

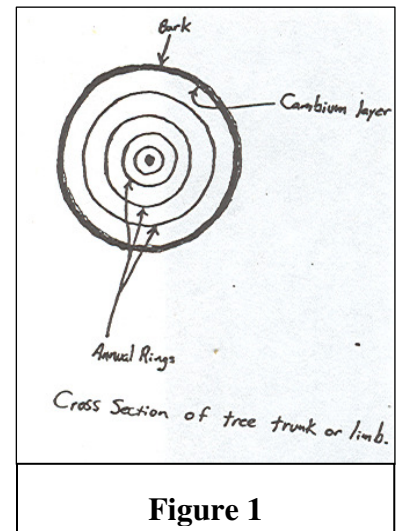
Practical Grafting

By Tom Wahl, Red Fern Farm

Grafting is the art of cloning plants by taking a piece of tissue (usually a bud, or a twig with one or more buds) from one plant and attaching it to another plant. If done successfully, all subsequent growth on the plant will come from the grafted bud or twig. The resulting new plant is genetically identical (a clone) to the one from which the bud or twig was taken.

In the grafting process, the cambium layer is of primary concern. The scion (from the tree to be propagated) is attached to the rootstock in such a way so the cambium layers of the scion and rootstock grow together, fuse, and form a union. The cambium is a two-cell-thick layer of tissue lying between the bark and the wood on a limb or trunk of a tree (See Figure 1).

If you have ever peeled the bark off a limb in late Spring or early Summer you will have noticed a wet, slimy film on the outside of the wood and the inside of the bark. This is the cambium from which the wood and the bark are produced, and which heals wounds.



There are potentially many reasons for grafting. Here we will deal with grafting for the propagation of fruit or nut trees. People often ask “Why go to the trouble of grafting? Why not just plant seeds?” The reason for grafting is to get a tree with known characteristics of fruit size, quality, productivity, ripening time, cold hardiness, etc. For example, if you want a Jonathan apple you must either buy one or graft your own. If you plant a seed from a Jonathan fruit the resulting tree will very likely be very inferior to the parent. The fruit may be small, hard, and sour or tasteless. Only about one in a million apple seedlings is as good as its parent.

To understand a discussion of grafting it is important to be familiar with the terms used:

Bark Slippage—A condition which occurs during active cambium growth, when the bark separates very easily from the wood on a tree. This happens in Spring and early Summer after leaf-out, and usually again in late summer.

Bench Grafting—Any grafting done using small, bare-root or potted rootstock which are carried to a table or workbench to be grafted (as opposed to grafting a tree growing in the ground).

Bud (noun)—A piece of tissue on a twig from which leaf, shoot, and flower buds grow.

Bud (verb)—The act of grafting by attaching a single bud from one plant to the rootstock of another plant.

Cambium—A two-cell-thick layer of tissue lying between the wood and bark, from which the wood and bark of a tree is derived. The cambium also transports carbohydrates between roots and leaves. For grafting to be successful the cambium layers of both scion and rootstock must grow together and form a union.

Compatibility—The condition which allows the cambium layers of different plants to grow together to form a union. Compatibility usually requires the plants to be closely related, usually the same species.

Cultivar—A contraction of the term “cultivated variety.” It usually refers to a clone of a plant which is regularly propagated commercially, such as “Jonathan Apple.”

Petiole—The stalk by which a leaf is attached to a twig.

Rootstock—Refers to the root system and lower part of the trunk of a grafted tree. Also refers to a tree which is used to attach a scion from another tree.

Scion—A piece of tissue—usually a bud or twig—which is taken from one tree for the purpose of attaching it to another. Whatever grows from the scion is a genetic duplicate (a clone) of the tree from which the scion was taken.

Scionwood—A section of twig from which scions are prepared for grafting.

Topworking—The act of cutting the top off a tree and grafting on a new top for the purpose of converting the tree from one variety to another.

Union—The point at which a scion and rootstock are attached to each other. Also refers to the successful joining between the cambium layers of scion and rootstock.

A few basic principles must be kept in mind for successful grafting:

--**Compatibility**—The cambium layers of the rootstock and scion must be able to grow together to form a long-term union. This requires they be closely related, usually the same species, i.e. apple grafted to apple, pear onto pear, cherry onto cherry, etc. Apples will not graft onto pears or cherries because they are not compatible. In some cases closely related species can be grafted, such as medlar onto pear. In other cases, such as with chestnut, the rootstock and scion must be even more closely related than just being the same species. Chestnuts often need to be grafted onto their own seedlings or siblings.

--**Dormant scion**—The scion must be dormant at the time of grafting, otherwise it will die before the graft union has time to heal. The scion must also be of good quality, collected at the right season, and stored properly until time of grafting.

--**Proper season**—The time of year must be correct for the species and technique being used.

--Proper technique—The technique must be correct for the species and the season. It must also be applied with an adequate level of skill.

--Ambient conditions—The ambient conditions must be correct. Many species will heal a graft union only within a narrow range of temperatures. That range will vary from one species to another. The cambium layers of both scion and stock must have oxygen and moisture. This means oxygen must be allowed in without letting too much moisture out. A proper wrapping or coating is usually required for this.

--Sharp tools—A sharp, thin-bladed knife (preferably a grafting or budding knife) should be used for grafting.

--Don't touch!—You should never touch any cut surfaces on either scion or rootstock with your fingers. Salt and oils on your skin are toxic to plant tissues.

The first step in grafting is to collect scionwood. For most grafting other than budding this is done during the dormant season (usually late winter or very early spring). The best quality scionwood usually comes from the middle half of the previous season's growth. Select vigorous, stout twigs, preferably at least 3/8" in diameter, and which showed a lot of growth the previous year. Avoid small diameter twigs which may have only grown a few inches the previous year.

On that twig, the best buds come from the middle half. Buds near the tip and the base are often immature (See Figure 2).

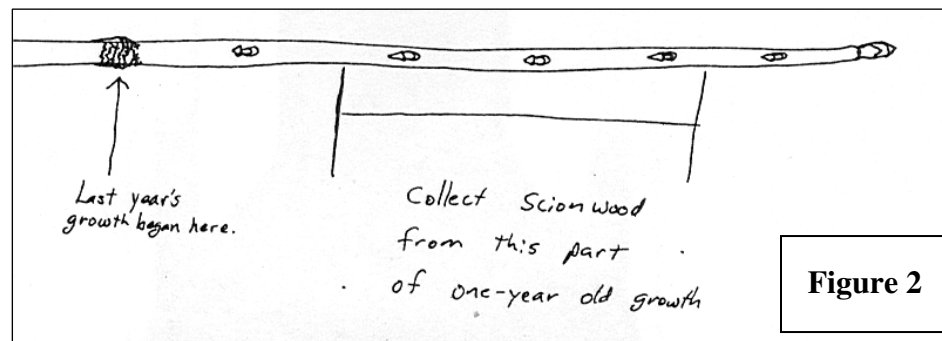


Figure 2

Even if you are collecting only one kind of scionwood, it is a good idea to label the twigs immediately upon collection. Scionwood should be immediately placed in a Ziploc bag with a slightly damp paper towel or newspaper (to maintain 100% humidity), but with no free moisture. It should be stored at close to 40 degrees F until grafting time (a refrigerator is just right). Scionwood should never be allowed to freeze or get too warm.

Successful grafting requires a three-way match between season, species, and technique:

Apples and pears can be grafted early (April) by cleft grafting. It can be done even before the leaves come out. They can be "T budded" or chip budded in late summer (late July through August). The Mega-Chipbud Inlay can be used from early Spring through early Summer, and again in late Summer.

Stone fruits (cherries, plums, apricots, peaches) are usually not cleft grafted, but are budded ('T' or chip) in late summer. For Spring grafting the Mega-Chipbud Inlay should be used.

Native fruits such as persimmon and pawpaw, as well as nut trees like chestnut, walnut, pecan, and hickory require warm temperatures for healing graft unions, and cleft grafting is seldom successful. Their bark does not slip well in late Summer, so "T budding" does not work well. The important thing is to graft these species late enough so the daytime high temperatures are getting up into the 80's.

The Cleft Graft

The cleft graft is usually used on pear and apple in early Spring, often before leaf-out. Cleft grafting is often use to topwork, or change a tree from one variety to another.

One the rootstock, select limbs between $\frac{3}{4}$ " and 2" in diameter. Cut the limb off perpendicular to the growth, leaving a stub at least 6" long (See Figure 3).

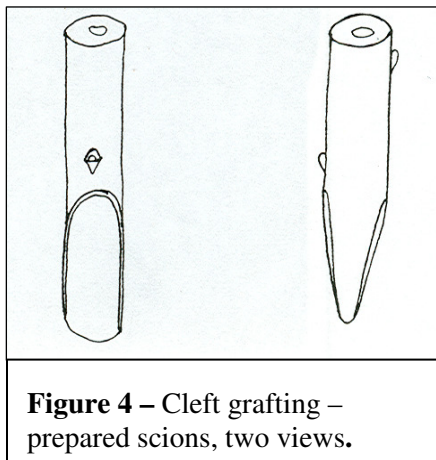


Figure 4 – Cleft grafting – prepared scions, two views.

Use a grafting tool or a large, heavy knife and hammer or mallet to split the stub in the middle for a distance of 3" or so. Select a good piece of scionwood 4" to 6" long, and bevel the lower, or root end with two sloping cuts (See Figure 4).

The result should be a blunt wedge shape. The tapering cuts should be 1"

to 1 $\frac{1}{2}$ " long. One edge of the wedge should be slightly thicker (in cross-section) than the other. This thicker edge is the one which will be lined up with the cambium layer on the rootstock (See Figure 5).

Use a grafting tool or a large, flat screwdriver to spread open the split in the rootstock. Insert the cut surface of the scion into the split in the rootstock with the thicker edge toward the outside. Make sure the cambium layer (where wood and bark meet) of rootstock and scion line up perfectly (See Figure 5 again). By tipping the scion outward very slightly you can be sure the cambium layers contact each other at some point.

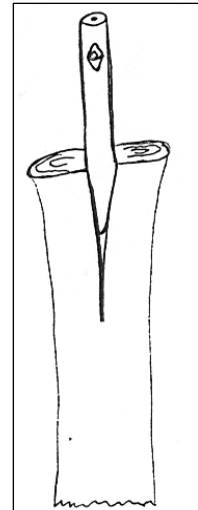


Figure 3
A cleft graft

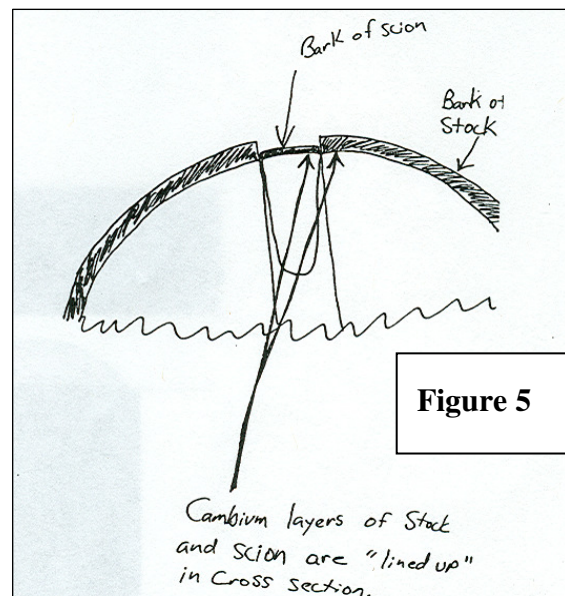


Figure 5

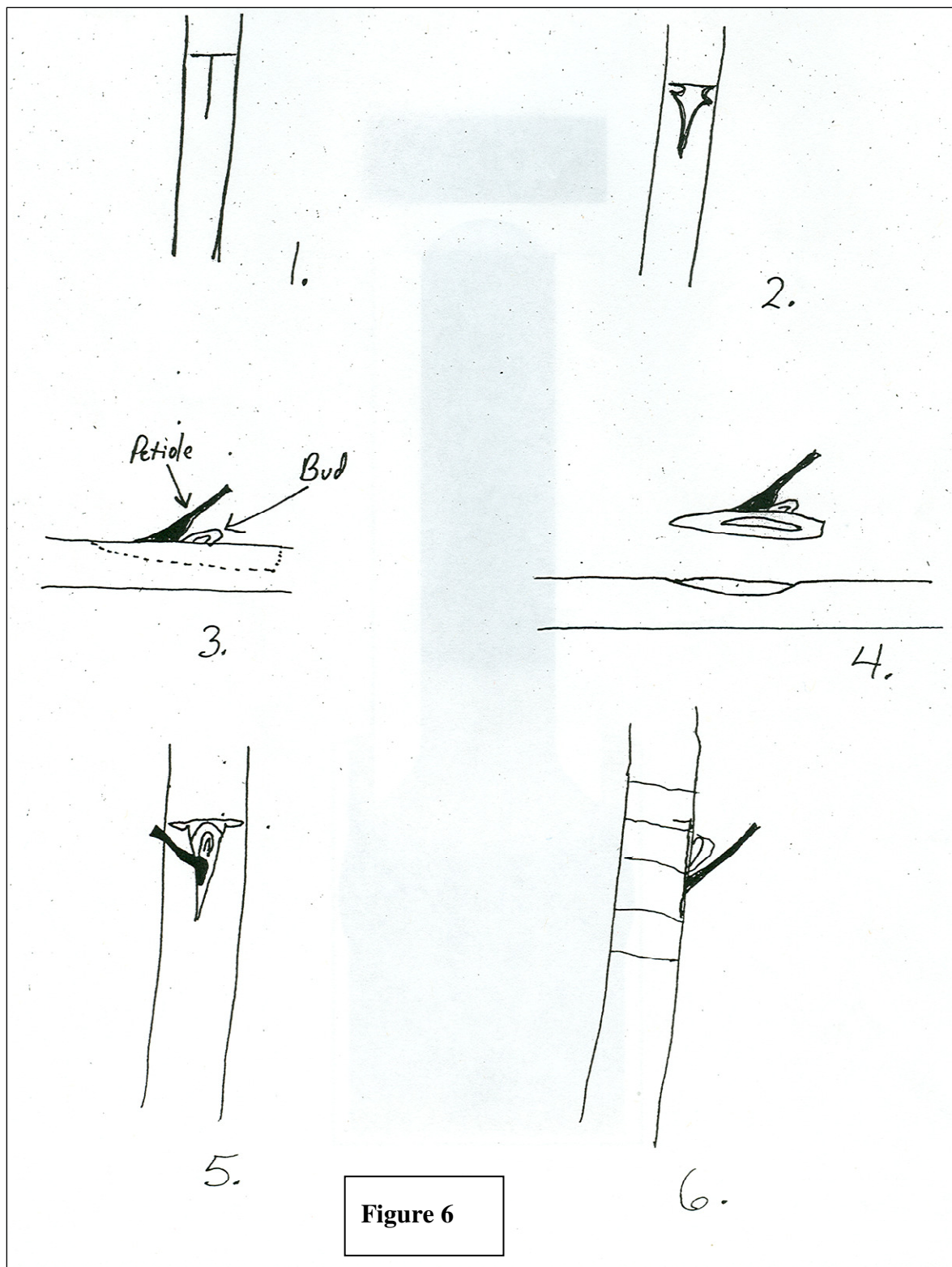
Coat all cut surfaces with grafting wax or Elmer's Glue, or wrap with Buddy Tape, or tie a plastic sandwich bag (with a small hole punched in it for the scion to stick out) over the whole thing. Avoid asphalt-based "grafting compound" or tree wound paint.

Growth from the buds on the scion should start within 2-3 weeks. Pinch off any growth from the rootstock which does not come from the scion. When the growth from the scion reaches about a foot long, tie it gently but firmly to a stout stake for support. New grafts are very vulnerable to breaking off in the wind for their first year or two. As the growth continues keep tying it to the stake until two feet or so are supported. Use soft cloth for the ties, never anything like string or wire which could cut into the bark.

"T Budding"

T budding is used most on stone fruits in late Summer, when next year's leaf buds (located just above this years leaves) are mature, and the bark is slipping (late July through August). From the tree to be propagated, select a bud stick from vigorous growth of the current season. Break off the leaves, but leave the petioles on. The petioles will become the handle for the bud later.

On the rootstock select a smooth, open section of branch between $\frac{3}{4}$ " and $1\frac{1}{4}$ " in diameter (2 to 3 year old growth). Cut through the bark down to the wood in the shape of a "T" about $1\frac{1}{2}$ " tall (See Figure 6). Peel the loose flaps of bark (from under the "hat" of the T) away from the wood.



On the bud stick make an upward cut starting just under the petiole of the selected bud. Cut under the bud, going just deep enough to take a little sliver of wood along with the bark and the bud. Trim off any excess bark about $\frac{1}{4}$ " above the bud. Use the petiole as a handle to insert the

bud between and under the loose flaps of bark on the rootstock. Wrap with Buddy Tape, leaving only the petiole sticking out. The new shoot from the bud will grow right through the Buddy Tape with no problem. If any other kind of wrap is used (such as rubber budding strips) then the bud must not be covered.

If the bud “takes” (the graft is successful) then the petiole will loosen and fall off of the bud in 10 days to 2 weeks. If the graft fails the petiole will turn stiff and hard and stick tightly to the bud. The bud will remain dormant the rest of the season, and will start growth the following Spring. Cut the rootstock off about 6 inches above the bud. Make sure all new growth comes from the grafted bud and not the rootstock. Pinch off any growth from the rootstock. Use the stub above the bud as a stake to tie up the new growth for support (See Figure 7).

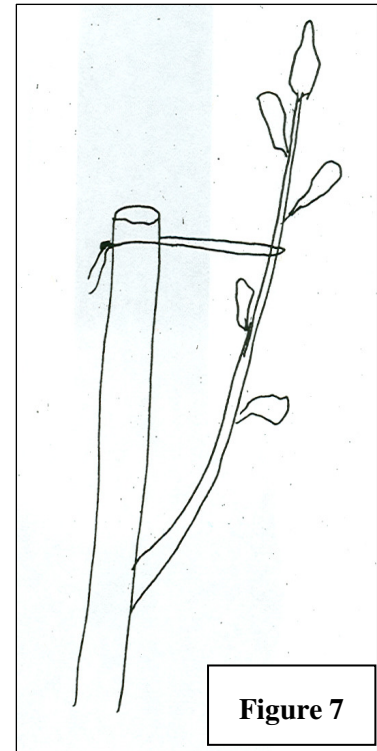


Figure 7

Chip Budding

Chip budding is done on the same kinds of trees and at the same time of year as T budding. It is done the same as T budding except for the following differences:

--The rootstock and the scion bud stick must be the same, or very close to the same diameter.

--Instead of a T shaped cut through the bark on the rootstock, a wedge-shaped piece of wood is removed from the current seasons growth.

--Another piece of wood of the same size and shape (but with a bud in the middle) is taken from the bud stick, to fit perfectly in the void on the rootstock (See Figure 8).

Wrap the chip bud the same as for a T bud.

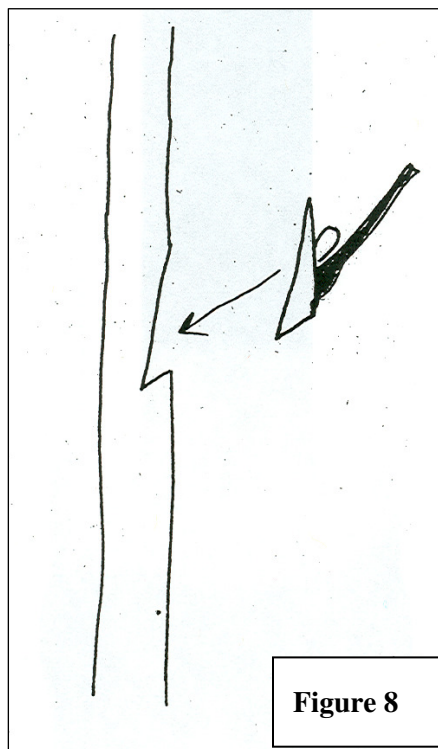
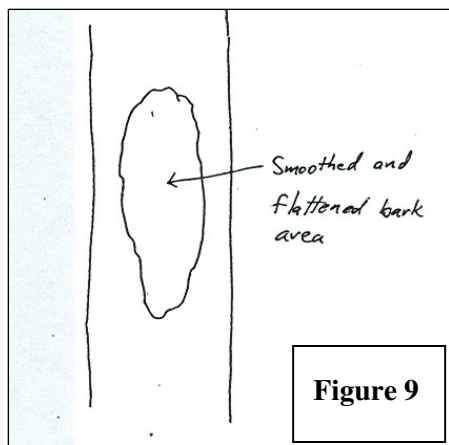


Figure 8

The Modified Mega-Chipbud Bark Inlay Graft

This technique, hereafter referred to as the Mega-Chipbud, has become my favorite for field grafting. It can be done on almost any species, and any time the bark is slipping. It requires very little skill, and yields high success from first time users on otherwise hard-to-graft species like pecan, hickory, and walnut. It is the best technique for chestnut, persimmon, and pawpaw. A variation of this method can be used for early season grafting before the bark begins to slip, and for bench grafting. It was recently imported from China, and as far as I know has no name in English yet (except for the unwieldy handle I gave it).

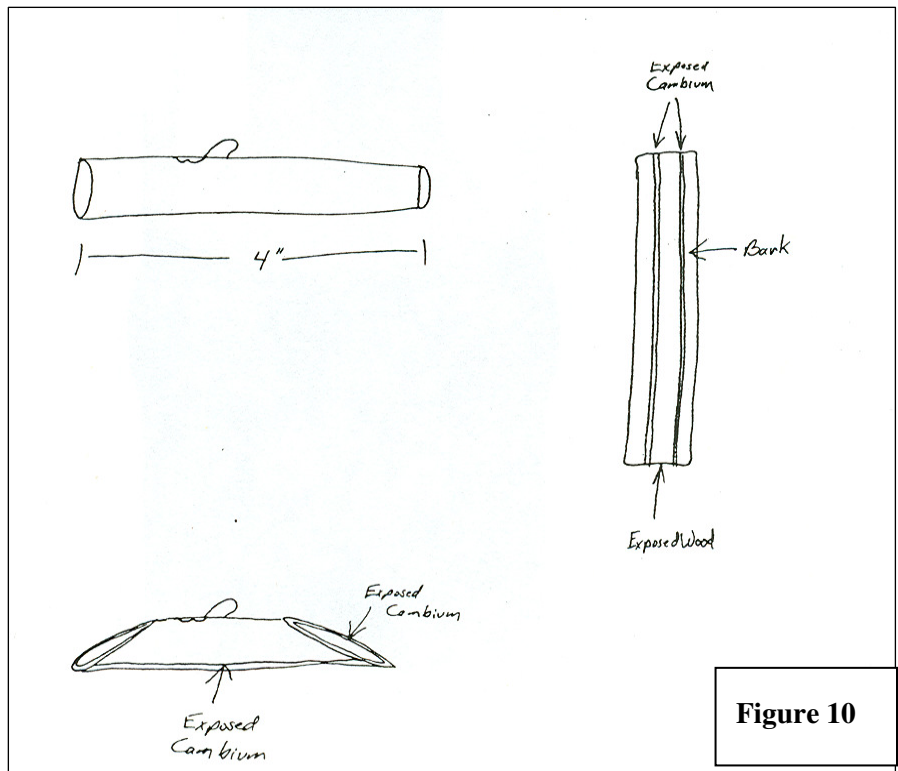


If the rootstock is large (1 ½" to 3") then the grafting area should be smoothed and flattened with a knife (See Figure 9).

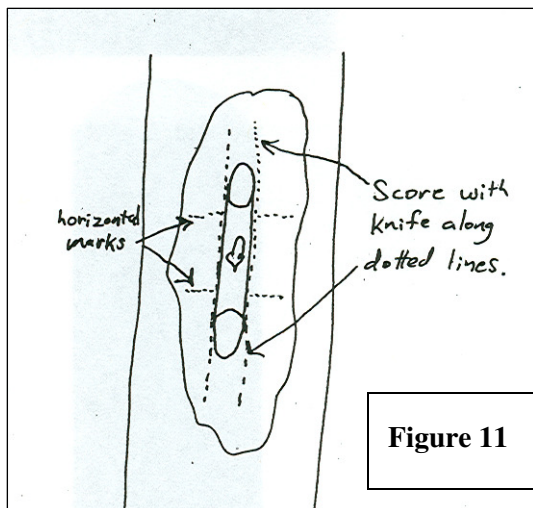
From the tree to be propagated select a piece of scion about 4" long with one bud in the middle. Shave a little off the back side, opposite the bud. Cut just deep enough to get into the wood while exposing the cambium (See Figure 10).

Cut sharp bevels starting just above and below the bud and sloping back toward the shaved backside. Be careful never to touch any of the cut surfaces with your fingers.

Hold the chipbud up against the rootstock with one or two fingers of your left hand and score the bark with a knife alongside the chipbud, and extending another ½" above and below it (See Figure 11). Make horizontal marks alongside the chipbud about halfway between the bud and the beveled cuts both above and below the bud.



Lay the chipbud aside. Be



careful not to loose it! Cut through the bark along both vertical marks, clear through to the wood. Make horizontal cuts through the bark, corresponding to the horizontal marks, but *between* the vertical cuts. This will release a rectangle-shaped piece of bark. Peel this rectangle away and discard it (See Figure 12).

Loosen the flaps of bark above and below the rectangle (See Figure 13) and insert the chipbud under the loose flaps (See Figure 14).

On small rootstock (1" or less diameter) wrap with Buddy Tape, including the bud. On large stock use a stronger tape such as electrical or duct tape to

press the bark flaps against the chipbud, and the chipbud against the rootstock. Do not cover the bud. Seal all cut surfaces with grafting wax or Elmer's Glue. Avoid Asphalt based compounds or paint. Prune the top of the rootstock severely, above the chipbud, but leave at least one small "nurse branch." Remove any shootgrowth from the rootstock, and stake and tie the growth from the chipbud to secure it from wind damage.

