions are kept dormant, since the general rule of grafting is to keep scions as, or more dormant than, the stock. By keeping scions dormant and by coating the entire scion as well as the cut surfaces of the stock with melted wax, grafting may be done as late as July.

Whip grafting of seedling rootstocks for growing young trees may be done during the dormant season in winter and the grafted stocks stored in moist sawdust until time for planting in the spring.

## Selection and Care of Scions

The selection and care of scion wood for grafting are of utmost importance. Twigs that have made growth of from 1 to 2 feet during the preceding season usually furnish the best scion wood. The buds should be plump and mature. The mid-portion of the one-year growth furnishes the best scions.

As mentioned before, it is essential that scions be kept dormant until set in the stock. Scions may be cut during the winter while dormant; but care should be taken to keep them cool and moist until time for using. If the scions are cut during the winter, coating them with paraffin and covering in moistened sawdust will increase the percentage of set.

## Methods of Grafting

The principal methods of grafting are cleft grafting, whip grafting, bark grafting, bridge grafting, and bud grafting or budding.

Topworking of trees is usually accomplished by cleft grafting, bark grafting, and budding. Bridge grafting is used to repair damage from rodents. Whip grafting is the common method used in grafting seedling rootstocks in the nursery.

## Topworking

**T**HE changing over of the entire top of a tree to an entirely different variety is called topworking. Mature trees may be topworked, but the older the tree and the larger the branches the more difficult is the task. Topworking of trees takes advantage of the root system already present and brings the trees into production more quickly than can be done by planting young trees.

In selecting limbs for topworking, each tree must be studied as an individual problem and limbs selected for grafting with reference to the future framework and form of the tree. A vigorous, upright branch in the center of the tree which will be the future central leader of the tree should be selected for grafting. A branch slightly leaning toward the prevailing wind is best for this purpose.

Trees may be trimmed during the winter season, preparatory to grafting, and the stubs to be grafted coated with melted brush wax to prevent drying out. The younger the trees the fewer the limbs that need to be grafted and the easier it is to find limbs of desirable size near the trunk. The limbs should be cut off as close to the trunk as necessary to obtain a limb diameter of from 1 to 2 inches on which to graft.

The majority of the remaining limbs, upon which grafts are not to be set, are then removed. Enough of these limbs are allowed to remain, however, to shade partially the limbs upon which the scions are set, and thus protect them against sunscald. For this reason, on

mature trees it is necessary to extend the time of topworking over two or three seasons.

After two or three seasons when the grafts have made sufficient growth to shade themselves and the main trunk parts of the tree, all other growth is removed. The graft growth itself is next thinned out. Where double grafts have grown, one each of these is removed and the tree pruned to correct its form.

### Topworking by Cleft Grafting

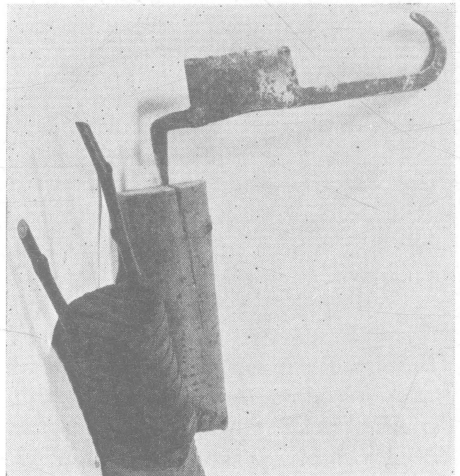
Cleft grafting is the most commonly used method of topworking. Limbs from 1 to 3 inches in diameter are grafted in this manner. Larger limbs may be grafted by using two clefts parallel to each other, one on either side of the center, and inserting four scions. On young trees from 2 to 4 years old, the scions may be placed in the trunk; on older trees, they are placed in the branches.

### Cleft Grafting of Young Trees

WHERE young trees are to be topworked, the trunk is cut off 18 inches to 2 feet from the ground and scions cleft grafted into it. One method used successfully on young trees is to cut them off with a sloping cut, setting one long scion in the stock at the top of the slope. The stock should then be trimmed off at the top of the slope to the width of the scion, and the slope cut on the stock so that the scion will be set on the windward side. This one scion may be from 10 inches to 2 feet long and the terminal bud may be allowed to remain.

The long scion may even be debudded, leaving only the buds that are needed for scaffold branches, as when starting a yearling tree. The entire scion and cut surfaces of the stock are coated with melted brush wax. If the grafting is well done, the scion will grow into a branched top in one season.

A special tool, known as a grafting tool, may be used to advantage in making the cleft and in holding it open to receive the scion. This tool is made of good steel and consists of a concave cutting edge with a hook or handle on one end and a turned up edge on the other. The cutting edge of the tool is concave in shape so that the limb will be cut clean first at the edge, before



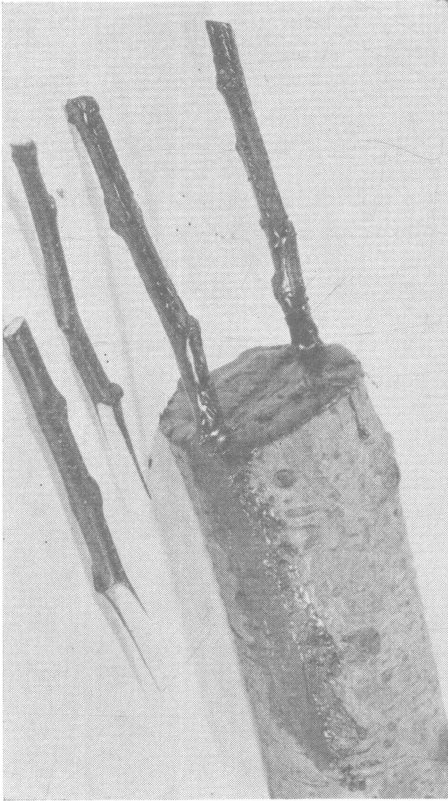
The grafting tool spreads the stock for scions without bruising the cambium layer.

the wood splits, thus giving a clean cut surface in which the scion may be set. The grafting tool may be hammered into the wood with a small wooden or rubber mallet.

In splitting the stubs of side branches, the cleft should be made in a horizontal direction; and, on vertical stubs in the top of the tree, the split is made in a direction allowing one scion at least to face the prevailing wind. On limbs that are cut to a bevel and only one scion set, the scion should always be placed on the upper or outer edge at the highest point of the bevel.

After the cleft is made, the grafting tool is removed, turned over, and the wedge on the outer end hammered into the cleft at the center of the stub. This opens up the cleft so that the scion can be easily inserted without tearing the bark.

Scions are usually cut from three to five buds long for topworking. The scion is cut off directly above the top bud. Beginning at the base of the lowest bud, the lower end of the scion is cut in a wedge shape with uniform, even sides and slightly thicker on the bud side. This wedge should not usually be over  $1\frac{1}{2}$  to 2 inches in length and should be blunt on the lower and front ends, rather than drawn to a fine, long point. The idea is to cut the scion as nearly to fit the cleft in the stock as possible. A steady, continuous stroke with a sharp, thin bladed knife is essential as the cut surface should be smooth and clean.



Cover both stock and scions completely with grafting wax. Scions are trimmed to wedge shape, then shaved thin on inner edge of the wedge.

After the wedge of the grafting tool is driven into the cleft at the center of the stub, the handle is pushed down slightly to spread the cleft farther apart. The prepared scions, one on either side, are then inserted in the cleft with the wide edge of the scion outward, so that the stock will clamp the scion most firmly in the region of the cambium. They are then slipped downward into the cleft until the lower bud is close to the cut surface of the stock.

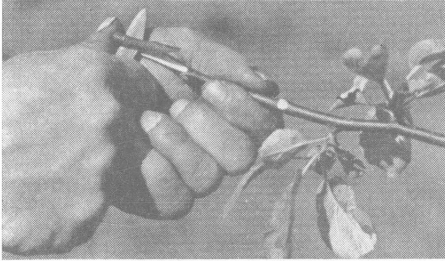
An effort must be made to make the line of the cambium

layer of the scions as nearly continuous as possible with that of the stock. Since the bark of the stock is thicker than that of the scion, the scion will always be a little toward the center rather than flush with the outside of the stock. Sometimes the scion is tilted very slightly to the outside, as this insures a contact of the cambium layers at some point, although this is usually not necessary.

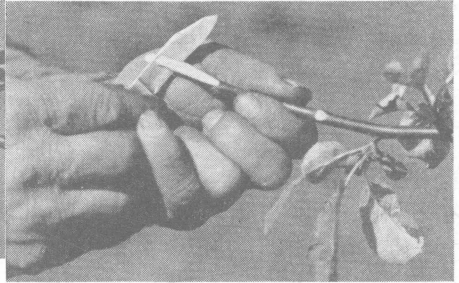
All cut surfaces of both stock and scion should then be carefully covered with wax to keep the parts from drying out before union has taken place.

### Topworking by Whip Grafting

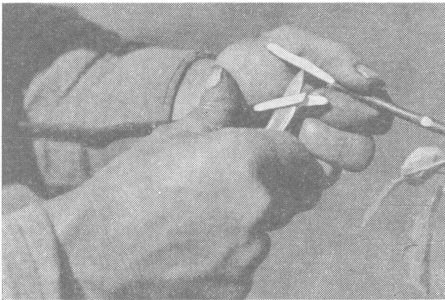
In top grafting trees, one may want to place grafts in limbs less than 1 inch in diameter. This is especially true when it is desirable to graft small trees without taking the chances of grafting in the trunk. Results from whip grafting are better when the stock and scion are of about equal size.



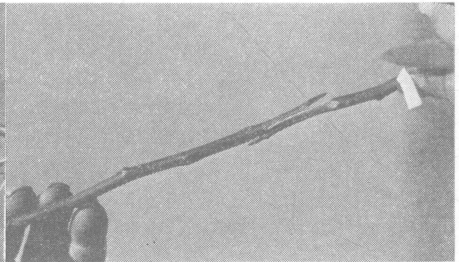
Making the first cut on the stock. A slanting 2 to 3 inch surface is desirable.



Making the tongue in the stock.



Making the tongue in the scion.



Placing scion in the stock with cambium layers in contact.

In making a whip graft, a sloping cut is made on one side of the upper end of the stock and a like cut to match made in the lower end of the scion. A tongue is cut in both scion and stock midway of the sloping cut and with the grain of the wood. When the scion and stock

are brought together, the tongues each slip into the slits made for them and are thus held together. The cambium layers of stock and scion should be matched so that they make contact with each other at the tongues.

This type of graft is usually wrapped to hold the parts securely together. Waxed yarn or cloth strips may be used for this purpose. Small rubber strips are ideal for this purpose, as they exert the necessary pressure to hold the parts together and expand with the growth. After the graft is wrapped, it is then thoroughly covered with a thin coating of wax.

### Topworking by Bark Grafting

Bark grafting is done in the spring when the bark peels readily. It is preferred by some because it is done without splitting the wood. It is used also in grafting limbs that are larger than are usually cleft grafted. Its weakness lies in the fact that the grafts are not sufficiently supported and, if vigorous growth ensues, are likely to be blown and whipped out by the wind.

Several methods of bark grafting are used, but all consist of placing the scions just under the bark. In one method largely used, the limb is cut off as for cleft grafting. The scion is cut with a long bevel on one side and a very short bevel on the other so as to leave a sharp chisel edge at the lower end. The scion is then held in place on the outside of the bark and the bark slit down with a knife approximately to correspond with the length and width of the bevel surface of the scion.

The lower end of the scion, with the long bevel towards the stock, is then pushed under the bark between the two cuts, the bark peeling as the scion is pushed downward. The lifted bark is then cut away even with the top of the short bevel and the scion tacked tightly to the stock with two small nails or brads.

Other scions, at intervals of 2 to 4 inches ( are put in place in the same manner entirely around the stub. The entire scions and cut surfaces of the stock are covered with melted wax. In shaping the scion, some prefer to cut halfway through the scion at the top of the long bevel, forming a shoulder that is placed against the top of the stock, giving added support to the scion.

Another method is to cut the scion to a very long, slim bevel from one side, slip it down between the bark, and tack it in place. If the bark is heavy, it is necessary to cut the bark in front of the scion before it will loosen enough to allow the scion to be pushed down into place. The scion is then secured and waxed in the usual way.

In placing scions in bark grafting, care must be taken that they are cut with a smooth surface as nearly as possible to fit the surface of the stock. A small block plane has been found very valuable in smoothing up and cutting the long bevel in this type of grafting. The knife of the plane may even be ground to slightly rounded cutting



edge instead of straight. This will enable the beveled surface of the scion to be cut slightly concave to fit the surface of the stock more closely.

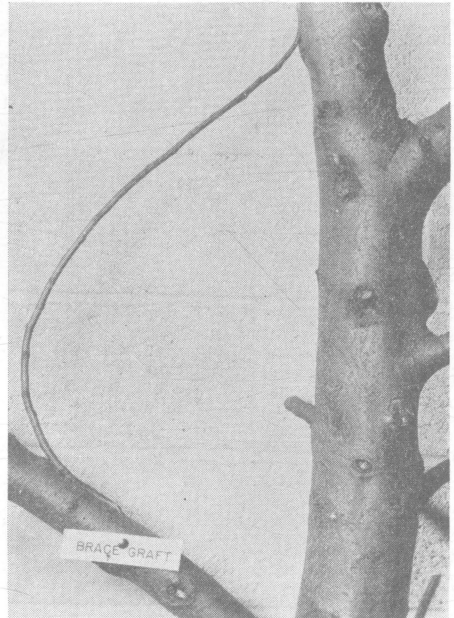
The small nails or brads used in bark grafting should be very slender so as not to split the scion, and should have wide heads so as to draw the scion closely to the wood. Those commonly known as cigar box nails or small nails, used in making up bee supplies, are fine for this purpose.

## Bridge Grafting

**B**RIDGE grafting is used to repair damage done to trees by mice, rabbits, or other bark peeling or eating animals. It may be used to advantage in bridging over damaged areas of the trunk caused by blight cankers, winter injury, disease, or serious mechanical injury. In preparing the tree for bridge grafting, the damaged bark should be cut back to clean, live, healthy bark. Scions of sufficient length should be selected to reach over the injury to healthy bark on either side, and extra length should be allowed for a bow or spring in the scion when finally set. Both upper and lower ends of the scion are beveled and the bark on the stock measured and cut as for bark grafting.

The lower end of the scion is fitted into the slot in the bark cut for it and secured with two small nails. The free end is then sprung down and fitted into the slot prepared for it on the upper side of the injured area, and this is nailed in place. Enough scions should be set over the injured area so that they will not be over 2 to 4 inches apart. Water sprouts or long one-year terminal growths make good scions for bridge grafting.

All cut surfaces should be carefully coated with wax. The upper ends of the scions should have special care as the wax tends to run off and leave uncovered spaces at the angle where the inner side of the scion meets the stock. The edge of the injured area should be covered with wax as well as the whole surface of the injury itself.



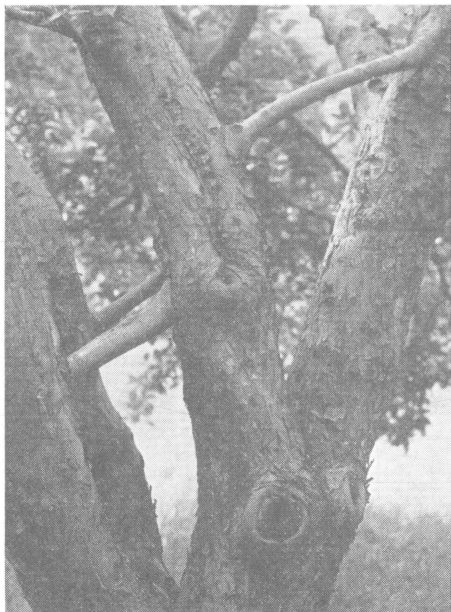
Beginning a brace graft to strengthen a crotch.

Where the injury extends from the base of the tree out into the roots so far that bridging with scions is impossible, one-year-old nursery trees can be planted at intervals around the base of the tree and the tops grafted into the healthy tissue above the injury.

## Budding

**B**UDDING is employed by nurserymen more than any other method in propagating a desired variety on seedling stock. Apples, pears, cherries, quinces, peaches, and plums all may be propagated by budding in Ohio.

The essential considerations in budding are the same as in grafting, except that a single bud is made to grow upon the stock instead of a scion containing three or more buds. The success of the operation depends upon the uniting and growing together of the cambium of bud and stock. Shield or T budding is most generally used and takes its name from the shape of the small piece of bark cut off with the bud or the cut made in the stock.



Brace grafts tie main limbs together within a few years.

In Ohio, budding is generally done during the latter part of July or during August. The exact time of budding depends upon the ripeness of the buds on the current season's growth and upon the ease with which the stock peels. Stocks should be in good growing condition and bark slipping easily for success in budding. Buds should be secured from the variety of fruit desired, the buds in the axils of the leaves on current season growth being used. The buds should be well formed. Vigorous shoots having formed their terminal buds generally contain good mature buds. Buds taken from the central two-thirds of the growth are better than buds taken from the tip or bottom ends of the growth.

These growths are cut from the tree and the leaves trimmed off, leaving about half an inch of the petiole of the leaf to act as a handle when inserting the bud. These sticks containing the buds are then wrapped in moist cloth to keep

them fresh while budding. In budding on the limbs in topworking, buds are placed in an outside position or on top of the limb. Buds are more successful when placed on current season or one-year wood. With proper care, buds may be grown on older wood. The thicker the bark the less likely the buds are to succeed.

In budding, the cut in the stock is made in the shape of a T. The bark of the stock is first slit for a little more than an inch lengthwise of the stem. Next, the knife edge is rolled across the stem at the top of the lengthwise slit, completing the T-shaped cut. If the crosswise cut is made with a downward slant to the knife, the corners where the two cuts cross each other may be raised up slightly when the knife blade is brought out. If the bark does not raise up easily enough to admit the bud without injury by this method, the edges must be loosened and raised with the tip of the knife.

The bud is now cut from the twig in the shape of a shield, starting the knife blade about  $\frac{1}{2}$  inch below the bud, cutting deep enough into the twig so as not to injure the bud, and running up under the bud and out again about  $\frac{1}{2}$  inch above the bud. The small bit of wood cut out with the bark is sometimes removed, but ordinarily it is disregarded. The bud is now grasped by the projecting petiole, inserted in the T-shaped opening, and pushed downward into place. If the bark at the top of the shield projects above the cross cut, it should be cut off even, so that the under surface of the bud fits closely to the stock.

The bud is then wrapped to hold it tightly against the stock until the union takes place. Rubber budding strips are ideal for this purpose. The size of these strips varies from  $3\frac{1}{2}$  inches long and  $\frac{3}{8}$  inch wide to 5 inches long and  $\frac{3}{16}$  inch in width, according to the size of the stock and the length of time the wrapping is to remain. These strips rot off and need not be cut.

In wrapping a bud, the wrap is started below the bud, crossing the first turn to hold it in place, continuing the wrap up to the bud, then above the bud, and placing the free end back under the last turn which holds the end in place. This method holds the bud tightly in place and makes a smooth wrap without tying any knots. Three or four turns of the wrapping, both below and above the bud, are sufficient.

The bud will remain dormant the remainder of the season but should start growth the next spring. The stock should be cut off just above the bud in the spring and care taken the first few weeks of active growth to remove all sprouts arising from the stock around or directly below the bud.

## Grafting Waxes

**S**EVERAL kinds of waxes are used in grafting. One of the oldest hand wax formulas consists of 4 parts of rosin, 2 parts of beeswax, and 1 part tallow. These materials should be melted together slowly and

not allowed to boil. When melted, pour into cold water to cool. Grease the hands with tallow and work the wax until it is straw colored and uniform in texture. This wax may then be wrapped in oiled paper and kept indefinitely soft enough to apply without artificial heat when temperatures are mild.

### Brush Wax

Brush waxes are kept in a melted condition by means of small portable heaters. Orchard supply companies can supply these heaters. This type of wax is more practical than the hand wax where much grafting is to be done. A satisfactory brush wax can be made by melting together 5 parts of rosin, 1 part of beeswax, then adding  $\frac{1}{4}$  part of linseed oil and  $\frac{1}{2}$  part of lamp black or powdered charcoal. The lamp black or charcoal gives toughness and pliability to the wax.

High-melting-point paraffin has been increasingly used as an ingredient of brush waxes in the past few years. Plain paraffin, if applied alone, however, has a tendency to crack in cold weather and flake off. Satisfactory commercial paraffin brush waxes may be purchased. Paraffin wax, sold by orchard supply companies, is one of the best. These waxes contain other ingredients mixed with paraffin to give added elasticity and sticking qualities. The success of using paraffin alone as a brush wax after severe weather is past depends largely on applying it while almost smoking hot. It will then go on in a thin, almost transparent coat much like varnish and will stick remarkably well. A high-melting-point paraffin is preferred as it will not be affected by hot weather.

### Paraffin Brush Wax

A satisfactory brush wax can be made by melting together 1 pound of rosin, 5 pounds of high-melting-point paraffin and 3 fluid ounces of linseed oil. This wax is applied when melted and quite hot.