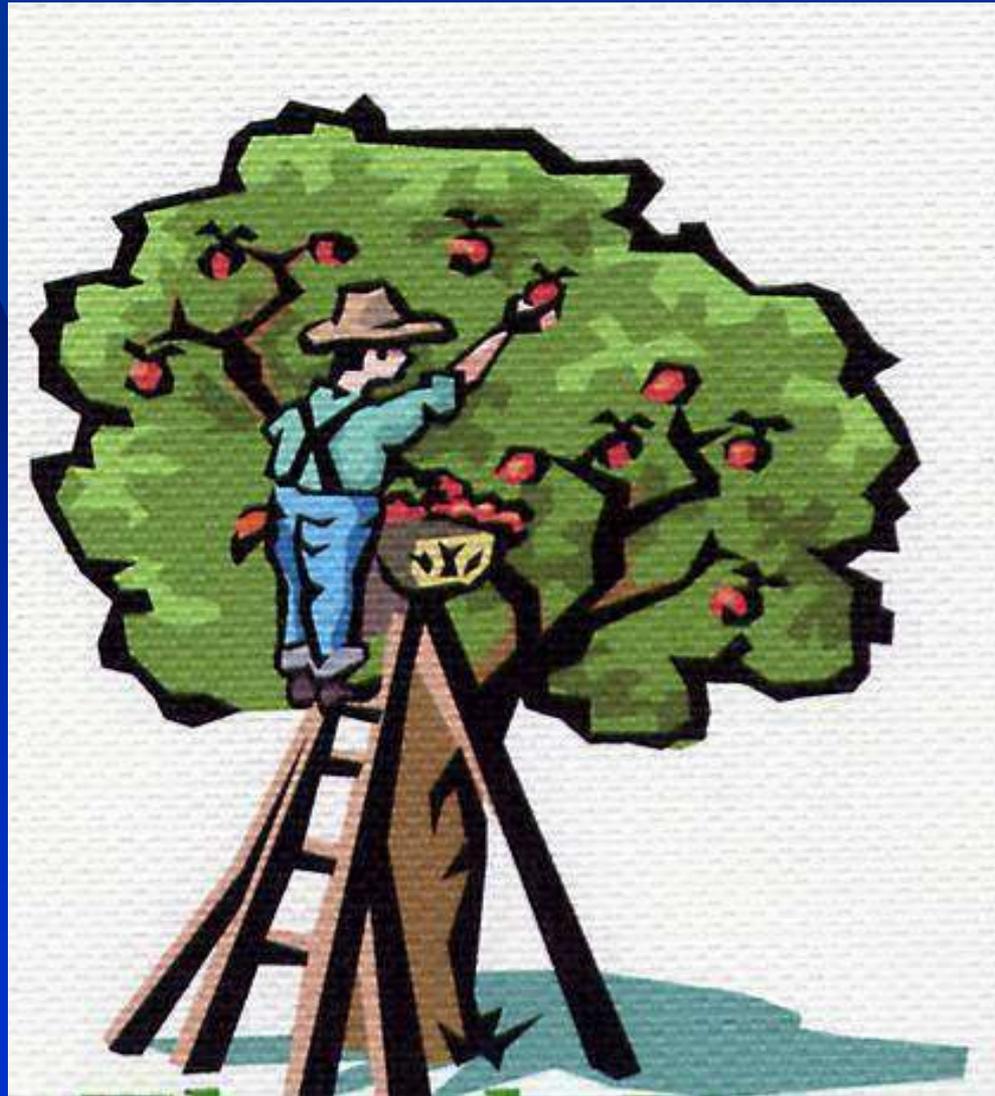
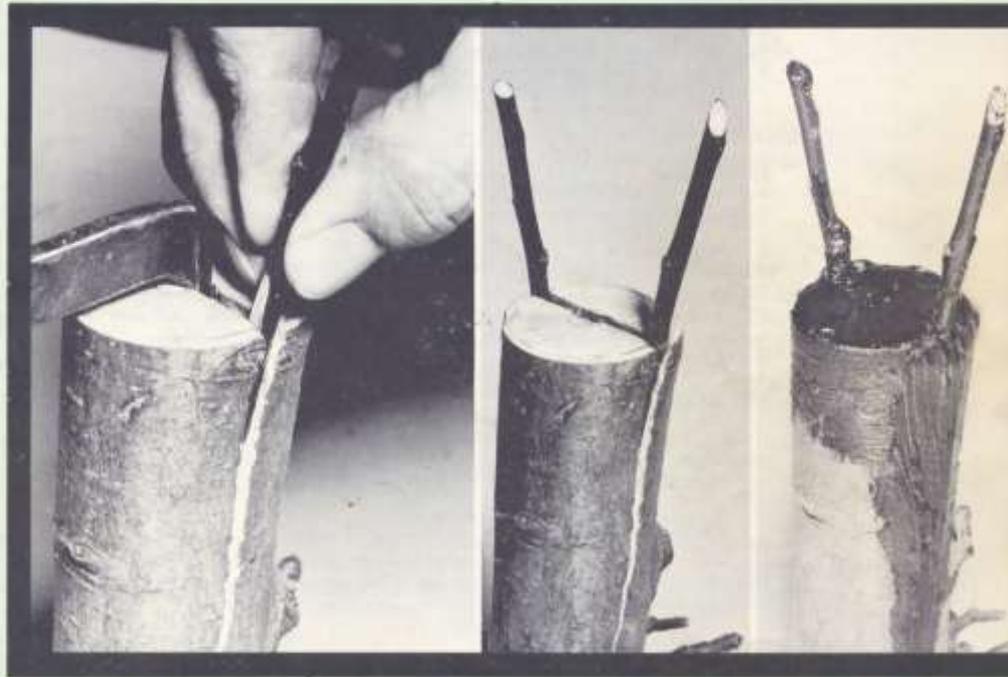


# Grafting Fruit Trees



Loyd Collett

4/5/2011

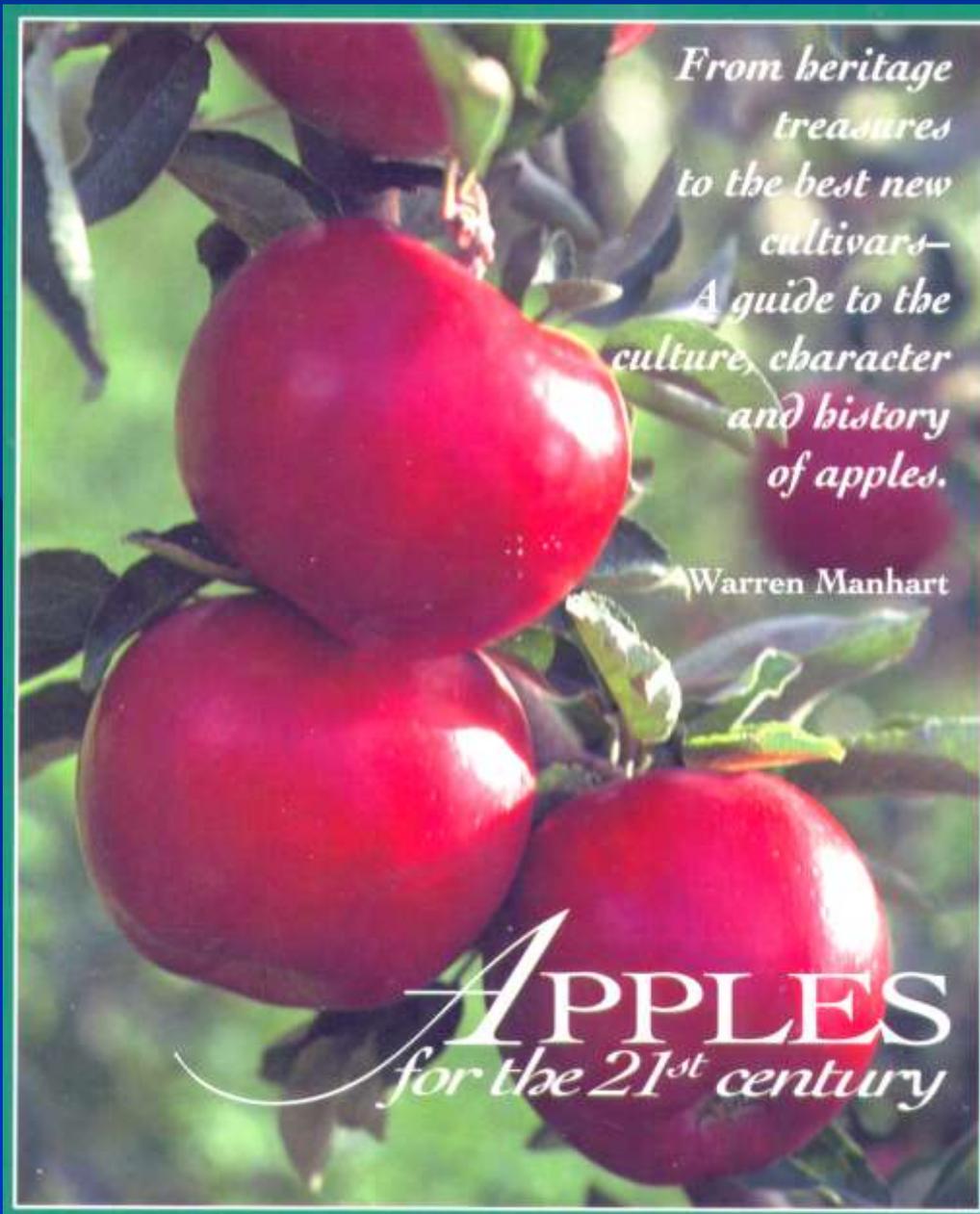


## **GRAFTING FRUIT TREES**



PNW Bulletin 62

PNW BULLETIN 62



*From heritage  
treasures  
to the best new  
cultivars—  
A guide to the  
culture, character  
and history  
of apples.*

Warren Manhart

**APPLES**  
*for the 21<sup>st</sup> century*

# Introduction

- The goal of grafting and budding is to join together two living plant parts so that the combination grows as one plant.
- Grafts are made because the plant variety does not grow true-to-seed and cuttings are difficult to root.

# Reasons For Grafting

- To perpetuate a variety.
- Change one variety to another.
- To control tree size, earlier fruiting, and adaptation to difficult soils or climate.

# Rootstock

- Midget (4-8 ft.)
- Dwarf (8-12 ft.)
- Semi-Dwarf (12-20 ft.)
  
- Semi-Standard (20-25 ft.)
- Standard (25-35 ft.) – most hardy and vigorous

# Mini-dwarf Rootstock (4-8 ft,)

- Rootstock – M.27 (EMILA 27)
- Size: 10-20% of standard
- Very precocious (2 yrs.)
- Poor anchorage – Permanent support
- Good choice for container culture or high density planting

# Dwarf Rootstock (8-12 ft.)

- Rootstock – M9 (Bud.9) EMILA 26
- Size: 20-30% of standard tree
- Very precocious (2-3 yrs.)
- Anchorage: poor, support required
- Suitable for container culture or high density planting

# Semi-Dwarf Rootstock (12-20 ft.)

- Rootstock: M.7, EMILA 7, Geneva 30
- Size: 30-50% of standard tree
- Somewhat precocious (3-4 yrs.)
- Good anchorage – stake first 5 yrs.  
    otherwise – free-standing
- Heavy suckering from roots

# Semi-Standard (20-25 ft.)

- Rootstock – MM.111
- Size 75-85% of standard tree
- More precocious than seedling (i.e. poor)
- Good anchorage – typically free-standing
- Very tolerant to drought & soil conditions
- Because of size – use limited to extreme conditions

# DWARFING INTERSTEM

(MM.111 rootstock with M.9 interstem)

- Get a dwarf, but strong free-standing tree
- Requires double grafting
- Expensive to produce
- Good for the north



# Full –Size Rootstock (Standard)

- Antonovka – Russian suckerless
- Size: 25-35 ft. tree
- Hardy to –50 F.
- Wide soil adaptability

# Other Rootstocks

- European Pear – OH x F 333  
(Old Home Farmingdale)
  - Asian Pear – Pyrus Betulifolia
  - Cherry – Krymsk 5, Gisela 6
  - Other Stone Fruits – Krymsk 1,  
St. Julian A, Mariana 2624

# A Form of Surgery

- Working with living tissue.
- Must work quickly.
- Precision is required.
- Match cambium with cambium.
- Prevent wound infection.
- Maintain hygienic surroundings.
- Must have healthy plant parts.

# Conditions for Successful Graft

1. Compatibility
2. Same genera
3. Cambial contact
4. Air-tight seal
5. Warm temperature
6. Healthy plant tissue
7. Right time of year

# Common Methods of Grafting

1. Whip-and-Tongue
2. Cleft grafting
3. Bark grafting
4. Budding

# Gathering Scion Wood

- **Timing:** In winter during dormant stage.
- **Authenticity:** Take from healthy, proven, productive trees true to name and type.
- **Selection:** One-year old wood about a pencil diameter and 6 to 10 inches long.
- **Storage:** Moist and cool in tightly sealed plastic bag – refrigerate until ready for use.

# Tools and Materials Needed

- Sharp knife
- Grafting wax or compound
- Grafting tape or budding strips
- Nails or brads
- Grafting tool
- Brush for applying wax

# 1. Whip & Tongue (Bench Graft)

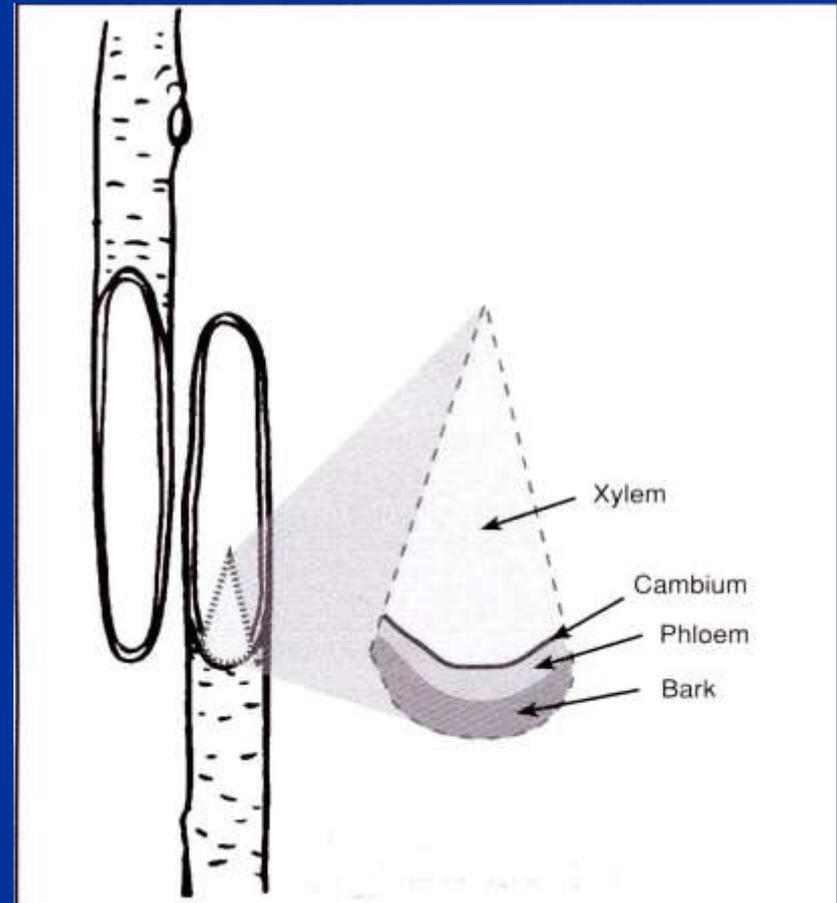


Callus  
tissue

- Works best when stock and scion are of similar diameter, preferably between  $\frac{1}{4}$  and  $\frac{1}{2}$  inch.
- The stock should be smooth and straight-grained with no twigs or branches.

# Preparing the Stock & Scion

- The cuts on both stock and scion should match.
- On both parts, make a smooth sloping cut 1 to 2 inches long.
- Make the cuts with a single, smooth cut with no waves or whittling.



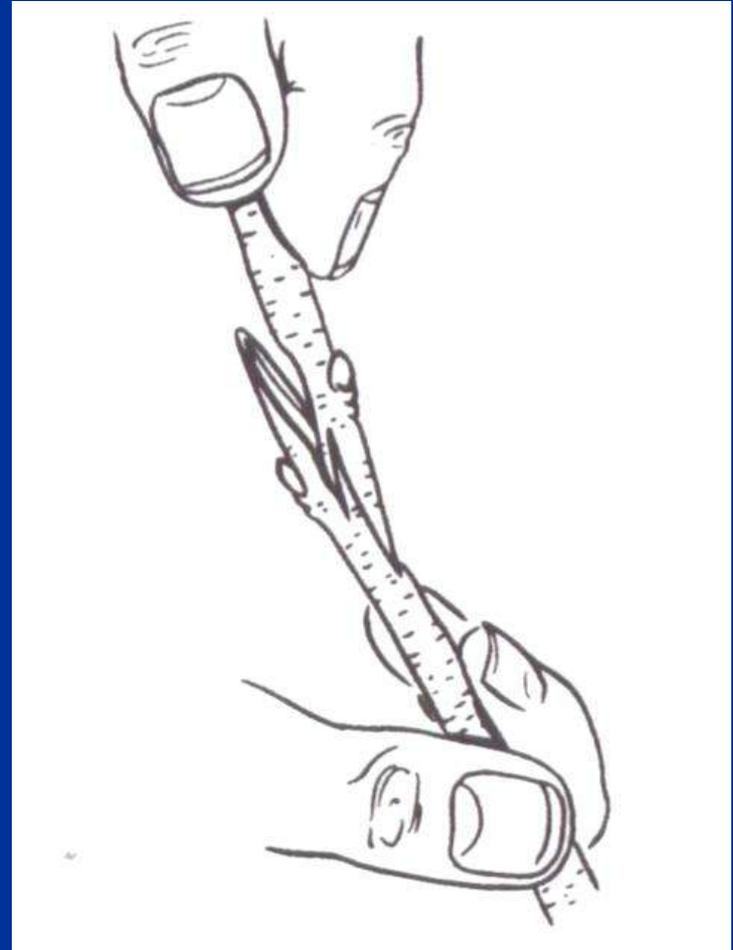
# To Form the Tongue

- Hold the one-sided, slanting cut of the stock facing you and support it with your finger from behind. About one-third down from the tip of this cut, make a downward cut about  $\frac{1}{2}$  inch long and parallel with grain of wood.
- Turn scion upside down, and Make the same exact cut on bottom of scion.



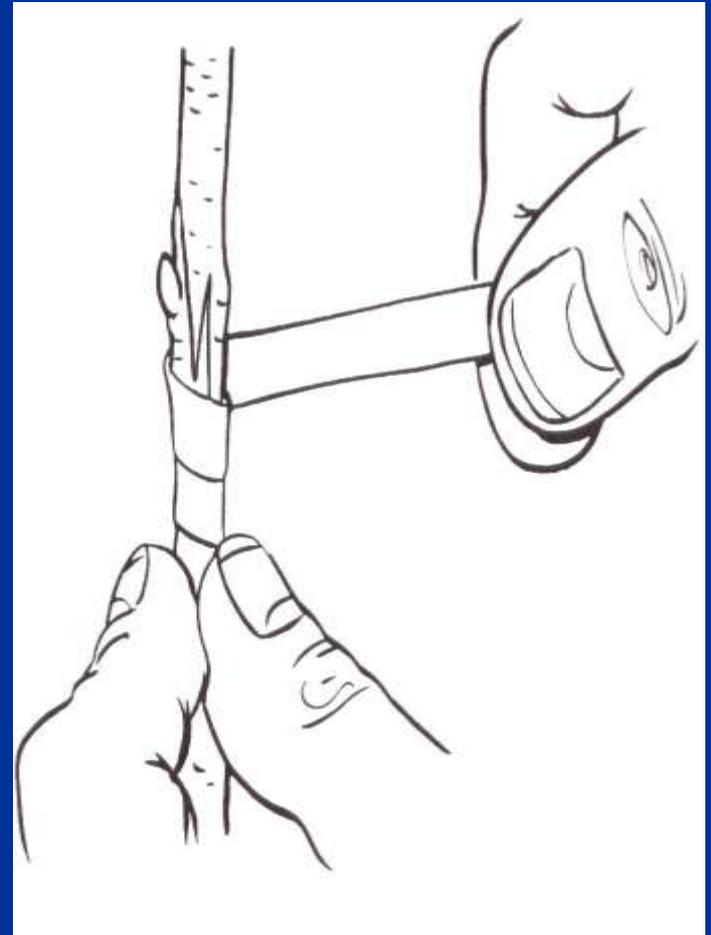
# Fitting Stock and Scion

- Push together tightly enough so that the cut surfaces match closely, inter-locking the two pieces.
- The cambial area (area immediately under the bark) must be aligned for a union to develop.



# Wrapping the Graft

- Wrap the graft with a rubber budding strip, grafting tape, or electrical tape.
- If the wrapping material does not decay naturally, cut or remove it about a month after growth begins.



# Care of the New Tree

- If the wrapping material does not decay naturally, cut or remove it about a month after growth begins.
- As growth continues, remove all sprouts or other growth that originate below the graft.

With growth well started,  
remove grafting wrap or  
split vertically with sharp  
knife or razor blade and  
let the sun pull the  
material away from the  
Scion.



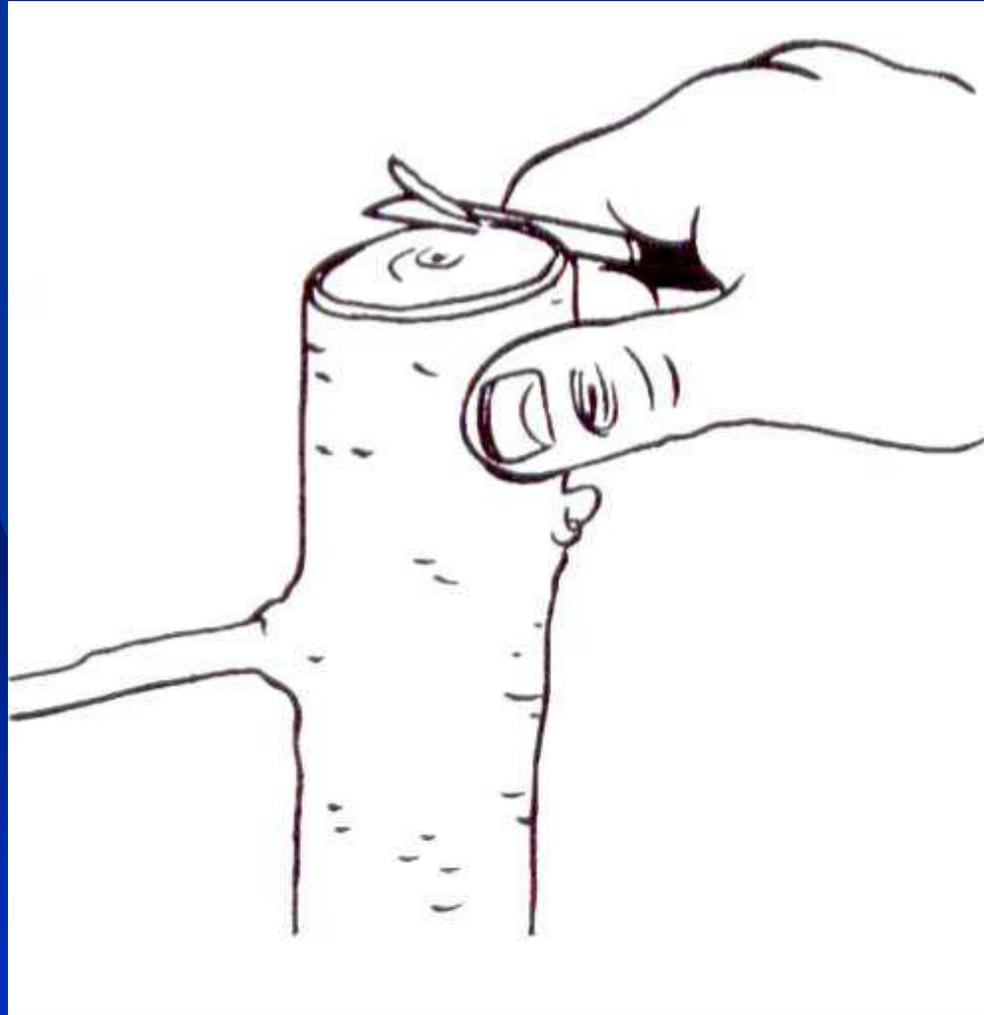
## 2. The Cleft Graft

- Grafts using small scions and large understocks.
- Most commonly used to topwork a tree [to change from one variety to another]
- Young trees may be grafted on the trunk, while older trees are grafted on branches not more than 3 inches in diameter.
- Branches fully exposed to sunlight are more successful.

# Preparing the Understock

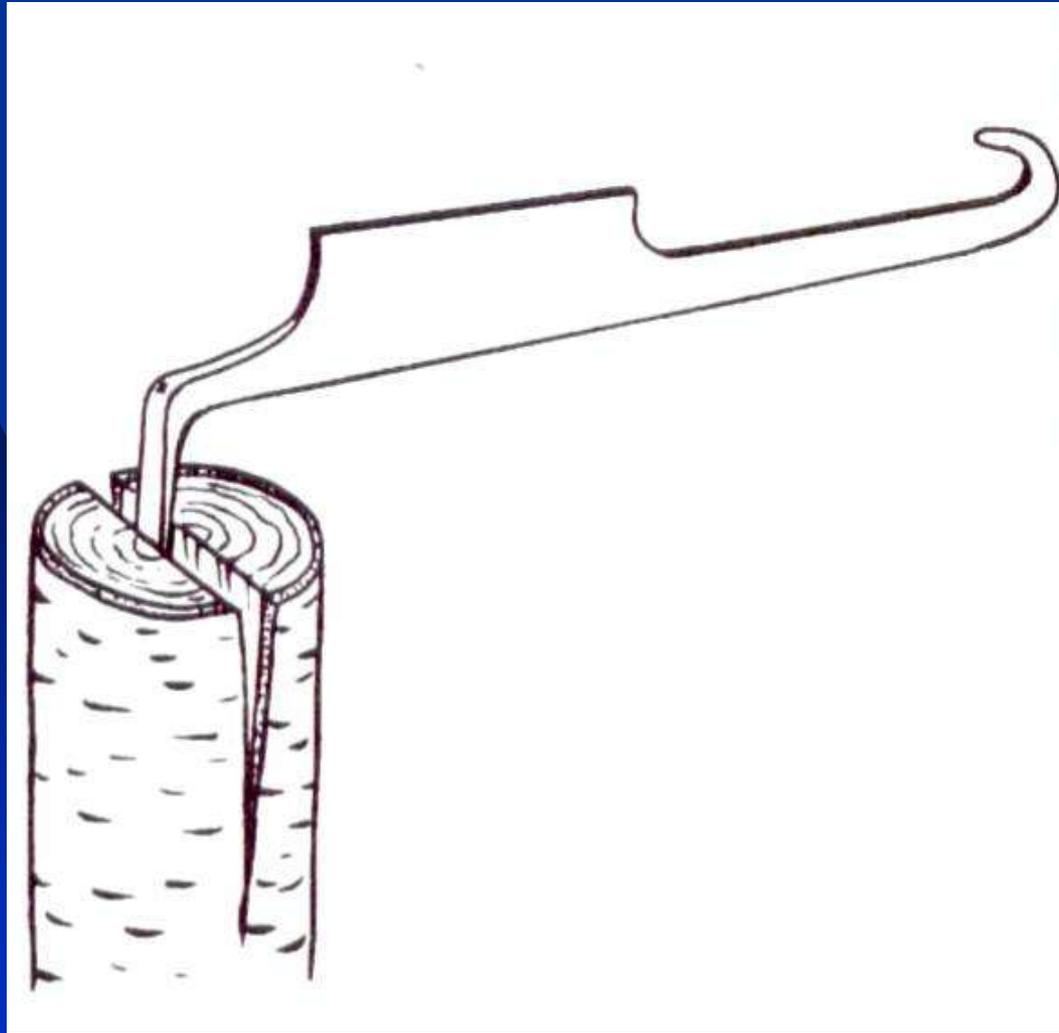
- Branches of large trees, or the trunk of a small tree must be sawed off to provide a stock for the scions.
- Select a smooth, knot-free, straight grained section for the graft.
- Saw the branch off at right angle to the grain. Don't tear or split the bark.

## Cleft Graft



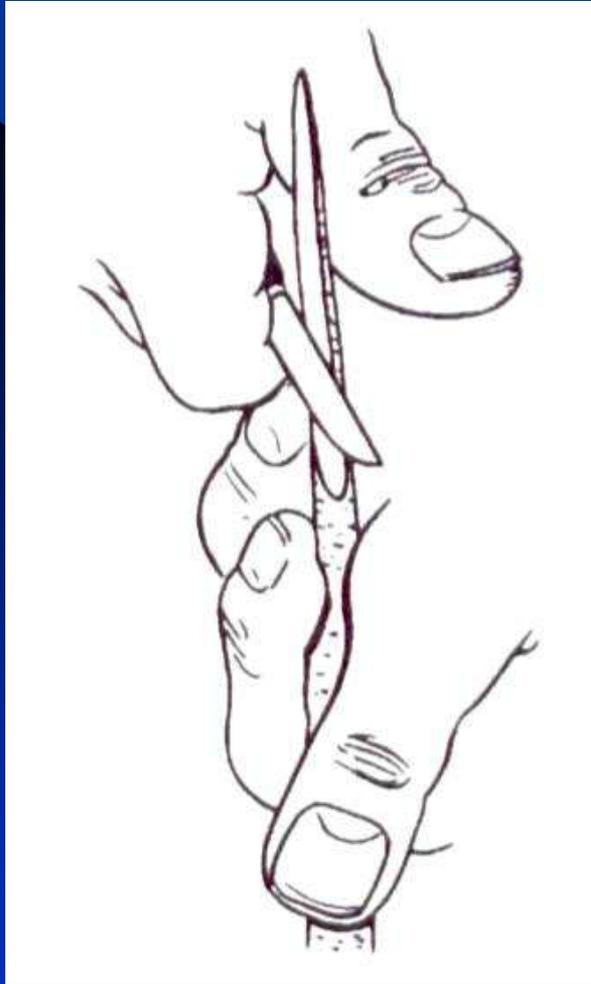
Cut stock smoothly. Trim any rough edges with knife, visually exposing the cambium.

## Cleft Graft

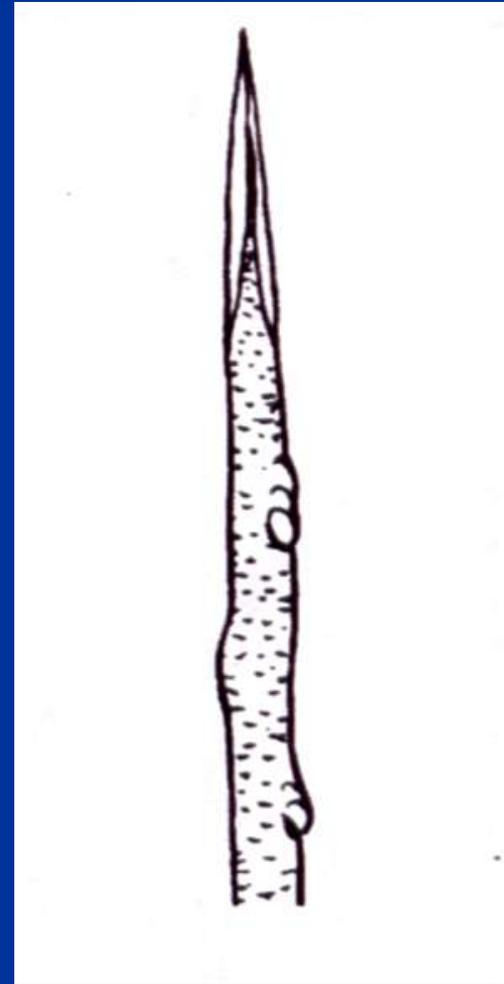


Split stock, and open with a grafting tool or heavy knife.

# 2-step preparation of the Scion



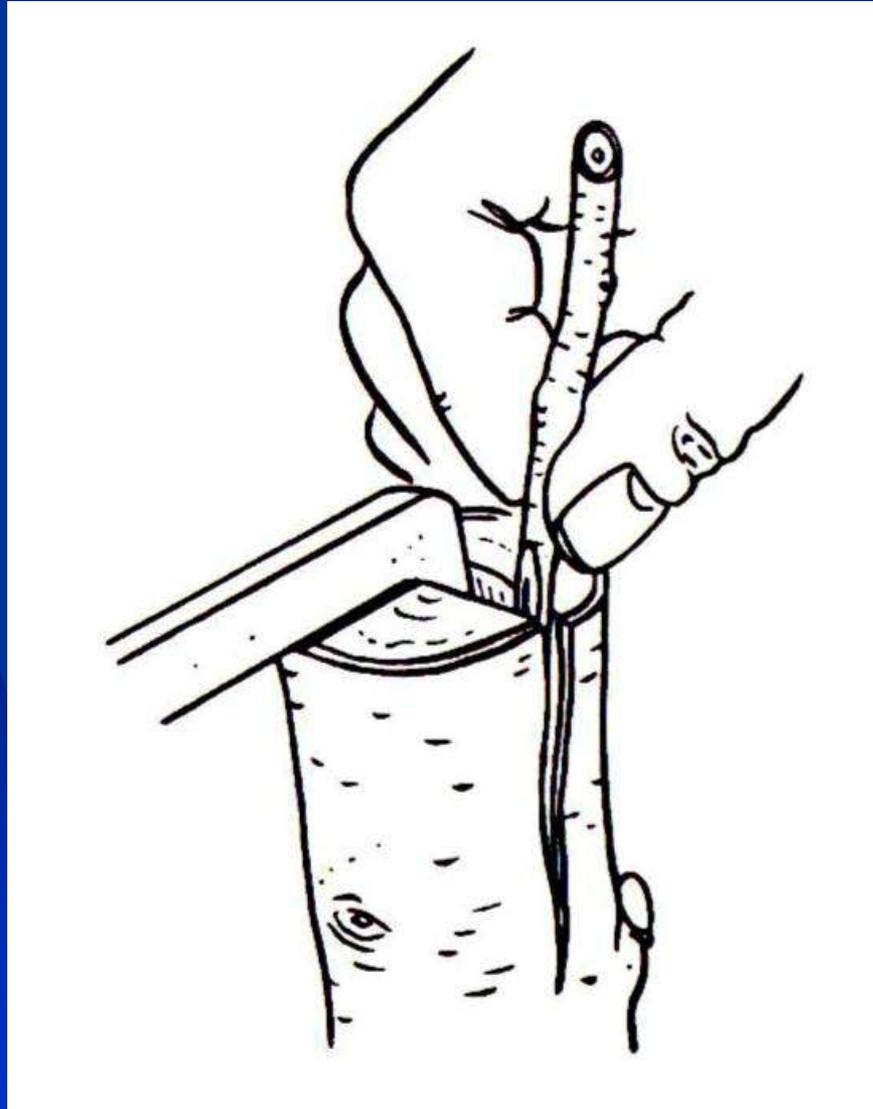
Cleft Graft



1. Make a long smooth cut

2. Cut again to make a pie-shaped wedge.

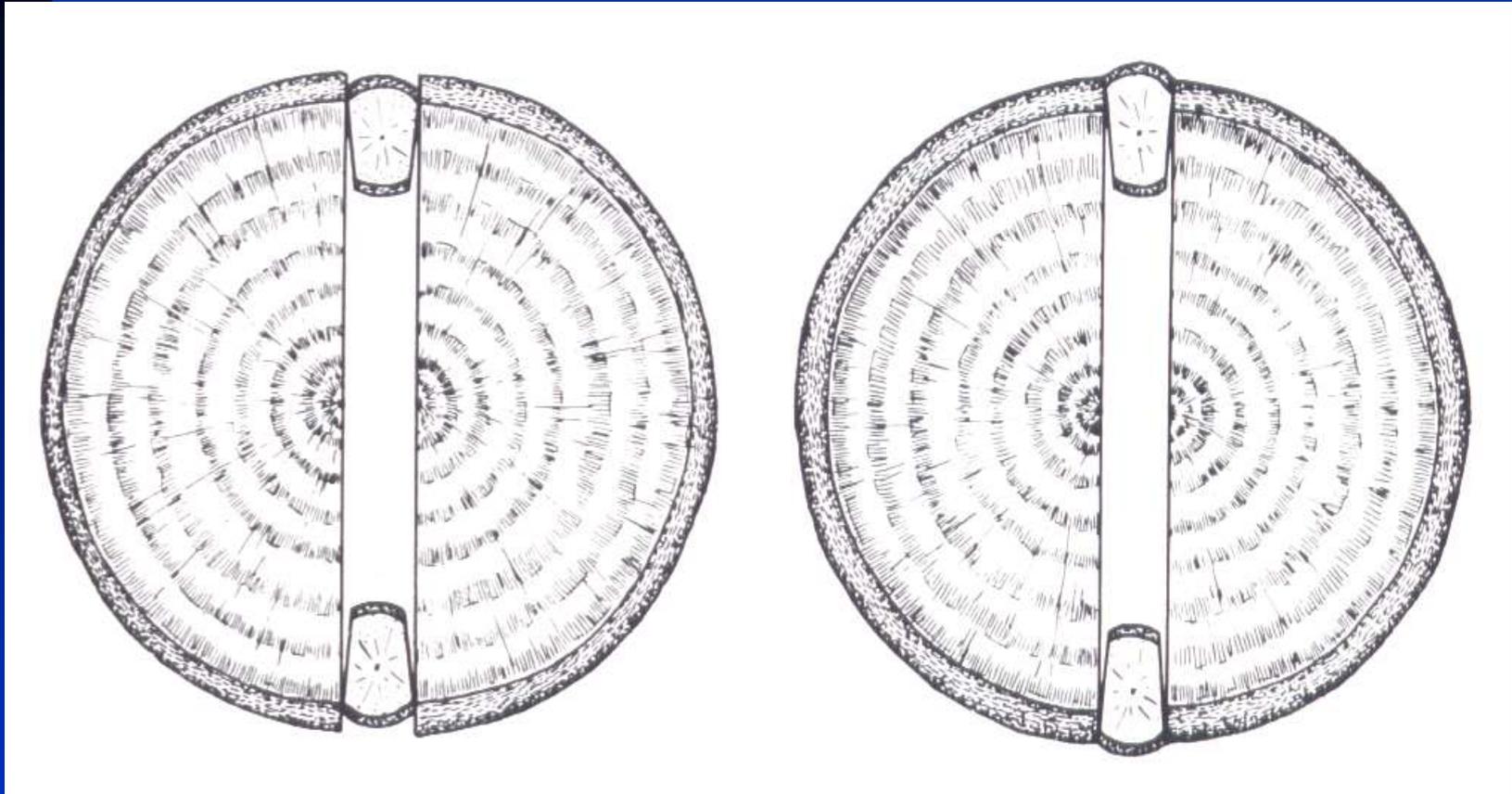
## Cleft Graft



Promptly insert scion into stock after cutting

**Good cambial contact**

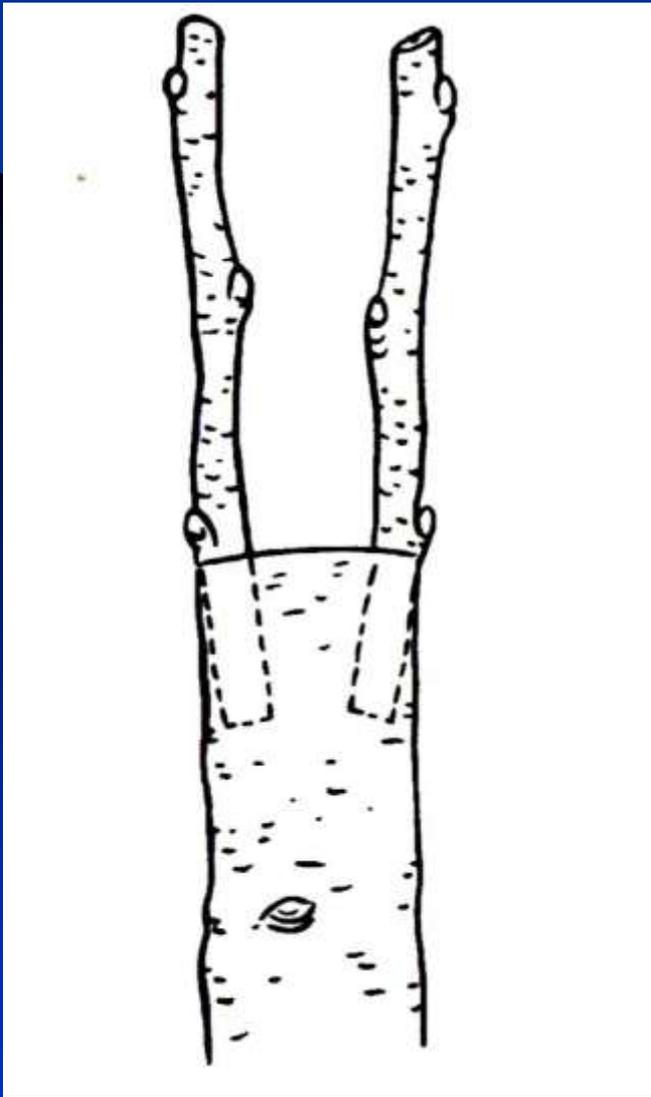
**No cambial contact**



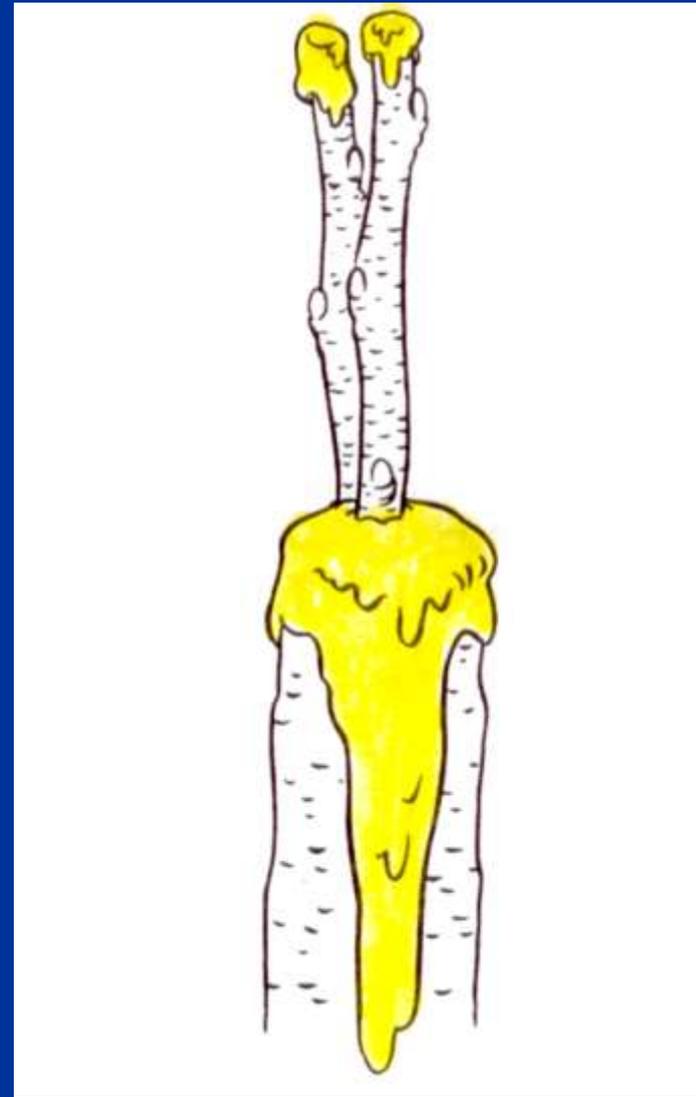
**Right**

**Wrong**

**Cambium layers must match closely.**

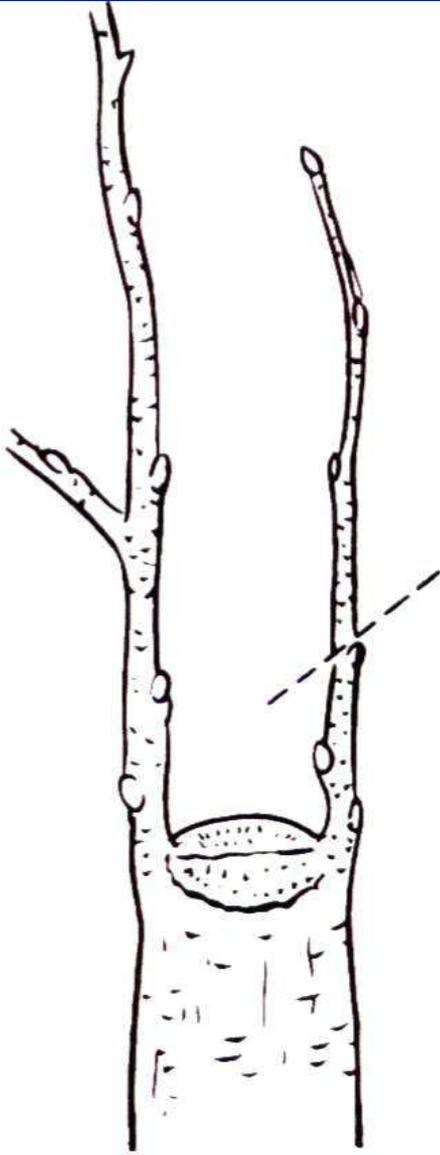


## Cleft Graft



A very slight slant can ensure cambial contact.

After insertion, wax thoroughly to prevent drying.



After the first year, if both scions survive, shorten one to allow the other to develop faster.

The shortened scion is removed later, after it has helped cover the wound.

# Topworked Tree



2-yr. old grafts

# Cleft Graft Scar



A very strong graft union

# Same Tree – 10 yrs. Later



# Cleft Graphs On Limbs



3 limbs

Freedom apples

2 limbs

Akane apples

# 4-Way Cleft Graft

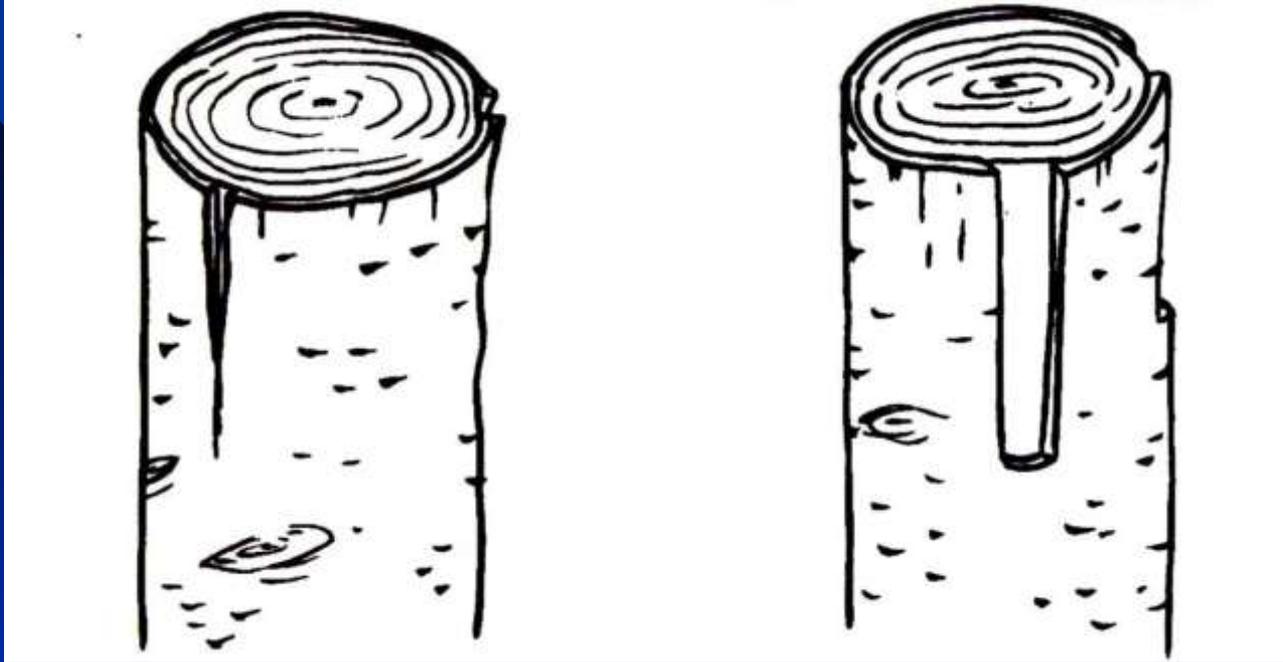


### 3. Bark Graft (veneer graft)



Tree trunk

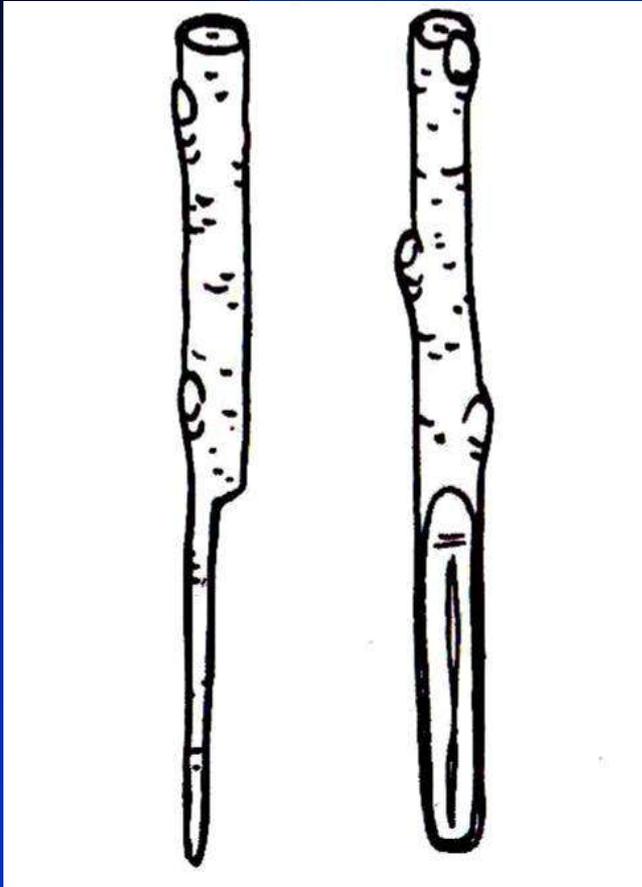
# Stock Preparation



*Make single or double cut in bark for scion*

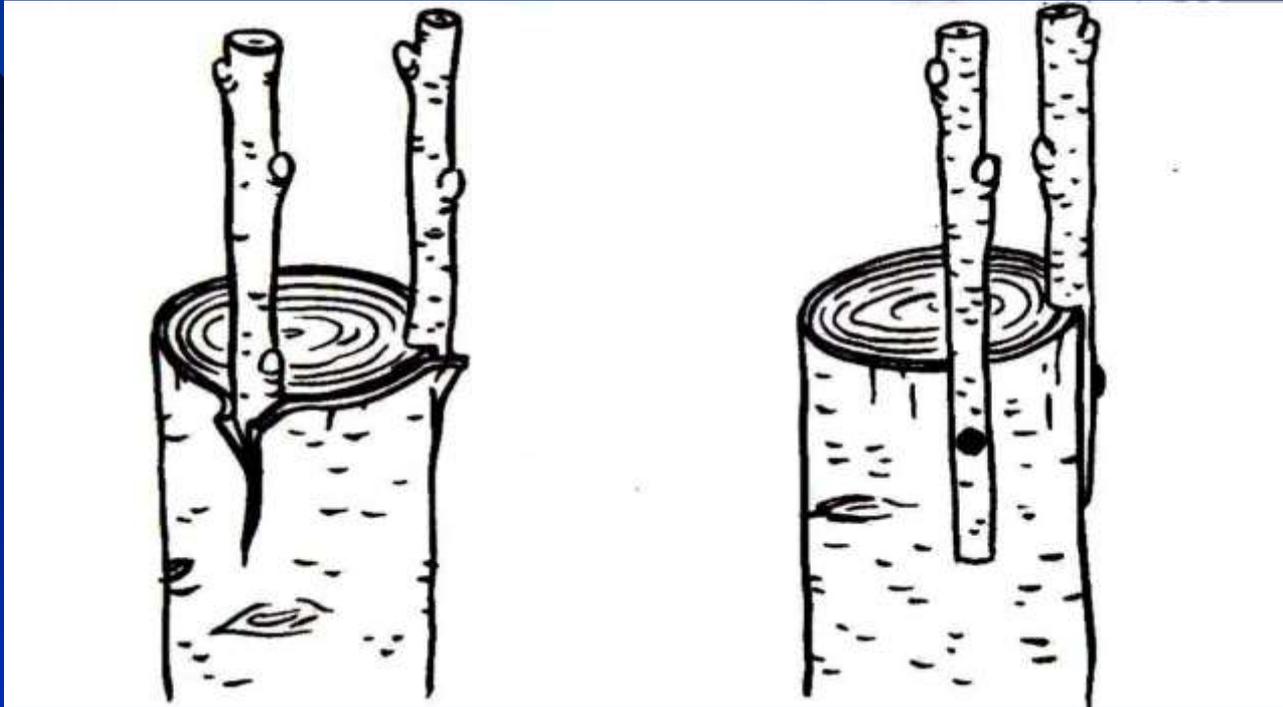
The bark graft can be made only when the bark slips or easily separates from the wood, usually in early spring as growth begins.

# Scion Preparation



- The dormant scion should be 4 to 5 inches long with 2 or 3 buds.
- Cut inward 1½ to 2 inches from base then downwards, forming a shoulder and long, smooth cut. extending about one-third through the diameter of the twig.
- **The scion may alternatively be shaped into a one-sided wedge.**
- On the opposite side cut a small wedge for easier insertion.

# Inserting the Scion



If the scion is large enough, one or two small nails may be used to tighten the scion to the stock. Wax over all cut surfaces.

# New Bark Graft In Trunk



All but four scions will be removed after healing is well under way and trained into four scaffold branches.



Bark Graft  
Five Years Later

A  
P  
P  
L  
E  
  
B  
A  
R  
K  
  
G  
R  
A  
F  
T



# Bark Graft On Trunk



Another Variety  
Change

20 Years Later

(Round spot is a  
Healed limb scar)

# Bark Graft in Limb





Grafting into limbs  
will preserve a  
strong and well  
balanced limb  
Structure.

# 1-year Old Bark Grafts



# Extra Security



# In-arching

Using the bark graft technique.

Tree trunk damaged by winter freezing.



# Budding (“T” budding)

- A method of grafting using a single bud.
- Faster than other grafting methods.
- Percentage of success can be high.
- Well adapted to small rootstock.
- Small amount of plant material required.
- Can be done with rootstock in the ground or lifted and worked on a bench.

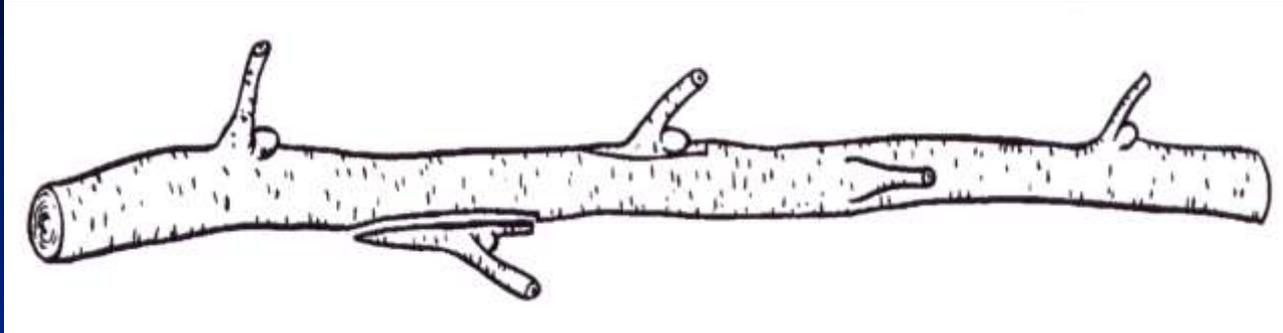
# Preparation for Budding

- Budding is done when the bark slips, usually August after new buds have set.
- Young plants selected for the understock must have vigorous growth so bark will slip.
- Remove any branches from bottom 6 inches of trunk.
- Most budding of small trees is done 5 to 6 inches above ground (but can be higher).
- Can be used to top-work a large tree.

# Budstick?

- A twig from the current season's growth.
- Should have good vigor and plump, well-developed buds.
- Buds in center of twig are better than those near the tip or base.
- Clip off the leaves, allowing about ½ inch of the leaf stalk to remain as a handle.
- Best to use immediately (but can be stored).

# Selecting the bud from Budstick



To cut bud from budstick, start  $\frac{1}{2}$  inch below the base of the bud. Make a smooth, slicing cut upward that extends  $\frac{1}{2}$  inch above the bud.

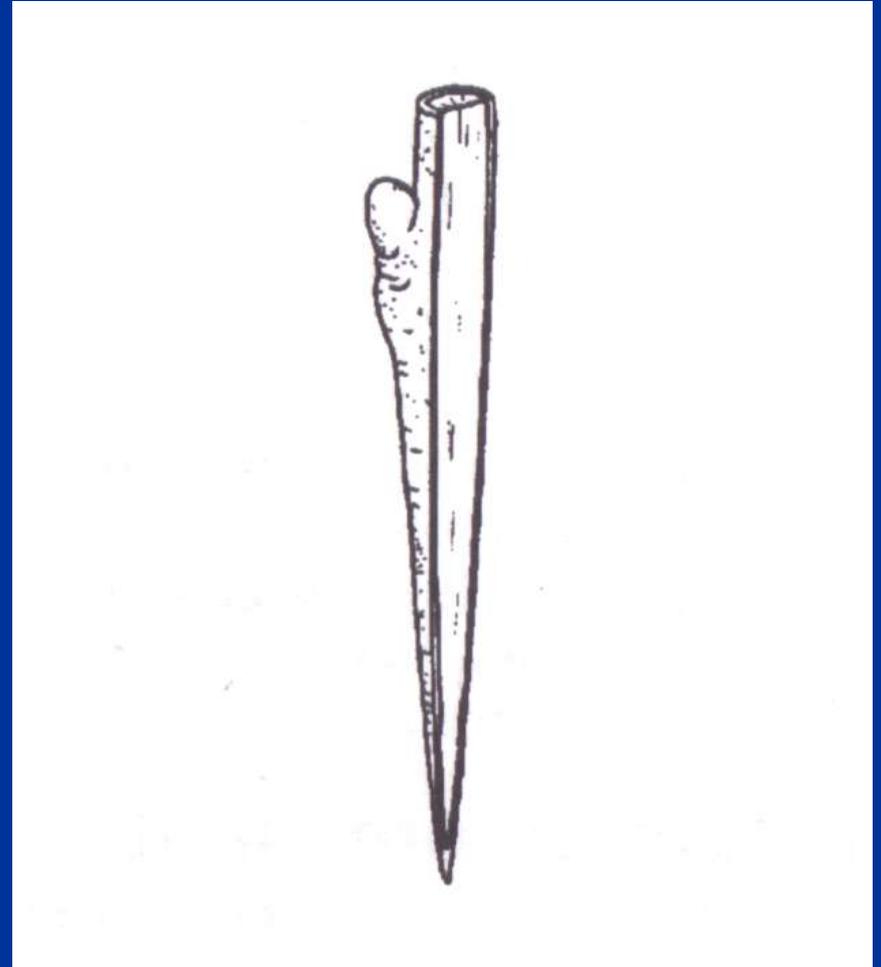
As you finish the cut, use the thumb to pinch the bud against the knife blade to detach the bud.

# The Finished Bud

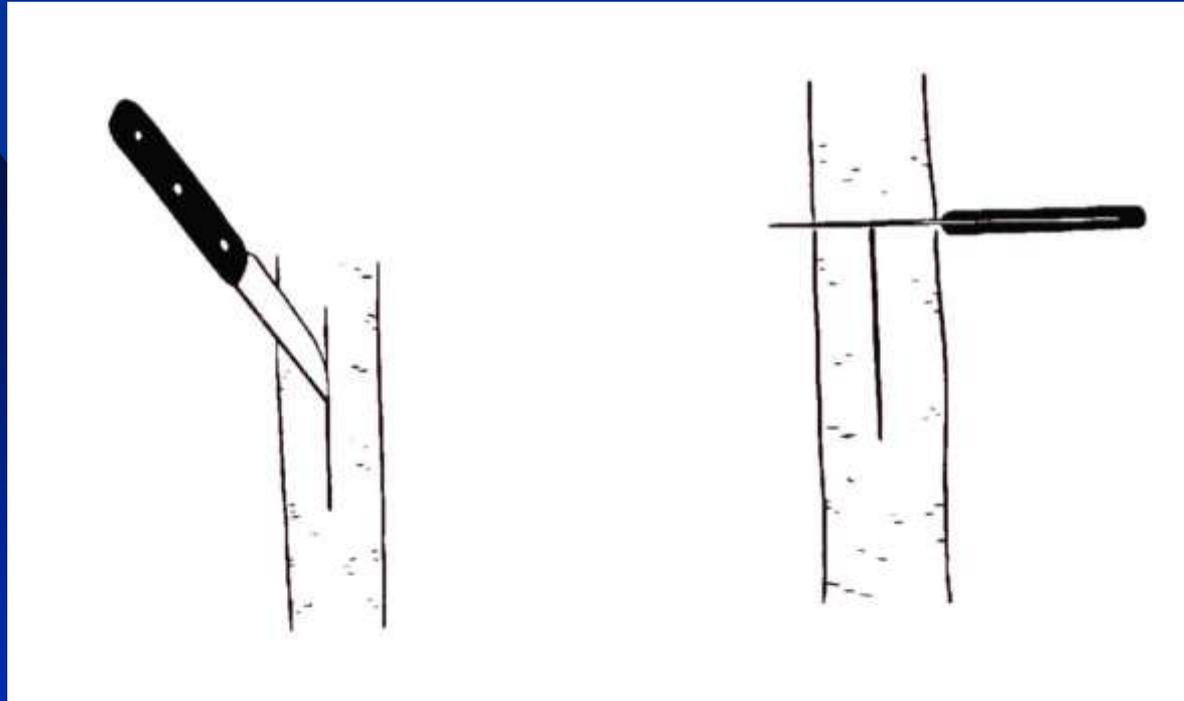
You must cut the wood (shield) attached to the bud straight. A curve in the shield (wood attached to the bud) makes poor cambial contact.

Some budders remove this wood shield, leaving only the bark and bud for insertion.

Insert immediately, before the bud or understock dries out.

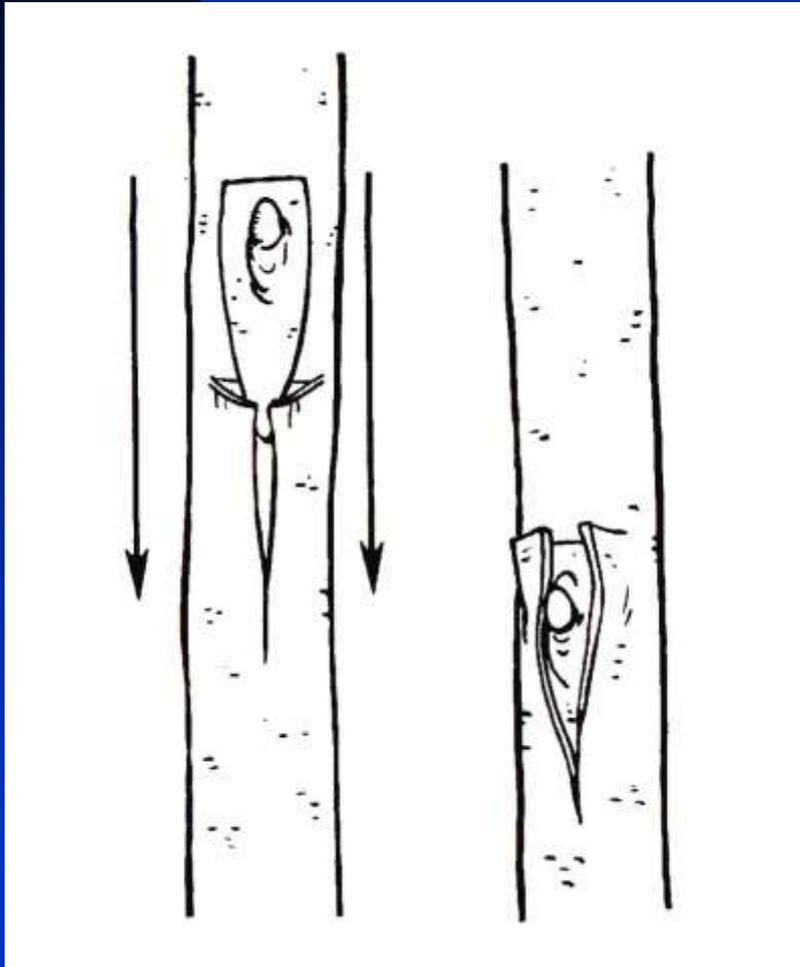


# Forming a “T” Cut in the Stock



Select a smooth, branch-free location on the stock. Make a vertical cut through the bark about 1½ inches long, then make the cross cut at the top of the first cut. Cut through the bark but not into the wood.

# Insert the Bud



Gently lift the bark at the junction of the two cuts with the knife.

Place the base of the bud shield into the slit at the top of the T cut.

Slide the bud down into the vertical slit until the top of the shield is even with or below the cross cut.

Leaving the  $\frac{1}{2}$  inch of leafstalk as a handle can make insertion easier.

Prompt insertion as soon as the buds have been cut from the budstick is important for success.

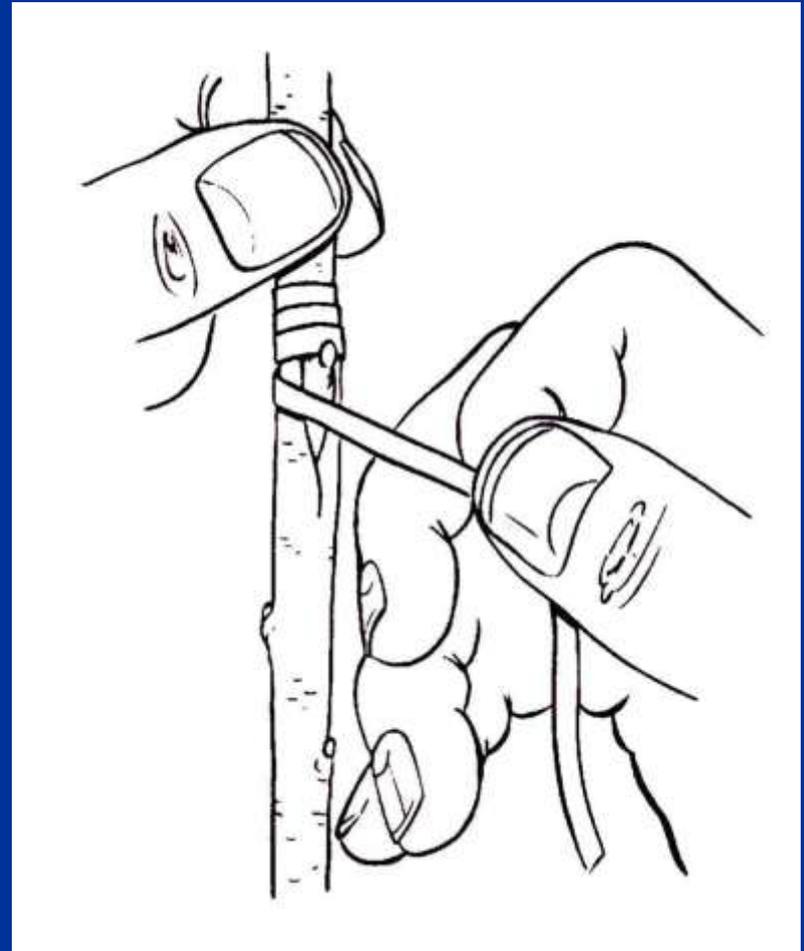
# Wrapping the Bud

Rubber budding strips are common and easy to use. However electrical tape can also be used.

Start either above or below the bud. Starting above the bud and wrapping downward keeps from pushing the bud out of the bark.

Cover all cut surfaces in the bark, leaving the bud exposed.

Electrical tape will need to be cut or removed after about a Month.



# Care of the Young Bud

- Check the bud after about 10 days. If the bud and surrounding bark are shriveled and dry, it has not taken.
- If the union has taken place, the bud and shield will look fresh, green and the petiole has fallen off.
- In late winter, cut off the stock above the bud to allow the new bud to grow into a new tree.
- As the bud begins growing, remove all shoots growing from the rootstock below the new bud.

# Alive & Well

Callus Tissue



# Growth Starts In Spring.

Top of rootstock  
or grafted limb has  
been removed.



# Bud Graft Crook

Y  
O  
U  
N  
G  
  
T  
R  
E  
E



The top of this tree  
Has been bud  
Grafted

In total – this tree  
Has been top-  
Worked 3 times

1. Bark graft
2. Cleft graft
3. Bud graft



J  
A  
P  
A  
N  
E  
S  
E  
  
P  
L  
U  
M



Plum  
Over-growing  
Rootstock

Shows a slight  
incompatibility



# Bur-Knot



- Minor problem  
  
(Tree could break off if severe)

# Reasons for Graft Failures

- Stock and scion are not compatible.
- The cambiums were not meeting properly.
- Scions were upside down.
- Grafting was done at the wrong time.
- Understock or scion were not healthy.
- Scions were dried out or injured by cold.
- Scions were not dormant.

- The graft was not properly covered with grafting wax.
- The scion was displaced by storm, birds or other means.
- The graft was shaded too much by other growth.
- The graft was attacked by insects or disease.
- The graft union was girdled because tape was not cut or released in time.

# Planting New Tree

- When tree is dormant
- Keep root system moist
- Dig ample size hole
- Do not add soil amendments to hole
- Return bottom soil to bottom of hole
- Place graft union 2-4 inches above ground
- Add 5 gal. water to each tree
- Stake tree for support

# Support

(Figure – 8)  
tie





Carol DeMuth

Artist

Toledo, Oregon