

Propagating Nut Trees

*Kansas State University
Agricultural Experiment Station
and Cooperative Extension Service*

The quality and production of most native pecan and walnut trees can be improved by budding or grafting improved varieties on native trees. Both propagation methods yield desirable results when successfully performed.

Budding consists of transferring a section of bark containing a bud from a selected tree to another. A union forms and the bud grows, developing into a tree of the selected variety. Among the various budding techniques, patch budding has been highly successful. This method offers flexibility, since it can be done during spring and summer months on nursery stock and on larger trees. Injury to trees by budding methods usually heals rapidly.

Grafting is accomplished by transferring a scion (shoot) from a selected tree to another. A union forms and the scion grows and develops into a tree of the selected variety. Whip grafting and bark grafting are the methods most often used. Whip grafting is used to propagate desirable varieties onto native seedling rootstocks. Bark grafting generally is used for topworking larger native trees to the selected varieties.

Bark grafting technique, the 4-flap bark graft, can be used to propagate a variety onto a rootstock and to topwork native trees to a desired variety.

Propagating Terms

In discussing various budding and grafting techniques, several terms will be frequently used.. Become familiar with these terms and instructions will be easier to follow.

BUDDING- A method of grafting. It consists of inserting a single leaf bud, the scion, with or without attached bark and wood piece, into the stock by specific techniques.

BUDSTICK- The term applied to the current season's growth from which single bud are removed for budding.

CALLUS- A mass of cells that develop from and around wounded plant tissue. It occurs at the junction of the graft union, arising from the cambium of both scion and stock.

CAMBIUM LAYER- A single layer of cells between the wood and bark tissues which surrounds all woody portions of a tree. On graftage, the cambium of the scion must line up with the cambium of the stock as perfectly as possible if a good union is to result.

GRAFTING- Inserting a section of stem with leaf buds (the scion) in the stock. Several different procedures may be employed in grafting techniques. Dormant scions are used; therefore, grafting is done in early spring, usually before growth begins.

ROOTSTOCK- That part of a tree which makes up the root system of a grafted or budded tree.

SCION- A short piece of twig or bud with attached section of bark which is inserted into the stock.

SEEDLING- A plant that has grown from a seed.

STOCK- A plant or part of a plant upon which a scion variety is grafted or budded.

TOP WORKING- The practice of changing the top of a tree from one variety to another by budding or grafting methods.

SEASONS FOR BUDDING AND GRAFTING METHODS

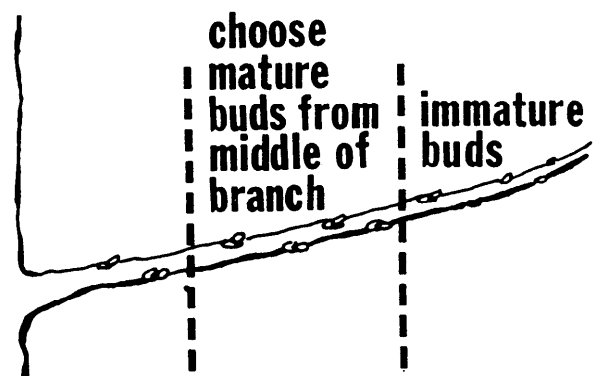
Technique	Season to Use
Patch budding	Spring-late April and May Summer-June-September
Whip grafting (Bench graft or whip & tongue graft)	Late winter while stock is dormant
Inlay-bark graft	Spring-late April and May
Flap graft (4-flap bark graft)	Spring-late April and May

Collecting and Storing Dormant Scions or Bud Wood

Advance planning and preparation is the first step in successful propagation. Scion wood must be collected and stored for later use.

February or early March is the best time to collect scion wood. These procedures should be followed in obtaining and storing the propagating wood until it is used.

1. Scion wood must be collected while the tree is dormant.
2. Collect scions from the most recent growth on the trees.
3. The characteristics of good scions are:
 - A. Straight and smooth
 - B. Healthy plump buds
 - C. Diameter from 1/2 to 5/8 inch
 - D. Free of insect and disease damage
 - E. Lengths cut about 12 to 14 inches are most easily handled.



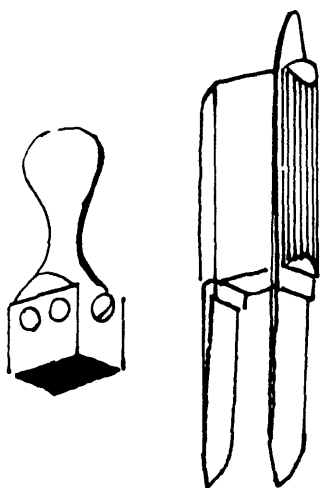
Mature wood with mature buds is necessary for budding and grafting.

4. When scions are cut they should be properly labeled with variety name or other identification.
5. Care should be taken to prevent scions from losing moisture. Placing scion wood in plastic bags that are kept nearly airtight is satisfactory. Scions may also be placed in insulating materials which are kept moist.
6. Scions must be held in cold storage to retain dormancy until they are used for propagation. Optimum temperatures are 32° to 36° F.

Patch Budding

Tools that are essential to do a good job of patch budding are-

- Ice chest to keep scion wood moist and cool
- A patch budding knife
- Sharp knife
- Wide rubber bands made especially for budding



Types of Patch Budding Knives.

This type of budding may be done in the **spring** after the bark begins to slip (late April or May), or the **summer** (June-September).

Spring Budding

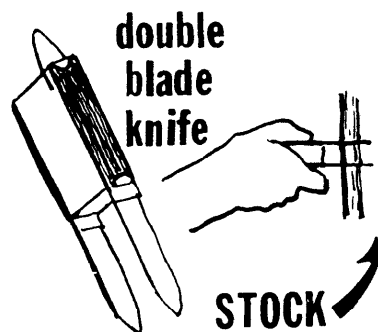
Buds for spring budding are secured from scions cut during dormancy. The scions must be stored as described earlier to prevent development and growth before they are used.

Scions must be seasoned before or at about the time budding begins to promote bud slip. This is done by placing them in a warm room for 4 to 7 days before budding. During seasoning, the scions are wrapped in moist paper or cloth, and should be used soon after the bark slips readily.

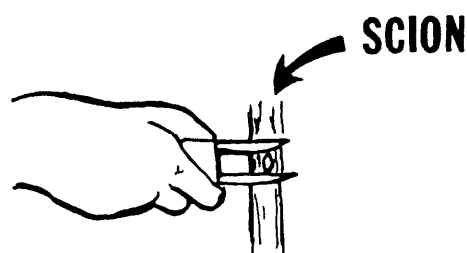
Late Summer Budding

For budding in late summer or early fall, buds are taken from scions freshly cut from a tree of the desired variety.

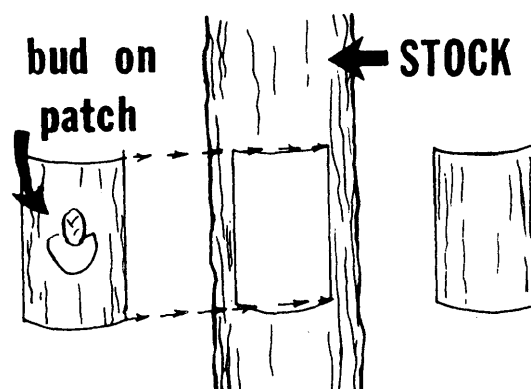
Use only mature buds which are on the middle and base of the bud stick. Discard the terminal one-third of the stick. Cut the leaf stalk just above the bud. The remaining stalk serves as a handle to lift the bud when it is cut from the bud stick.



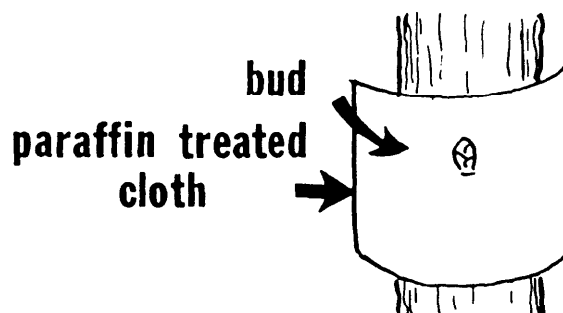
Use double bladed knife to make patch cut on the stock.



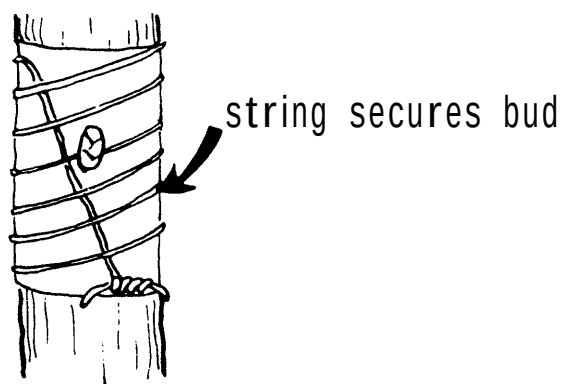
Use the double bladed knife to remove a plump, healthy bud and patch of bark from the scion wood stick.



Place patch with bud into the cut on the stock. (Do not touch the back part of the patch.)



Place a small square of paraffin treated cloth, plastic bag, or a wide rubber budding band over the patch. Leave the bud exposed.



If a small square of paraffin treated cloth or plastic bag is used, tie the bud patch in place with cotton string.



After the inserted bud begins growth, remove the top of the stock above the bud. This forces growth of the new shoot. If the inserted bud remains dormant, cut off half the top above the bud to force it into growth.

Durable wrapping materials may need releasing after the wound of the budding operation has healed. Under good growing conditions this will be about 3 weeks after budding. This can be done by cutting the tape or other wrapping material with a knife blade on the back side of the stock opposite the transplanted bud.

Strip Bud

The procedures for this budding method are similar to those for patch budding. The stocks should be about one inch in diameter at the location where the bud is to be inserted. Use the oldest two-thirds of branch (about 1/8 to 1/4 inch) from current season's growth from the desired parent tree. Transport it in an ice chest to keep it moist and cool.

To remove the bud from the branch, make a sloping cut into the branch and away from the bud about one-half inch below the base of the leaf, and another sloping cut one-half inch above the bud (Figure 1). A rocking motion with the sharp knife will help to make a uniform cut to separate the bud and leaf from the branch (Figure 2). Cut off the leaf blade, but keep the petiole attached to use as a handle.

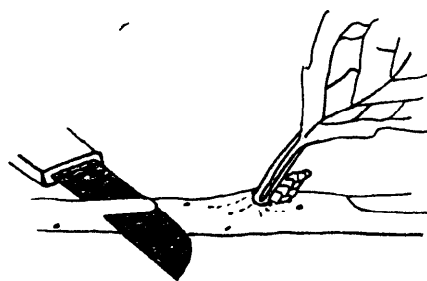


Figure 1

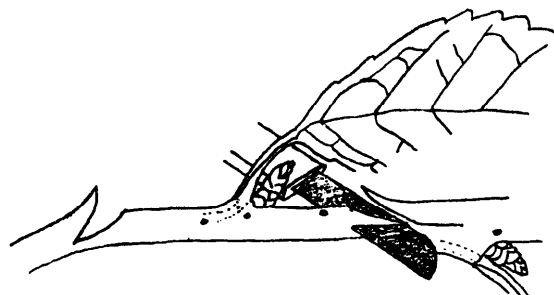


Figure 2

At the point on the stock where the bud will be inserted, place the bud on the bark and trace the outline of the bud with the knife (Figure 3). Follow the traced outline so they will cover the ends of the inserted bud.

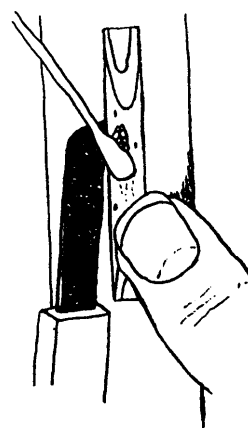


Figure 3

Before you insert the bud, be certain it is oriented as it grew, so it is not placed on backwards. Freshen the cut surfaces on the bud by lightly scraping or removing a thin slice of tissue (Figure 4). To insert, slightly lift the

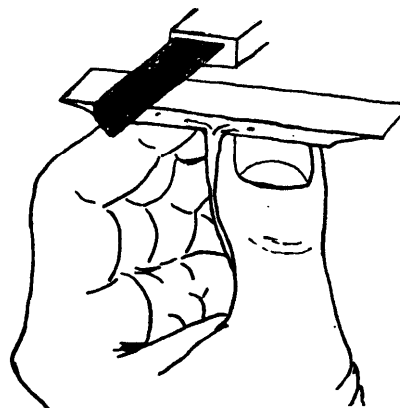


Figure 4

flap of bark at the bottom of the slot and insert the bottom end of the bud. Then insert the top end of the bud in the same manner (Figure 5). Secure the bud by wrapping plastic budding tape around the stock being sure that the flaps of the stock cover the ends of the buds (Figure 6).

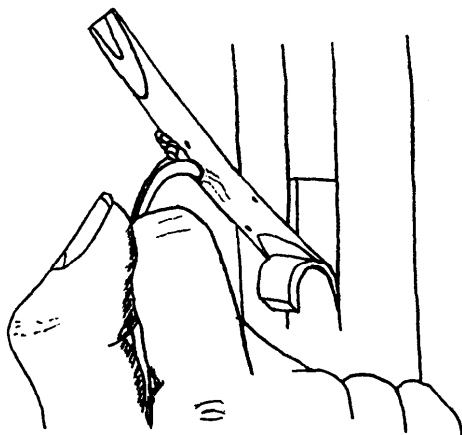


Figure 5

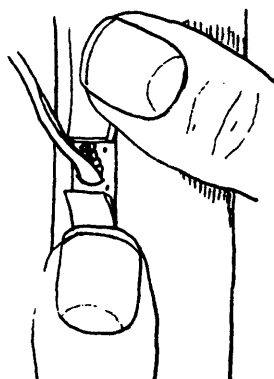


Figure 6

It is at these contact points that callus tissue of the stock and bud first unite. The budding tape should be wrapped in a manner so the base of the leaf and small bud are not covered (Figure 7).

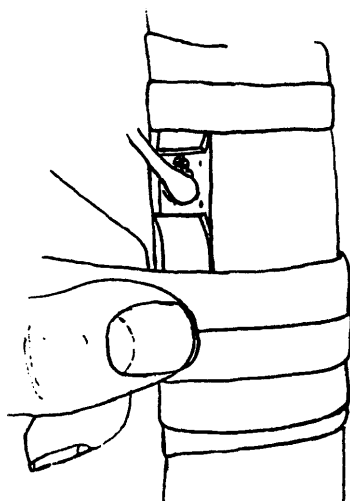


Figure 7

Protection against moisture loss can be provided by wrapping the union with a strip of polyethylene. One and one-half wraps is adequate. Tie or secure the ends of the polyethylene with budding tape or masking tape. Identify the variety or selection of the bud.

As growth first begins, remove the polyethylene wrapping. About 2 weeks later, remove the budding tape so it does not restrict the main growth.

Growth from buds made by about mid-July will usually harden off before low winter temperatures occur. However, growth from later inserted buds may suffer winter injury.

Refer to "After care of Buds on Grafts" in the publication and provide protection against the wind, birds, or other sources of damage to the new growth.

Whip Grafting

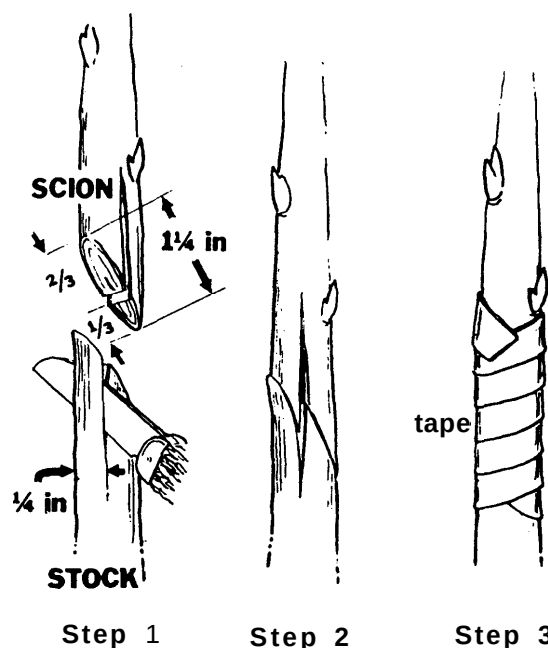
Whip grafting should be done in early spring as new growth is beginning. This method may be used to propagate seedlings or branches of trees of 1/4 to 3/8 inch in diameter.

This equipment is needed for whip grafting.

- Ice chest to keep scion wood cool and moist
- A sharp knife
- Vinyl grafting tape or wide rubber bands
- Plastic bag and foil or wax for covering the graft.

Steps in Whip Grafting:

Choose a piece of scion wood with one to two healthy buds. The scion wood and stock should be equal in diameter. Cut both stock and scion with a long slanting cut (1 1/4 to 1 1/2 inches). Then split the stock and scion about one inch (Step 1).



Steps in whip grafting.

Place the two ends together so that the shorter tongue of each enters the split of the other. The cambium layers of each must be in contact (Step 2).

After the scion is in place, wrap the entire wound with a rubber band. Raffia, waxed cloth, or waxed thread may also be used (Step 3). The entire graft should be covered. Suggested materials are aluminum foil which is then covered by plastic. This procedure aids in healing the graft union.

Bark Grafting

The following equipment is needed for bark grafting:

- Ice chest to keep scion wood cool and moist
- Pruning saw
- Pruning shears
- Sharp grafting knife
- Flathead brads, number 18, 5/8 inch
- Small tack hammer
- Nail apron
- Aluminum foil, and quart size polyethylene bags
- Soft cotton string and plastic plant tie

The proper time for propagating pecans by the inlay bark graft will vary slightly from year to year depending on how warm the weather has been, but the best time will be in May. The grafts take or unite best when the trees have been allowed to complete their first flush of growth. This would be when the tree to be grafted is about 1/4 to 1/3 leafed out.

Keep the scion wood cool and moist until it is used. Do not let it dry out during the grafting process. The scion with four to six strong buds should be about six to eight inches long for easy handling.

The Four-Flap Graft

This type of grafting or propagating procedure of improved cultivars (varieties) to all nut trees is fast becoming the easiest type of grafting by the orchard and home owner who normally does not do a great deal of grafting. It is ideal for smaller trees or branches, up to one inch in diameter. Larger trees are better suited to other types of grafting procedures such as the inlay bark or bud graft.

The four-flap graft works best if graftwood (scion) and stock are the same size, but it can be made with scions 25% smaller or larger than the stock.

Scionwood gathered in late February or early March and stored in a temperature near 32 degrees until the time to graft is used in this method of grafting.

The best time to make this graft is early spring when the bark slips freely on the stock for grafting. This may be as early as late April in southern Kansas.

The following step by step procedure tells and shows how the four-flap graft is made.

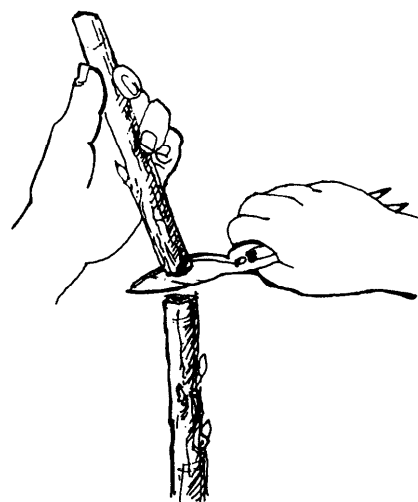


Figure 1

Step 1. Cut the stock straight across with sharp pruning shears at the point you wish to graft. Remove or cut back to approximately 6 inches all lateral (branch) growth on stock. (Fig. 1)

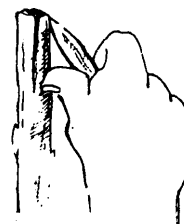


Figure 2

Step 2. Make four vertical cuts 1 1/2 inches long and equally spaced (quartered around the stock). Make cuts through bark only. (Fig. 2)

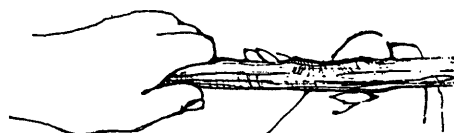


Figure 3



Figure 4

Step 3. Choose a smooth straight scion and cut to about six inches in length with 2 or 3 buds remaining. With a sharp knife, cut the scion on four sides, starting the cut about 1 1/2 inches from the bottom end. The cut should be made only through the bark. The end view will be square. (Fig. 3 & 4)

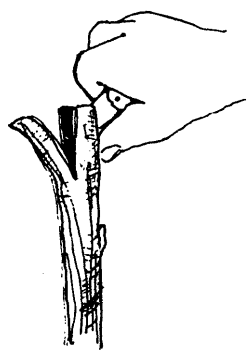


Figure 5

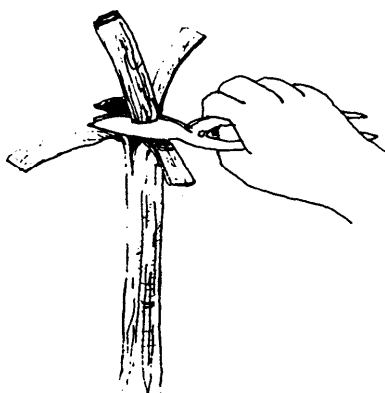


Figure 6

Step 4. Pull the four flaps of bark down and cut inner stock plug off square. Be careful not to damage the four flaps. (Fig. 5 & 6)



Figure 10



Figure 11



Figure 12

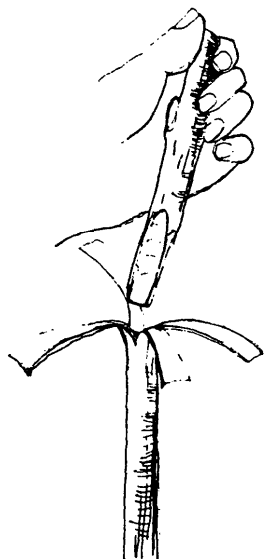


Figure 7



Figure 8



Figure 9

Step 5. Insert the scion upright on the stock. Pull the four flaps in place to cover the four cut surfaces on the scion. (Fig. 7, 8, & 9)

Step 6. Wrap the areas with masking tape, budding tape, or tie with a material that has some stretch to allow expansion of graft union as it begins to grow. (Fig. 10)

Step 7. Cover the tape with a piece of household aluminum foil. (Fig. 11) Clip the corner of a poly bag (pint or quart size), and carefully slip it down over the graft union and stock with the scion above the aluminum through the bag. (Fig. 12) Tie the bag to the scion above the aluminum foil but below the first bud on the scion. Then tie the bag approximately 1 inch below aluminum foil on stock. These ties may be made with any material that will stretch and not deteriorate. (Fig. 13)



Figure 13

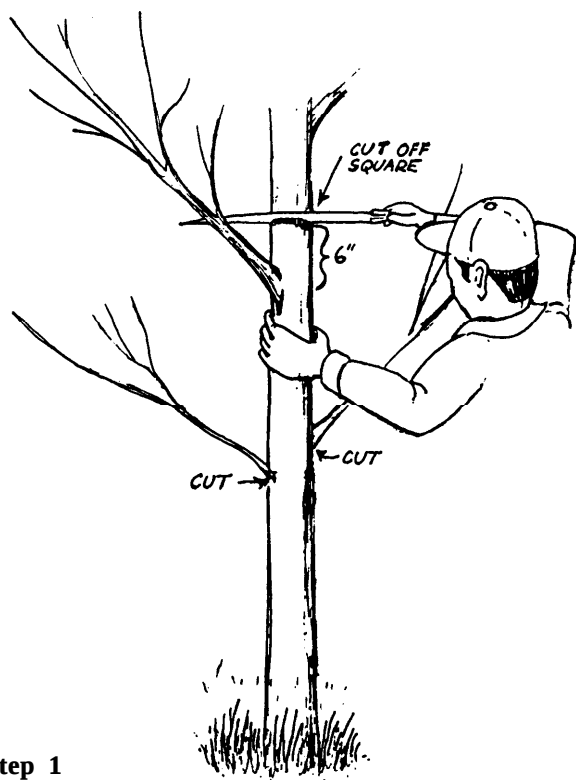
Some care should be taken after the graft is made. The grower should keep growth on the stock in check throughout the first season by removing the growing tips. It should be made several times during the growing season. This will cause a trashy or bushy trunk to develop, resulting in increased tree diameter and overall vigor. After 2 to 3 years remove all trashy branches below the scion.

Modifications of the 4-flap graft can be made to adapt the method to varying conditions such as small size stocks and scions. Small diameter stocks may have two flaps cut instead of 4; and the bark on the scion scraped off rather than cut. The rest of the procedure described for 4-flap graft should be followed.

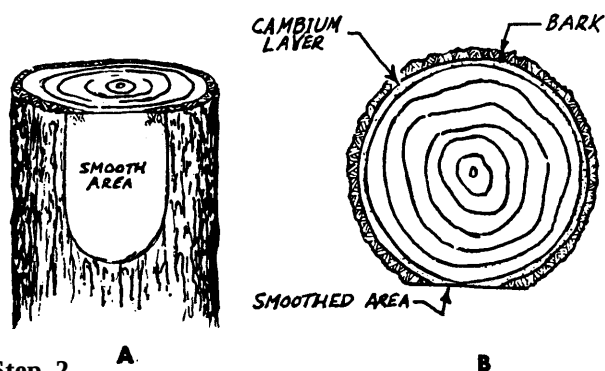
Inlay Bark Grafting

Choose pecan trunks or side limbs 1 1/2 to 3 inches in diameter to receive a scion wood. Make a cut straight across the trunk or limb with a sharp saw (Step 1). A small bow type saw is excellent for this cut. If livestock are grazing in the area, make the cut 7 or 8 feet above the ground. Leave two or three side branches below the cut depending on the vigor of the tree. Make the cut about 6 inches above the uppermost side branch. The remaining branches help to keep the tree vigorous, protect from sunscald, and keep the graft from growing too rapidly. If the graft does not grow fast enough, one or two of the side branches can be removed to force it.

Select a section of the stock (trunk or limb) with a flat surface so the flat cut surface of the scion will fit closely against it. If possible, a spot on the southwest side should be chosen so the prevailing wind will blow the growing graft toward the tree. Remove a thin layer of the rough outer bark to provide a clean area (Step 2A), but do not cut into the growing tissue (Step 2B).

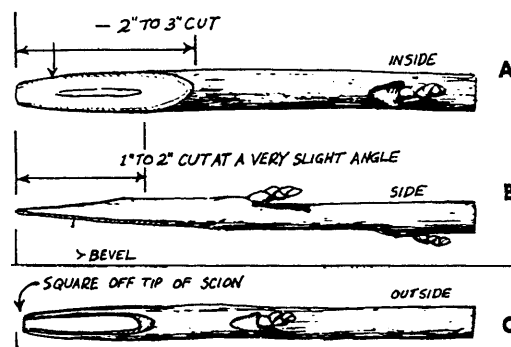


Step 1

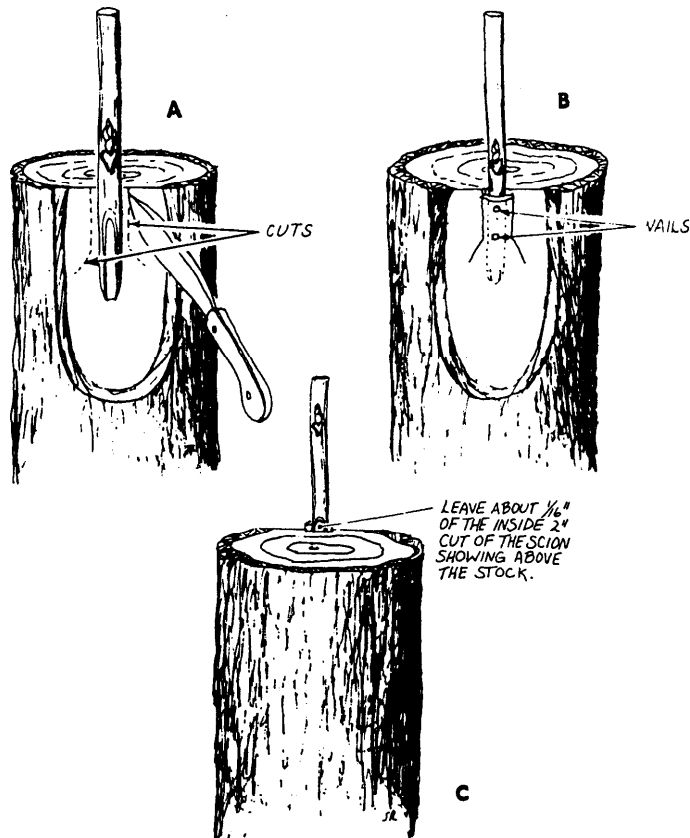


Step 2

A good grafting knife with a sharp blade is essential for the next step. Hold the knife firmly and with a level trajectory make a smooth, straight cut 2 to 3 inches long toward the bottom of the scion (Step 3A and 3B). This cut should begin about 1/2 inch below the second bud. On scions 1/2 inch or more in diameter a slanting shoulder or bevel cut (about 45°) halfway into the scion at the beginning of the long cut will allow the graft to be placed in an upright position. The entire surface of the long cut should be smooth with no waves. Trim the bark slightly along the sides of the long cut to expose the cambium layer which is located between the bark and the woody portion (Step 3A). Turn the scion over and make a shallow cut on the back side that begins slightly lower than the first long cut. This cut should be just deep enough to expose the cambium (Step 3C).



Step 3



Step 4

Place the cut surface of the scion against the shaved area on the stock, and allow 1/4 to 1/2 inch of the cut surface to extend above the stock. Hold the graft firmly upright with the left thumb, and begin a cut straight into the bark at the top of the stock on the right side of the graft (Step 4A). The knife point should cut through the bark and down to the wood. Draw the knife blade straight down about one inch and then flare out at the bottom. The cut should end about 1/2 to 3/4 inch from the bottom of the scion.

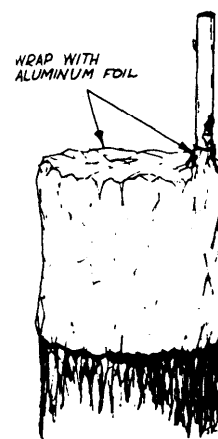
Hold the scion firmly in position with the thumb of the right hand, and do not allow it to move after the first side cut has been made. Bring the left hand around the back of the stock, and hold the scion in position with the first three fingers of the left hand while making a cut on the left side of the scion identical to the one on the right side.

Use the point of the knife to peel back the flap of bark to allow the scion to be inserted into the slot made by the two cuts through the bark. Press the flap of bark lightly against the scion to hold it in the slot. Apply firm but gentle pressure on the top of the scion to force it into the slot until about 1/4 inch of the cut surface is above the top of the stock.

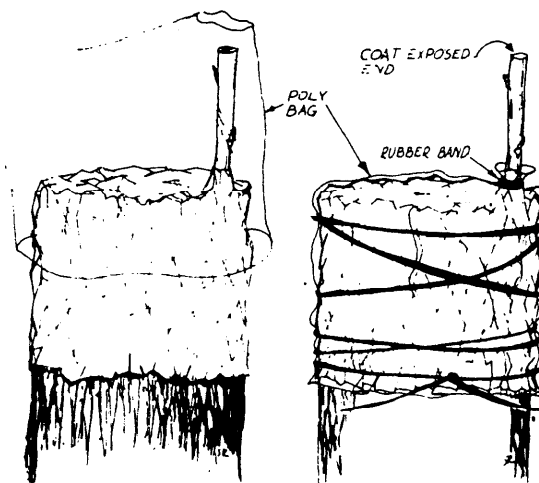
The scion must be held firmly against the stock until the two have united or grown together. This is done by the use of 2 eighteen gauge wire nails, 5/8 or 3/4 inch long. Drive the nails carefully with a tack or other small hammer through the flap of bark and scion into the stock (Step 4B and 4C).

The exposed portions of the scion and stock should be covered to prevent damage from wind and sun. Aluminum foil provides the base cover. It reflects sunlight and reduces temperature around the graft. With a 6 to 10-inch square of aluminum foil (regular household type), tear a line down to the center of the square. Fold the foil around the stock so that the bottom of the tear fits right under the lowest bud on the scion (Step 5A). Fold down the flaps on the divided end of the foil to cover all cut surfaces including the exposed cut surface on the scion. The foil should be crimped down to form a loose mold around the stock, but a good fit is necessary around the scion just above the exposed cut surface. Do not cover the scion above this point.

Polyethylene plastic film is used as the final cover to assure high relative humidity around the graft at all times (Step 5B). Cut a small hole in the bottom of a pint or quart size plastic bag, and slip the inverted bag over the scion and work it down gently until the cut corner of the bag rests just below the lowest bud. Tie the bag around the base of the scion with a rubber budding strip or plastic plant tie (Step 5C). Twine may be used, but it will require cutting when the scion begins to grow to prevent girdling. The open end of the bag must be tied around the stock. Use reasonably strong twine since the foil and plastic bags should remain in place until the dormant season. They reduce the number of sprouts that tend to grow near the top of the stock, and provide some protection against insects.



A



B

C

Step 5

Coat the cut surface at the top of the scion with orange shellac or white glue to reduce moisture loss.

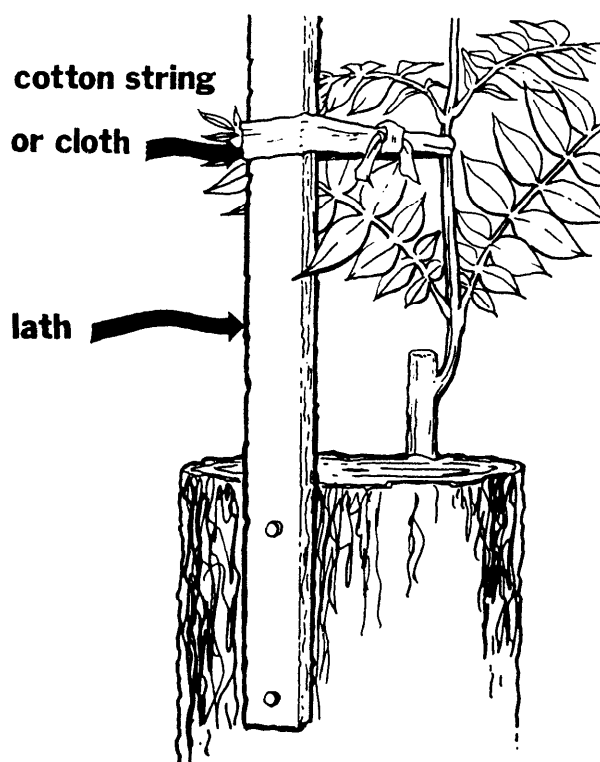
After the graft starts to grow, prevent wind damage by nailing a lath or light board opposite the scion extending from the cut surface at least 24 inches. Tie the tender shoots to the lath with soft cotton string or soft strips of cloth. The lath supports the new shoots and prevents wind breakage. Remove the lath after the union is well healed. All sprouts below the graft should be removed the following winter (Step 6).

Aftercare of the Graft

The care of the tree after grafting or budding is as important as the operation itself.

A successful graft will usually begin growth in about three weeks. Grafts from two year old wood are usually slower to start growth than those from one year old wood.

Shoots from the graft may grow so rapidly that they become top-heavy and are easily damaged by wind. Such shoots should be supported by tying them to one by two inch stakes nailed to the stock (Step 6). Excessive growth



Step 6

may be reduced by removing the growing tips of shoots after they have made a growth of 20 to 30 inches.

If the grafts are in an area being grazed, and within reach of livestock, install a protective fence or barrier around the tree.

During the first summer, remove shoots that arise

on the stock near the grafted area. Clear out other tree growth in the grove to give the grafted trees adequate growing space.

If the graft is growing slowly, cut back some of the native branches left on the stock at the time of grafting. This will encourage additional growth of the graft.

The poly bag and foil may be removed in August or September if ants are working on the graft. Otherwise, the bag and foil may remain in place for the remainder of the year.

The square shoulder opposite the graft on large stocks (4 inches) will often dry and decay before healing. Healing can be accelerated by removing this edge of the stock with a sloping cut at a 20° to 30° angle downward and away from the side where the graft is growing. This operation can be done during the first winter.

When two grafts are placed on one stub and both grow, the least desirable one should be removed during the first winter. The extra graft can be removed with a portion of the stock as suggested above for removing the square shoulder on large diameter stocks. If both grafts are allowed to grow, a weak V-crotch angle will likely develop, causing the tree to be vulnerable to breaking and splitting.

About three years are required to grow a new top from the scion. During this time the native branches should be removed. For example, if three native branches were left on the stock, remove one each year. This practice depends upon the vigor of the tree and graft. Delay removal of these native limbs if the grafts are making excessive growth. Likewise, hasten their removal if the graft is growing slowly. Remove the native branches flush with the main trunk.

Train the new tree to central leader system by cutting back or removing side branches that crowd and compete with the leader.

Notes on Grafting and Budding

Frank D. Morrison
Extension Specialist-Horticulture

Brand names appearing in this publication are for product identification purposes only. No endorsement is intended, nor is criticism implied of similar products not mentioned.

Publications from Kansas State University are available on the World Wide Web at: <http://www.oznet.ksu.edu>

Contents of this publication may be freely reproduced for educational purposes. All other rights reserved. In each case, credit Frank D. Morrison, Propagating Nut Trees, Kansas State University, August 1981.

Kansas State University Agricultural Experiment Station and Cooperative Extension Service

C-639

August 1981

It is the policy of Kansas State University Agricultural Experiment Station and Cooperative Extension Service that all persons shall have equal opportunity and access to its educational programs, services, activities, and materials without regard to race, color, religion, national origin, sex, age or disability. Kansas State University is an equal opportunity organization. Issued in furtherance of Cooperative Extension Work, Acts of May 8 and June 30, 1914, as amended. Kansas State University, County Extension Councils, Extension Districts, and United States Department of Agriculture Cooperating, Marc A. Johnson, Director.

File Code: Horticulture and Landscaping-6