

# GRAFTING AND BUDDING

Malcolm Dana and George Klingbeil

## The Art of Grafting

Grafting is the art of combining a twig or bud of one plant with a branch or root of another so that a union forms and growth continues.

Grafting is used mainly to propagate trees, to change cultivars for pollination or other purposes, to develop trees on hardy, disease resistant, or dwarfing stocks, and to repair trees damaged by rodents or equipment.

Of the many methods of grafting and budding, only cleft grafting, whip grafting, bridge grafting, and shield budding are described here. Although this publication primarily addresses itself to fruit tree grafting, the methods described can be applied to many other woody plants.

Grafting in the orchard is done in spring from the time growth starts until full bloom. Whip grafting for the propagation of trees (bench grafting), as described on page 3, may be done anytime during the dormant season. If bench grafting is done too early in the season to plant immediately, wrap the plants in plastic, and store them in a cold place (such as a refrigerator) until it is warm enough to plant them. Shield budding is done from mid-July to early September.

Stone fruits are propagated in the nursery by budding—other methods are not satisfactory. Apples, pears, and quince may be propagated by budding or whip grafting.

### Some Basic Grafting Terms

To better understand grafting and budding methods, you must be acquainted with some common grafting terms. These terms will be used often:

**Scion**—The twig or bud which will become the top of the new plant.

**Stock**—The root or rooted part of the plant upon which the scion is grafted. A stock may be a young seedling plant or a large tree.

**Cambium**—A thin layer of cells between the bark and the wood which unites the scion and stock. As the tree grows, cambium cells divide to produce bark on the outside and wood on the inside.

**Graft union**—The place where the scion and stock grow together. For a graft union to form, there must be contact between **CAMBIUM** layers of the stock and the scion.

### Tools and Materials for Grafting

Certain tools and materials are required to do a good job of grafting.

#### For Cleft Grafting

- A sharp knife
- A grafting tool (a suitable substitute is a sturdy butcher knife and a screw driver)
- A hammer or mallet
- A fine-toothed saw
- Grafting compound and a brush to apply it.

#### For Whip Grafting

- A sharp knife
- Grafting compound
- Grafting tape.  
(Rubber electricians's tape or polyvinyl take may be substituted for the grafting compound and tape.)

#### For Bridge Grafting

- A sharp knife
- Flat-headed wire nails 3/4 inch long
- A hammer
- Grafting compound and a brush to apply it.

### Grafting Compound

The most commonly used grafting compounds are the water emulsions of asphalt. They are readily available, can be applied cold, hold well, and are inexpensive. Do not use roofing asphalt or tar—they contain materials injurious to trees. Though ready-made grafting waxes are available, you can make a good brush wax with the following:

5 pounds of rosin, one pound of beeswax, 1/2 pound of powdered charcoal and 1/2 cup of raw linseed oil. Melt the rosin over heat, add beeswax and melt. Add the linseed oil, remove from heat and slowly add the charcoal, stirring constantly. For best results, pour the mixture into shallow pans and allow it to harden. The wax must be melted for use.

Do not use extremely hot wax on the tree. Do not use improvised, unproven materials to protect grafts.



## Scion Wood

- Scion wood for grafting should be collected from trees when they are dormant (November through March).
- Select well-hardened and mature water sprouts or one-year old terminal growth about 1/4 to 3/8 inch in diameter. To keep the scions in a dormant condition until needed, store them in moist sphagnum moss, sawdust or plastic in a cold place (such as a refrigerator).



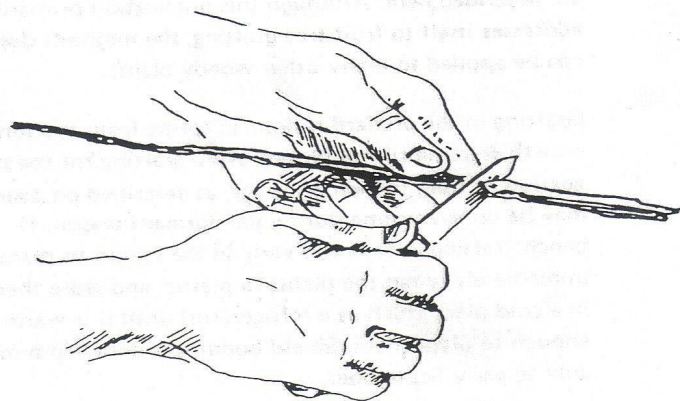
## The Cleft Graft

### Preparing the Stock

- Select branches that will provide for a well-balanced tree. They should be about 2 inches or less in diameter and near the trunk or on main scaffold limbs.
- Select a knot-free, straight section on the stock branch. To avoid tearing the bark, saw off the limb about a foot above the selected point. Make the final cut at the upper part of the smooth section at right angles to the grain. Smooth the cut surface with a sharp knife.

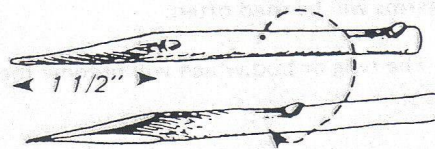
### Preparing the Scion

- Do not let the scions dry out. It is best to prepare them when they are to be used.
- Shape the lower end of the scion into a wedge about 1-1/2 inches long. The lower end of the wedge may be left blunt.



- Make the inner side of the wedge thinner than the outside. The lowest bud on the scion should be slightly above the bevels of the wedge and on the outside (thick side) of the scion.

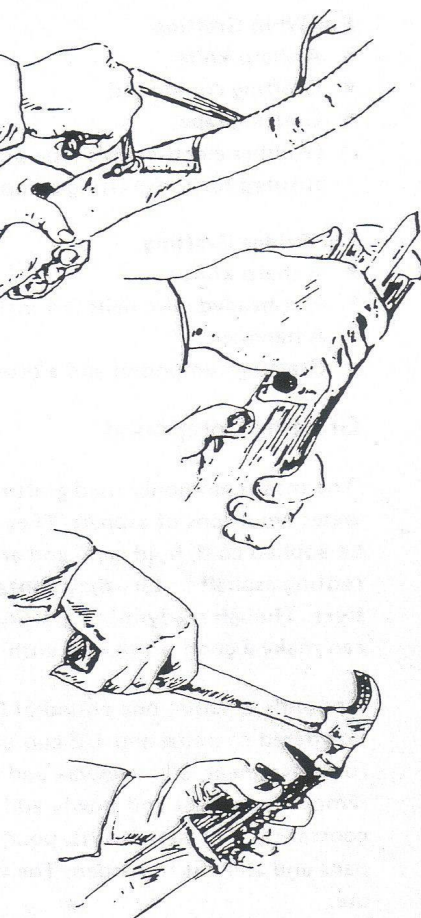
ROTATE



- Shorten the scion to 3 buds. Cut the top of the scion with a sloping cut 1/4 inch above the upper bud.



- With the grafting tool and mallet, split the stock through the center to form a cleft. It is not necessary to drive the grafting tool more than 2 inches into the stock. Cut any slivers with in the cleft.

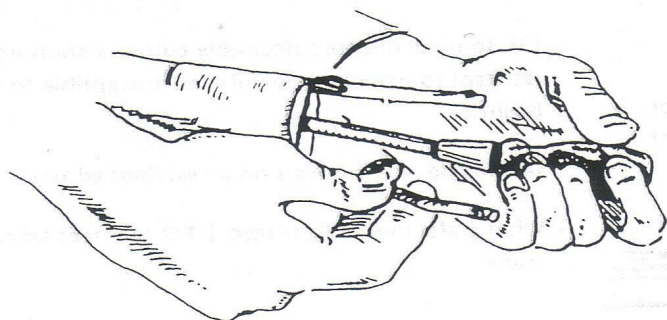


- With the wedge of the grafting tool, open the cleft wide enough to insert the scions.

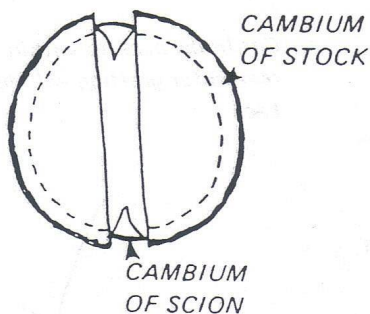


## Making the Graft

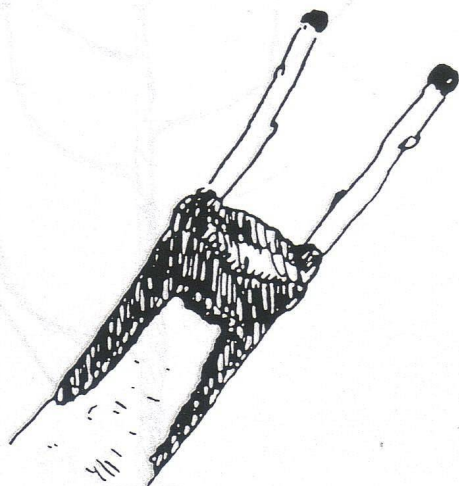
- Insert the scions with the thick side facing the outside of the stock and with the cambium of the scions in contact with the cambium of the stock. Do not insert the scions at an angle. Since the bark of the stock is thicker than that of the scions, set the scions in from the outer bark of the stock so the two cambium layers can meet. Be sure the top of the bevel cuts are even with the stock.



CROSS SECTION VIEW



- Remove the wedge and seal the stub, cracks, and tip of the scions with grafting compound to prevent the graft from drying out.



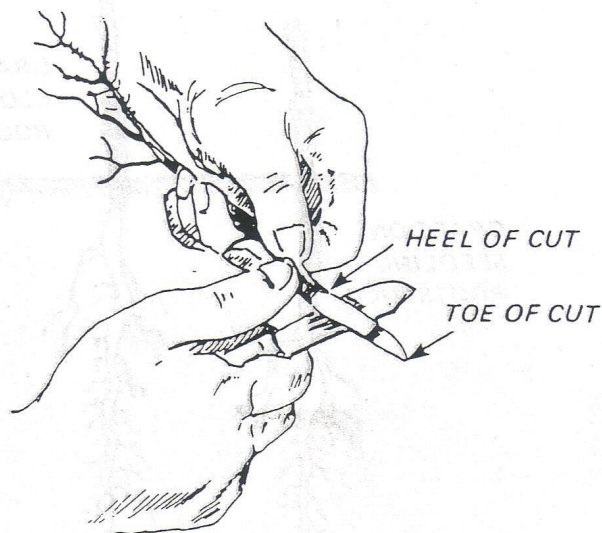
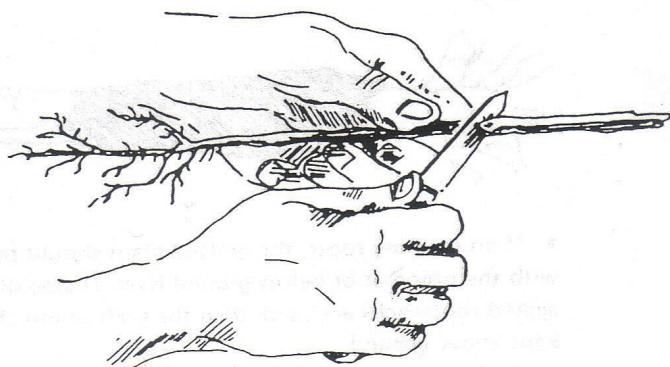
- Let the scions grow undisturbed the first season. The following spring, cut back the poorest growing scion to a few buds and let the stronger scion continue growth. Leave both scions until the graft is completely healed and then remove the weaker one.

## The Whip Graft

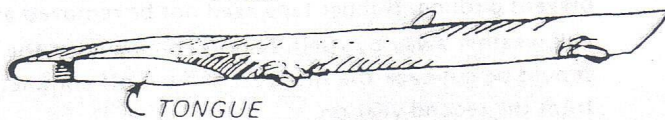
### Whip Grafting to Produce New Trees

Young apple and pear trees may be topworked by whip grafting and propagated by root grafting. The stock and scion should be the same diameter where they are grafted.

- Choose the scion wood as you would for cleft grafting.
- Select a stock that is smooth and straight. With root grafts, some side roots may be trimmed off where the graft is to be made.
- —Make a smooth, sloping cut through the stock about 1-1/2 inches long. On the surface of this cut, about one-third of the way from the toe, make a slit or tongue about 1/2 inch long. Slant this slit slightly toward the base or heel of the first cut.

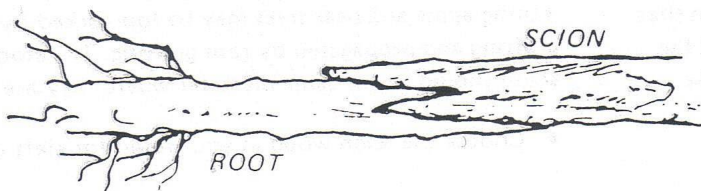


- The scion should be about 4 inches long (3 buds) and prepared in the same manner as the stock with the tongue at the base of the scion.

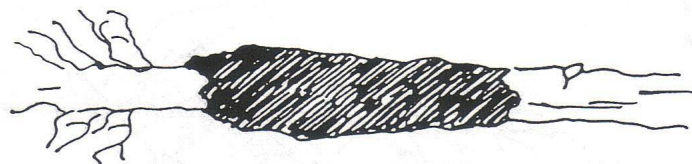
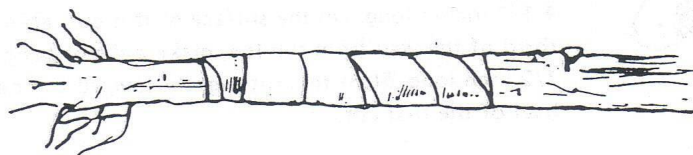




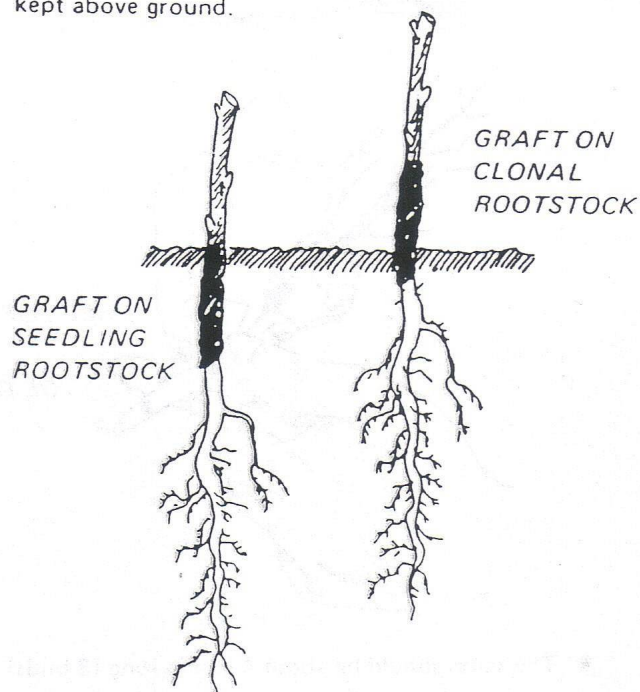
- Fit the cut surfaces of the scion and stock firmly together, slipping the tongue of the scion under the tongue of the stock. The cambium layers should match on one or both sides. If the toe of either scion or stock extends beyond the heel of the other, cut it off evenly.



- Wrap the stock and scion firmly with grafting tape or rubber tape. It is best to seal the grafting tape with grafting compound.



- If on seedling roots, the grafted plant should be planted with the union at or below ground level. If clonally propagated rootstocks are used, then the graft union should be kept above ground.



- When the scion starts to grow, cut the grafting tape to prevent girdling. Rubber tape, need not be removed as it will weather away by itself. Shoots coming from the root should be cut back the first year and cut off completely from the second year on.

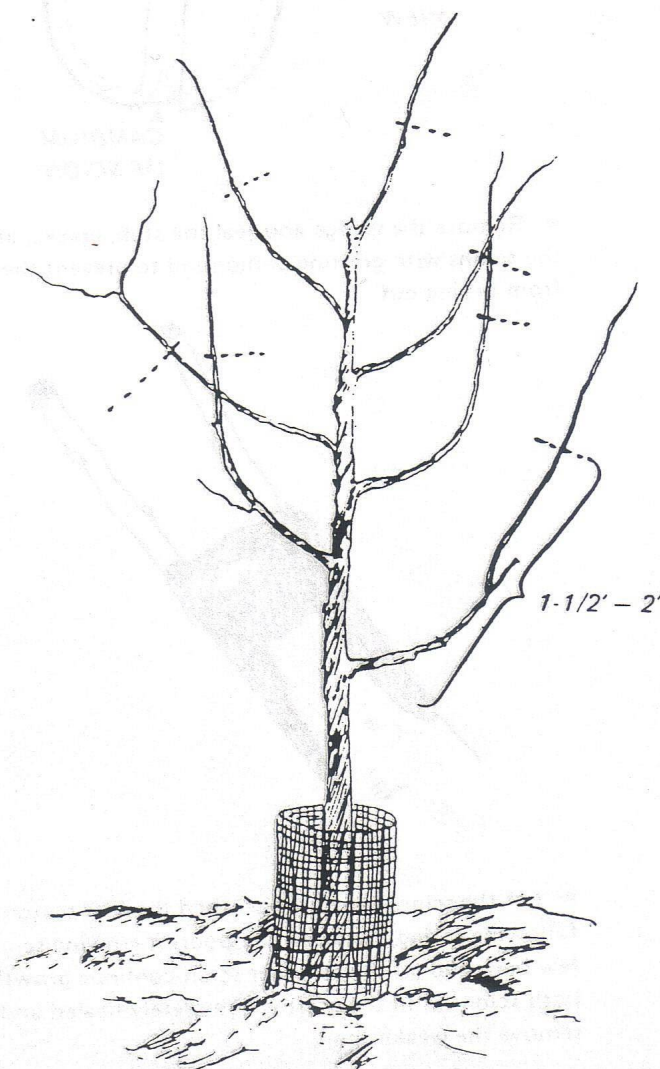
### Whip Grafting to Change Cultivars of Established Trees

The technique just described can also be used to introduce cultivars for any of the following reasons:

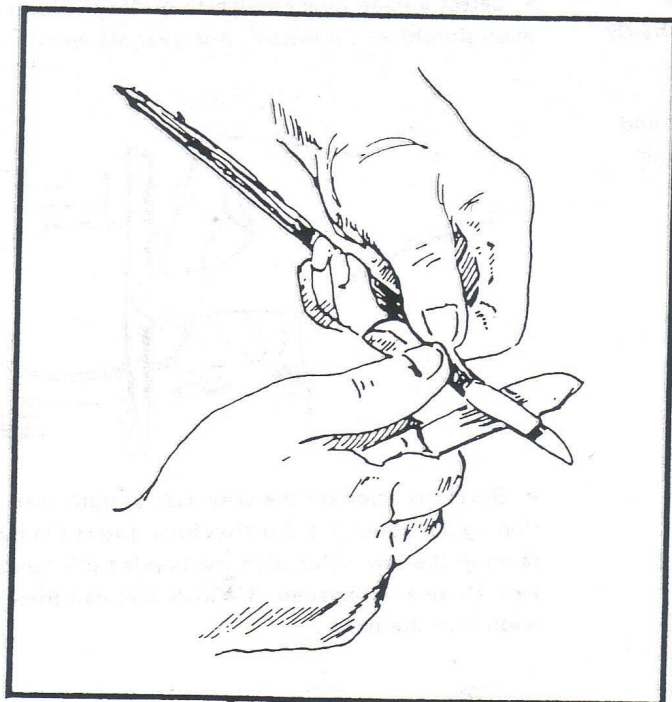
- (1) to introduce pollinator cultivars
- (2) to place relatively tender cultivars on hardier rootstocks
- (3) to place disease susceptible cultivars on disease resistant rootstock (as in cultivars susceptible to fire-blight)
- (4) to add new cultivars on an established tree.

Whip grafts should be placed 1-1/2 to 2 feet from the main trunk.

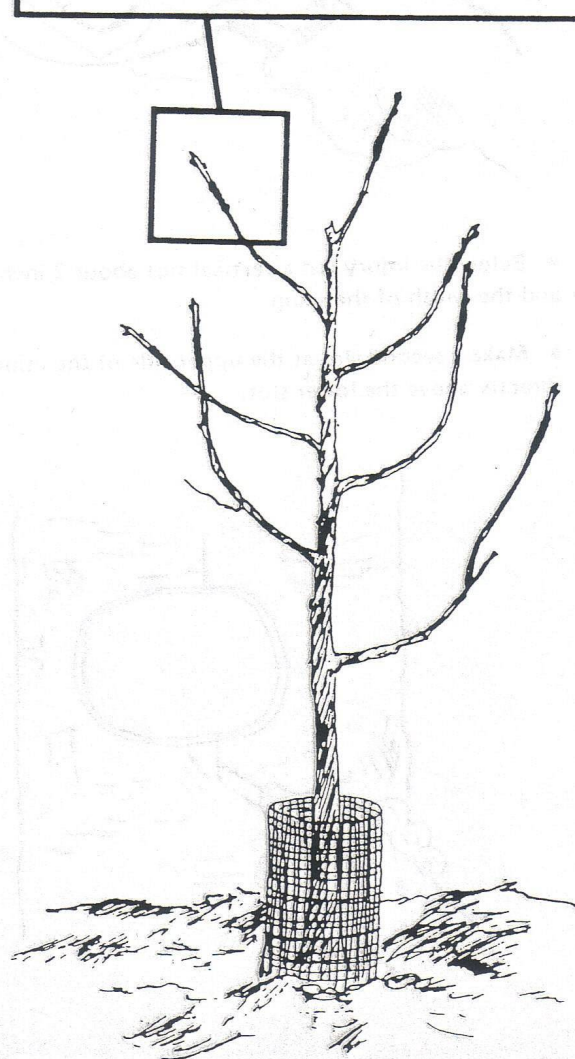
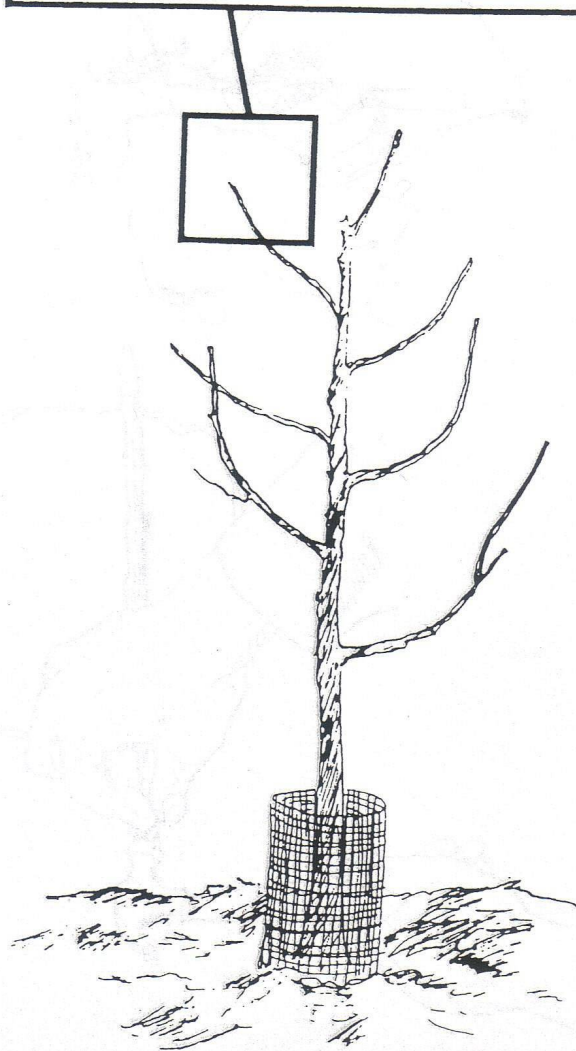
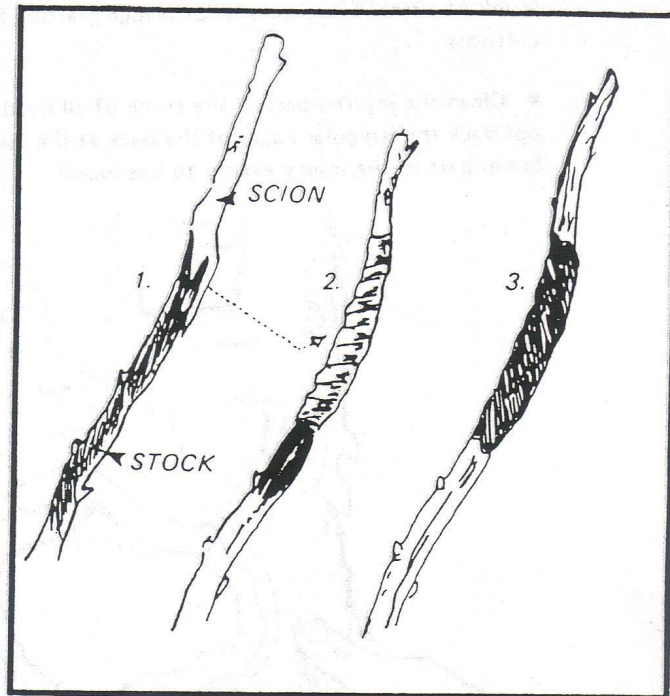
Cut limbs back to within 1-1/2' - 2' from the trunk. Your reason for grafting will determine how many limbs you cut back.



Prepare the scion and stock in the same manner described on p. 3.



Fit scions and understocks together. Wrap with grafting or rubber tape and seal entire graft union with grafting compound.

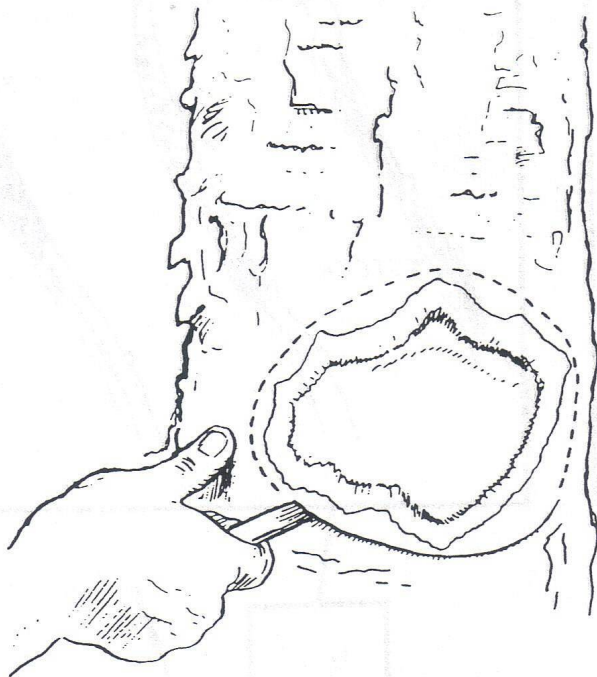




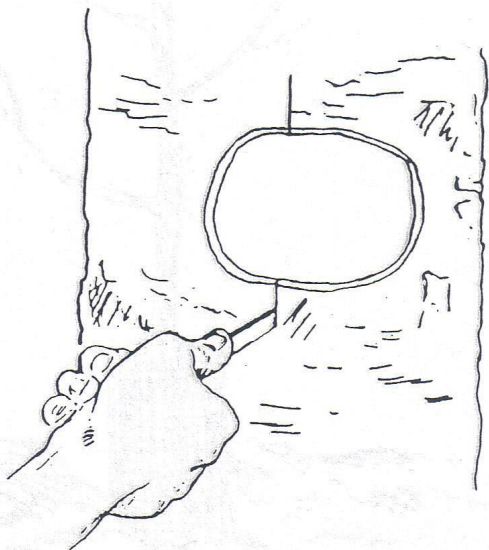
## The Bridge Graft

This graft is used to bridge over an injured area on the trunk of a tree. Select scions for bridge grafting from hardy cultivars.

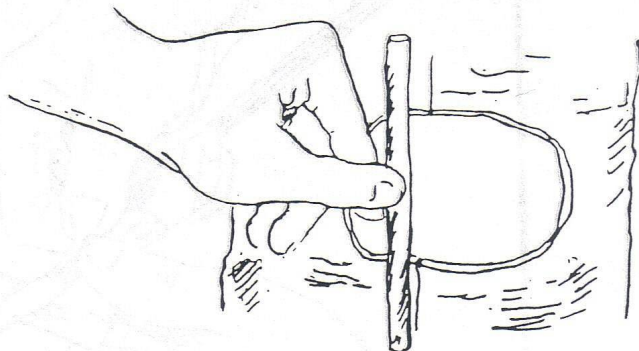
- Clean the injured part of the stock of all dead bark and cut back the irregular edges of the bark at the upper and lower part of the injury evenly to live wood.



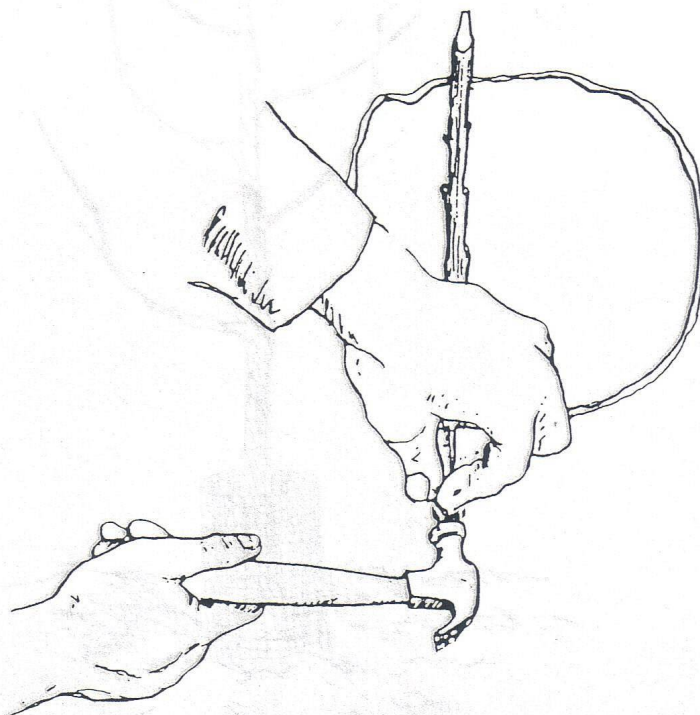
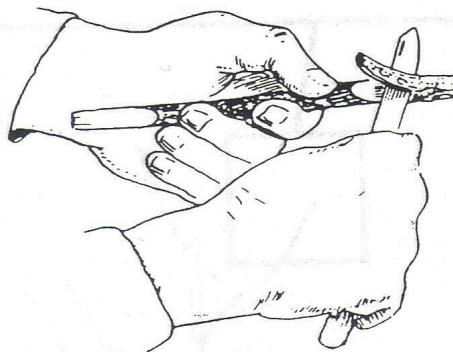
- Below the injury cut a vertical slot about 2 inches long and the width of the scion.
- Make a second slot at the upper side of the injury directly above the lower slot.



- Select a scion long enough to bridge the injury. The scion should be a dormant, one-year old wood.



- Bevel the scion on the same side at both ends with a sloping cut about 1-1/2 inches long. Insert the base of the scion in the lower slot with the beveled side toward the tree. Drive a flat-headed, 3/4 inch wire nail through the scion into the trunk.

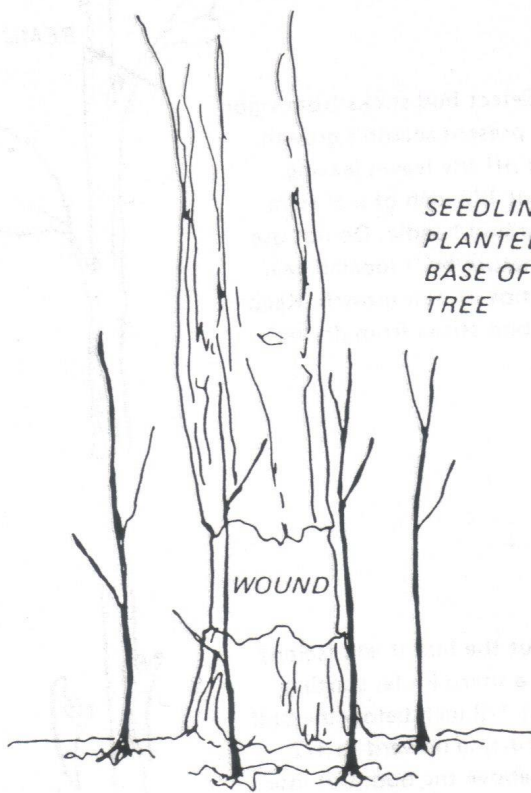
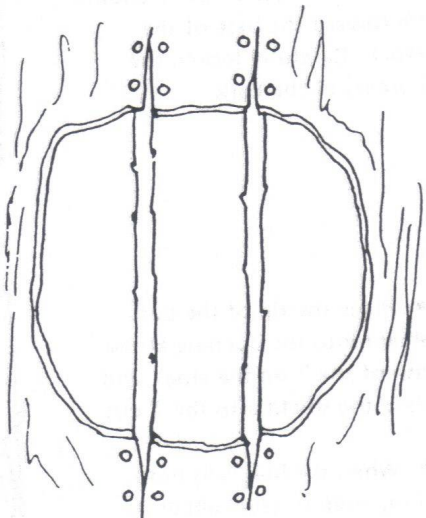


- Follow the same method with the top of the scion, making certain to get a "bow" in the scion to allow for tree sway.



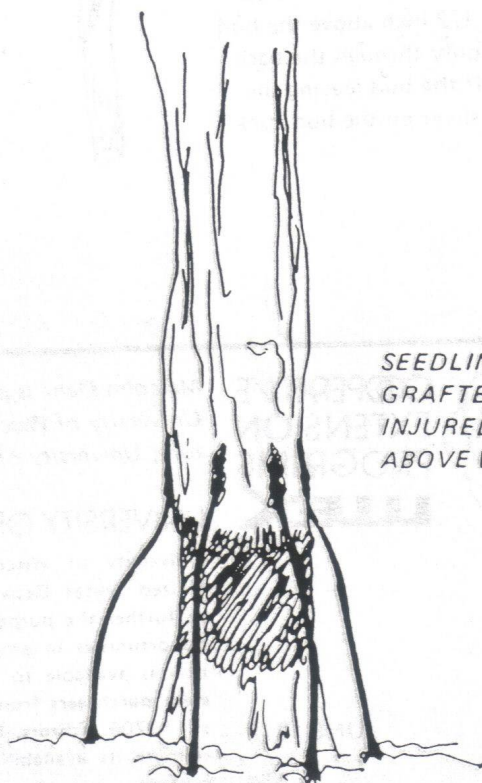
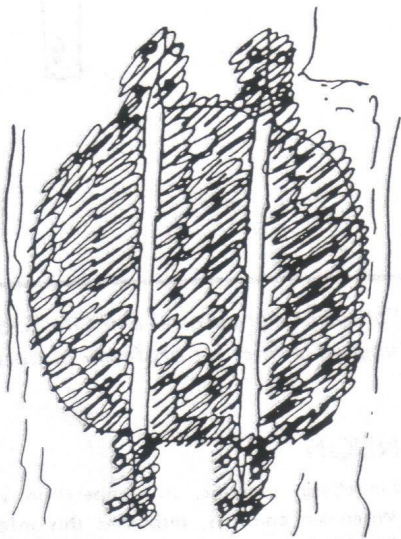
In cases where bridge spans are impractical, approach grafts or inarching may be used. Plant seedlings or rooted whips near the injured trunk and graft the whip to the tree above the injured area.

- Place scions at 2-inch intervals around the injured part of the tree.



SEEDLINGS PLANTED AROUND BASE OF INJURED TREE

- When the scions are all in place, carefully seal the graft unions and the injured area with grafting compound. Keep all shoots removed from scions.



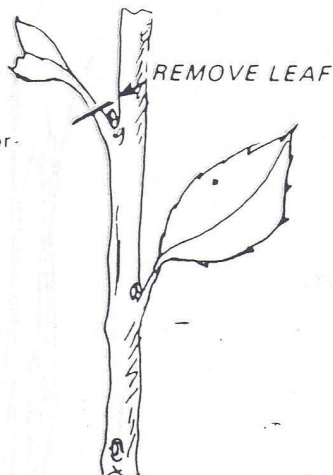
SEEDLINGS GRAFTED TO INJURED TREE ABOVE WOUND



## Shield Budding or T-Budding

Budding is used to propagate stone fruits and also may be used to propagate apples, pears, and ornamentals. It is usually done from mid-July to early September.

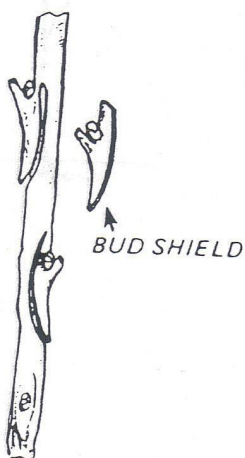
- Select bud sticks from vigorous present season's growth. Clip off the leaves leaving about 1/2 inch of leaf stem for a bud handle. Do not use immature buds located near the tips of new growth. Keep the bud sticks from drying out.



- Select current season's growth for stock, 1/4 inch to 1/2 inch in diameter. Make a T-shaped cut 1-1/2 inches long through the bark of the stock. The base of the T should be toward the base of the stock. Carefully loosen the corners of the bark.

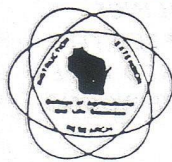
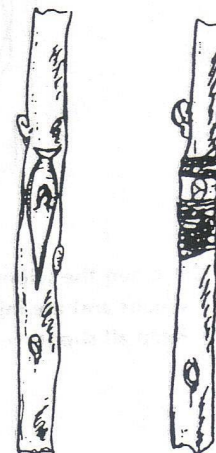


- Cut the bud shield (scion) with a sharp knife, starting about 1/2 inch below the bud and cutting upward to 1/2 inch above the bud. Cut into the wood under the bud about twice as deep as the bark. Then make a cross cut about 1/2 inch above the bud going only through the bark. Lift off the bud leaving the wood sliver on the bud stick.



- Place the tip of the bud shield into the opening at the top of the T on the stock and slide the shield into the T cut.

- When the bud is in position, wrap it with rubber budding strips, twine, or raffia. Start with a self-binding loop slightly below the base of the T.



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