Budding and Grafting

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The Home Orchard: Growing Your Own Deciduous Fruit & Nut Trees

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Fruit Tree Terms

- **Rootstock** – tree below graft union
- **Scion** – Tree above the graft union
- **Crown**: trunk below ground (also canopy)
- **Tree size**
  - **Standard** – 20-25 ft.
  - **Semi-dwarf** (dwarfing rootstk) - 12-20 ft.
  - **Genetic dwarf** (std. rootstock) - 8-12 ft.
    - Peaches, nectarines, citrus
GRAFT / BUD UNIONS

English on Black Walnut

Almond

English on Paradox Walnut

Apricot
Genetic Dwarf Peach
INTERNODE LENGTH

Standard Peach

Genetic Dwarf Peach
Fruit Tree Terms (Cont.)

- **Branch** – Growth that is 1+ years old
- **Shoot**: current season elongated growth
- **Scaffold branch**: main structural limb
- **Spur**: short fruiting twig
- **Water sprout**: vigorous shoot from branch or trunk
- **Sucker**: shoot from rootstock or roots
Spurs

Asian Pear

Cherry
Peach Fruiting Branches

Veg. bud

Flower buds
Vascular Tissues

- **Phloem** – inner bark tissue that conducts carbohydrates, hormones, etc. from the site of production to tissues and organs throughout the tree.

- **Xylem** - woody tissue, located inside the vascular cambium, through which most of the water and nutrients in a tree are conducted.
Meristematic Growth

- **Meristem** – undifferentiated plant tissue from which new cells and new plant tissues arise.
  1. **Apical meristem** – forms terminal growth
  2. **Vascular cambium** (“cambium”) – actively dividing layer of cells between bark and wood; produces new sapwood to the inside and new phloem to the outside; causes thickening

- **Callus** – undifferentiated tissue that forms a around a wounded plant surface
Cross-Section of Trunk

- Rays
- Heartwood
- Wood (Xylem)
- Cambium
- Bark
- Xylem
- Cambium
- Periderm
- Phloem
Cross-Section of Trunk

- Bark
- Sapwood
- Heartwood
- Vascular cambium
- Functional phloem
Growth of Cells
1 Day After Graft

Stock

Scion
Growth of Callus Cells 5 Days After Graft

Scion

Callus bridges

Callus bridges

Stock
Natural Graft between Two Young Stems
Sequence of Healing of a Graft Union
Callus & Secondary Tissue Growth after Cleft Graft
Grafting Terms

- **Grafting** – branch or bud of a plant inserted into the stem or trunk of another
- **Budding / bud grafting** - inserting a single bud (scion) onto a stock
- **Budwood** – current-season’s shoot or 1-year-old branch used for budding
- **Scion wood** - 1-year-old branch for grafting
- **Topworking** – grafting onto large limbs to change the species or variety
Budding and Grafting

Reasons

- Produce new fruiting tree from rootstock sucker of dead, injured, or fruitless tree
- Repair tree with dying trunk
- Add pollenizers
- Make fruit salad trees
- Make tree or shrub with different colored flowers
Grafting Rootstock Suckers
Multi-Graft Trees

Fruit Salad Tree - FOHC

Pluots
Pink-Flowering Almond – FOHC
Kiyo’s Tree, Rancho Cordova
Knives
Folding T-budding knife with bark lifter

Knife with folding T-budding and grafting blades
Simple budding knife
Folding T-budding knife with separate bark lifter
Simple grafting knife
Popular Grafting Methods

**Budding**
- T-budding
- Chip budding

**Grafting**
- Whip graft
- Bark graft
- Cleft graft
Popular Grafting Methods

**Budding**
- T-budding
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**Grafting**
- Whip graft
- Bark graft
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T-Budding

- Removal of bud of desired variety (without wood), insertion in stock
- Bark must be “slipping”
- Spring → branch for current season
  - Late summer → branch for next season
- Use vigorous 1-year-old shoots, > ¼ in.
- Cut branch ½ in. above top of bud to force growth
T-Budding

Remove leaves from scion, leave petiole.
T-Budding

Top of T cut into bark  Downward cut into bark

Stock
T-Budding Stock

Peel back bark
T-Budding
Scion

Cut under bud, starting ½” below bud

Cut through bark only, ½” above bud
T-Budding
Scion

Squeeze bark, remove bud shield from wood

Or remove thin strip of wood too
T-Budding
Scion into Stock

Insert bud shield into T cut
T-Budding
Wrap with budding rubber or parafilm
Bud that “took”

Fall budded, headed in winter, new spring growth
Popular Grafting Methods

**Budding**
- T-budding
- Chip budding

**Grafting**
- Whip graft
- Bark graft
- Cleft graft
Chip Budding

- Removal of bud of desired variety (with wood), insertion in stock
- Bark doesn’t need to be “slipping”
- Done in dormant season, early spring (budwood stored in fridge), or late summer
- Use vigorous 1-year-old branches > \( \frac{1}{4} \) in.
- Cut branch \( \frac{1}{2} \) in. above top of bud to force growth
Budwood for Chip Budding

• Collect just before budding
• Base of current-season, fast-growing shoots (late summer) OR 1-year-old dormant branches (late winter / early spring)
• Buds that are mature, leaves removed
• Refrigerate immediately if needed, store in plastic bag with moist paper towel or newspaper
Chip Budding
Chip Budding
Remove leaves from scion, leave petiole
Chip Budding
Scion

Angled cut ½” below bud

Cut under bud to first angled cut
Chip Budding

Chip (inverted) with angled cut ½” below bud

STOCK

Make the same two cuts in the stock
Chip Budding
Scion into Stock

Chip inserted into stock

Smaller chip inserted on one side
Chip Budding
Parafilm Wrapped (Single wrap over bud)
Forcing Growth
(if needed)

Girdling (Shown Here) and Notching

3 months after spring girdling

Dormant season
Popular Grafting Methods

**Budding**
- T-budding
- Chip budding

**Grafting**
- Whip graft
- Bark graft
- Cleft graft
Whip Graft
Whip Graft

• Removal of 1-yr.-old branch of desired variety, insertion in stock (tongue in groove)
• Done before bud swell
• 1-year-old wood – match size
• Angled cut 1-1½ in. long in stock, scion
• Vertical cut 1/3 the distance from cut tip
Fig. 57 Whip-and-tongue graft
Whip Graft

Stock & scion of similar caliper

Make 1” to 1 ½” angled cuts in stock & scion
Whip Graft

Slice off “tail”

Equal cuts in stock & scion

Top of stock

Bottom of scion
Whip Graft

¼” vertical cut starting 1/3 the distance from the tip

Twist the knife outward to make insertion easier
Whip Graft

Scion inserted into stock

Parafilm tape wrapped
Whip Graft

3 weeks later

Remove competing shoots
Whip Grafting on an Older Branch or Trunk
Whip Grafting on an Older Branch or Trunk
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Whip Grafting on an Older Branch or Trunk
Commercial Walnut Grafting (early spring)

Make cuts in bark a few days before grafting
Angled cut on stock

Vertical cut on stock
Angled cut on scion

Vertical cut on scion
Scion inserted into stock

Wrap graft union
Graft wrapped

Wax over tape if tape is not airtight; wax over top cut
Months later

Lower shoots weren’t removed
Staked shoot

No stake was used
Popular Grafting Methods

**Budding**
- T-budding
- Chip budding

**Grafting**
- Whip graft
- Bark graft
- Cleft graft
Bark Graft

In spring:
Cut off limb, scrape bark

In winter:
Choose scion wood with plump buds
Bark Graft

Choose 1-yr.old scion below bend

Make long sloping cut

Make small sloping cut on back side
Bark Graft

Make 2 cuts through bark the width of the scion
Bark Graft

Peel back bark between cuts

Cut bark flap, insert scion
Bark Graft

Inserted scion, nail in flap & scion

Wax over all cuts
Alternative Bark Graft Method

Dual sloping cuts

Use single cut in bark, push knife laterally
Alternative Bark Graft Method

Insert scion

Inserted scion (no nail)
Alternative Bark Graft Method

Wrap tightly with plastic tape

Wax over tape & all cuts
Popular Grafting Methods

**Budding**
- T-budding
- Chip budding

**Grafting**
- Whip graft
- Bark graft
- Cleft graft
Cleft Graft

Choose 1-yr.old scion below bend

Split stock

Hold stock open
Cleft Graft

Make 2 slicing cuts at base of scion, slightly angled to each other.
Cleft Graft

Make angled cut at base

Insert scion in stock
Cleft Graft

- Scion inset in stock
- Match cambiums
- Use 2 scions for large stocks
Cleft Graft

Wrap tightly with grafting tape

Pat on grafting wax
Two Other Topworking Methods

Side Graft
Saw Kerf Graft
Side Graft
Saw Kerf (Cut) Grafting
What Topworking Would You Do in This Situation?
Innovative Grafting
Approach Graft

Fig. 23  Spliced approach graft
Bridge Graft
Arborsculpture
Tie Down Branch Beyond Graft
Slicing cut 1
Slicing cut 2
Cuts
Square of Cambial Contact
Grapevine Propagation
Grape Bud

- Smaller secondary dormant bud
- Flower cluster primordia
- Apical meristem of primary bud
- Tendril primordia
- Larger secondary dormant bud
- Diaphragm
- Pith
- Leaf petiole
- Phloem Xylem
Cane Stocks Debudded
Scions
Figure 1.12. Omega cut graft (left) and revolving knife cut graft (right).
Putting Scions Together
Figure 8. One type of machine used to prepare root grafts of grapevines and fruit trees. See figure 9 for an illustration of the graft made by this machine.
Growing Grapes from Cuttings

- Take cutting from dormant vine, ½ in. dia.
- Cut to 18 in. long
- Cut off all buds but the upper 2
- Stick in loose soil, upper 2 buds exposed
- Plant 2 per hole, remove weaker one
Questions?