Plant Propagation PLS 3223/5222

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Chapters 11-13

Grafting and Budding
Origins, Terminology and Benefits

Chapters 11-13 Grafting and Budding

Lectures

- Origins, terminology, and benefits
- Graft union formation
- Types of graft and budding procedures
- Graft incompatibility

Guest Lectures

Williamson - Principles and procedures of grafting and budding

Dr. Jeff Williamson

Dr. Williamson is a professor of Horticultural Sciences with the University of Florida. He is a deciduous fruits extension specialist and his research includes the culture and management of deciduous crops.

- Grafting and Budding Lecture
- Grafting and Budding Demonstration

Origins

Chinese - 1000 BC

Aristotle (300BC) – considerable understanding

Paul the Apostle (Romans) - grafting “good” olives on “wild”

Early U.S. nurseries were tree fruit nurseries

TERMINOLOGY

- **Grafting** is the art of joining two pieces of living plant tissue together in such a manner that they will unite and subsequently grow and develop as one composite plant.
  - As any technique that will accomplish this could be considered a method of grafting, it is not surprising that innumerable procedures for grafting are described in the literature.

TERMINOLOGY

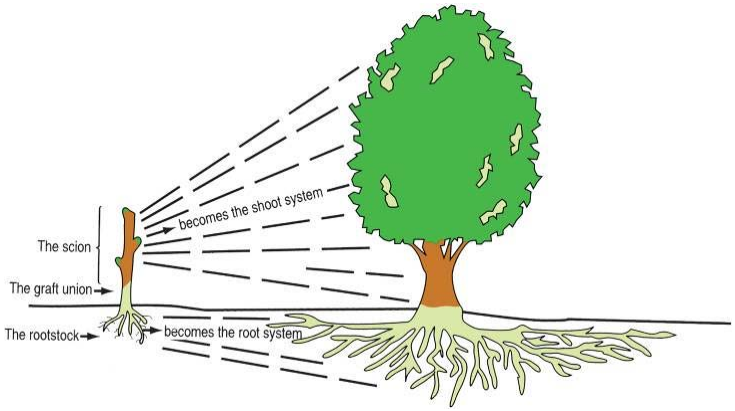
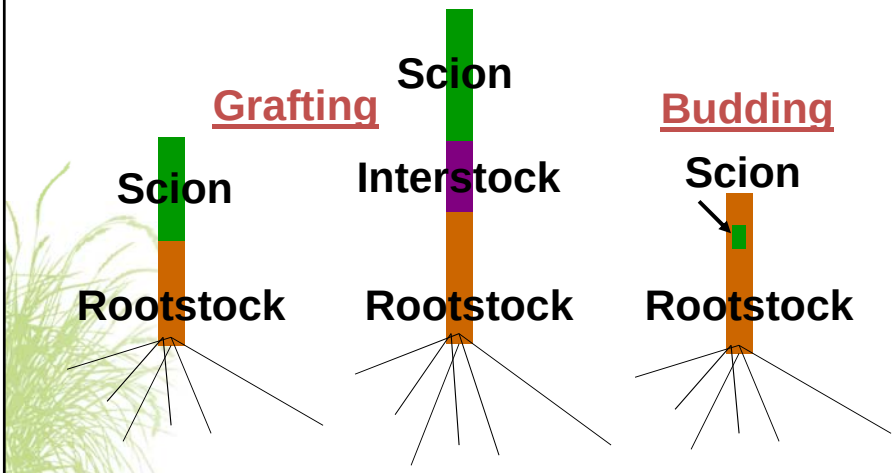


Figure 11–5 In grafted plants the shoot system consists of growth arising from one (or more) buds on the scion. The root system consists of an extension of the original rootstock. The graft union remains at the junction of the two parts throughout the life of the plant.

TERMINOLOGY

- **Budding** is a form of grafting.
  - However, the scion is reduced in size and usually contains only one bud.
  - An exception to this is patch budding of pecan, where secondary and tertiary buds are adjacent at the same node to the primary bud.

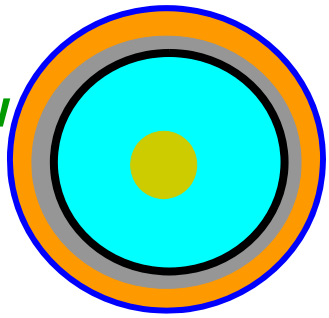
Terminology



Terminology review

"Bark"
- Periderm
- Cortex
- Phloem
- Cambium

"Wood"
- Secondary xylem
- Pith (if present)



TERMINOLOGY

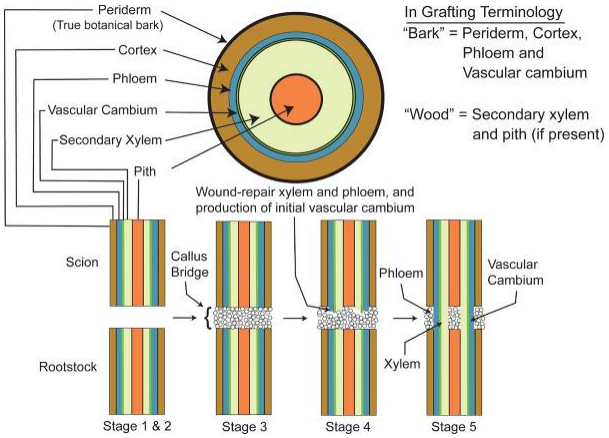


Figure 11–6 Top: Grafting terminology of the "bark" and "wood" and associated tissues with schematic drawing of a stem cross section of a young woody plant stem. Bottom: Schematic longitudinal section of the stages of graft union formation: (Stage 1) Lining up vascular cambiums of the rootstock and scion, and (Stage 2) subsequent wound healing response. (Stage 3) Callus bridge formation. (Stage 4) Wound-repair xylem and phloem occur in the callus bridge just prior to initial cambium formation. (Stage 5) The vascular cambium is completed across the callus bridge and is forming secondary xylem and phloem.

Reasons for Grafting or Budding

- Perpetuating clones
- Disease resistance: cucumbers, tomatoes
- Vigor: roses, citrus
- Hardiness
- Topworking
- Hastening reproductivity
- Special forms: dwarfing apples, weeping or upright ornamentals
- Repair of mouse damage

Creating composite plants

- Different cultivars may be combined - each part providing a special characteristic

- Scions - clones
- Interstock - clones
- Rootstock - seedlings or clones

Benefits of scions

- growth rates
- fruit characteristics
- yield
- growth form
- disease resistance
- pest resistance

Selection, Handling, and storage of scionwood for grafting

- Generally one-year-old or less
- Healthy, vegetative buds must be present
- Select vigorous, well-matured, hardened shoots from the upper portion of the tree
- Select mature wood with short internodes

Storage of Scion Wood for Grafting

- Keep slightly moist
- Keep cold enough to prevent elongation of buds.
- Often stored in plastic bags
- Often contain moist saw dust or peat moss distributed throughout the bag
- Short term storage temp. 40 F
- Long term storage temp. 32 F

Scionwood for Budding

- Also called – budwood or budsticks
- Collect from current season's growth
- Use promptly after cutting
- Usually only a days supply at a time
- The leaves are generally removed as the budwood is collected

Benefits of rootstocks

- Greater resistance to environmental stress and disease
- Hastening plant growth rate and reducing nursery production time
- Improving transplanting success

SEEDLING AND CLONAL ROOTSTOCK SYSTEMS

- Utilization and Propagation of Seedling Rootstock
- Utilization and Propagation of Clonal Rootstock

Figure 11–7 An incompatible graft with the melon scion forming adventitious roots above the grafted Cucurbita rootstock. The melon will establish its own roots above graft, which is not desirable

Rootstocks for Grafting or Budding

Seedling Rootstock remains the major rootstock source for most crops

– exception – apples

- Certain clones may be used as seed sources
- Seedling genetics can make important contributions to tree productivity

Seedling rootstock production

Field production

Seedling Rootstock production

Container production

Rootstocks for Grafting or Budding

Clonal rootstock – specific genotypes selected for potentially useful characteristics

- Apple rootstocks (East Malling)
- Pear rootstock ('Old Home' X 'Farmingdale')

- Propagated via asexual reproduction
  - layering, cuttings or micropropagation techniques

Clonal Rootstock production

Stooling by trench layering

Clonal Rootstock production

Cutting and Container production

Clonal Rootstock production

Micropropagation

Benefits of interstocks

- Commonly referred to as Double-Working
- The interstock makes it possible to avoid certain kinds of incompatibility
- The interstock may possess a particular characteristic not possessed by either the rootstock or the scion.
  - Disease resistance
  - Cold hardiness
  - Dwarfing effects

Benefits of interstocks

- Reduce vegetative growth
- Enhance reproductive maturity
- Obtain special forms of plant growth
  - Weeping forms
  - Tree forms (roses)
  - Patio (miniature) fruit trees

Other grafting applications

- Repair damage to established trees
  - Winter injury
  - Mechanical injury
  - Animal injury
- Disease indexing – testing for virus diseases

?

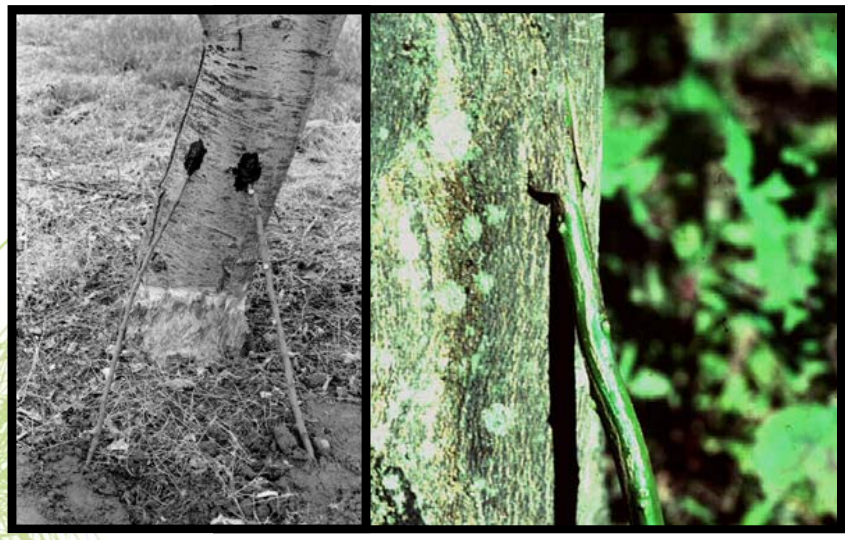
Repair Graft

Inarching - The top of the new rootstock plant usually extends above the point of the graft union.

- used to replace or repair damaged roots

Bridge graft – scion wood is used to reestablish a connection for water, nutrient and carbohydrate supply.

- used to repair damaged trunks or stems



Natural grafting

- Common in nature
- May be used to provide additional structure for trees
- Not as obvious in root systems but more widespread than with branches
  - More significant because of the exchange of water , nutrients, metabolites, and disease.