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Citrus Propagation[1]

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Home fruit growers often want to propagate their own citrus trees, or change varieties by top-working an existing tree with one or more varieties of citrus. As with many gardening activities, considerable satisfaction may be gained from growing your own citrus trees. Furthermore, several excellent citrus **cultivars** (**culti**vated **var**ieties) are difficult, if not impossible, to buy locally and are most easily obtained by propagating your own. Moreover, dooryard citrus trees from local retail outlets are sometimes mislabelled as to cultivar and/or rootstock. With patience and a little practice, home fruit growers can master the art of growing their own trees.

It should be noted, however, that home fruit growers may find it difficult to obtain the highest quality plant material from which to grow their trees. This is because registered, true-to-type, disease-free propagation wood and seed are generally available in bulk for the commercial nursery trade, not in small quantities suitable for home gardeners.

COMPOSITION OF A CITRUS TREE

Most citrus trees consist of two distinct parts. The **rootstock**, or **stock**, comprises the root system and lower stem or trunk. It is usually grown from seed. The upper part of the tree, consisting of the limbs, leaves and fruit, is known as the **scion**. The scion is derived by inserting tissue of the desired cultivar into the rootstock in such a way that it unites with the rootstock and develops the fruiting portion of the tree. By using different plants for the rootstock and scion, horticulturists have been able to incorporate more desirable characteristics into a single tree. These attributes include tolerance to unfavorable soils, pests, diseases or cold, and greater yields of high-quality fruit.

DEFINITIONS OF HORTICULTURAL TERMS

There are several terms that the reader should become familiar with before attempting to master the techniques described in this fact sheet. **Plant propagation** is the art and science of reproducing plants while preserving the unique characteristics of a plant from one generation to the next. **Grafting** is a specialized type of plant propagation where part of one plant (the scion) is inserted into another (the rootstock or stock) in such a way that they unite and grow as a single plant. **Budding** is a particular type of grafting with the scion consisting of a single bud attached to a piece of bark and sometimes a thin sliver of wood underneath. Budding is the method of choice for propagating young citrus trees because it works well for citrus and requires less skill than other types of grafting. There are many types of budding but those most commonly used for citrus in Florida are the inverted **T bud** and the **chip bud** (hanging bud).

Sometimes it is desirable to change the cultivar of an existing citrus tree. This procedure is known as **top working** and involves grafting a new cultivar onto

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the existing scion. Several grafting procedures (including T budding) can be used to top work citrus but some of these procedures require considerable skill. This procedure will be discussed in a subsequent section of this publication.

CITRUS SEED

While seeds removed from citrus fruits will grow into trees and eventually produce fruit, the seedlings may not always be true-to-type (identical to the parent tree), and may not produce fruit for ten or more years. Even then, the fruit will be of unknown (and often inferior) quality. However, plants propagated vegetatively will be identical to the tree from which the propagation material was taken and will fruit in two to three years.

Citrus seeds are quite suitable, however, for growing rootstock plants on which the desired cultivar may be budded. Seed from common, edible citrus fruits (sweet orange, grapefruit or mandarin) can be used for growing rootstock plants at home, but this would not be recommended for commercial purposes. Cultivars have been identified, or developed through breeding programs, which may not have edible fruit, but are excellent rootstock plants, such as rough lemon, sour orange, Trifoliate orange, Carrizo citrange, Swingle citrumelo, Cleopatra mandarin, and other lesser used varieties. For best results, seeds from one of these plants should be used. Recommended rootstocks vary with many factors including the type and cultivar of citrus grown, soil conditions and climate. Your county extension agent can help you select a rootstock to suit your needs.

Unless citrus seeds are purchased, they should be extracted from mature fruit, rinsed thoroughly in water, and planted as soon as possible. If extracted seeds are not planted immediately after rinsing, they should be spread evenly on absorbent paper and placed away from direct sunlight. When the surface moisture has dried, the seeds should be placed in polyethylene bags and stored at 40-45° F (the refrigerator vegetable drawer works well).

Seeds should be planted at a depth of 1/4 to 1/2 inch in suitable pots or flats containing sterile potting media. Removing the seed coats, or soaking seed in aerated water for about eight hours just prior to planting, can reduce the time required for germination and seedling emergence. Sunlight, warm soil temperatures and sufficient moisture are required for rapid germination and seedling emergence. Under ideal conditions, emergence will likely occur during a 2 week period beginning 7 to 10 days after planting. Plants should be trained to a single stem (no branches within 6 to 8 inches of the soil).

BUDDING

Budding is usually done when seedling stems are 1/4 to 3/8 inch in diameter (about the diameter of a pencil). Budding can be done anytime there is a suitable stock on which the bark is slipping and when suitable budwood is available. Usually, the bark is slipping from April to November, depending on location. The area to be budded should be pruned clean of thorns and twigs. The preferred budding height is 6 inches above ground level.

Selection of Budwood

Buds should be collected from healthy, disease-free trees of the desired cultivar. This is usually done by collecting twigs from the next to last growth flush (the wood behind the current growth flush) or from the current growth flush after it has begun to harden or mature. Budwood should be round (not angular as is young wood), relatively straight and have well formed buds in the leaf axils (Figure 1). Often, the presence of a few longitudinal gray lines on the green bark indicate the proper stage of maturity. Whenever possible, budwood should be approximately the same diameter as the rootstock stem to be budded.

After budwood is cut from the tree, the undesirable wood and/or growth flush should be discarded and the remaining budwood trimmed to 8-10 inch lengths. Leaves should be cut off leaving a stub of the petiole about 1/8 inch long to protect the bud. Trimmed budsticks should be labelled as to cultivar, date, and budwood source and used immediately, or placed in suitable storage.

The importance of selecting budwood from disease-free trees cannot be overemphasized. Several serious virus, or virus-like, diseases can be spread by using infected budwood. These diseases can kill trees, or make them nonproductive. Homeowners should also be aware that importation of budwood into Florida from other states or countries is strictly forbidden. Moreover, certain areas of Florida may be quarantined due to the presence of a particular citrus disease. Budwood should not be moved from quarantined areas to other parts of the state. When moving budwood long distances within Florida, it is

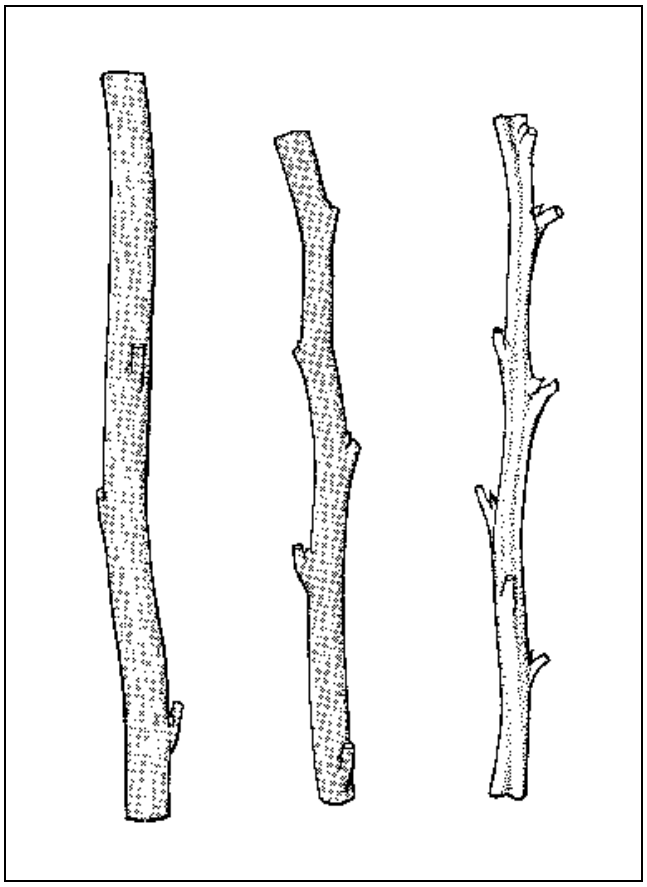

Figure 1. Comparison of budwood at maturity stage: wood of the current flush (right); older wood (left); wood one growth flush from current flush (center).

advisable to first check with the Florida Department of Agriculture, Division of Plant Industry.

Storing Budwood

Budwood should be used as soon after its collection as is practical. However, it can be stored for up to 2-3 months under proper conditions. Budsticks not used immediately should be placed in sealed polyethylene bags and stored at between 40-45° F. The vegetable drawer of the refrigerator is usually ideal for budwood storage. Do not put water or wet packing material into the storage bag as this will cause the budwood to mold or decay.

Inspect budwood every 2 to 3 weeks for the presence of mold, or excessive moisture inside the bag. Lightly molded budwood should be carefully washed in cold, mild soapy water, rinsed and stored in a clean bag. Budwood which is excessively moist should be lightly blotted with paper towels. Shrivelled, darkened, or heavily molded budwood should be discarded and any unaffected budwood should be washed and returned to storage in a clean bag. Stored budwood should remain moist and cool, but not wet. It is best not to remove budwood from storage until a couple of hours before its use.

Budding Tools

Before attempting the following procedures, several items should be on hand and in good working order. A razor-sharp knife is needed to make smooth, clean cuts necessary for sufficient contact between the scion bud and rootstock during the healing process. The sharper the knife the better. Knives designed specifically for budding are available at garden supply stores and are usually best, although some pocket knives are suitable. Any blade will become dull with use and require periodic sharpening. A sharpening stone (wet stone) and honing oil will be needed. Polyethylene budding tape (available in clear or green) is used to wrap buds to prevent drying and promote bud union formation. Clear tape allows you to observe the bud during the healing process.

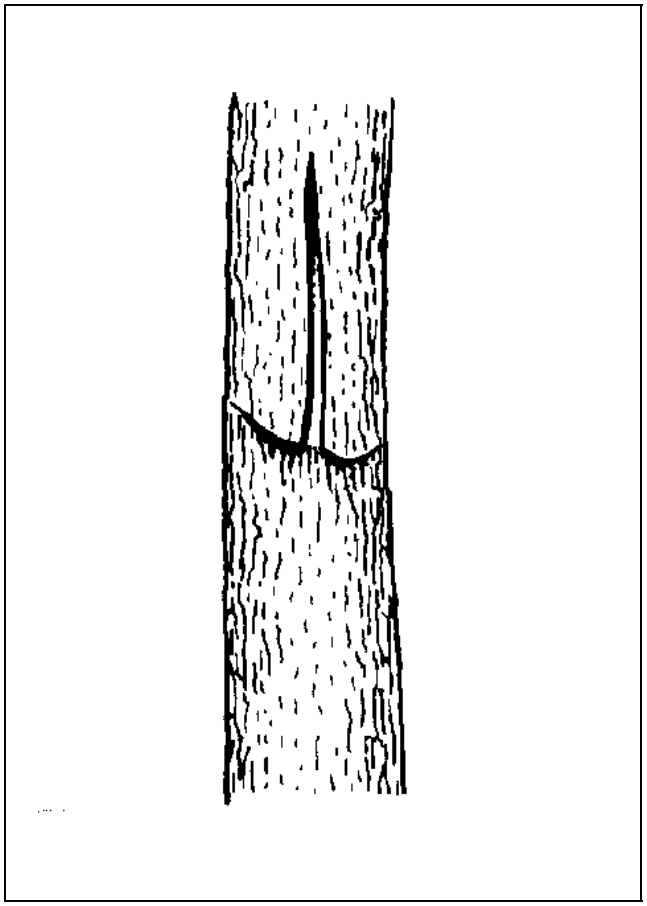

Figure 2. An inverted "T" incision is made through the bark on the rootstock stem several inches above the soil line.

T Budding

T budding is a relatively simple procedure and is recommended over chip budding for the inexperienced budder. Most Florida citrus trees are propagated by the inverted T bud procedure, but the standard (upright) T bud is equally satisfactory. T budding may be conducted whenever the rootstock plant has attained suitable size, its bark is slipping (the bark separates easily from the wood underneath), and suitable budwood is available. These conditions usually occur during periods of growth between April and November. All thorns, stems and leaves should be removed from the area to be budded. The preferred budding height is approximately 6 in. above the soil surface.

A very sharp knife is used to make a vertical cut in a smooth area of the rootstock stem about 1.0-1.5 inch long completely through the bark. A horizontal cut is made through the bark at the bottom (inverted T) or top (regular T) of the vertical cut. The cut is made at a slightly upward angle, again cutting completely through the bark. The point of the knife can be used to lift the bark along the vertical cut (Figure 2).

Remove buds from the budstick while holding the apical end (tip) of the budstick away from you. With the knife blade almost parallel to the axis of the budwood, begin the cut about 1/2 inch above the bud removing a shield-shaped piece of bark and wood about 3/4 to 1 inch long with a flat, smooth cut surface. Cut only deep enough to remove a thin sliver of wood under the bark (Figure 3). The bud should not be scooped out because too much wood will be removed with the bud. Avoid touching the cut surface of the bud shield by holding it between the thumb and knife blade, or by carefully using the leaf petiole stub as a handle.

The bud should be immediately inserted into the stock, not allowing the cut surface of the bud to dry. Slide the bud shield (the bud with associated bark and wood) under the bark flaps of the rootstock with the cut surface flat against the wood of the rootstock plant (Figure 4). The bud shield should be completely enclosed in the T incision; if part of it protrudes beyond the incision, cut it off.

Buds should be wrapped immediately following their insertion into the rootstock. Wrap buds with budding tape (polyethylene strips about 1/2 inch wide by 6-10 inches long). Begin wrapping below the bud with 3-4 turns and finish with several turns above the bud covering all exposed surfaces of the bud with tape. The end of the tape is secured beneath the last circular turn. The wrap should be firm without being excessively tight (Figure 5). Wraps should be removed after 14 to 21 days and should not be left on more than 30 days. If a successful union has formed between the bud and the rootstock the bud will be green and show no signs of shriveling or drying. Callus formation should also be evident around the edge of the bud.

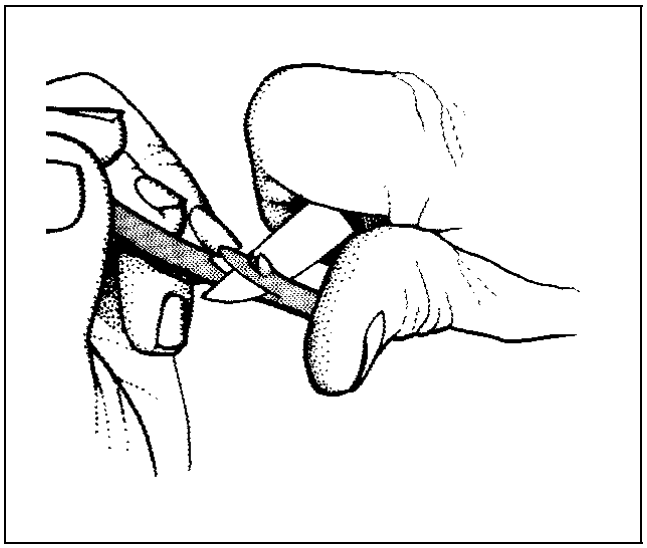

Figure 3. A smooth, continuous cut removes a bud and a thin sliver of wood which is used in T budding.

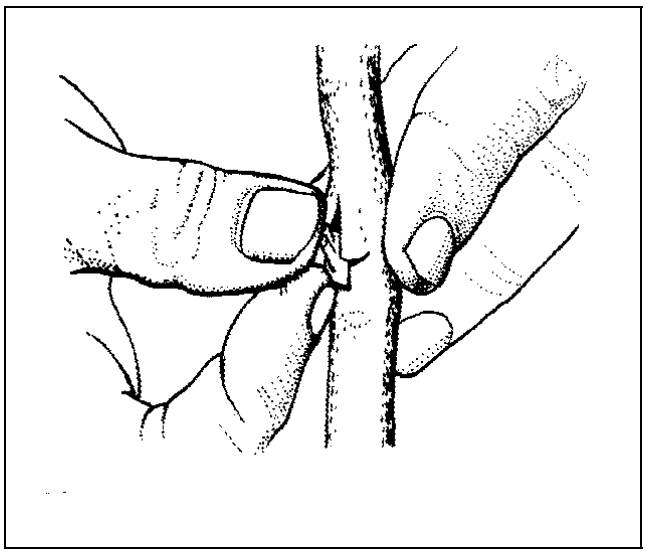

Figure 4. During T budding, the bud is slipped under the bark flaps created by making the "T" incision on the rootstock.

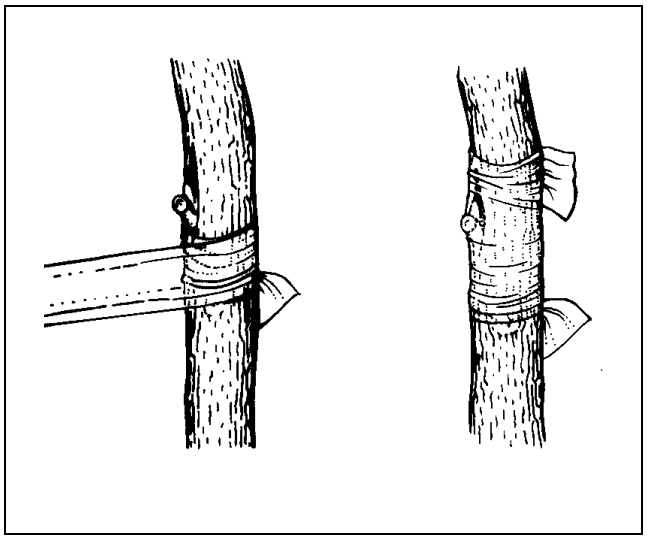

Figure 5. (a) Begin wrapping below the bud, overlapping the tape with each revolution. (b) Tie the tape securely after several revolutions above the bud.

Chip Budding

Chip budding requires slightly more skill than T budding and is usually done whenever the bark of the rootstock plant is not slipping or has become too thick to T bud. The chip bud is cut while holding the budstick with the apical end toward the budder. A thin slice of wood with a scion bud is removed by making a smooth upward cut about one inch long and just into the wood. A second cut is made at the top of the first cut, forming a notch. A chip is removed from the rootstock in a similar manner. Because only two thin lines of cambial tissue are available for healing on both the scion bud and rootstock, it is important that matching on both sides occurs whenever possible (Figure 6, Plates 13 and 14). However, if the scion bud is smaller than the rootstock, matching the cambium layers along one side is often adequate. **Cambial tissue** is a thin layer between the bark and the wood of a tree. This is an area of active cellular growth of a tree. The scion should be wrapped as described for T budding so that all cut edges are completely covered.

AFTERCARE

After the wrapping has been removed and the union between the bud and stock has occurred the bud must be "forced" into growth. Naturally occurring plant hormones produced in the upper portion of the rootstock seedling may prevent the scion bud from growing unless the bud is forced. Buds are forced by cutting about 2/3 of the way through the stock, on the

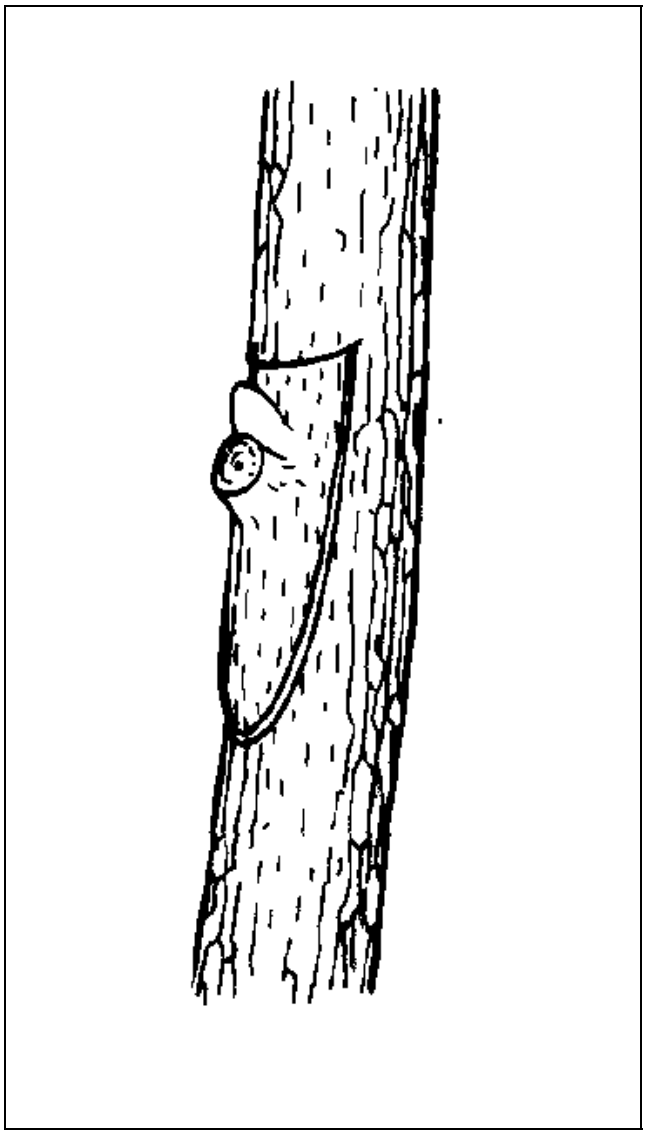

Figure 6. The chip bud is placed in the notch removed from the rootstock. The cambium layers of the bud and rootstock should be aligned at least along one side.

same side as the bud and about 1 to 1 1/2 inches above it. Then the seedling top is pushed over to lay on the ground. This procedure is known as **lopping**. The rootstock top will continue to supply the roots and developing scion with food and other growth substances during the early stages of scion development. After the scion bud has grown several inches, the lop may be removed by making a cut about 1/2 inch above the scion. If lopping is not practical, the rootstock top can simply be removed with a sloping cut completely through the rootstock about 1 inch above the scion bud (Figure 7, Plate 15).

Rootstock sprouts which form along the main stem, especially in close proximity to the scion bud,

should be removed as soon as they develop since they will retard the growth of the developing scion. As the scion grows, it will need to be staked and tied at regular intervals to prevent breaking of the scion. When the nursery tree reaches a height of about 18 to 20 inches, the top should be pinched out to stimulate lateral shoot development.

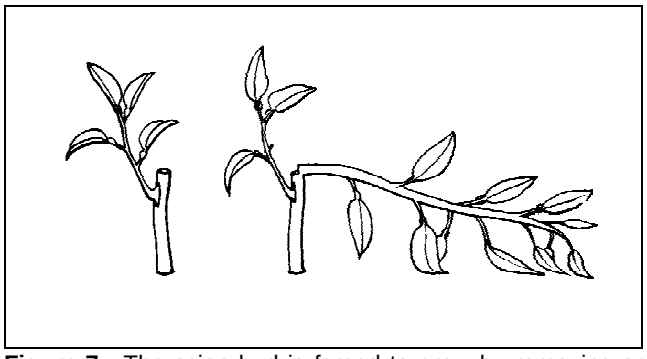

Figure 7. The scion bud is forced to grow by removing or lopping the seedling top above the scion bud.

OTHER PROPAGATION METHODS FOR CITRUS

Layering and Cutting

There are severl other propagation methods for citrus. **Layering** is a propagation method by which roots are induced to develop from stems while they are still attached to the tree, or **cuttings** can be taken from a citrus tree and rooted. Layering is most commonly used on larger branches, while smaller branches may be used for cuttings. Both techniques can be used for citrus, but the resultant plants grow on their own roots without the advantages offered by rootstocks.

Propagation of rootstocks by cuttings or by layering is usually not economically feasible for commercial nurseries. However, periodic shortages of rootstock seed following severe freezes often stimulates temporary interest in propagating rootstocks by cuttings.

Grafting

Grafting procedures other than budding involve the use of a scion having two or more buds. There are numerous types of grafts including whip, cleft, bridge, in arch, stump, side, inlay bark, approach and others. Grafting is most commonly used to repair existing trees, to top-work existing trees to change varieties, and to produce new plants. Grafting is not commonly practiced with Florida citrus because it is a more difficult means of propagation compared to budding.

Top-Working

Top-working is the process of changing the top of an established tree from one cultivar to another, or to multiple cultivars, by budding or grafting. Several procedures may be used when top-working citrus trees. They include bark grafting, cleft grafting and T budding. T budding requires less expertise than either of the grafting procedures and will most likely be the method of choice for the home orchardist.

To top-work a citrus tree by T budding, prune the tree back to leave only a few branches of 2-5 inch diameter, or smaller. Insert 1-3 buds on the upper side of the remaining scaffold limbs, using the T bud method. Remove unwanted buds and sprouts to insure that only the desired scion buds grow. If limbs are so large that budding would be difficult, prune back to major scaffold limbs, removing all of the top (Caution: severely pruned trees should be whitewashed to prevent sunscald). After limbs sprout back and mature a bit (6 months or so), the sprouts can be budded as initially described, using 4-6 of the stronger sprouts on each limb. The same method can be used to bud root sprouts that develop when the entire tree top has been frozen back, or has declined for other reasons.