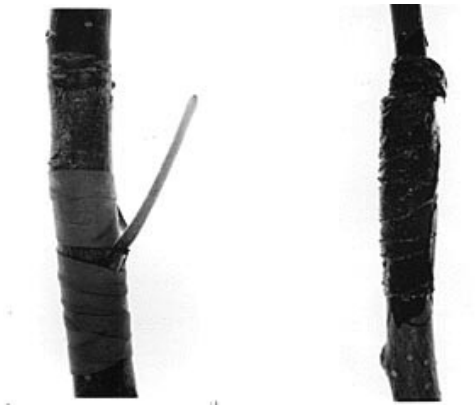
GRAFTING AND BUDDING FRUIT TREES



A budded apple shoot completely wrapped with rubber budding strips, top right. Nurseries often use this method to produce fruit trees. At bottom left, asphalt grafting compound is applied to a completed whip graft to prevent wood tissues from drying out. This method is used mainly on young apple and pear trees when branches are small. A cleft graft, bottom right, covered with asphalt grafting compound is used for topworking established apples and pear trees.

Table of Contents

Section
Page

1. What Is Grafting?

The seed from a Haralson apple will produce an apple tree, but it will not produce a Haralson apple tree. Likewise, the seed from a Honeygold apple will not produce a Honeygold apple tree. In other words, fruit trees cannot be reproduced "true" to the original cultivar from seed. They can only be reproduced by grafting. Grafting describes any of a number of techniques in which a section of a stem with leaf buds is inserted into the stock of a tree. Grafting is useful however, for more than reproduction of an original cultivar. It is also used to repair injured fruit trees or for topworking an established tree to one or more different cultivars.

By top-working you can do the following:

- An undesirable cultivar can be changed by grafting a preferred cultivar to the branches.
- Cultivars that lack hardiness or have poor-crotches (narrow angled) can be made more durable by grafting them on hardy, strong-crotched cultivars such as Hibernal, Virginia, or Columbia Crab.
- Pollinator cultivars can be grown much sooner by topworking than by planting young trees.
- New cultivars for trial can be brought into bearing in 2 or 3 years if topworked on stock of bearing age.
- Interesting novelties can be developed by grafting several cultivars on one tree.

2. A Glossary of Grafting Terms

Topworking	The operation of cutting back the branches and top of an established tree and budding or grafting part of another tree on it.
Understock or stock	The part on which the scion is inserted; the part below the graft.
Rootstock	That part of a tree which becomes the root system of a grafted or budded tree.
Scion	A piece of last year's growth with three or four buds; the part inserted on the understock.
Cambium	The growing part of the tree; located between the wood and bark. At the season when bark separates freely, cambium will be both on the wood surface and on the inner bark.
Dormant	The condition of live trees at rest—as in winter.
Budding	A type of grafting that consists of inserting a single bud into a stock. It is generally done in late July and August, the latter part of the growing season.
Budstick	A shoot of the current season's growth used for budding. Leaves are removed, leaving ½ inch of leaf stem for a handle.
Cultivar	Denotes a cultivated type of plant. (Now used in place of the term "variety.")

3. What Trees Can Be Grafted?

Young, vigorous fruit trees up to 5 years old are best for topworking. Older apple and pear trees of almost any age can be topworked but the operation is more severe and those over 10 years old must be worked at a higher point. Hibernal, Columbia, or Virginia crab, because of their 3 vigor and their strong, well-placed branches, are very good understocks.

Young trees should have 1 to 2 feet of branch between the trunk and the graft. Otherwise the good crotch formation of the understock will be lost by the trunk expanding past the union.

Trees up to 5 years old can be grafted at one time. On older trees about half—the upper and center part only—should be worked at one time. The remainder should be worked a year later.

4. How to Collect and Store Scions

Scions are selected from the previous season's growth, while they are dormant, but before growth begins in the spring. If the scions are left on the tree until spring, however, there is some danger that the buds will start to grow or be injured during winter. Scions cut in November grow best in Minnesota.

The scions should be tied securely, carefully labeled and placed in moist (not wet) sawdust or moss or wrapped in plastic material. They should be kept in a cool, moist place where they will remain fresh and dormant until spring.

5. When to Graft

It is best to graft in the spring, from the time the buds of understock trees are beginning to open, until blossom time. The usual time is April or early May.

6. Tools and Materials Needed

1. Budding knife
2. Grafting knife
3. A fine-tooth saw for cleft grafting
4. Pruning shears
5. Dormant scions (cultivar labeled)
6. Tying material such as grafting tape, adhesive tape, electrician's ber tape or rubber strips
7. Asphalt water emulsion compound for covering grafts
8. A light hammer for bridge grafting
9. A cleft-grafting chisel and mallet, or a heavy knife or hatchet can be used for a small job

7. Protective Coatings

All grafts should be covered with a protective coating immediately after completing the graft.

Electrician's tape is an excellent material that will bind and protect graft unions. Choose a brand that is elastic and amply adhesive. A good tape for the purpose will stick well to itself. Do not stretch this tape too tightly or it may crack or weather. Better brands will last throughout the first summer, after which the tape is no longer needed.

Asphalt water emulsion is now widely used as a protective coating on graft unions. It is of pasty consistency and can be applied with a brush. It is preferable, however, to smear it on thicker with a small paddle.

8. Methods of Grafting

The Whip Graft

The whip graft is used mostly on young apple and pear trees when the branches are relatively small (not more than ½-inch in diameter) and the understock is about the same diameter as the scion of the new cultivar.

Cut—Cut off a branch of the understock, leaving a stub at least a foot long. Make a straight, slanting cut about 1½ inches long on both the scion and the stock (see A and C in Figure 1). Make the cut straight and even—one stroke with a sharp knife will do it. For the tongue, make a straight draw cut (not split), beginning near the top and cutting about the full length of the level (B and D).

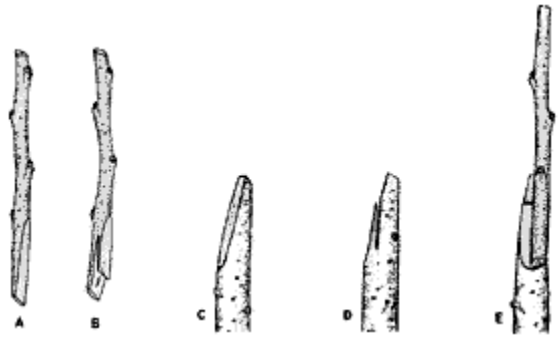


Figure 1. The whip graft is usually used for grafting root stocks and scions but can also be used for grafting small branches.

Union—Match the two parts together (E). Unless the scion and stock are the same size, be sure the scion is in contact with the inner bark on one side. If the toe of either the stock or scion extend beyond the heel of the other, cut if off evenly.

Tying and covering—Bind tightly with tape, then carefully cover the union and binding material with grafting compound.

This type of graft is difficult for the beginner but is used extensively by experienced operators. It lends itself to the tape method of binding. Tape serves to seal the wound and bind the parts together.

While other types of grafts depend on the bark slipping well, the whip graft does not. In fact, it is best if you make this graft before the narrow tongue of wood.

Aftercare—Remove wrapping as soon as the scion has started to grow to prevent girdling of the tree.

The Cleft Graft

The cleft graft is used for topworking older established apple and pear trees, either on the trunk of a small tree or on the side branches of a larger tree. It is best adapted to branches 1 to 2 inches in diameter. The grafts are made within 2 to 3 feet of the trunk or main branches and preferably not more than 4 to 6 feet from ground, or new top of tree will be too high.

Cuts—Select a place free from knots and cut off the stock with a saw. Cut the cleft (avoid splitting if possible) with a grafting chisel, large knife or hatchet. After a few trials you will learn the proper depth of cleft. In horizontal branches, the cleft should be sidewise, that is, not perpendicular, to reduce breakage from birds and storms.

With a sloping cut about ¼ inch above the upper bud, cut the scions to include three buds, and to a blunt wedge about 1½ inches in length with one side slightly thicker than the other (see A and B in Figure 2). If the scion wedge is cut to a sharp point there is danger of the bark peeling. Also a sharp scion wedge' will not fit the cleft as well (C).

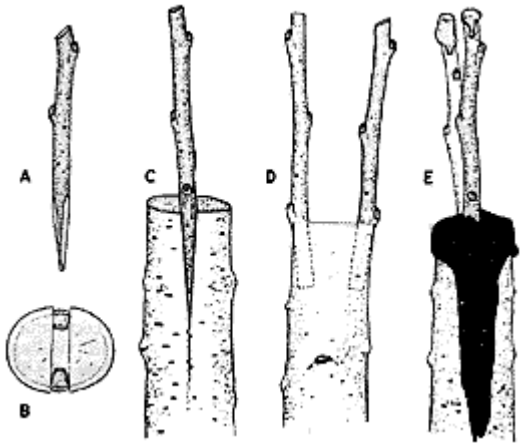


Figure 2. The cleft graft is the one to use on large branches.

Union—Open the cleft slightly with a grafting tool or screw driver. Insert a scion on each side, with the inner bark of stock and scion in contact. Have the thick side of the scion outward (B).

Keep in mind that the bark of the larger stock is thicker than the scion bark, so the scion should not be flush with the stock. A very slight tilt will assure a contact, at least where the cambium layers cross (D).

Tying and covering—There is no need to tie, unless the stock is small and does not bind well. Cover the unions with grafting compound and be sure the cleft is covered its full length (E).

Aftercare—Scions that are growing vigorously will need attention to prevent breakage by birds, ice and storms. Either tie the scion to a supporting brace (see B in Figure 3), or pinch back the tips before growth becomes excessive. For additional support, circle all the shoots from one stub with twine (A).

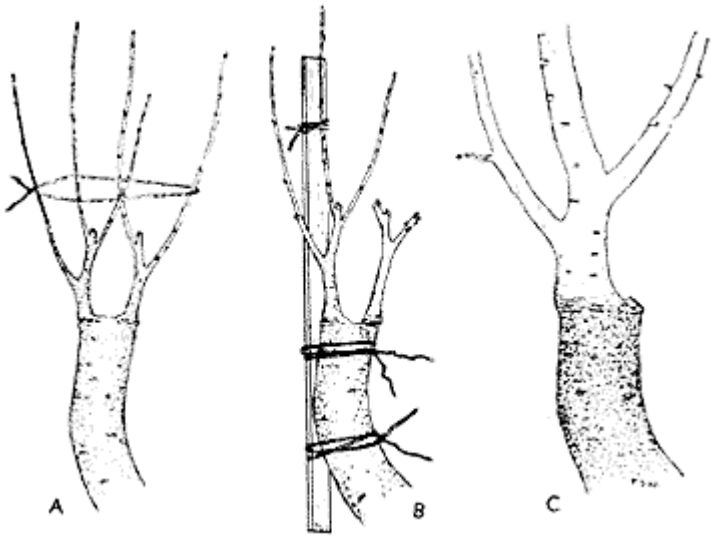


Figure 3. In this example of a cleft graft, three stages in the growth of a branch from a scion are shown.

During the first season, let all scions and the shoot growth from below the graft grow undisturbed. However, do not permit this understock growth to shade out the scions. The second spring, select the most suitable scion as the permanent branch and consider the others as spares. Leave the spare scions on to assist in healing over the stub, but cut them back to a few buds on each (see B). The third spring, severely cut back the spare scions again. In the fourth season, or when crowding is noted, cut off all of the spare scions as seems necessary (C).

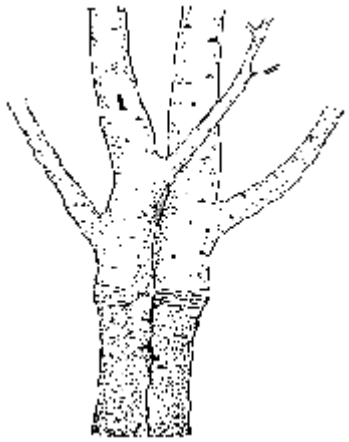
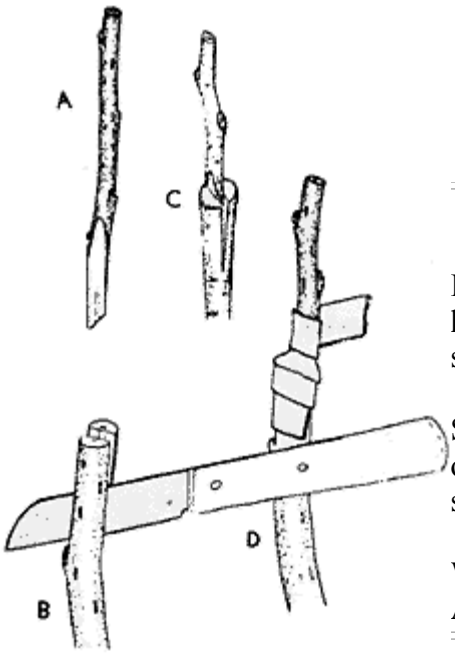


Figure 4. Trouble ahead in the next storm. Don't let two leaders compete.



The Modified Cleft Graft

Instead of trying to master the whip graft or side graft, use a simple kind of cleft graft on small understock. Stock (see B) about the same size as the scion (A) may be split and a wedge-shaped scion inserted.

Should the stock be larger than the scion, be careful to set the scion to one side instead of on center (C). In this way the cambium of stock and scion will make contact.

Wrap this graft union (D) carefully with a good grade of rubber tape. As the graft grows the tape stretches and eventually deteriorates.

Very large trees are generally poor subjects for cleft grafting, so when grafting their large branches, a slightly different method is ordinarily used.

Carefully saw off the branch undercutting it first to avoid tearing the bark. You may need to recut the stub to get it smooth. Saw the branch to receive the scions, instead of splitting it.

Make two saw cuts about 4 inches deep at right angles to each other across the end of the stub, making a + shape. Then fit the scions into the four places made by these cuts.

The Side Graft

Although the side graft is adapted to a wide range of branch sizes (¼ to ¾ inch diameter), its use is generally restricted to branches that are too large for the whip graft yet not large enough for the cleft graft. As the name suggests, the scion is inserted into the side of the stock, which is generally larger in diameter than the scion.

Cuts—Select a smooth place on the understock branch at least a foot from the trunk. Make a slanting cut at a narrow angle almost to the pith (core of the branch) (see B in Figure 5). Cut the scion to a short, sharp wedge (about 1 inch) with one side thicker than the other (see A).

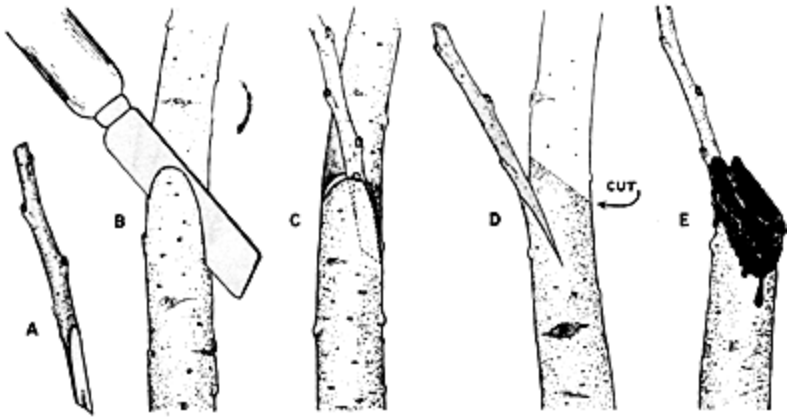


Figure 5. In the side graft, the cut goes across the grain to reduce splitting.

Union—Bend the branch slightly to open the cut. Press the scion in so the cambium layers of the stock and scion meet at one side (C).

Tying and covering—Tying is unnecessary if the stock binds well, but you may have to tie small materials if the scion is not held firmly. Cut surfaces should then be covered with grafting compound (E).

Aftercare—In about two weeks, cut off the stock above the union (D) using sharp shears in order to avoid disturbing the scion. Then cover the cut surface with grafting compound (D).

If the graft has been tied, cut the binding shortly after growth starts; this will prevent girdling. In the first season, you may allow some shoot growth from below the graft, but do not permit this growth to shade the scion growth. After the first season, all growth should be cut off, except that of the graft.

Inspect grafts during the growing season to guard against faulty covering or binding. If shoots are attacked by fire blight, cut them 6 inches below the visible symptoms.

The Budding Graft

Budding is a form of grafting in which a single bud is used as the scion rather than a section of stem. It is the most commonly used method for fruit tree production in the nursery, but can also be used for topworking plum, cherry, apricots, and peach as well as young apple and pear trees. (Cherry, plum, apricot, and peach are not easily cleft grafted or whip grafted.)

Budding is done in the summer, usually from July 15 to August 15, when the bark of the stock slips easily and when there are well-grown buds. The first step is to cut bud sticks

of the desired cultivar from strong shoots of the present season's growth (see A in Figure 6). These buds should be mature, as indicated by a slightly brownish color.

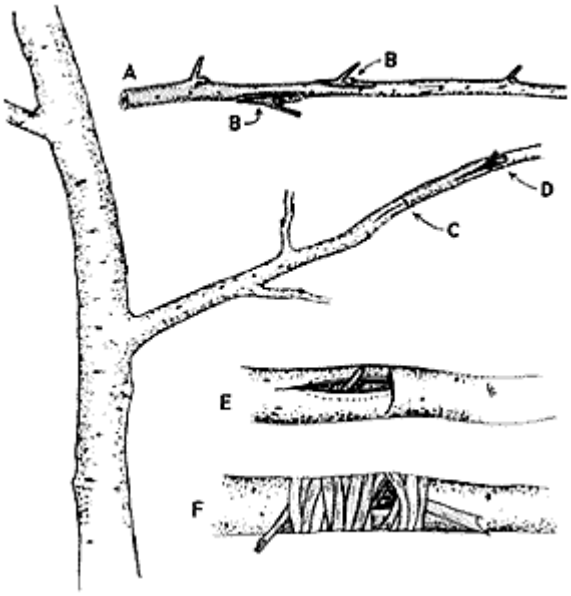


Figure 6. In budding, a single bud does the work of a scion.

Clip off the leaves as soon as the bud sticks are cut, leaving about ½ inch of the leafstalk for a handle. Discard the soft tips of the bud sticks. Wrap the bud sticks in moist burlap, moss or paper to prevent drying out.

Branches from the size of a lead pencil up to ½-inch diameter may be worked by this method. The bark of larger branches is too thick for satisfactory budding.

Cut—On the branches of the stock, about 15 inches or more from the trunk, make a T cut just across the bark (C). Then, with a knife blade or bark separator, lift the corners and carefully loosen the bark.

Bud With Wood Attached

Cut a bud from bud stick (A) which includes a thin piece of attached wood (B). Start the bud under the flaps of bark and lead it down by the handle (see D and E in figure 6).

Tying—Use rubber strips, electrician's tape, or adhesive tape to tie the bud. Wrap and tie tightly, but be sure you do not cover the bud (see F in Figure 6).

Aftercare—Cut the tie before it binds too tightly—that is, in two or three weeks. Cut on the side away from the bud. Rubber strips need not be cut. The bud should remain

dormant until the following spring. Cut off the stock above the bud as soon as the bud starts growing.

Do not permit any shoot growth.

After the second year, remove all extra growth from the stock, that is, keep only the bud grafted shoots. When two or more buds grow, all can be used, but one is usually enough to produce a new branch.

Bud With Wood Removed

As illustrated in Figure 7, cut from A well under the bud to B. Remove the knife and rock the blade just through the bark at B. Grasp the bark between your thumb and finger and pinch the bark with attached bud (C) free from the wood (D). If the bud stick is fresh and in good condition, you will be successful after a few tries.

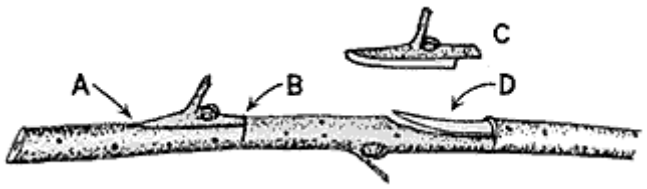


Figure 7. Bud with wood removed.

Buds which have the sliver of wood removed have a complete cambium surface exposed to meet the cambium of the stock and sometimes result in better growth, but they are not rigid enough to handle easily. Buds with wood attached are easier to handle and usually give good results. (See above, for "Tying" and "Aftercare" of the bud.)

The Bridge Graft

When the bark of a tree is removed (girdled) completely around the trunk, that part of the tree above the damaged area will die. Even though completely girdled, some trees may leaf out and remain alive for one season, but both the top and root will die the second year unless shoots have been produced below the girdled areas.

Girdling can be caused by rodents, which damage many fruit trees each year. Occasionally a tree may only appear to be girdled if the gnawing has not gone through the bark to the wood. Sometimes the girdled area extends less than halfway around the trunk, and such injuries are protected from drying out, new bark will grow from the cambium. As soon as you discover an injury, cover it with an asphalt grafting compound.

Rabbit damage is usually some distance above the ground or snow line. These animals cut off twigs and pull off bark in shreds. Mice work near the ground out of sight under grass or snow. They usually begin at one spot and enlarge it. Pocket gophers gnaw off roots below the ground. Trees hurt in this way often tip over and cannot be repaired.

The following supplies are necessary to repair girdled trees:

1. A sharp knife, such as a good jackknife
2. Small nails for tacking scions to the tree
3. A light hammer
4. A nail set
5. A saw for trimming old thick bark
6. A shovel or trowel if damage is below the ground
7. A heavy scrub brush for cleaning excavated bark
8. Dormant or fresh cut scions for bridges
9. Asphalt grafting compound or asphalt wound dressing

Scion—Scions for apple trees may be taken from any hardy cultivar of apple or crab apple. Pear scions must be used for pear, plum for plums, and so on. Old trees rarely produce good scion wood unless they were pruned well the previous year. If 1-year old-wood is not available, 2-year wood may be used. If you can anticipate the need, you should cut the scions before any growth begins. Keep them in moist and cool storage. You may cut the scions, fresh as needed, if you bridge promptly before shoot growth begins.

Small Tree—Apple and pear trees under 2 inches in diameter are too small to bridge. The swaying of such small trunks by strong winds will dislodge the scions. If the tree is under 1 inch, it is best to saw it off just below the girdle, then cover the cut with asphalt wound dressing or grafting compound. Shoots of the same cultivar probably will grow out from above the place the tree originally had been grafted. Trees between 1 and 2 inches can best be treated by cutting or sawing them off below the injury in the spring and placing scions in the stubs by cleft grafting. Cherry and plum trees usually are not bridge grafted successfully. If they are only 2 or 3 years old, cut off below the injury and a new shoot will grow out from above the place where the tree originally had been grafted.

How To Bridge Graft—Bridge grafting is done in the spring after growth has started when the bark of the tree to be repaired will lift readily (slip) from the wood—usually between April 15 and May 15.

The first step is to trim the bark of the girdled trees both above and below the girdle. Cut back damaged or frayed bark an inch or so to sound bark. The edges should be clean and smooth. Scrape down old rough bark to live bark.

Two methods of setting scions are used: (1) the L-cut, best for trees with thin bark, and (2) inlay, for trees with thick bark.

To make the L-cut, start at the edge of live bark and cut a slit about 2 inches long in the bark below the girdle (left side in Figure 8). Lift the edges with a dull smooth tool. Such a tool can readily be shaped from hardwood or a piece of plastic. The rat tail of a comb is good for this purpose. *Do not use the scion to lift the bark.*

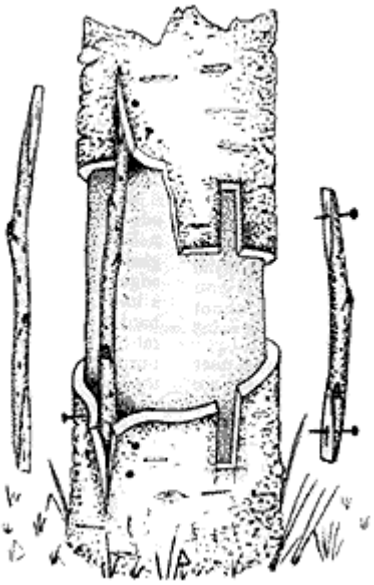


Figure 8. Two methods of bridge grafting (L-cut on the left and inlay on the right) are shown. The scion on the left is inserted under the bark at each end; the scion on the right is laid in a groove at each end.

Prepare a second slit at the upper side of the girdle directly above the first.

Shape the scion on the lower end and measure against the girdle to determine the length of the scion. Shape the upper end of the scion to a definite taper with a longer flat surface next to the tree. Slip the ends under the bark, nail them in position and nail down the flaps of bark. In nailing either scion or bark, use care to avoid crushing the bark. A nail set will help to avoid injury to the bark.

The **inlay** method (right side of Figure 8) is the best bridge grafting technique. In fact, it is a necessity for a short span. Select a curved scion to make an inlay bridge. Measure the distance to be spanned and make the scion long enough to extend 1½ to 2 inches beyond the girdle at each end. Cut a straight, smooth face on each end.

Place a nail in each end. Tack this lightly to the tree bark to mark the place. Mark around each end on the bark to get the exact size of the scion. Remove the scion, cut to the wood on the marks, and lift out the piece of bark. Then fit the scion in the channels in the bark and nail carefully. One nail is usually enough.

In either grafting method, place a scion every 1½ to 2 inches around the tree.

There is a third method to insert scions in bridge grafting, as shown in Figure 9. Little or no trimming is done to the bark that borders the damaged area. This is a little less tidy and it requires somewhat longer scions, but it is quicker and equally effective.

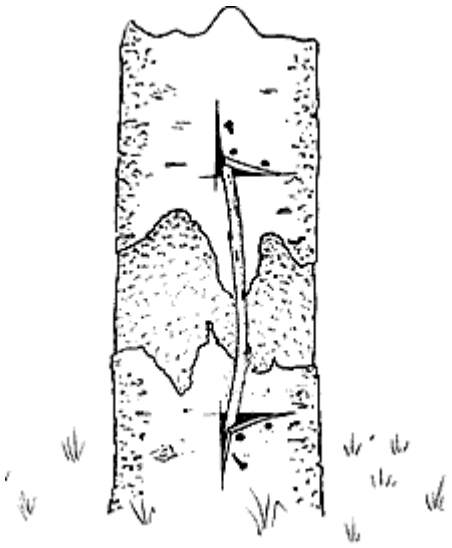


Figure 9. A quick way to bridge girdled trees. Scions are cut and inserted essentially the same as in Figure 8.

Covering and care—When all the scions are in place, the graft unions should be covered with grafting compound. Note that the entire girdled surface should be covered and more than one coat may be necessary.

In bridge grafting, after the scions begin to grow, it is important that all shoots or leafy growth be cut or rubbed off the scions.

9. How to Protect The Graft

Immediately after completion of the graft the scions should be protected from drying out. Use a grafting compound on the graft unions and other cut surfaces.

Some Reasons Why a Graft Fails

1. The scion and stock were incompatible; apple will not unite with plum, for example.
2. The grafting was done at the wrong season.
3. The understock was not healthy.
4. The scions were not vigorous.
5. The scions were dry or injured by cold temperatures.
6. The scions were not dormant.
7. The cambium of scion and stock were not meeting properly.
8. The scions were upside down.
9. The graft was improperly covered with grafting compound.
10. The scions were displaced by wind, birds or storms.
11. The graft was shaded too much after growth began.
12. New growth was damaged by aphids or other insects.
13. New growth was killed by fire blight.
14. The union girdled because the bindings or label were not released in time.

10. What If Grafts Fail?

One hundred percent success in grafting is rare. The failure of one or two scions is not serious, since usually more scions are inserted than are necessary for the completed tree. On branches where the scions fail let the shoots grow. These can be budded the same summer or grafted later. Some shoot growth is needed for regrafting, but don't let them become so dense that they crowd the scions.