

# **PROPAGATION OF WOODY PLANTS BY GRAFTING AND BUDDING**

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Propagation of woody plants by grafting and budding can be one of the most challenging, and at the same time the most rewarding of propagation techniques. The information included in this pamphlet is intended as a guide to get you started. You will want to experiment and try different techniques and treatments to find a system that works best for you and your garden. In the Northeast United States, where our nursery is located, grafting is generally done in the winter and budding in the summer. In other parts of North America, the timing may be different for certain species of plants, but the techniques outlined here generally apply. Grafting refers to the insertion of a small branch, called a scion, into the bark of a plant of the same genus. Budding is similar except only one bud and a little bark is used instead of a small branch. The internet and reference books on propagation are great resources for finding additional information on the grafting and budding of woody plants.

## **GRAFTING**

The techniques covered in this article fall under the heading “bench grafting” or sometimes called “pot grafting”. Bench grafting of woody ornamental plants is typically performed indoors and for us, is performed during the months of January and February. A greenhouse can help provide excellent results, but bench grafting can be done in any indoors location provided that the proper conditions for success are met. Bench or pot grafting is a common technique for Japanese Maples, most conifers, dogwoods, European Beeches and others. Grafting consists of a rootstock, scion wood, the carpentry of joining the two, and the necessary care of the plant before and after grafting.

### **Rootstocks**

The grafting process actually begins a year or more before the grafting will occur with the purchase or propagation of the necessary rootstocks. Rootstocks are healthy young seedlings of plants of the same genus as the plants to be grafted on them. There are exceptions to the same-genus requirement, but for the most part, the scion and rootstock should be of the same genus. Propagation reference books contain lists of scions and their recommended rootstocks.

The rootstock wants to be approximately the diameter of a pencil at the time of grafting. Purchasing one or two-year old bare root seedlings and potting them up in the spring will typically yield a rootstock of the required size by winter.

Grafts and their subsequent success are only as good as the rootstocks they are placed on. Therefore, select strong, straight and well rooted seedlings. Pot the seedlings in containers that have enough room for root growth, but are not too large to handle during grafting. A pot that is 2” – 4” in diameter and 4” – 6” deep is usually adequate. Keep the potted rootstocks watered and fertilized during the summer so that they enter dormancy as healthy as possible. Older seedlings with thick trunks do not make good rootstocks unless you will be making high grafts at the top of the seedling.

Allow the rootstocks to go dormant naturally in the fall and store them in a coldframe or other accessible, but protected area until it is time to graft. Approximately two to three weeks before you will be grafting, move the rootstocks into a greenhouse or heated area to begin forcing root growth.

### **Scion wood**

The best scions are cut from healthy branches of the previous season’s growth. A terminal branch generally yields the best results for the graft and subsequent growth. Two-year old wood can be used if the scion is very small such

as on some dwarf conifers. Scion wood for winter or spring grafting should be collected when it is fully dormant in December – February.

Collect the scion wood as close as possible to the time that you will be performing the grafting operation. It is usually best to collect the scions on a day where the temperature is above freezing. If the scions need to be stored for a while before grafting, then wrap them in moist paper towels and place them in a reclosable plastic bag. Store the bagged scions in a refrigerator below 40-degrees F but above 34-degrees F. Storage above 40-degrees F may not keep the scions fully dormant. Be sure to label your scions so you'll know what variety they are when you graft.

## Grafting Procedure

The pot grafting technique that will be described here is called side veneer grafting. There are many other techniques for grafting that can be used as well. These are explained in various propagation reference books.

Two to three weeks before you will be grafting, move the rootstocks into a greenhouse or heated area to begin forcing root growth. A bottom heat system that allows you to heat the roots to 65 – 70-degrees F while keeping the tops cool at 50 – 55-degrees heat is best. However, keeping the entire area where the rootstocks are located at 65-degrees or so can also work. The goal is to stimulate root growth with out excessive top growth by the time grafting will occur. Be sure to not let the rootstocks dry out in the heat. You do not want the potting media to be dripping wet, just moist. Too much water in the pot can be harmful at the time of grafting due to excessive sap in the graft union. While the rootstocks are being heated, sort through them and remove any weak, deformed or otherwise undesirable seedlings. Clean the lower 3" – 6" of the seedling's stem. Remove any branches, needles and dirt within this area. Cleaning the outside of the pot will help keep your hands clean during the grafting process.

When you are ready to graft, assemble your rootstocks, scions and equipment at a comfortable work station. Cleanliness is important during the grafting operation. The grafting knife should be extremely sharp and clean. Periodically clean the knife and any other cutting instruments with alcohol. The use of finger safety tape (Available from Gemplers. See References) on any fingers that could contact the sharp edge of the grafting knife is recommended.

Prepare the scions for grafting by removing any needles or branches on the lower 1/3 of the scion.

Select a straight, blemish and wound free section in the lower 4" of the rootstock stem to make your first cut. All cuts on the scion and rootstock should be made in one, smooth motion. This will yield the best surface for mating the scion to the root stock. Make the first cut in a downward direction to create a small flap or veneer on the stem of the rootstock. Do not cut this flap off. The width of this cut should be as close to the width of your scions as possible, while still penetrating the bark of the rootstock.

Make two downward cuts on the scion, one on each side of the scion. Make one angled cut at the end of the scion to trim the cut surfaces to length. The length of the cuts should be equal to the length of the cut made on the rootstock.

Insert the scion into the rootstock, aligning the outside of the scion with the edge of the cut on the rootstock. Ideally both sides of the scion should align with both sides of the cut on the rootstock. If they do not, then align one side only. Close the flap onto the scion, aligning its edges with the edges of the scion.

Tie in the scion with a rubber strip. Do not pull the strip excessively tight, but tight enough to firmly hold the scion to the rootstock. The wrapping of the strip should start and end above and below the cuts.

Coat the union area with wax. Ordinary canning or paraffin wax that is heated just above the melting point works well or specialized grafting wax can be used.

In the following diagrams you can see the procedure described above. Please not that although the first diagram shows a side wedge graft, it is almost identical to a side veneer graft. The only difference is in the end cut on the

scion. The side veneer graft has only one cut on the end of the scion (iv in Diagram 19-9) where the side wedge graft has two cuts.

The side veneer graft can be used for most all woody plants, both deciduous and evergreen.

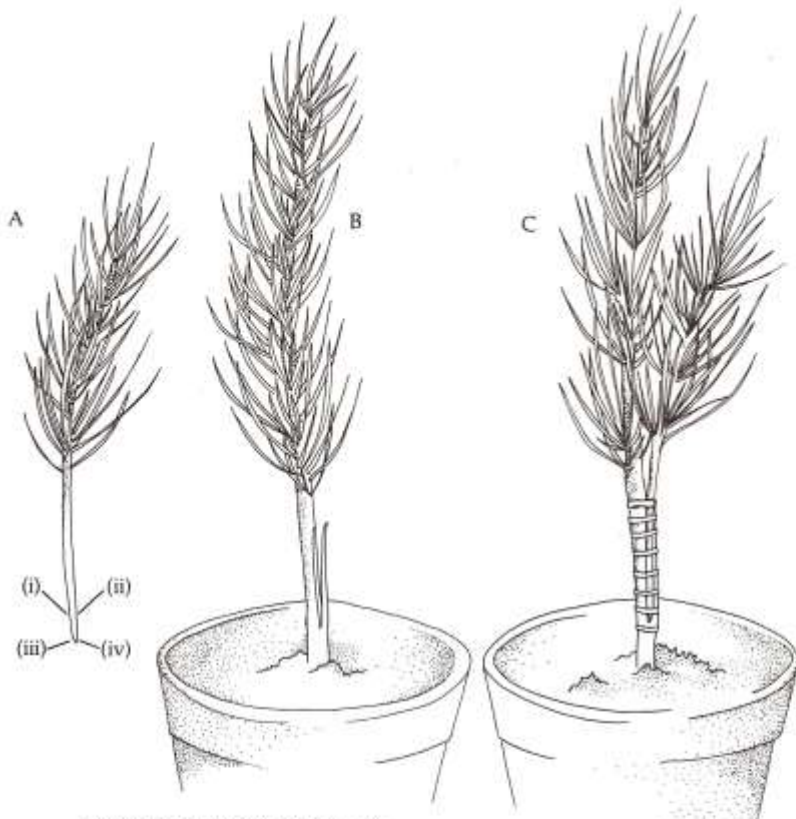
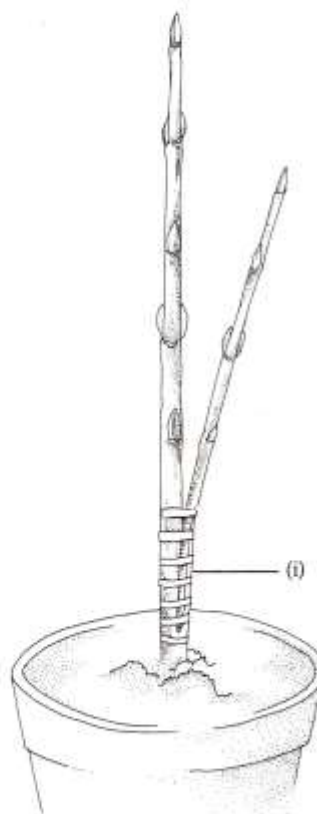


Diagram 19-9. Side wedge graft of *Cedrus*. A. Prepared scion. (i) and (ii)—two opposite cuts made to form a wedge; (iii) and (iv)—two 3 mm ( $1/8$ " ) long cuts made to give a firm base. B. Prepared rootstock—a thin flap consisting of rind and a sliver of wood is made to accommodate the scion. C. The completed graft matched on both sides of the scion and tied-in.

Diagram 19-10 (right). Completed side wedge graft of *Hamamelis*. The scion was cut on opposite sides to form a wedge which was then matched between a flap of rind and sliver of wood on the rootstock (i). Note that the tying-in was completed below the basal cut on the rootstock.



Some deciduous species such as *Acer palmatum* (Japanese Maple) and *Fagus sylvatica* (European Beech) can be grafted by using an apical whip or apical side veneer graft. The procedure is essentially the same as described above except the rootstock is cut off at the time of grafting (B in Diagram 19-13). An apical side veneer graft would prepare the scion as above. The vertical slice on the rootstock would leave a flap as above. The rootstock is cut off before the vertical slice is made. The “church window” (i in diagram 19-13) is important. Wax the entire union, including the cut-off top of the rootstock.

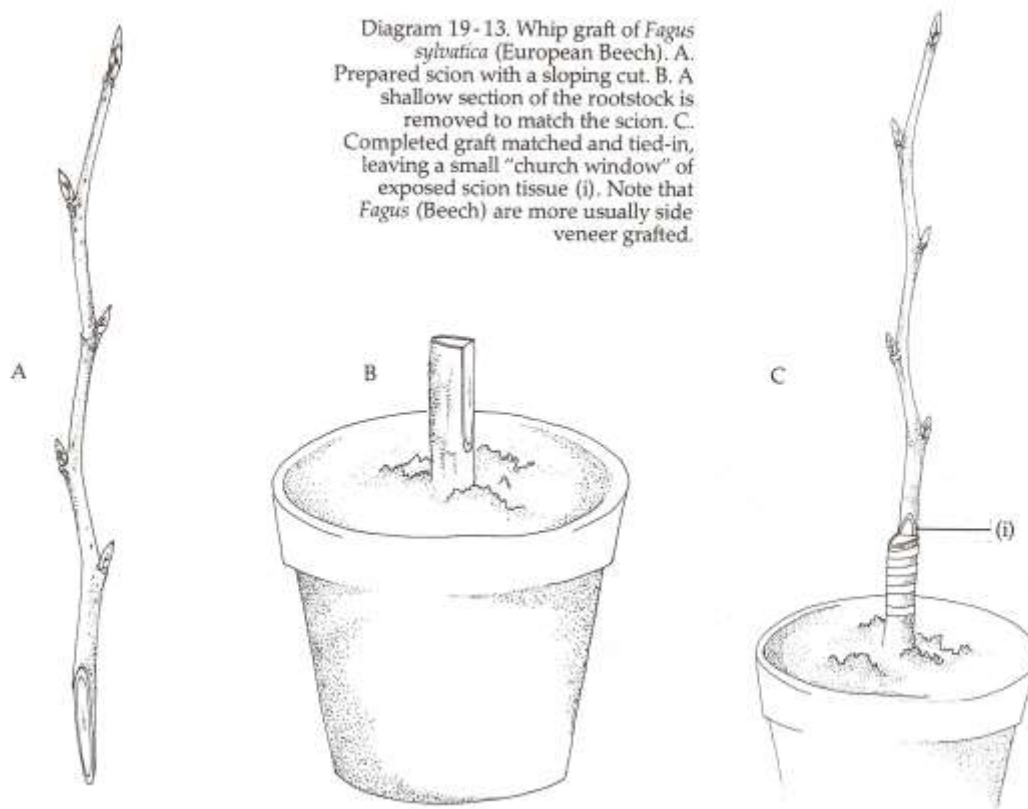


Diagram from *Practical Woody Plant Propagation for Nursery Growers*, page 557, by Bruce MacDonald

### Aftercare of the Graft

Move the grafted plants back to the area where you preheated the rootstocks. Warm roots (65 – 70-degrees F) while keeping the tops cool (50 – 55-degrees F) is best. If this is not possible, then keeping a steady 60 – 65-degrees F is the next best option. Air temperatures above 65-degrees F can force the scion into to growth before the union is knitted and lead to possible failure. Keep the media in the pots moist but not dripping wet. Do not let the media dry out as this is a critical time for the knitting graft. The plants need plenty of light, but direct, intense sunlight can dehydrate the scion. Keeping the humidity high in the growing area will help the scion survive until the graft union is knitted.

After several weeks, the scion should show some signs of growth. If you used the side veneer graft method, cut back about 1/3 of the rootstock when the scion is starting to show signs of growth. After about 3 – 4 more weeks, the

scion should be in full growth. At this time cut back another 1/3 of the rootstock. If the scion is growing very well, you may take off all the rootstock at this time. Other wise wait another couple of weeks before making the final rootstock removal. Apical grafts do not have any rootstock to remove, but there may be rootstock suckers that come up and these should be removed as they appear.

By mid summer the graft is ready for potting up or planting in a protected area. After potting or planting, remove the rubber strip from the union. This is important to prevent possible girdling of the trunk by the strip. Grafted plants that are not a dwarf type will probably need to be staked for the first couple of years to establish a good, straight trunk.

## **BUDDING**

Budding of woody ornamental plants is typically performed during the month of July in Central NY State. Warm weather after budding occurs is required to assist with the knitting of the bud to the rootstock. Budding is a common technique for fruit trees, shade trees, and other deciduous trees. Budding is not suitable for evergreens. Budding consists of a rootstock, bud wood (A scion that contains fully developed buds), the carpentry of joining an individual bud to the rootstock, and the necessary care of the plant before and after budding.

### **Rootstocks**

The budding process actually begins a year or more before the budding will occur with the purchase or propagation of the necessary rootstocks. Rootstocks are healthy young seedlings of plants of the same genus as the plants to be budded on them. There are exceptions to the same-genus requirement, but for the most part, the bud and rootstock should be of the same genus. Propagation reference books contain lists of buds and their recommended rootstocks.

The rootstock wants to be approximately the diameter of a pencil at the time of budding. Purchasing one or two-year old bare root seedlings and potting them up in the spring will typically yield a rootstock of the required size.

Bud grafts and their subsequent success are only as good as the rootstocks they are placed on. Therefore, select strong, straight and well rooted seedlings. Pot the seedlings in containers that have enough room for root growth, but are not too large to handle during budding. A pot that is 2" – 4" in diameter and 4" – 6" deep is usually adequate. Keep the potted rootstocks watered and fertilized during the summer so that they are as healthy as possible by the time that budding occurs. Older seedlings with thick trunks do not make good rootstocks. Seedlings can also be planted directly in the ground and budded where they are planted.

### **Bud Wood**

The best "sticks" of bud wood are cut from healthy branches of the current season's growth. A terminal branch generally yields the best buds and subsequent growth.

Collect the bud wood as close as possible to the time that you will be performing the budding operation. It is usually best to collect the bud wood early in the morning on the day that you will be budding. If the bud wood sticks need to be stored for a while before budding, then cut off the leaves and wrap the sticks in moist paper towels and place them

in a reclosable plastic bag. Store the bagged scions in a refrigerator. Be sure to label your scions so you'll know what variety they are when you bud.

## **Budding Procedure**

The budding technique that will be described in this pamphlet is called chip budding. There are many other techniques for budding that can be used as well. These are explained in various propagation reference books.

Sort through the rootstocks and remove any weak, deformed or otherwise undesirable seedlings. Clean the lower 3" – 6" of the seedling's stem. Remove any branches, leaves and dirt within this area.

When you are ready to bud, assemble your rootstocks, bud wood and equipment at a comfortable work station. Cleanliness is important during the budding operation. The budding knife should be extremely sharp and clean. Periodically clean the knife and any other cutting instruments with alcohol. The use of finger safety tape (Available from Gemplers. See References) on any fingers that could contact the sharp edge of the budding knife is recommended.

Prepare the bud wood by removing any leaves. Sometimes the leaves can be "snapped" off, but if the leaf stem tears the bud wood, then the leaves will need to be cut off. It is OK to leave a small stub of the leaf petiole when cutting off the leaves.

Select a straight, blemish and wound free section in the lower 4" of the rootstock stem to make your first cut. All cuts on the bud wood and rootstock should be made in one, smooth motion. This will yield the best surface for mating the bud to the root stock. Make the first cut in a downward direction to create a small flap on the stem of the rootstock. Make a second horizontal cut to remove the flap or "chip". The width of this cut should be as close to the width of your bud wood as possible, while still penetrating the bark of the rootstock.

Make a downward cut on the bud wood, going behind a bud. Make one angled cut at the bottom of the cut to create a "chip" with the included bud. This chip should be that same size as the chip that was removed from the rootstock.

Place the chip and bud into the mating surface on the rootstock. Tie in the bud with a rubber strip. Do not pull the strip excessively tight, but tight enough to firmly hold the bud to the rootstock. The wrapping of the strip should start below the chip and each layer should overlap slightly as you wrap your way up the trunk. The rubber strip should not twist and should lay flat. If the bud is large, then the strip should be wrapped to allow the bud to just peak out of the wrappings. Smaller buds can be totally covered up. The wrapping of the strip should end and be tied off above the chip. If the wraps of the strip overlap and seal the union, no other protection is necessary.

In the following diagrams you can see the procedure described above.

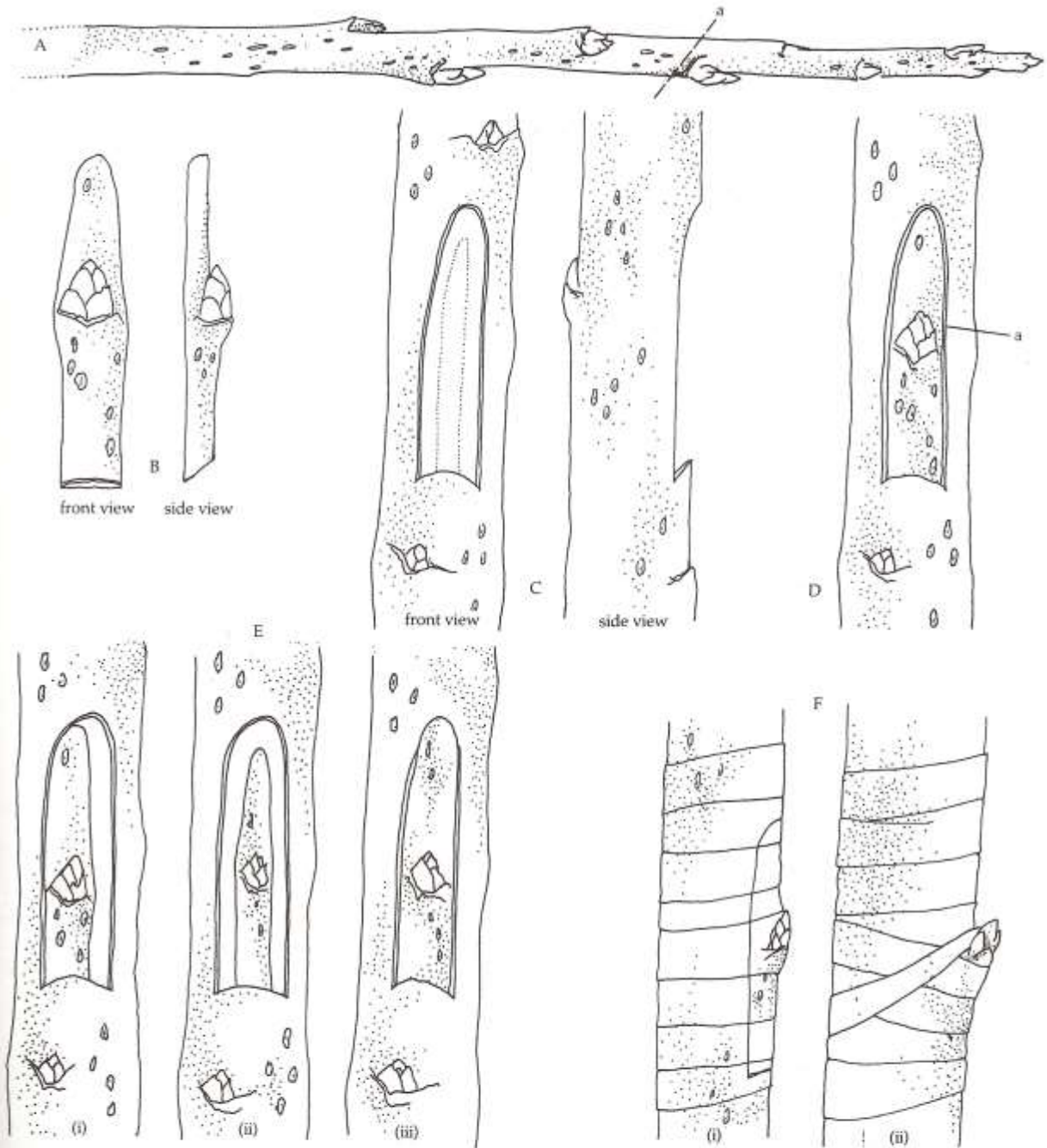


Diagram 17-4. Chip budding. A. The prepared bud stick ready for chip budding, showing (a) removal of the immature tip. B. Front and side views of the prepared scion (bud) chip. C. Front and side views of the prepared rootstock. D. Good matching-up of the scion (bud) chip and rootstock. Note (a) the ring of exposed rootstock tissue around the perimeter of the bud chip. E. Examples of correct and incorrect matching-up for scion of a different size from the rootstock. (i) Match the scion on one side of the cut only if the scion is smaller in width than the cut. (ii) Incorrect matching-up of a scion smaller in width than the cut. (iii) The scion was cut too long so that it extends above the apex of the cut on the rootstock. F. Examples of tying-in. (i) Small and hard buds are covered when tying-in with polyethylene tape. (ii) Soft and prominent buds are left exposed when tying-in with polyethylene tape.

Diagram from *Practical Woody Plant Propagation for Nursery Growers*, page 483, by Bruce MacDonald

## Aftercare of the Bud

Move the budded plants to an area where you keep the media in the pots moist but not dripping wet. Do not let the media dry out as this is a critical time for the knitting graft. The plants need plenty of light and warmth.

The bud should be knitted in by fall, at which time the rubber strip can be removed. Be careful not to pop off the bud as you remove the strip. Rubber strips offered by AM Leonard and others will naturally decompose and fall off if no wax is applied to the budded area. The bud will not grow during the remainder of the season after budding.

Just prior to growth beginning in the spring, cut off the rootstock just above the bud. Place a small piece of light weight angle iron in the soil as close to the rootstock trunk as possible. The inside 'V' of the angle iron should surround the trunk and act as a guide to direct the newly developing bud to grow straight up and not sideways.

By mid summer the graft is ready for potting up or planting in a protected area. Budded plants will probably need to be staked for the first couple of years to establish a good, straight trunk.

## RESOURCES

### Recommended reading:

Creative Propagation  
By Peter Thompson  
Published by Timber Press  
Portland, OR  
800-327-5680  
[www.timber-press.com](http://www.timber-press.com)

Native Trees, Shrubs & Vines  
By William Cullina  
Houghton Mifflin Company  
Boston, MA  
Available at most on line booksellers

### Propagation supplies and equipment:

A. M. Leonard, Inc.  
Piqua, OH  
800-543-8955  
[www.amleo.com](http://www.amleo.com)

Charley's Greenhouse Supply  
Mount Vernon, WA  
800-322-4707  
[www.charleysgreenhouse.com](http://www.charleysgreenhouse.com)

Gemplers  
Madison, WI  
800-382-8473  
[www.gemplers.com](http://www.gemplers.com)