

Grafting and Budding

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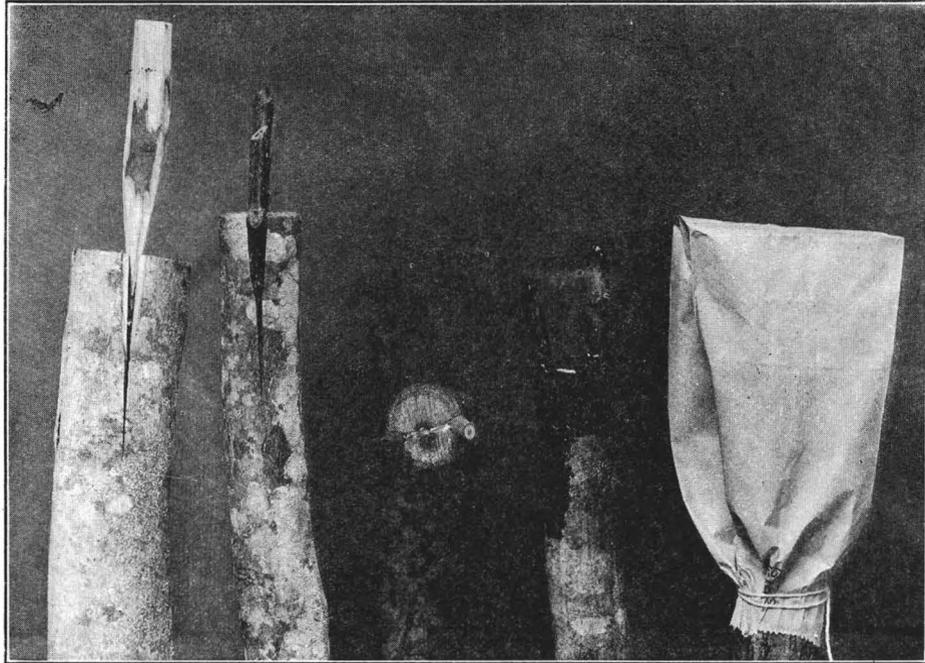


Figure 1. Successive steps in walnut grafting, using the modified cleft.

Grafting and Budding

By

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THE BUDDING AND GRAFTING of trees is an important feature of horticultural practice. It has its commercial value in allowing the changing of trees from one variety to another, and in some cases from one kind of fruit to another. It makes possible the growing of a number of varieties of fruit in a small space. The process is not a difficult one with most fruits, but can be readily performed with proper care and attention.

GRAFTING

Collecting scion wood. The wood used in grafting is wood that grew the previous season. This should be healthy, well matured, of average size for kind of tree, and with well-formed, mature buds. The wood at the base of the last year's growth with small, weak buds and that at the tips of the shoots, which is frequently soft and poorly matured, should be discarded. Collect the wood while wholly dormant before the buds show any sign of opening. The best time is usually about the first part of February or earlier. Early storage may avoid damage by winter injury but increases troubles from storage. The use of scion wood showing signs of growth generally meets with failure. To prevent drying out of this wood, pack it in moist moss, sawdust, or sand, and store in a cool place. An objection to the use of sand is the fact that unless the sand is thoroughly cleaned off the scion wood it has a tendency to dull the grafting tools. Scion wood kept too wet will mold or decay. Many people store the scion wood by digging a hole two to four feet deep in permanent shade, where water will not seep in, as on the north side of a building. This is well covered to hold the temperature even and as low as possible. Cold storage at 32° to 34° is also used by some propagators for material like walnuts where the scion wood must be stored for several months.

Time for grafting. The best time for grafting most fruit trees is about two to three weeks before the buds open out. With care and a favorable season this work can be done before this date or later, but two to three weeks before leafing out is the most favorable time at which to carry on this operation. The best time for grafting walnuts, however, is after the buds break out.

Grafting waxes. Many forms of grafting wax are in use, but the one most commonly used and the one giving satisfaction, is made as follows:

Rosin	5 pounds
Beeswax	1 pound
Pulverized charcoal	$\frac{1}{2}$ pound
Raw linseed-oil	1 gill

Melt the rosin and beeswax over a slow fire. After melting add the charcoal and oil, stirring to prevent boiling over. Pour into a greased pan or

into a box lined with greased paper, to cool. For use, this wax must be melted to a consistency that will merely flow easily but should not be heated any hotter as it may be injurious to tissues of the tree. It can then be applied with a brush. If it is melted on a stove and the pan placed in hot water it will remain thin enough for use for some time. When large amounts of wax are to be used obtain a pail of a gallon capacity or larger and a pan that will set in the top. Punch holes around the pail, both at the top and the bottom, to allow for ventilation and then in the bottom place some form of alcohol or kerosene burner. An old lantern burner will work successfully. The ready-made equipment can be purchased in the market.

A hand wax or cold wax can be made as follows:

Rosin	4 pounds
Beeswax	2 pounds
Tallow or linseed-oil	1 pound

These materials are thoroughly melted together and then the liquid poured into a vessel of cold water. When it becomes hard enough to handle it should be taken out and pulled or worked until it becomes tough and has the color of very light-colored manila paper. In pulling or applying by hand, the hands should be well greased, tallow being good for this purpose. This wax may also be melted and applied with a brush.

Paraffin as a grafting wax can only be used with safety when it is absolutely shaded from the sun's rays. Except for experienced propagators, its use cannot be recommended. The waxes for which the formulae have been given can be used without injury to plant tissues but paraffin at times will completely kill the bark within a few hours.

Cover all exposed parts. In waxing over, care should be taken that all exposed surfaces of small cuts are coated. This is to prevent evaporation of moisture from the soft wood. On limbs or wounds more than three inches in diameter, wax only the sap-wood and the cut surfaces of the scion wood. The hard, inner heart-wood of the limb can be coated with bordeaux paste to prevent the entrance of heart-rot. Grafting wax is not a disinfecting substance and will not prevent the entrance of fungi that cause the heart-rot in fruit trees. Since rewaxing is often necessary after a short time, the surface should be carefully gone over and cracks or openings closed up again.

Unite or cross the cambium layers. *In any form of grafting, the essential point is so to place the scion on the stock that the cambium layers of the two are brought into contact with each other.* The cambium layer is that line or layer of cells found between the wood and the bark. This is the growing part of the tree and in this part will come the union and joining together of the stock and the scion. The person grafting should not pay attention to the union of the outer edges of the bark of the scion and stock but should see that the cambium layers, found between the bark and the wood, are brought into contact so that the cells of the two can grow together.

KINDS OF GRAFTS TO USE

Whip graft. This form of graft is seldom used on material larger than $\frac{3}{4}$ -inch in diameter, but it is the one most universally used on small material such as nursery stock. Both stock and scion are made with a sloping cut,

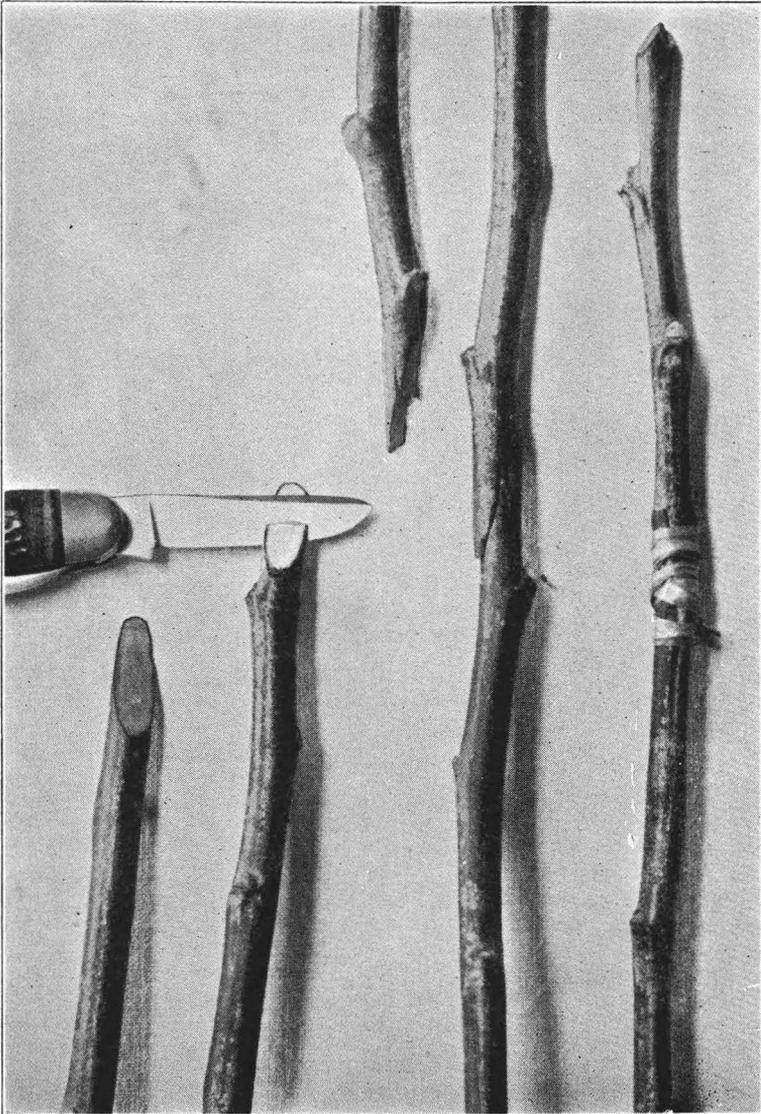


Figure 2. Making a whip graft.

then each one is slit between the center and the tip of the cut. Force together the two tongues thus formed with the cambium layers matching on one side. The scion and stock will usually not be of the same size, but matching on one side is sufficient. The graft may then be firmly tied and, if above the ground and exposed to the air, should be thoroughly waxed over (Figure 2).

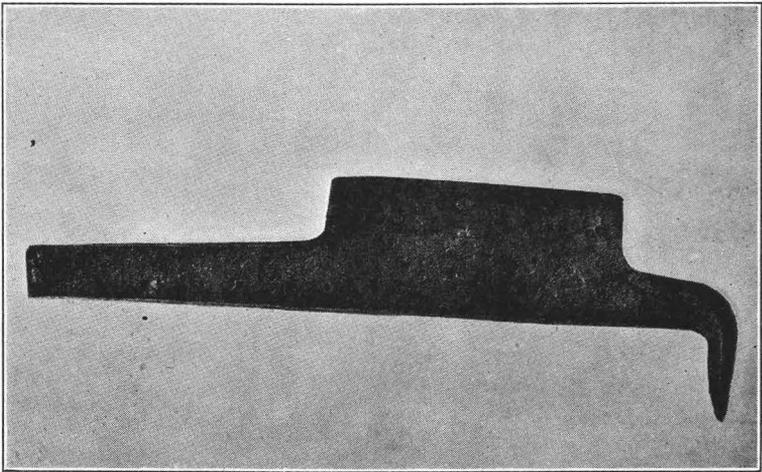


Figure 3. A clefting iron. The tip is used to hold the cleft open while the scion is being inserted. This iron can readily be made by any blacksmith. Care should be taken not to have it too thick, as a thick tool will split the stock too much.

This form of graft is used in root grafting, both in piece root and whole root grafting during the winter time, after which the material is bundled and stored away in sand or other similar material until spring, when it is planted in the nursery. It is also used in grafting over seedlings in the nursery, as well as working over small branches on trees in top-working.

A modified form of this is used in walnut grafting. The stock is cut off at the desired height from the ground at right-angles to the ground. Then instead of making a sloping cut that comes out on the opposite side of the stock, it ends by intersecting the cross-cut about midway between the center and the opposite edge of the stock. A split or slit is then made at the point where the two cuts come together. The scion is cut as usual and the two tongues are forced together as with any form of whip grafting. This kind of graft is used in nursery work on the smaller walnut seedlings.

Cleft graft. This form of graft is used on material too large for whip grafting. The stock is cut off where desired and then split with a clefting iron (Figure 3). With wood that splits easily it is advisable not to split through the center but off to one side so that the split will not go too deep; or cut above a knot and split into the knot, which will stop the splitting. Keep the cleft open with the tip of the iron or with a wooden peg. The scion is made by two sloping cuts on opposite sides of the scion, forming a wedge from top to bottom and from front side to the rear (Figure 4). Start the sloping cut midway between the buds and make it at one draw

leaving one edge slightly thicker than the other. Place a scion at each end of the cleft in the stock with the thick edge of the scion toward the outside in such a way that the cambium layers of the scions and stock come together. A very slight angle to the scion will insure the crossing of the

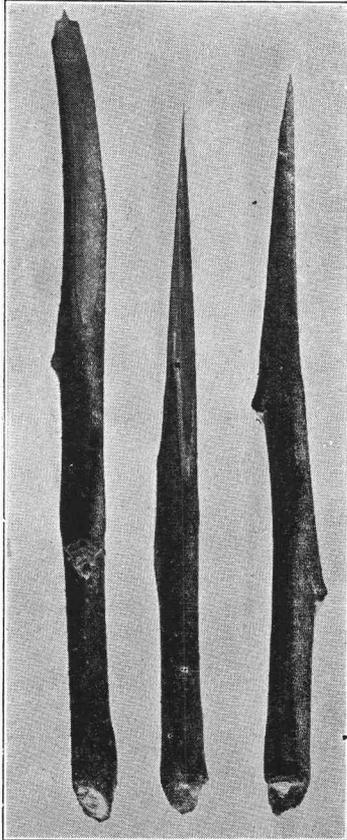


Figure 4. Scions for cleft grafting viewed from different angles.

cambium layers. An exact matching of the cambium layers for the full length is practically impossible, but putting it in at a slight angle will insure contact and union enough to start the growth. Removing the peg or the grafting iron will force the pressure at that point where the cambium layers come together so that there is sure to be a contact. Wax over according to directions previously given (Figure 5).

Bark graft. With limbs more than two inches in diameter two scions set in the cleft do not heal over the wound rapidly enough and often allow the live wood to die back at points between the scions. This is due to the

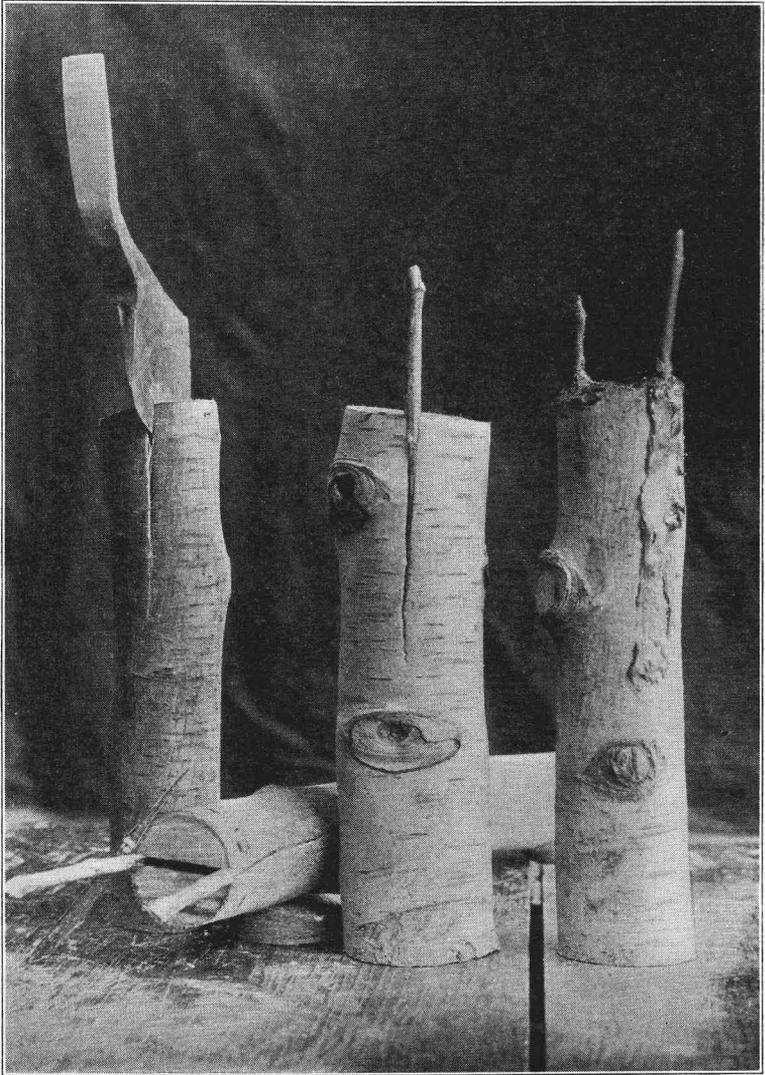


Figure 5. Steps in cleft grafting.

fact that there is not enough leaf surface to elaborate food and furnish it to that place, but instead it is drawn to the area next to the scions. With this condition there is a dying back of the tissues affording an easy entrance for heart-rot (Figure 6). The aim should be to keep the cambium layer alive around the whole circumference of the stock and to do this the bark

graft is used to fill in. The scion may or may not be made with a shoulder but is cut equally from either side so that it presents a long, tapering tongue. This tongue is then forced down between the wood and the bark along the cambium layer. Plenty of scions should be set in at intervals from two and one-half to three inches around the stock so that the cambium layer will be sure to keep alive and the callus tissue will be rapidly formed. This form of graft takes very readily but does not form as strong a union as the cleft graft. Therefore, in grafting over the larger limbs the scions in the cleft graft should be set at the point where they will be left permanently, while the bark grafts can be used to fill in the intervals.



Figure 6. Illustrating how the bark will die down when the scion does not "take" on a large cut. The bark dies away, allowing the entrance of heart-rot.

In walnut grafting the scion wood is usually too large that to proceed as usual with the cleft graft would necessitate too large a cleft opening. To avoid this the clefts are started as for other cleft grafting and then, with a sharp knife or chisel, wood is cut away on both sides of the cleft (Figure 1). This removes a triangular piece of wood and leaves a triangular opening when the peg or grafting iron is removed. The scion should be cut to fit this space, but extreme care is necessary to see that the cuts are clean and smooth both on the stock and scion. After the scion and stock are fitted together, if the opening is large, the cleft is then filled with paper to avoid using a large amount of wax.

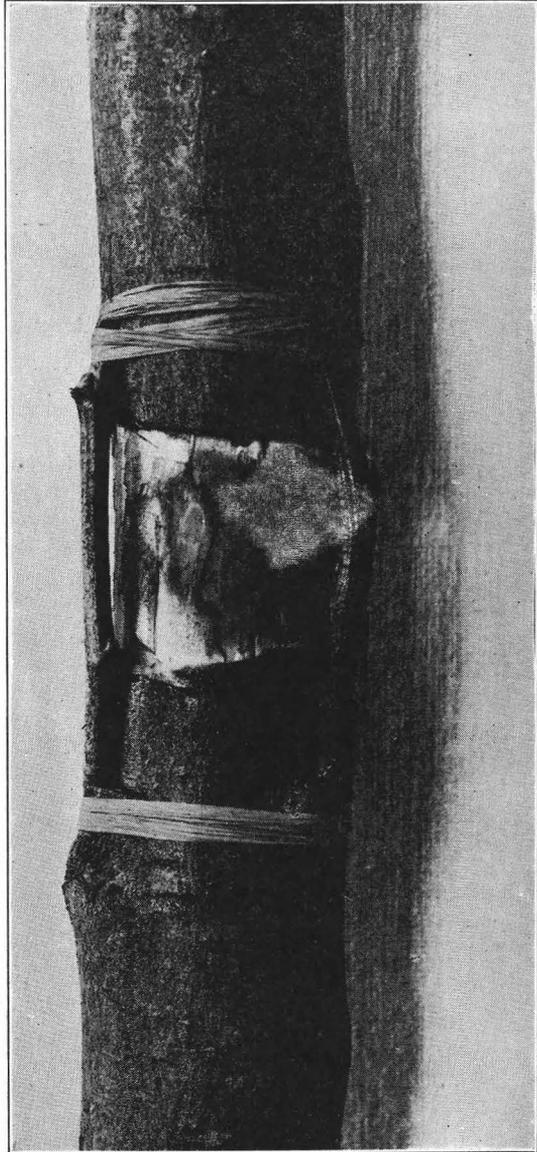


Figure 7. Bridge graft.

Bridge graft. Frequently trees, for one reason or another, are partly or completely girdled to such an extent that the tree will be unable to heal over the wound. In such a case bridge grafting may be of value in saving the life of the tree.

The scions for this purpose are cut four to six inches longer than the part girdled. The scions are cut with a long, sloping cut at each end. These cuts should be so made at each end of the scion that by putting the cut surfaces flat on a board the scion will be forced up only in the center and not twisted.

In the bark, an inch or so from the edge of the girdle, both top and bottom, make an incision through which the scion can be pushed. This can be triangular in shape or dished out so that the scion can be pushed in easily. Insert both ends of the scion in corresponding incisions and force well up under the bark. If the cut surfaces do not fit snugly to the wood of the trunk, fasten them down with a nail or brad, or tie them down (Figure 1). Place at intervals of two and one-half to four inches around the trunk. Wax over the exposed surfaces of the grafts as with other forms of grafting. Then paint over the girdle with bordeaux paste.

This method of treatment will in most cases save the tree, but a tree cannot be expected to maintain normal growth and vigor under such handicap.

A good many other minor forms of grafting are in use, but those described are the most essential and all that are in common use.

With some kinds of trees, particularly walnuts, the young growing shoots are very tender and need protection. Paper sacks are tied over the grafts. As the growth develops, the sacks are at first torn open on the side to avoid too sudden exposure and then later entirely removed.

BUDDING

Budding usually is carried on during the late summer when the bark slips well and the buds to be used are well matured. Spring budding can be used but is not recommended as a rule.

The bud wood is of the same or current seasons' growth. The buds are in the axils of the leaves or in the angle between the base of the leaf-stalk and the shoot. Use that part having plump, mature buds. The basal buds are often not satisfactory nor are the tip buds where the wood is flexible, very soft, and immature.

The wood is cut just before using. After choosing the material, cut off the leaves, leaving a leaf stalk one-half to three-fourths inch long so that the bud can be handled easily (Figure 8A). With a sharp knife make a transverse cut on the stock just through the bark at the point desired and then a downward cut from this transverse incision. This makes a T, from which this form of budding takes its name. Cut off the bud with a little attached wood and by lifting the bark on the stock with the knife, or by bending the little tree backward, force the bud down under the bark from the top of the longitudinal cut (Figure 8B). Tie the buds in with a couple of wraps below the bud and as many more above the bud. The tying material is either moist raffia or string cut the desired length. The end of the wrap can be secured by slipping it under the last loop or by cutting a notch and pulling the string through the notch above the bud.

METHODS OF TOP-WORKING OLD TREES

Budding. This can be done by cutting back severely, and as new shoots develop, budding over where desired. The great objection to this is that it is almost impossible to heal over the wounds left from cutting off the older limbs. Healing over can be accomplished much more easily by grafting. This method is especially useful for peaches which cannot be grafted successfully.

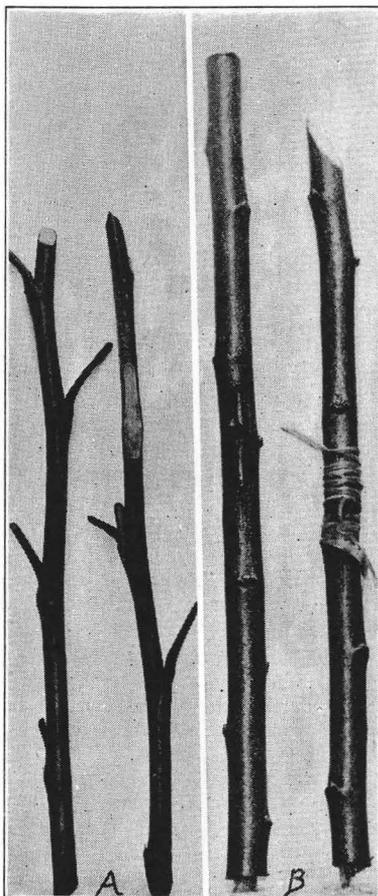


Figure 8. (A) Bud stick ready for use.
(B) Bud inserted and tied.

Grafting. With trees more than three to four years old, at least one good-sized limb should be left to carry on the activities of the top until the grafts become large enough for this purpose. With large trees, only a third or half the tree should be worked over at one time, finishing the work

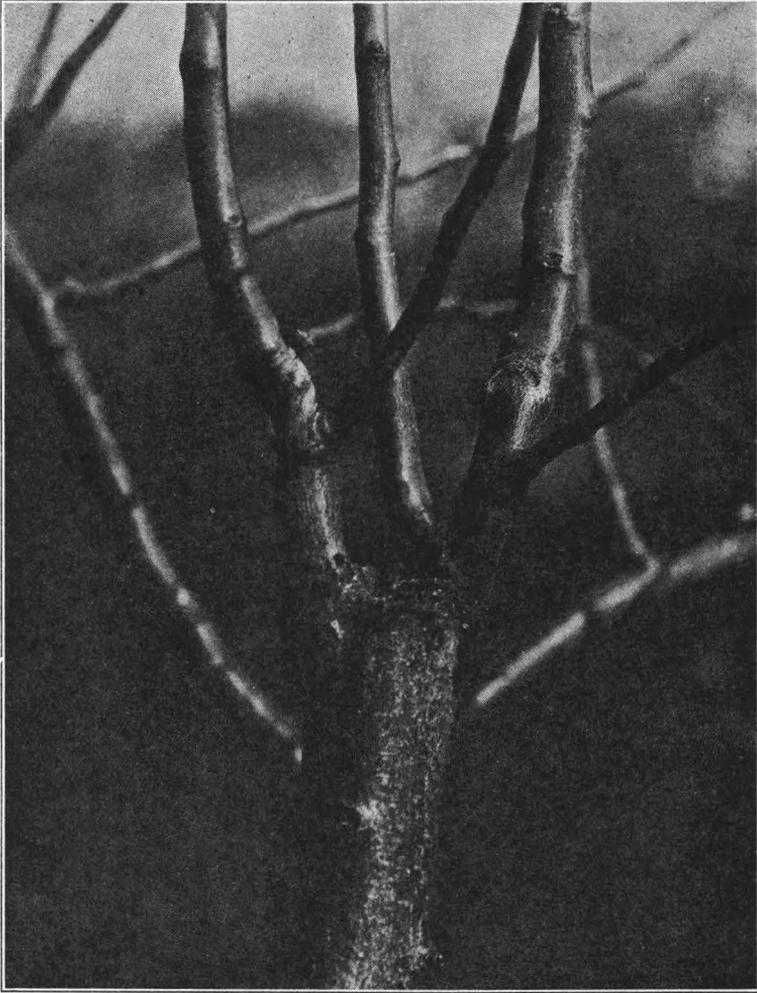


Figure 9. Before pruning the limbs. (One year after grafting.)

the following year or two. In many cases it takes the tree too long to recover from the loss of leaf surface, if the whole top is cut back at once. Removing only part of it keeps the activities of the tree more nearly balanced and the growth of the scions will be much more rapid.

In cutting off limbs growing in an upright position a sloping cut is advantageous. If the cut is made at right-angles, the callus formation around the edge will form a cup to hold the water, affording ideal conditions for developing of fungi that cause heart-rot. Split this limb so one scion will be at the tip of the cut as that scion will generally grow the best.

After the first year choose the shoot that is to be left permanently and prune it as circumstances demand. Cut the other shoots back to one bud (Figures 9 and 10). This will prevent their growing very extensively and give the strength to the single shoot that is left to develop the limb. These other short shoots will grow enough to keep the callus formation developing rapidly, and in that way heal over the wound (Figure 11). Continue heading them back until the wound is practically healed over, when they should be removed entirely. The small scars left from cutting off these stubs will heal over readily.

During the time large wounds are healing over, the surface should be covered with bordeaux spray or a paste, made as follows:

1. Copper sulfate	1½ pounds
Water (hot)	1 gallon
2. Unslaked lime	3 pounds
Water	1 gallon

Dissolve the copper sulfate in the water in a wooden container, as metal containers are quickly eaten through. Slake the lime in the water

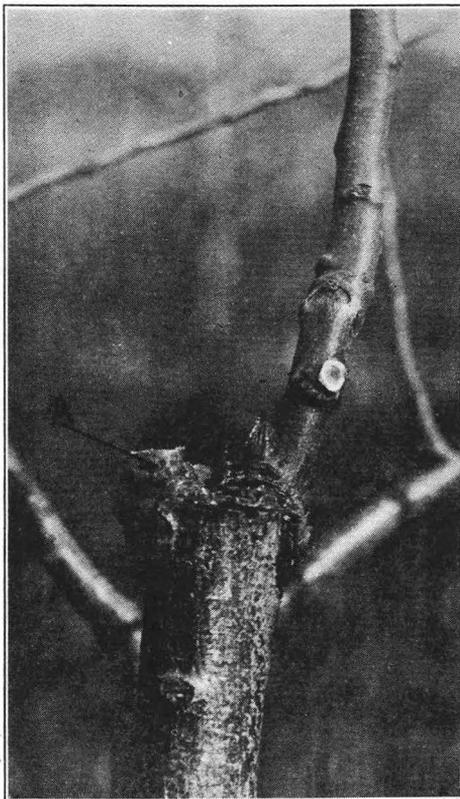


Figure 10. Same limb as in Figure 9 after pruning. One bud (A) left to carry on a limited growth and to keep the surrounding tissue alive.

in a separate container. For use mix equal amounts of 1 and 2. This material prevents the entrance of fungi that will cause decay. Several weeks later a more lasting form as recommended by the Oregon Experiment Station in Extension Bulletin 485 can be applied: "This wound dressing is made by stirring raw linseed-oil *into* one of the commercially prepared bordeaux dusts. A quantity of the dust, sufficient for the project at hand or convenient for a day's operation, is placed in a pail. While stirring, raw linseed-oil is *slowly* added until a thick smooth paint is formed. It is desirable that the paint be thick when prepared, for it apparently becomes thinner after standing a short time. It is most conveniently applied with a brush and should be brushed out to a thin smooth coat."

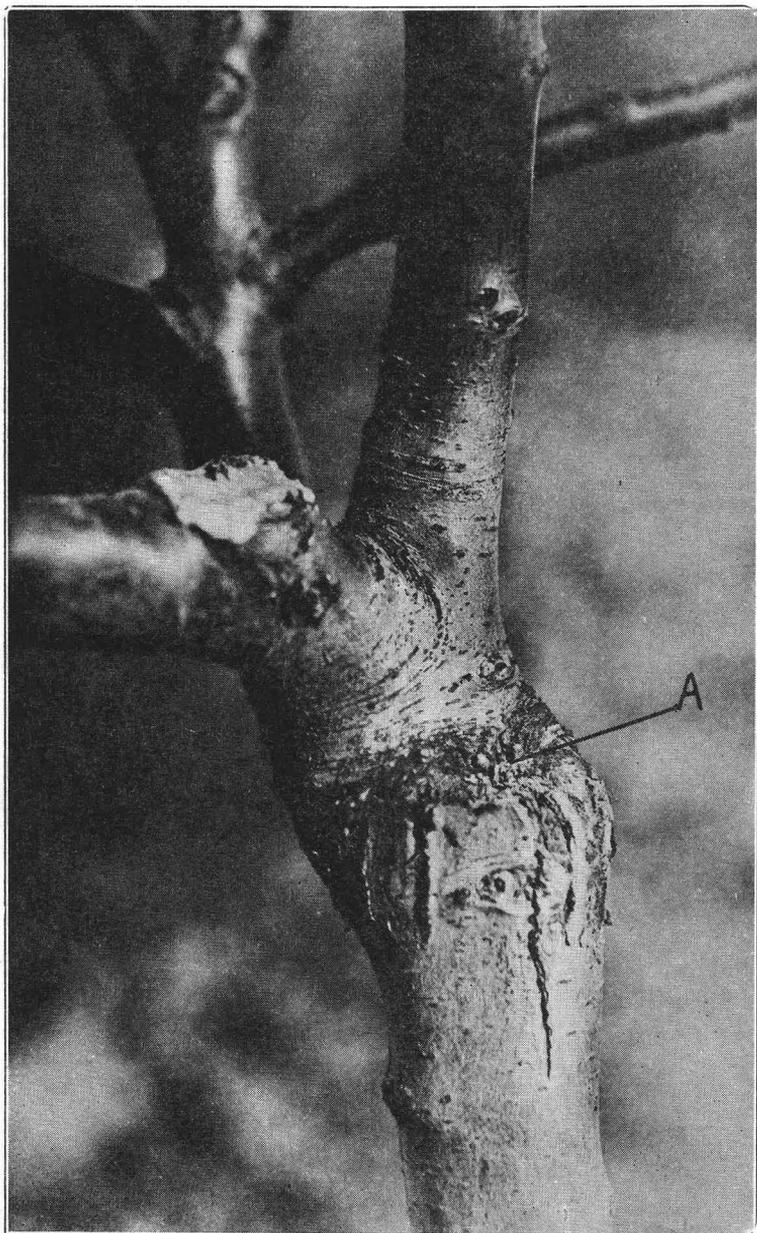


Figure 11. Showing where the tissue is covering over the stub that had been left to help heal the wound and then itself was removed (A).