

COOPERATIVE EXTENSION WORK IN AGRICULTURE AND HOME ECONOMICS
 UNIVERSITY OF HAWAII, HONOLULU 14, HAWAII
 UNITED STATES DEPARTMENT OF AGRICULTURE COOPERATING

GRAFTING AND TOPWORKING THE MACADAMIA*

Edward T. Fukunaga
 Assistant Agriculturist
 Hawaii Agricultural Experiment Station

The basic operation of grafting consists in placing the cambium (the actively growing tissue just under the bark) of the scion (a short piece of the desired plant) in direct contact with the cambium of the stock (a growing plant). The operation is done by inserting a prepared scion bearing several buds into a cut on the stock and protecting the union (the contact point between the stock and the scion) from the elements.

One thing beginners must remember is that macadamia wood is harder and more brittle than the wood of most other commonly grafted plants such as hibiscus, avocado, and mango. Many who have successfully grafted plants with softer woods have experienced difficulty in obtaining successful grafts with the macadamia. Most of these failures have been due to the use of incorrectly sharpened grafting knives.

Any grafting knife with a hard steel blade and a solid handle will do, but the blade must be beveled on one side only, the other side being flat like a carpenter's chisel. For a right-handed person the bevel should be on the side facing the operator when the knife is held in his right hand with blade pointing to his left and cutting edge down. (See figure 1.) Left-handed persons should use knives beveled on the opposite side. The cutting edge should be razor sharp.



Figure 1. Grafting knife beveled for right-handed person.

The best time for grafting is from January through March. However, if the scions are prepared as directed, good takes can be obtained any time of the year.

Several methods have been used in grafting macadamias. However, the side-wedge method is the simplest and, since excellent takes can be obtained by it, nurserymen use it exclusively.

The Side-Wedge Graft

Scion Wood Treatment

1. In general, older wood gives better takes. Wood taken from sections of branches several years old and with relatively few leaves attached is best. Younger wood may be used, but the percentage of takes is likely to be somewhat smaller.

*Original circular written by Ashley C. Browne, Specialist in Horticulture.

2. Sections of branches with diameters ranging from 1/2 to 3/4 inch are girdled. Girdling is done by removing a ring of bark about an inch wide from around the stem and scraping off the slippery inner bark. Girdling prevents carbohydrates, formed in the leaves of these branches, from being transported back into the main part of the tree. The section of the branch above the girdle thus becomes rich in stored foods. When out for scion wood, this section will insure better takes than other sections of the tree.
3. Six to eight weeks after girdling, the branch is cut off at the girdle. The branch may remain uncut for a longer time if necessary -- even until the new bark completely bridges the girdle.
4. After the girdled section is removed, all leaves are cut off close to the stem with a sharp knife or pruning shears. The branches are then cut into sections about 5 inches long, care being taken that each section contains at least two nodes or whorls of buds. The top of the scion is cut just above the top whorl of buds. The bottom may be cut anywhere, just so that the scion is long enough to handle and there are at least two nodes on it.

All wood in the section above the girdle may be used for scions. However, sections with stems less than the diameter of an ordinary pencil are discarded as they give poor takes.

5. The scions are placed in a box between several layers of wet burlap or moist moss immediately after they are cut. Scions may be kept for a week before grafting provided they are kept moist, but it is best to graft them within a day or two after cutting.

Preparing the Stock for Grafting

1. Stock plants should be in vigorous growing condition. If necessary they should be fertilized a few weeks before grafting. The plants may be dormant or in any stage of flush. Stocks with stem diameters of about 3/8 inch near the base are ideal for grafting. Larger stocks can be grafted with as good or even better takes, but the grafting operation becomes progressively more difficult as the stock grows larger. The stock may be as small as pencil size, but the chances for takes become smaller. Stocks smaller than pencil size give poor takes and are not ordinarily grafted.
2. Before grafting, all leaves up to 4 or 5 inches from the ground are stripped off. Leaves attached higher up which interfere with the grafting operation are trimmed. The stock is then topped about 15 inches from the ground. The topping may be higher for larger plants and lower for smaller plants. It is very important that at least three or four whorls of leaves be left on the stock.

The Grafting Operation

1. Grasp the stock with the tips of the fingers of the left hand as shown in figure 2. The third finger should be directly opposite the point where the cut is made. Place the knife with the flat side of the blade toward the stock and press down and into the stock. Twist the hand holding the stock, pushing with the thumb in such a way so as to bend the stock backward (away from the operator) at the point of the cut. Rock the knife handle up and down in the same plane with the cut while exerting pressure downward. Keep cutting

until the stock "gives" and bends back, opening the cut without causing the stock to split down the middle. It is usually necessary to cut about two thirds of the way through the stock.

Most literature stresses the point that the cut should not be extended to the center of the stock. However, it has been found that better looking grafts can be made by the method described here and, also that the scion is held more firmly in the stock with less chance of knocking it off before the union is formed.

How much pressure to exert in banding the stock while cutting must be learned through experience. Too much pressure will cause the stock to split before the cut is completed. Too little pressure will make the cutting difficult.

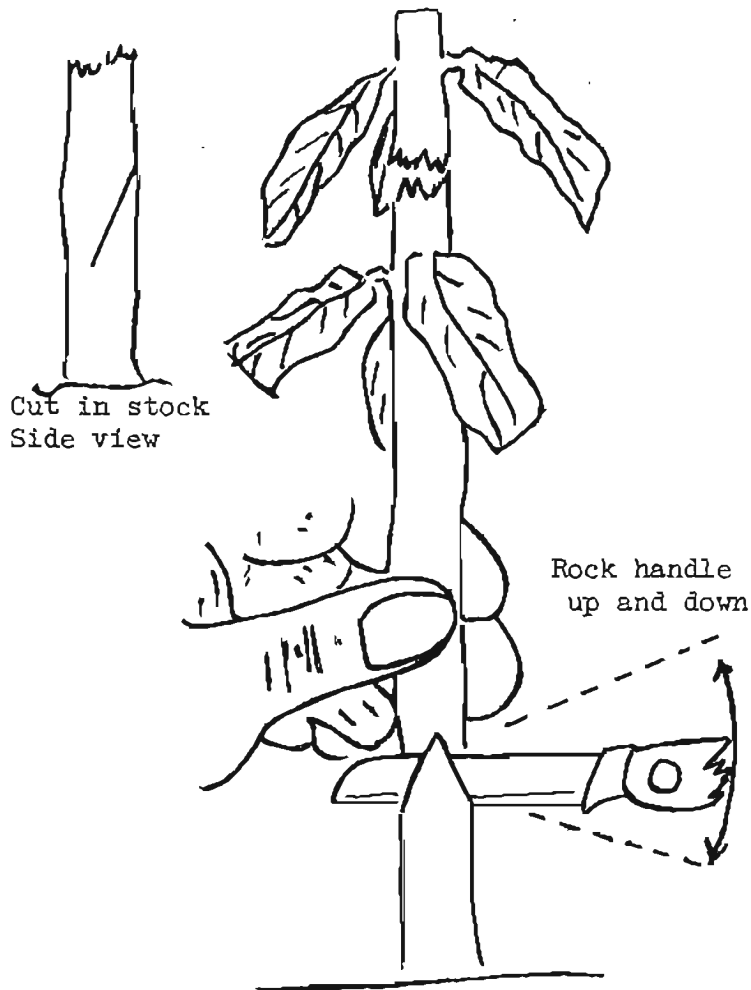


Figure 2.
Making the cut in the stock

2. Select a scion with a diameter about the same as the stock and cut a wedge on the bottom of it. The wedge should be about the same length as the cut in the stock. One side should be slightly longer than the other as indicated in figure 3.

In cutting the wedge, grasp the scion in the left hand and cut as shown in figure 4. Do not try to cut the wedge with one stroke, but cut off thin slices on both sides until the desired shape as shown in figure 3, is attained.

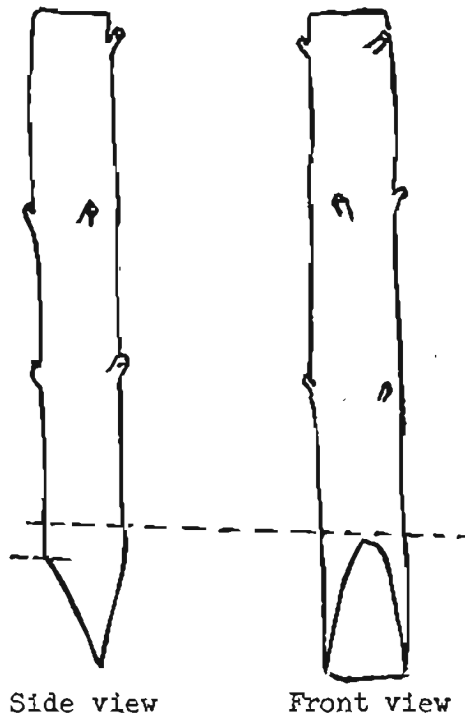


Figure 3.
Scion prepared for grafting.

3. Open the cut in the stock by bending the stock back and insert the wedge into the opening. Press the scion all the way in. The scion should be in line with the base of the stock as illustrated in figure 5.
4. Tie the graft securely with raffia or bind with tape. Special tapes prepared for grafting can be obtained, but any kind of tape may be used. Raffia is preferable since it breaks naturally when the graft takes and the union begins to expand. Tape must be cut after the union between scion and stock takes place.
5. Coat the graft and the entire scion with melted paraffin containing from 5 to 10 per cent beeswax. Apply the paraffin with a small brush. (If beeswax is not obtainable, paraffin alone will be satisfactory in most cases.) Be sure that no cut surface is exposed. The binding material should also be completely coated.

The paraffin should not be too hot. To be sure that it does not get too hot, place a few drops of water in the paraffin melting pot. When the water begins to boil, the pot should be taken off the fire. Special lanterns for melting paraffin can be purchased.

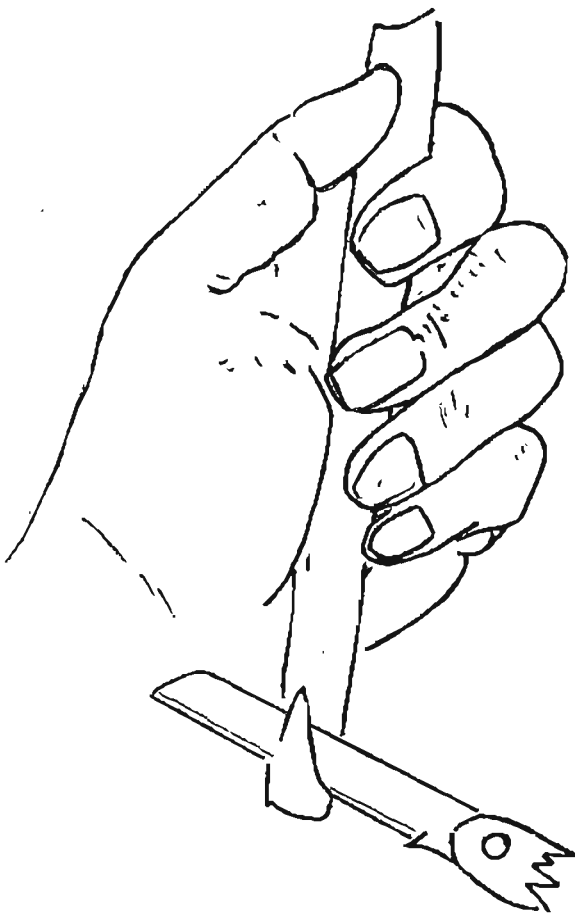


Figure 4.
Cutting a wedge on the scion.

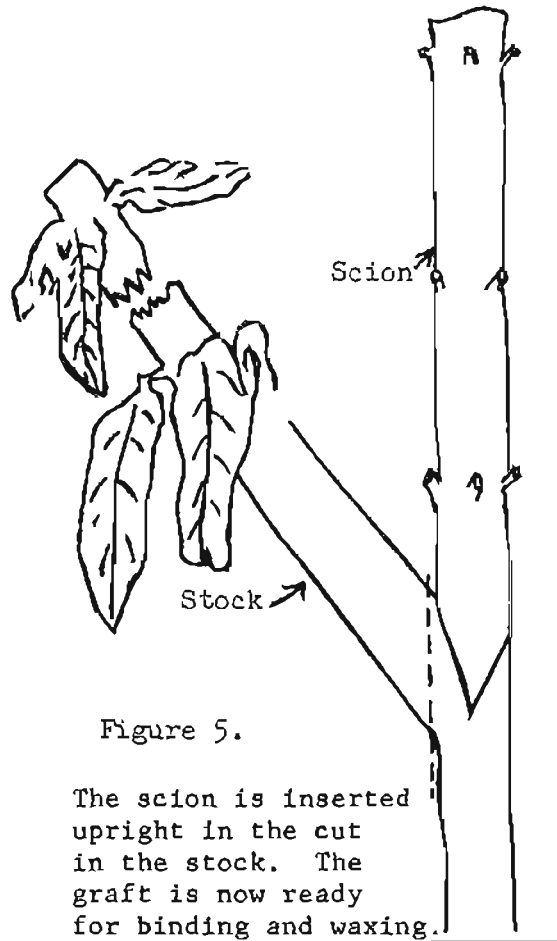


Figure 5.

The scion is inserted upright in the cut in the stock. The graft is now ready for binding and waxing.

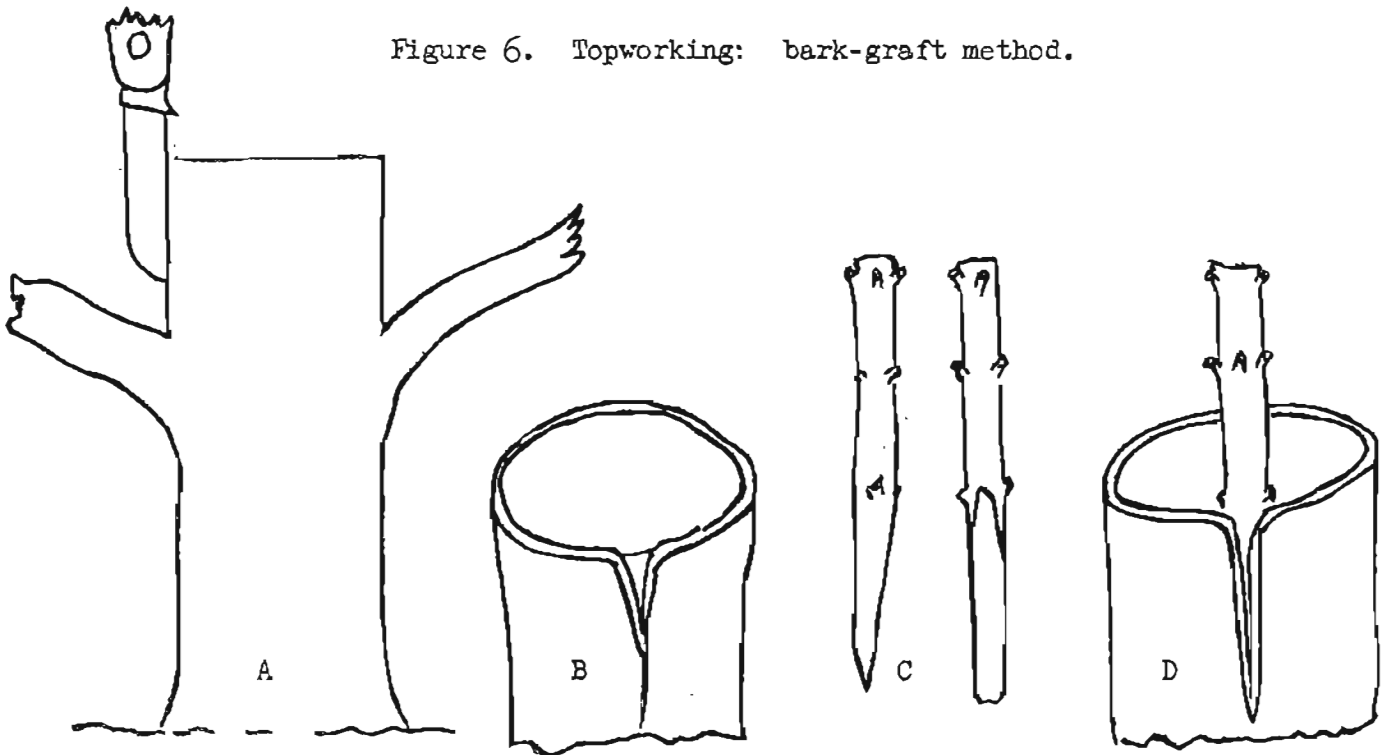
Care after Grafting

1. Weeds around grafted plants should be kept under control. Weeds compete with the stock for water and nutrients and, if allowed to grow tall, will shade out the new shoots from the scion and eventually kill them.
2. When the new shoots begin to emerge on the scion, remove all except the three emerging from the node nearest the top. Shoots from lower nodes are kept only when shoots from the top node are weak or fail to emerge.
3. When the shoots have grown 5 or 6 inches and after some leaves have hardened, remove two of the shoots, leaving only one to develop.
4. Four to six months after grafting, when the new shoots have grown 8 to 12 inches cut off the stock at the point indicated by a dotted line in figure 5. Ordinarily nothing need be done to the cut surface. However, in rainy sections, it is safer to coat the wound with melted paraffin-beeswax mixture.

Topworking

Bark Graft (See figure 6.)

1. Prepare scions by girdling as in grafting.



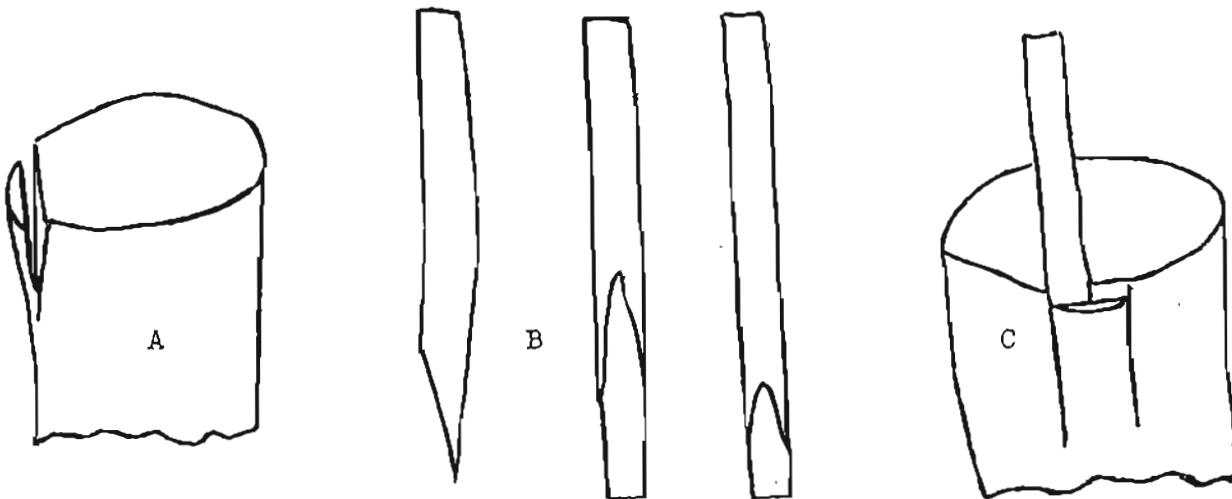
2. Saw off the main trunk of the tree a few inches above the first whorl of branches. It is very important that a few branches be left on the stump until the graft has grown considerably.

To prevent the trunk from splitting during the sawing, first saw half-way into the trunk on the side the tree will fall. Then saw the opposite side of the trunk 2 to 3 inches above the first cut until the tree topples over. Then saw off the short half stump which is left.

3. Press the knife blade into the bark perpendicular to the trunk at the rim of the cut stump, as indicated in figures 6-A. The cut should be about $1\frac{1}{2}$ inches long and deep enough to reach the wood.
4. Lift the bark along the rim of the cut, as shown in figure 6-B.
5. Cut a long wedge at the bottom of the scion, as shown in figure 6-C. Note that one side of the wedge is long and the other side very short.
6. Insert the wedged scion, long-cut surface inside, between the lifted bark and the wood, and hammer it down gently with the handle of the grafting knife or pruning shears until the cut surface on the scion does not show.
7. Make two or three similar grafts along the rim of the cut stump.

8. Bind around the top of the stump with raffia or tape and coat all cut surfaces and the binding material with melted paraffin-beeswax mixture.
9. After the scions take and new shoots have grown a few inches, leave only one growing scion, cutting off the others with pruning shears close to the stump. All dead scions should be pulled out of the stump entirely. Eventually only one shoot on the remaining scion is allowed to grow.

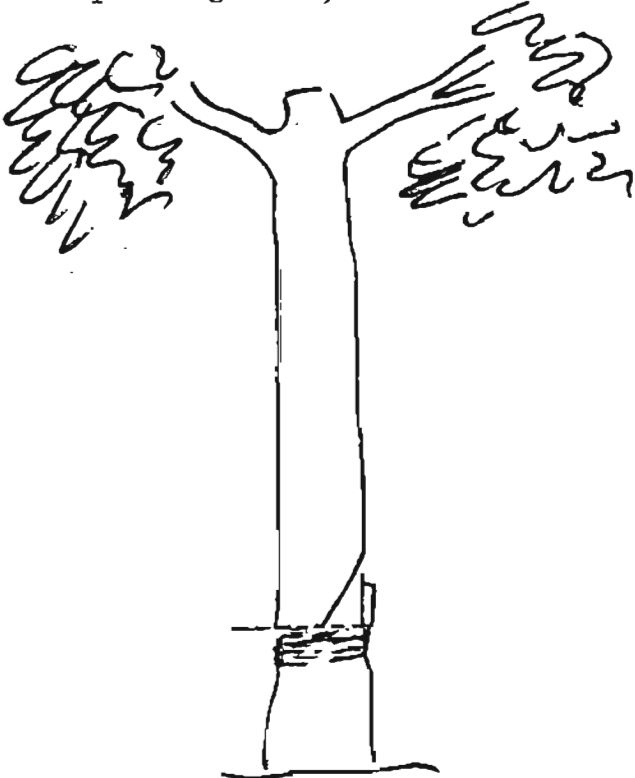
Figure 7. Topworking: modified bark-graft method



Modified Bark Graft (See figure 7.)

1. Prepare the tree as in bark-graft method.
2. Cut a slit on one edge of the stump, as indicated in figure 7-A. The cut is made into the wood. The width of the slit (or cleft) varies from 1/2 inch to 2 inches or more, depending upon the size of the stump.
3. Cut a long, slender wedge on the bottom end of the scion, as shown in figure 7-B. One side of the wedge should be twice as long as the cut on the other side. The length of the longer cut should be the same as the depth of the slit.
4. Insert the wedged scion, long cut toward center, into the slit. It is necessary to place the scion to one side of the slit so the cambium on one side of the scion is in contact with the cambium of the stock (see figure 7-C).
5. Make two or three similar grafts on the stump. Then bind the stump with raffia or tape and coat all cut surfaces, including the scion and binding material, with melted grafting wax. Make sure that all holes are filled with the wax.
6. Care of the graft after union is formed is the same as for bark graft.

Combinations of bark and modified bark grafts can be made on the same stump. In general, the bark graft is simpler and should be used whenever possible. However, there are times when the bark will not "lift," as in the case of very old trees or younger trees at certain seasons. There are several other methods of topworking trees, but these two are most commonly used in Hawaii.



Occasionally one wishes to topwork trees on which the first branches occur several feet above the ground, while it is desirable to topwork below these first branches. In such cases the tree is cut off above the first few branches, leaving only about one third to one fourth of the original foliage. A notch is then sawed off on the main trunk a suitable distance above ground and grafts are made in the sawed notch, as shown in figure 8. When the new shoot on the scion has grown a couple of feet and has several branches of its own, the tree is cut off at the point indicated by a dotted line in figure 8.

In any case, shoots will emerge from various locations on the cut stump. Save a few of those emerging from points closest to the top of the stump. In case the grafts fail to take, these new shoots can be grafted by the side wedge method when they attain the desired size. When the graft is successful, no shoot emerging from the original tree should be allowed to develop.

Figure 8.

Topworking done on wedge sawed into the trunk of a large tree.

This circular was written at the request of the Agricultural Extension Service for out use.