# Propagation



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**by Rob Brokaw, Nurseryman**
**Brokaw Nursery**
**P.O. Box 4818**
**Saticoy, CA 93004**

# Introduction

This is a description of cherimoya propagation as practiced in a California nursery for production of trees for commercial fruit growers. Many other techniques are or have been utilized in other parts of the world, some of which are undoubtedly superior to those described herein.

Many of these practices have been loosely adapted from avocado propagation; indeed there are many similarities between these two subtropical fruit species.

Casual propagators or foreign nurserymen, or anyone for that matter, certainly should not take the processes described in this article as gospel.

They are techniques to be improved on. It is hoped that they will serve as points to be addressed by others who will refine them and in the doing provide growers with superior trees which are efficiently produced.

# Nursery Propagation

## Propagation Methods

Two basic methods of plant propagation exist — sexual and asexual. Cherimoya seeds are the result of pollination mixing the genetic traits from a female and male parent. The result is a unique genetic individual whose characteristics can be explained by dominate and recessive genes.

Asexual (vegetative) reproduction of a known cherimoya parent plant, with superior qualities the nurseryman/orchardist desires to increase, is generally achieved through grafting a scion from the superior plant to a rootstock.

The ability exists to propagate cherimoya cuttings, but benefits have not been proven. Eventually techniques to tissue culture superior plants may be developed although the economic realities may preclude this as a viable commercial propagation method.

## Why Graft?

Cherimoya trees are normally produced by nurserymen as grafted seedlings. This approach enables the propagator to select a rootstock for its growth or survival traits in various soils and to match it to a fruiting variety of known desirable characteristics.

In some cases seedling trees are planted in the hope that the resulting fruit will possess desirable characteristics, but this procedure is a chancy proposition and most growers prefer the known quality of an existing named variety. Since the cherimoya gene pool has been only slightly narrowed by varietal selection, the fruits resulting from a given population of seedlings will be of widely varying characteristics.

Without exception, commercial growers in California plant grafted cherimoya trees rather than seedlings. The reasons for this approach are straightforward:

- the grower has significant investment in land, irrigation systems, etc.;
- requires a uniformly satisfactory orchard tree to achieve orderly cultural and harvesting operations;
- fruit brokers demand fruit that is of consistent quality and matures during a given season.

***Essentially all trees produced for sale to farmers by commercial California nurseries are grafted.***

Some backyard growers will plant seedlings with the intention of grafting at a later date or to see what kind of fruit is produced, if any.

As subtropical evergreen trees go, the cherimoya is relatively easy to propagate. The most critical aspect of propagation of cherimoyas is timing; each operation must be done during the proper season.

### Growing Seedlings

Seeds are sown during the early Autumn of the year. The first seeds of the new crop are sometimes used, but more frequently seeds are stored from the previous season's crop. Storage of cherimoya seeds can be problematic.

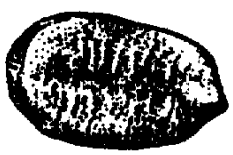
Cherimoya seeds are prone to rapid decline of viability during the first six months of storage. It may be that experimentation with humidity levels, temperatures and controlled atmosphere will give us the ability to store cherimoya seeds over long periods in the future.

### Selecting Seeds

For now, seeds are selected from very mature fruits during the mid point of the harvest season. The fruits are allowed to soften, and the seeds are extracted by hand either before or after the fruit has rotted.

If the seeds are to be stored, they are air dried and kept in air tight plastic bags at 42°-45° F.

**Figure 1. Cherimoya Seed**



**Root radical and leaf shoot will emerge from pointed tip of cherimoya seed.**

If a fungicide can be legally applied to the seeds prior to storage, seed longevity may be improved.

Some propagators soak the seeds for 24 hours in plain water prior to planting. This procedure serves two purposes:

1. most of the nonviable seeds will float, while viable seeds will sink to the bottom of the container, thus allowing bad seeds to be identified and discarded;
2. the seeds will take in some water. This absorption of water initiates germination, giving the seeds a head start.

## Sowing Seeds

Seeds are sown in flats that are at least 5 in. deep and contain a standard bedding medium. This medium may contain peat, perlite, vermiculite or other components.

***The critical characteristic of a soilless potting mix is that the combination not be prone to waterlogging.***

The seeds are placed on approximately 1 in. centers in the bedding medium, then covered to a depth of not more than 1 in. Orientation of the seeds does not seem to be critical; most will land on their sides.

The seeds are covered to a depth of 1/2 in. in the medium and placed in a temperature controlled environment. The medium is maintained at a temperature of 75°-85° F.

The seeds will tolerate some departure from this temperature regimen at the cost of timing and percentage of germination. The medium is irrigated as necessary. Caution must be taken that the medium is kept neither too wet nor too dry. The seedlings will emerge in four to five weeks

When the first true leaves (figure 4.) unfold, the seedlings are transplanted into liner bags, usually made of soft polyethylene having a volume of about 1/2 quart. This size may vary widely with no ill effect.

***Care must be taken to avoid either planting seedlings with crooked roots or bending the root during transplanting.***

Plants with crooked roots often perform tolerably well in the nursery only to decline and sometimes die within 2 to 4 years after planting in the orchard. The root tip can be pinched back to ease transplanting. No more than 25% of the root's length should be eliminated.

Potting medium for greenhouse culture is often the same as that used in bedding. The same rules apply:

- the medium should drain freely while providing humidity and anchorage to the developing root system.
- the pH should be slightly acid.

**Fertilization**

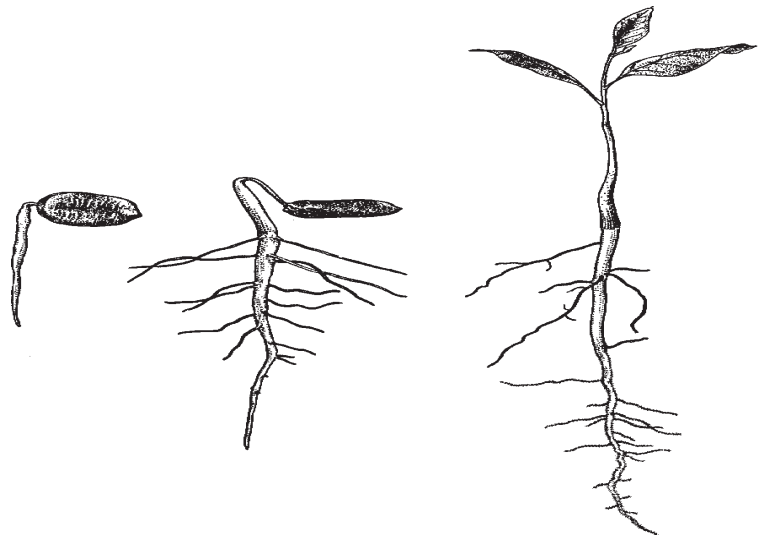
Slow release fertilizers are frequently incorporated into the potting medium and augmented by fertilization. The principal need during this time is for nitrogen, which is supplied in liberal doses.

Other elements need only be added in routine proportions to correct any deficiencies in either the potting medium or irrigation water.

Growth after transplanting is rapid under greenhouse conditions. Seedlings can be grafted when they reach a height of 10 in. and a stem girth of 2/10th inch at 3 inch above soil level. This stage will be as early as 6 weeks after transplanting under optimum growing conditions.

Seedlings remain perfectly graftable well beyond this time frame. Grafts will succeed equally well on either succulent or woody rootstock. Grafting success is very likely diminished only when roots start to crowd in the liner pot.

**Figure 2. Stages of germinating seed**



# The Grafting Process

## Grafting Season

Grafting is done in spring as the orchard trees are cycling through the odd dormant period that is peculiar to cherimoyas.

Cherimoyas differ from other trees in that the leaf buds are not located in an axil, but rather directly behind, and therefore underneath the base of the petiole of the leaf from the previous growth cycle.

Therefore the dormancy that we see in cherimoyas is actually the process of the new leaf pushing the old leaf off of the branch as it emerges. Sometimes the old leaf falls prior to pushing the new leaf but certainly not always.

## Selecting Buds

The best buds for grafting are those which have started to emerge or are about to. It is easiest to identify those that have initiated growth. They are characterized by a tufted dome of cottony substance emerging from the bud site. This substance is actually the bud before it becomes defined.

The tuft may vary in color from brown or beige to light green. Greener buds are generally the most vigorous, while the brown buds are likely to be emerging at slower pace.

It is suspected that the more vigorous buds result in the best grafting success, but this hypothesis has not been proven. These buds are usually but not always found at or near the terminals of branches.

A given branch may be harvested repeatedly, since the elimination of the terminal will stimulate growth of those buds which find themselves comprising the new terminal. Insofar as possible, graftwood of more or less the same size as the seedlings to be grafted should be selected.

The disadvantage to using emerging buds is the very poor shelf life of this material. If grafting is to be done more than 12 hours after the harvest of graftwood, it is best to use buds which have not emerged. In this case some care must be taken to select buds which are very close to emerging.

The harvester must then observe other buds on the same branch, on other parts of the tree, and on neighboring trees as well as temperatures of the previous days, soil moisture, and other growth factors in determining which buds are about to "pop". This procedure is instinctive and much easier to do than to describe.

***All graftwood should be used or discarded within three days at most, although some success will be possible (at horrendously poor success rates) up to 10 days and more after harvest.***

## Storing Graftwood

Immediately upon severing the graftwood from the tree, it should be placed in a cool and moist container. An ice chest lined with foam rubber or, better yet, wrapped in a burlap sack inside a cool ice chest, is sufficient. Optimum temperature is 42 -45 F.

If longer term storage is necessary, refrigerator temperatures in the presence of 100% humidity but no standing water is best.

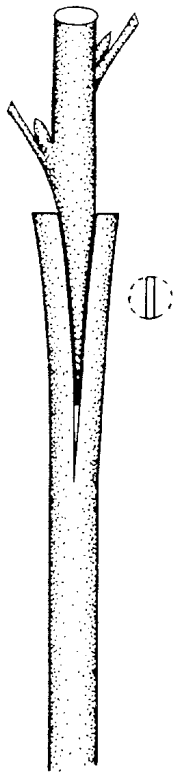
## Cleft or Wedge Grafts

The most commonly used graft for young cherimoyas is known as the wedge, or cleft graft (Figure 3).

This is the same graft widely used on avocados in California greenhouses. It consists of cutting the scion on two sides to form a wedge, then driving this wedge into a single cut made down the length of the decapitated rootstock.

The rootstock should be pruned to a height of about 3 inch; the cut should correspond to the length of the cut surface on the scion. In most instances this will be approximately 1 inch.

**Figure 3. Small cleft graft.**



An attempt should be made to match the size of the scion to that of the rootstock. It is difficult to make such a match and many propagators will shave off one side of an oversized scion if no one is watching.

After the scion is inserted, the union is wrapped with tape, parafilm, or a rubber grafting band. All cut surfaces should be covered to prevent desiccation. Graftlings are placed on a greenhouse bench with a light plastic covering draped overhead for the first week after grafting.

This "greenhouse within a greenhouse" will provide a marginal increase in humidity and temperature while reducing the light reaching the graftlings. This environment is considered to be a necessary postoperative care. The greenhouse is kept within the 70°-85° F range, with humidity as close to 100% as possible.

Care must be taken to ensure good air circulation at all times in the greenhouse. If the air is still and unrefreshed, ethylene levels can accumulate to the point of toxicity to the plants.

Graftlings are especially susceptible to ethylene toxicity since plant tissues that are decomposing (e.g. petioles) as a result of grafting will release copious amounts of ethylene.

After 10 to 12 days, the most vigorous buds will begin to emerge. Indeed, if actively growing green buds were used, they sometimes grow continuously as if they were unaware that they had been removed from the donor tree. Within 21 days the vast majority of successful grafts will have emerged.

A few will develop after this period, but they are generally weak and should be considered to be culls.

As the grafts are developing, sprouts will emerge from the rootstock stems. These should be discouraged since they deprive the developing graft of needed sustenance but only by removing the tips.

There are two reasons for this procedure:

1. cutting back to the stem can present a point of entry for infection, and
2. the leaves that develop anywhere on the plant should be considered as solar collectors and are therefore to be preserved. They will provide valuable nutrients to the root system while the graft is developing.

As the graftlings develop, they will need to be sorted so that the more vigorous plants do not shade out the slower ones. Once the grafts reach 5 inch or so in length they can, weather permitting, be moved to an outdoor area which is protected from direct sunlight by lath or saran (shadecloth). Usually 50 per cent shading is desirable. A bit of wilt is to be expected during the first few days in this new environment.

If at the end of seven days of normal weather the graftlings are not showing signs of wilt, they may be moved to full sun. Again, they will likely show some slight droopiness which is normal if not excessive.

By the end of another 7 to 10 days of normal weather they should again be looking perky. They are now ready for transplanting into the larger field pots.

# Field Growing Nursery Plants

## Transfering Liners Into Nursery Sleeves

### Culling Liners

Prior to planting in the field, the graftlings should be sorted once more. This sorting will serve to eliminate any weak, shaded trees (which will be held back for a later planting) and to ensure uniformity in the nursery planting.

During this sorting any grafting tape should be removed from the graft site. Grafting bands and parafilm do not need to be removed as they will deteriorate on their own.

Once sorted, the graftlings are transplanted into larger containers. In California these are usually bottomless cylinders or sleeves with a capacity of approximately 12 quarts.

### Soil Mix

They are filled with a mixture of soil, sawdust, sand and possibly another organic material such as compost.

This mixture, while allowing for good plant growth, more closely approximates the real world conditions in orchard soils. For the first time the cherimoya roots are coming into contact with real dirt rather than an inert medium.

It is during this phase of growth that the cherimoya rapidly gains bulk. It is fed a dilute nutrient solution containing both macro and micronutrients and given the care necessary to develop a strong structure, both above and below ground.

The propagator's concerns during this period are preventive as much as deliberate. Accumulations of salts, insects, root suckers, fungi, etc. must be avoided.

***Soil moisture in the sleeve must be maintained at the optimum level for plant development.***

Small trees must be removed from the nursery row before their larger neighbors shade them out. If all goes well, one year of field growth will produce a tree of more than 3 feet height. It will have undergone one or two prunings to thicken-up the trunk and encourage lateral branches. The tree is now ready for planting in the orchard.

**Figure 4. Container grown nursery plants**

**Plants should not experience transplant shock if the proper planting practices are performed. The new trees quickly establish a vigorous root system in the orchard soil providing adequate soil moisture is maintained.**

# Topworking

## Changing Cultivars In An Established Orchard

The main reason for grafting a different top onto an existing grove tree is to obtain a more profitable variety, commonly with superior quantity or quality of fruit. Occasionally, growers may wish only to diversify their varietal holdings.

Many noncommercial growers with only a tree or two would benefit from topworking an inferior seedling or grafted variety to a better top. This conversion might change the tree to a standard commercial variety, or it might change the tree to a variety wanted as a dooryard tree because of some commercially undesirable trait.

A dooryard tree may be grafted to two or more varieties. In the long run, pleasure-giving dooryard trees may well help the commercial cherimoya industry by encouraging individual enthusiasts, who in turn introduce the fruit to their neighbors, friends, and perhaps visitors from regions where the cherimoya is still little known.

Topworking can make a good tree better-fruiting, but it cannot be expected to make an unhealthy tree healthy. If the tree is in borderline condition from neglect, rectify the care and reestablish a strong vigorous tree before topworking it.

## Stump versus Sucker Grafting

The easiest method of topworking a cherimoya is to sucker graft. No special tools are required and it makes use of plentiful small grafting wood.

It can be done over a much longer portion of the year, can be done lower on the trunk and gives much quicker complete healing of the graft union. It is also useful when stump grafting fails and the trunk is less suitable for grafting.

Stump grafting is a much older technique that has been used commercially on many tree species. It's advantages are:

- Every tree can be readily grafted, whereas you can wait in vain for suckers, especially when the stump is cut low.
- Some suckers are weakly attached to trunk or root, and grafts onto such a sucker will be lost if the sucker detaches.
- The tree can be left intact with its fruit growing until right before grafting time, instead of being cut down in the previous autumn to induce suckering.
- Stump grafts usually grow more rapidly than sucker grafts.

Because stump grafting uses larger scion wood than sucker grafting, the graftwood can be stored longer, and the timing of tree stumping is more flexible.

## Sucker Grafting

Cut off the stump at 1 1/2 to 2 feet. This is shorter than for stump grafting, since the stump itself is not grafted, but high enough to encourage stump suckers. A somewhat higher cut could provide a sturdy tie support for sucker grafts, on the leeward side especially. The cutting is usually done after harvest.

Immediately after cutting the old tree down, protect the stump against sunburn with whitewash or white latex paint, and against disease with Bordeaux mixture. Mixing 4 pounds of Bordeaux to 1 gallon of white latex and then diluting with 50 percent water is a good formula.

As suckers begin to develop, remove all except three: two of them, preferably on opposite sides of the stump, will be grafted, and the third is left for insurance should one of the other grafts fail. Suckers 2 or more feet tall are most easily grafted. First trim off all side branches to a height of about 1 foot, cutting to 1-inch stubs to avoid the risk of stem injury. Leave any stem leaves. Unless you plan to graft immediately, paint the exposed stem are white.

Graft near the top of the trimmed stem base in a smooth region free of side branches. The splice graft (figure 3) or cleft graft used in the nursery or conventionally used for sucker grafting.

In the field, take even greater care to prevent desiccation by minimizing the exposure of cut surfaces. Outdoors, budding rubbers disintegrate too rapidly; use 1/2 to 1-inch, 4-or 6-mil polyvinyl tape to seal the graft. A dab of asphalt emulsion seals the scion's cut tip.

Sucker stocks are commonly larger than the available scions. One solution is to match only one side of the splice cut, trimming excess stock to give a better taper.

Stems and clear wrapping materials exposed to the sun must be carefully covered with white latex. The scion needs additional protection, as provided by an 8 1/2-x-11- inch sheet of cheap white paper rolled into a cylinder and fastened at its base, just below the scion, by two staples from a hand stapler, the cylinder top flaring somewhat to permit better scion development and better light.

Avoid anything more than transient direct sun on the scion by angling the cylinder northward or closing the top with a staple. Butcher paper or other paper can also be used, as can various ties for the basal fastening.

A stake keeps the sucker from breaking out at its point of attachment to the old tree until it is firmly anchored. Stake when the scion has begun healthy growth, tying the stake to the sucker just under the graft.

Add a second tie to the graft as soon as the stem grows out of the paper covering. Make additional ties as needed with additional graft growth. Polyvinyl tape 3/4 to 1 inch wide and 8-mils thick makes a good tying material.

Downwind trunk suckers can be secured well to a taller stump, but root suckers that are somewhat removed from the stump are better off with individual stakes.

A single 2-x-2-inch pointed wooden stake driven into the ground next to the sucker an extending at least 2 feet above the graft union can do the job.,

Two stakes are better, one on either side of the sucker, especially with unusual winds or other hazards. When each sucker has its own stake, the stakes can be tied together for support. You can use metal stakes about 3/8 inch in diameter, driven into the tree root if necessary.

Maintaining white latex sun protection for the exposed stems is essential and may be needed into the second year, until scion growth provides adequate shade.

# Bark Grafting

Bark grafting is a form of stump grafting that is rapid, simple, readily performed by amateurs, and if properly done is quite successful. No special equipment is necessary and it can be performed on branches or stumps ranging from 1 inch up to a foot or more in diameter.

Working with larger diameter stocks can be a problem since it is difficult to heal over such large stubs before decay-causing organisms get started. The bark graft does not anchor the scion as solidly on the stock as the notch graft and it requires separation of bark from wood.

Bark grafting usually begins when the bark starts slipping and ends with the approach of summer heat, about mid-April through July. The weather affects these dates.

Bark is said to "slip" when the cambium is actively dividing. At this time, the bark may be peeled easily and cleanly from the woody center of the trunk.

The tree should be stumped at about 2 feet. The cut can be somewhat higher, especially if the bark higher up is significantly smoother or greener.

Cutting the stump off at a slight angle from the horizontal will help to drain excess water and sap. Too much of an angle, however, will make the grafts harder to wrap. About a day after stumping, the bark tightens. If the grafting is not to be done immediately after cutting, it will be necessary to wait about a month until the bark loosens again. The stump can then be recut and grafted.

Scionwood selected for the grafts is from firm, current season's growth, ranging from 3/16 to 3/8 inches in diameter. They are cut to 5 to 6 inches long with three to five buds per scion stick.

If longer than necessary, scions are liable to dry out before healing. A sloping basal cut about 3 inches long is made on one side of the stick. In some cases, a short, sloping cut is made on the opposite side of the stick.

Depending on the size of the trunk, 3 inch vertical cuts are made in the stump every 3 to 5 inches around the cut edge. The knife blade should be able to slip between the bark and the wood at this point.

Scion placement can either be centered in the bark incision (figure 5A) or to the side of the cut (figure 5B). The long cut surface of the scion faces the wood of the stock. Side-tapering the sticks will make a snugger fit. A little of the cut surface on the face of the scion should be visible above the rim of the stump after the scions are inserted.

Another technique that helps when the bark is not slipping is to insert the scion between two vertical cuts (figure 5C). Twos parallel vertical cuts are made in the bark as far apart as the scion is wide. Both edges of the scion will border on bark incisions and the scion is not side-tapered.

Traditionally the bark flaps are nailed in place with thin, flathead nails or staples. Binding the graft region with 3/4- or 1-inch, 6- or 8-mil vinyl tape works very well by itself. Start at the top of the stump, securing the scions sticks gradually spiral down the stump.

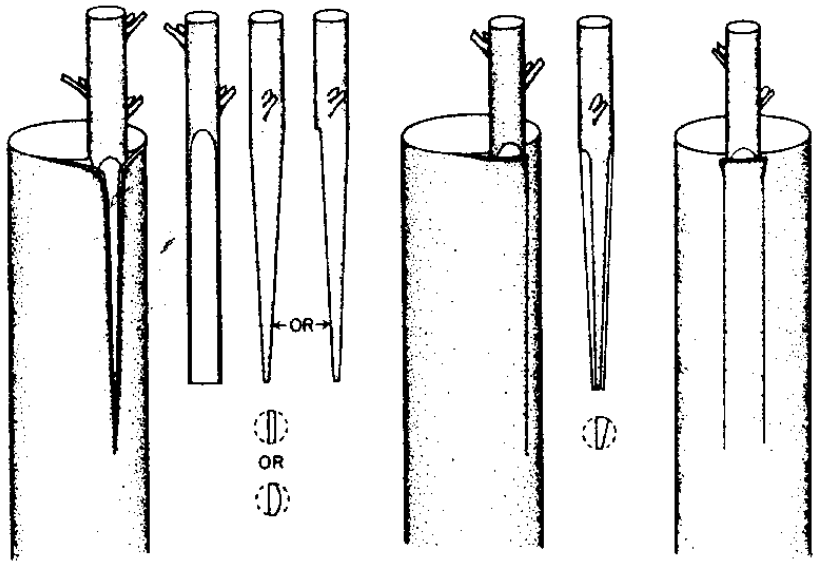
Overlap the tape to ensure a good seal, and maintain the tension. The wrapping can end just below the vertical cuts in the stump. The tape is then spiraled back up the stump, ending with a couple of wraps at the top edge, and is tied.

All remaining cut surfaces of scion and stump must be sealed to prevent desiccation. Black asphalt emulsion works well and is viscous enough to plug the openings between wood and bark on either side of the scion.

After grafting and sealing, the scions and trunk require protection against sunburn. This can be accomplished by covering the scions with paper bags as in sucker grafting. In windy areas, the scions are tied to bamboo or wooden stakes nailed into the trunk.

All adventitious shoot growth on the stump around the grafts is rubbed off to eliminate rootstock or interstem competition with the growing scions. It is helpful to mark the scions to avoid confusing them with adventitious shoots.

**Figure 5. Scion Placement for Bark Graft**




**a** **b** **c**

**a) scion center**
**b) scion inserted to the side of the cut**
**c) scion inserted between two vertical cuts**

# Notch (Saw-kerf or Wedge) Graft

A much stronger graft than the bark is the notch graft (figure 6). This does not require slipping bark and can be used on larger dimension trunks than bark grafts.

After the tree has been stumped, two to three small, vertical cuts are made near the stump's cut edge. A thin-bladed, fine-toothed saw is best for this work.

The cuts should be 1 to 1 1/2 inches into the stump and 4 inches long. The cut is widen to fit the scion by using a sharp knife to slice upward and outward, making a vertical V shape which is tapered inward.

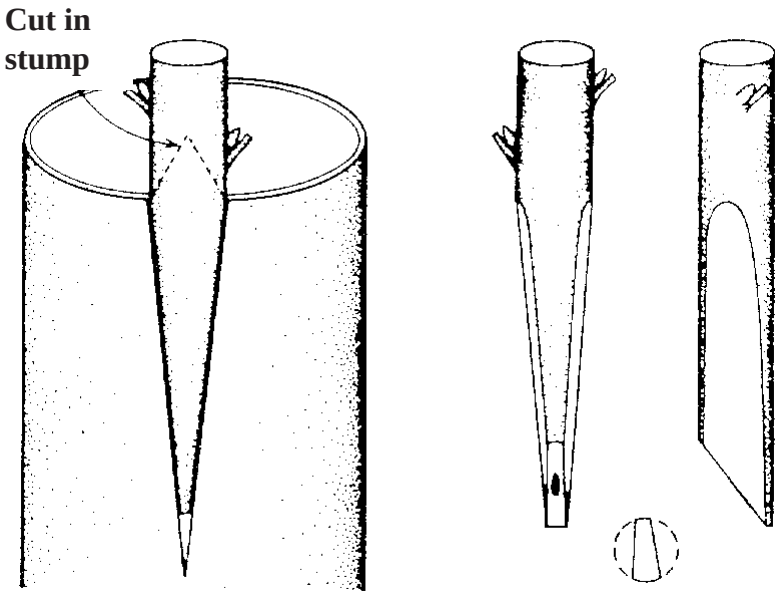
The scions should be 4 to 5 inches long and contain two to three buds. The scion stick is wedge cut, 1 1/2 to 2 inches long and beveled to match the cut in the stump. It is usually easier to widen the stump cut than to cut the stick to the dimensions of the notch.

After the cuts are completed, the stick is tapped into the notch making sure the cambiums of the stick and stump are lined up. Because the stump has thicker bark than the scion stick, there will be a slight recession when the cambiums are matched up.

It is not necessary to wrap the graft with vinyl tape as in bark grafting. Covering the graft with a sealant is important and sun protection as with the other grafting techniques is also required.

**Figure 6. Notch grafting.**

**Shaping and position for a notch graft.**



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