

**The University of Arizona
Master Gardener Association
Yavapai County Cooperative Extension**



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WHAT IS GRAFTING?

- UNION OF TWO *RELATED* PLANTS – A ROOT STOCK, AND SCION WOOD
 - Some advantages of each can be taken by the combination
 - Is a technique for cloning the scion wood parent
 - Requires the joining (healing together) of the two cambium layers
 - Compatibility of the two must be considered



GRAFTING ADVANTAGES?

- Cloning reproduces varieties precisely
 - Some species are difficult to root. Stem cuttings don't easily produce clones
 - May extend the use of rare / desirable scion material
- Root stock may
 - impart disease resistance or hardiness
 - shorten the time to fruiting
 - dwarf the matured tree
- Optimize cross-pollination and pollination
- Extend harvest time on one tree
- Accomplish successive ripening on one tree





GRAFTING DISADVANTAGES?

- Cloning cannot develop new varieties
- Requires specialized skills
- Resulting plant may be shorter lived, i.e. the graft may be frost killed
- Can spread viral diseases



SOME GRAFTING TYPES:

- Cleft graft – most common, most often taught, simplest and easiest
- Whip and tongue graft, very strong, secure result. More skill is required.
- Saddle graft – (upside down cleft)
- Bud graft – summer, when bark is slipping
- Bark or Rind graft – for mismatched diameters
- Bridge graft – can repair severe trunk damage or girdling

FACTORS FOR A SUCCESSFUL GRAFT:



Compatibility: The stock and scion must be compatible

Cambium alignment and pressure: The vascular cambium of the scion and stock should be tightly pressed together and oriented in the direction of normal growth. This encourages the tissues to join quickly, allowing nutrients and water to transfer from the rootstock to the scion.

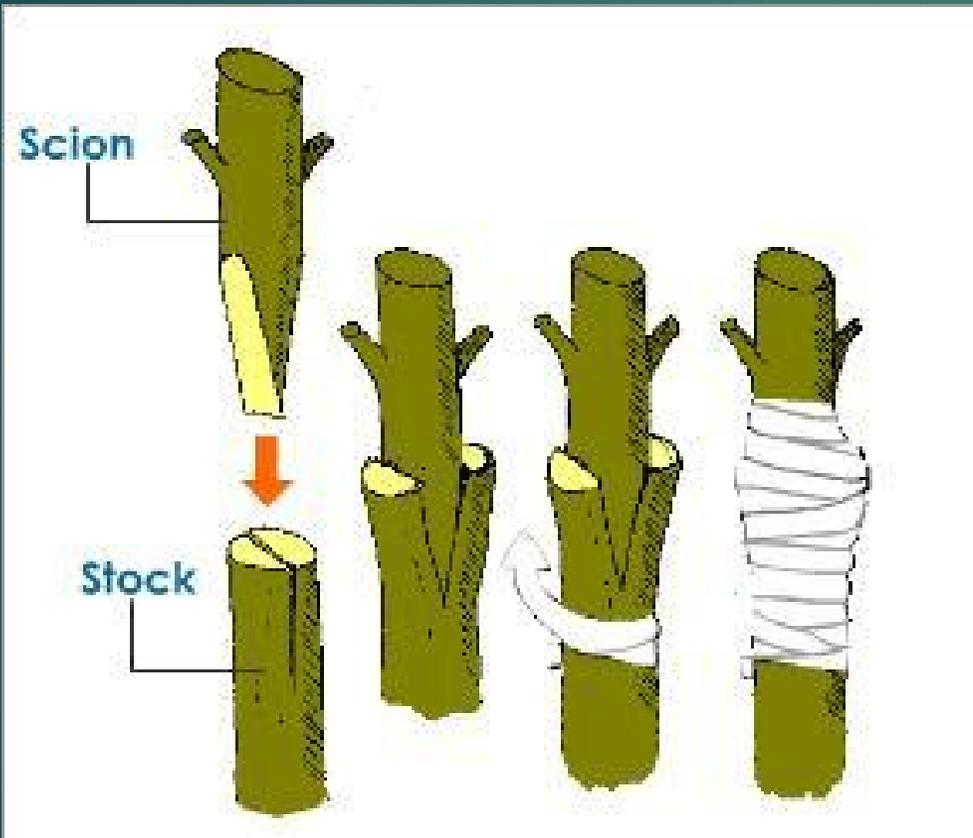
Timing: Grafting must be done at a time when the scion and rootstock are in the correct physiological stage (which can vary with species.) This usually means the scion buds are dormant while the cut tissues at the graft union are capable of producing callus tissue for healing the graft. Premature budding can drain the grafting site of moisture before the grafting union is properly established. Temperature greatly affects the physiological stage of plants. If the temperature is too warm, premature budding may result. High temperatures can slow or halt callus formation.

Protection: Immediately after grafting, all cut surfaces must be protected. Various grafting tapes (parafilm or electrician's tape) and waxes are used to **protect the scion and stock from dehydration**. To add structural support twine, elastics or string is used.



Cleft Grafting

<https://heritagefruittrees.wordpress.com/2012/09/17/the-cleft-grafting-process/>



- Grafts are wrapped to prevent drying out (which is the main cause of graft failure) and to strengthen the union while callousing and healing
- Utilizes "scion wood" with 3 - 5 buds
- Most common, easiest
- Best with fully dormant scion wood (cut early and refrigerated)
- and when roots are also dormant, OR actively pushing sap (leaves coming out at 'mouse ear' size)
- Timing varies with species

Cleft Grafting

<https://www.youtube.com/watch?v=ICVwHs4Nero>



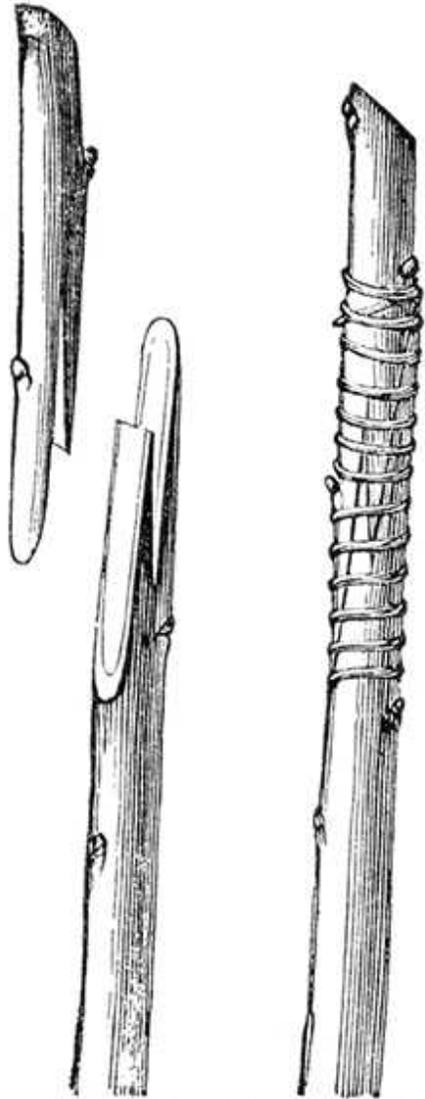


Fig. 2 — Greffe anglaise, montrant les languettes préparées et la manière de les réunir.

oldbookillustrations.com

Whip & Tongue Grafting

<https://www.oldbookillustrations.com/illustrations/whip-and-tongue-graft1/>

- Utilizes “scion wood” with 3 - 5 buds
- In early spring
- Best with fully dormant scion wood (cut early and refrigerated)
- and when roots are actively pushing sap (leaves coming out at ‘mouse ear’ size)
- Timing varies with species



Whip & Tongue Grafting

<https://www.youtube.com/watch?v=aKV6gPmzeDU>



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Bud Grafting

<https://youtu.be/8rhb8QBfjws>



Utilizes “bud wood”

On trees in summer
when bark is
“slipping”

Common practice
in rose bush & citrus
propagation.



Bark or Rind Graft

<https://www.youtube.com/watch?v=qTtXmBVsolY>

<https://youtu.be/JxEHqwfArP4>



Scion is slipped *beneath* the bark, over the wood. (with the root material in the ground.)

A method used to replace the variety of fruit

Can convert an entire, mature orchard into a different variety, or accomplish successive ripening on one tree.



Bridge Graft



To repair a tree (especially in historic orchards) scion wood is 'grafted' to each side 'bridging' an area which was damaged due to wildlife chewing, weather, or other mechanical damage.

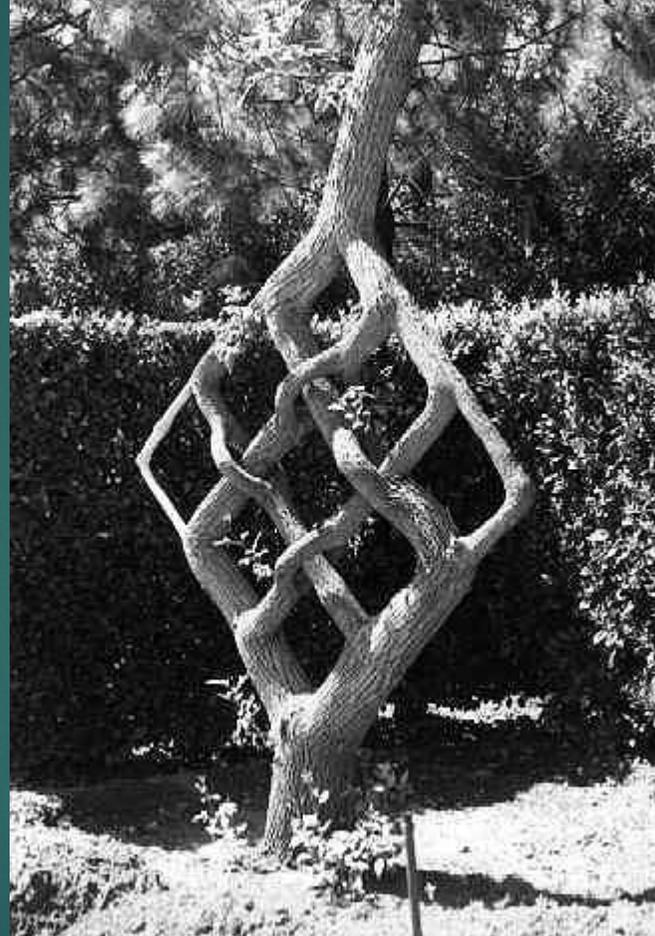


Approach Graft

<https://en.wikipedia.org/wiki/Grafting#/media/File:Needle.jpg>

<http://www.arborsmith.com/how-to-grow-a-chair>

- Ornamental
- Creates a novelty item





ROOT STOCK GOVERNS:

- Precocity – How long till it bears fruit
- Mature Size
- Security of root system – how long staking is required
- Some disease resistance, especially root diseases





SCION WOOD GOVERNS:

- Chill hour requirement
- Bloom Time
- Days to harvest after bloom – and timing of harvest
- Type and Quality of fruit
- Other disease resistance properties





GRAFTING TERMS:

- Top working – grafts on established trees
- Bench grafting – grafts on root stock (before planting, when it is out of the ground)
- Double working - interstem

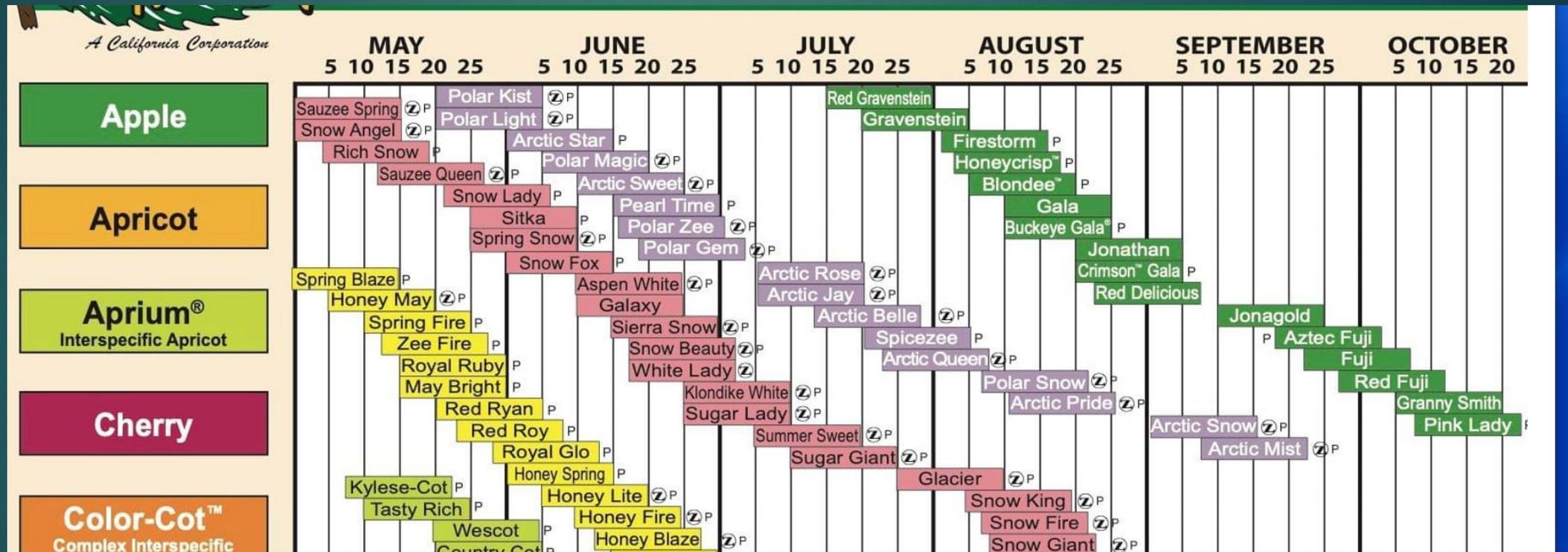


WHY TOP-WORK GRAFT?

- Variation of fruit
- Harvest season extension
- Weather considerations
- Conversion of undesirable types
- Preservation of genetic diversity



Variation of Fruit and Harvest Season Extension



Weather variability considerations

- Variations in:
 - Bloom time between varieties – Blossoms are the most tender
 - Frost susceptibility – When bloom is over, some fruit is less easily damaged than blossoms
 - Weather from year to year – best variety one year may not be best next year
 - More varieties can provide a more uniform crop.
 - Unanticipated micro-climate influences – wind protection



Bench Grafting



You can see the root on the right of his hands. He's pointing to where he will perform the graft.



Conversion of undesirable varieties and Preservation of heirloom varieties

- Opportunity to have a preferable variety on an established tree:
 - Limited varieties in young nursery trees available
 - Cider Apples
 - Specialty Baking Apples
 - Heirloom variety scion wood may be acquired (bought or traded for) on line.



Experience and Learnings

Approximations:

- Apples:
 - 78 grafted varieties added to 5 full/semi & 10 dwarf apple trees
 - No fruit on any grafts on the full sized tree. May take scions from it and put them on one of the other sized apples.
- Apricots:
 - 15 grafts added on apricots, 7 of those are interspecifics
 - Unusual and delicious interspecifics
- Cherries:
 - 8 varieties on 2 cherry trees
 - One sour onto sweet cherry
- Jujube
 - 2 varieties on 1 jujube, several others failed
 - One broke bud a full year after the graft was placed
- Mulberry
 - Multiple grafts onto mulberry, all leafed out, then failed
 - Scions were from Phoenix
- Peaches:
 - A couple very successful grafts onto full sized peach, several failures
 - Grafts on twiggy fruiting wood take, then die
 - Four successful genetic dwarf grafts onto 1 full, 1 on another genetic dwarf peach
 - Full converted to dwarf



Experience and Learnings

Approximations:

- European Pear:
 - 10 varieties of European pear onto a European pear
 - 5+ grafts onto Asian pear suckers
 - Root suckers can create new trees
- Asian Pear:
 - 6 grafts of heirloom pears on an established Asian pear
 - Preservation of Oregon historic pear orchard
- Persimmon:
 - 6 grafts on Fuyu Persimmon
 - Non-astringent converted to astringent
- Asian Plum:
 - 12 grafts on Asian plum, 3 are interspecifics
- European Plum:
 - 6 European plums added to another European plum
 - European pear good on Asian, not vice-versa
 - Europeans are the ones good for drying



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extension.arizona.edu/yavapai

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Cooperative Extension

Yavapai County

