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# Propagation by Grafting and Budding

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**Grafting is a term which covers many propagation techniques. It includes the scion or the above ground part of the plant.**

**Scion** A piece of detached twig or shoot. The scion usually contains two or three buds, although it may contain more. When the scion is only a single bud, the type of grafting is called budding.

**Cultivar** This is a term now used in place of variety. It means cultivated variety and differentiates a plant from a botanical or natural variety.

**The rootstock or lower portion of the grafted plant. The rootstock provides the root system for the new plant.**

**Rootstock (also stock or understock)** This term means the part of the graft that produces the root system of the grafted plant. It must be related to the scion and often has dwarfing or other desirable characteristics.

**Interstem on fruit trees helps dwarfing or incompatibility. Interstock (also interstem)** This is a piece of plant (to form part of the trunk) grafted between the scion and understock.

**Grafting with interstocks is double working. Interstocks are not normally needed with ornamental plants.**

**Grafting Tools; Usually simple but some machines are complex and expensive.**

**When grafting, make clean cuts in the tissue of the two pieces. The cambium tissues must match together. Cambium is the meristematic tissue layer in woody plants. It is a layer of tissue immediately under the bark in stem and roots.**

**The botanical limits of grafting**

**Grafting within species, Grafting of species within the same genus**

**Grafting of different genera within the same family** *Pyrus communis* (Pear) with *Cydonia oblonga* (Quince)

**Grafting between families:** Plants of different families cannot be grafted successfully Reports of relatively short-lived grafts of herbaceous plants of different families have been made but there is no successful commercial or home grafting of different woody plant families

**Reasons for grafting plants**

**Propagate plants not economically done other ways**

**Cultivars of ornamental shrubs and trees**

**To control tree growth and performance**

Malling series and other dwarf rootstocks

**To control grape phylloxera, fire blight and other pathogens**

**To bring fruiting plants into production earlier**

**Add a pollinator**

**All fruit crops are commercially grafted**

**Fruit at 2-3 years**

**Grafting to obtain special effects in plants**

**Weeping standards**

**Multiple cultivars on the same tree**

**Preserve old cultivars**

**Grafting as an orchard management technique**

**Top working of fruit trees to change varieties**

**Frame working of fruit trees to assist pollination**

**Successful grafting needs the right time of year**

Active growing stock + Dormant scion

**Scion material at correct stage of growth**

**Growing environment** Healthy, growing trees without pest problems

**Maintain correct polarity of stock and scion. The proximal scion end is fitted to the stock distal end.**

**Incompatibility in grafting**

**Graft compatibility means two closely related plants will graft if there is no physiological or morphological reason for a union to fail.**

**Graft incompatibility occurs when morphological or physiological reasons can prevent related rootstock / scion combination from forming a strong union. Incompatibility is not common with ornamental plants.**

**Most rootstocks used for grafting are closely related to the scion**

Vegetative propagation can transmit diseases

**There are two basic grafting systems**

**Field Grafting –rootstocks are grown and grafted in the field**

**Selection of suitable rootstocks**

**Ornamental rootstocks used are closely related species to the scion**

**Seeds are easy to propagate and fast growing**

**The rootstock vigor determine size and vigor of the grafted plant**

**This controls the size of fruit trees and shrubs**

**Bud grafting**

The scion is a single bud

It uses scarce scion material economically

Simple to learn  
Fast to do

High success rates (95-100% common)  
Budding produces a strong union

**T-budding**  
**Chip budding**  
**Patch budding**

**Plants that are budded**

Deciduous fruit trees  
Nut trees  
Citrus

Roses  
Roses  
Ornamental trees

**Top grafting**

**In top grafting the top is removed from the rootstock. The scion shoot is grafted in to the top end of the rootstock stem. Used both in the field and in bench grafting. Top grafting is much slower than budding. Many styles are complicated to carry out. Used in spring when t-budding is not possible.**

Cleft grafting  
Bark Grafting  
Bark grafting of walnuts  
Bridge grafting

**Examples of top grafted plants. Many species do not respond well to top grafting. Once the top is removed from the rootstock, uptake of water and mineral nutrients is restricted. This prevents a graft union from forming.**

**Graft the scion onto the side of the rootstock in side grafting. The top stays on the rootstock for moisture and nutrient uptake. Side grafting is only done on container grown rootstocks. The grafted rootstock is grown on in a greenhouse. Collect dormant scion material in winter and cold store until use.**

**Approach grafting is an old fashioned horticultural curiosity. Usually considered to be the last resort in grafting. Other grafting systems are detached scion grafting. In approach grafting the scion remains attached to the mother plant until the graft union forms. It is used to graft tomato varieties onto disease resistant rootstocks.**

**Grafting unrooted cuttings eliminates rootstock production. The unrooted cutting roots develop as the graft union heals. Both processes need the same greenhouse environment. Grafting machines speed up the grafting process. It also enables the grafting to be carried out by less skilled staff. Scions and rootstocks must match in diameter**

**Several materials are used for securing the graft union. It depends on grafting technique and post-grafting environment. Tie or wax the union is to keep it from drying out.**

**Tying materials for grafting**

Grafting Wax  
Toilet Bowl Wax

Silicon Seal  
Plastic Roofing Cement

Others?

**With t-budding, use rubber bands that disintegrate. PVC tape is used but must be cut off after the graft forms. Use laboratory "Parafilm". This thin, stretchable tape keeps the graft union from drying out. It degrades rapidly so it does not need to be removed.**

### Reasons for failure

Stock and scion were not compatible  
The cambiums were not meeting properly  
Scions were upside down  
Grafting was done at the wrong time  
Reasons for failure  
Scions were dried out or injured by cold  
Scions were not dormant  
Stock and scion were not compatible  
The scion was displaced by storm, birds or other means

Reasons for failure  
The graft was not properly covered with grafting wax  
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

### Rootstock nursery

Rootstocks are produced in specialized nurseries  
Clonal rootstocks are produced with mound layerage  
Seedlings are produced from seed sown in the nursery row

### Plant Propagation:

Mound layering: Strong root systems are developed in rows The shoots that arise are cut back close to the root each year to force plants As the plants grow media is mounded around the shoot base for rooting.

Layering: Layering is the rooting of the scion while it is attached to the mother plant

Tip	Mound
Simple	Air

### Mound Layering Media

Sawdust or sawdust with added ingredients is added several times during the summer to induce ideal rooting conditions at and above the crown of the growing rootstocks

### APPLE ROOTSTOCKS

M 27 – 20-25% SDLG  
M 9 – 25% SDLG  
M 26 – 33% SDLG  
M106 – 50% SDLG  
M 7 – 50-60% SDLG  
M 111 – 66% SDLG

### EMLA = VIRUS FREE STOCKS

GENEVA 65  
BUDAGOVSKI 9  
GENEVA 26  
GENEVA 30

Propagation by budding:

T-bud	Fruit trees, roses
Patch bud	Walnut, pecan
Chip bud	Fruit trees, grapes

### **Budding:**

“T” budding

Cuts in rootstock: 1 ¼” vertical cut      ¼” cross cut      6” above soil  
 Scion: shield 1” long      ¾” below to 1/4” above the bud

### **Chip and patch budding**

Newly budded trees

### **Summer Bud in August**

North side, Petiole abscises on good buds, Petiole dries and remains on dead buds

Top pruning The rootstock tree top is cut off in the spring. The cultivar tree grows during the year and is dug in the fall.

### **Time-line for trees**

Liners planted spring , Budded August, Cut rootstock off spring, Grow cultivar summer, Dig trees fall, Plant trees spring. Interstems – add one year

### **Propagation by grafting:**

Whip/bench/tongue graft was used long ago for tree production. A root and a scion were joined with an elaborate graft in a root cellar in winter.

### **Top grafting: crown of the root, trunk, and on limbs**

Grafting: Whip, bench, piece root, or tongue graft. Graftage: When plants are difficult to root or wanted on another root than their own, grafts of the desired scion and a rootstock are made  
 Graft = scion + root Bud = root + 1 bud

Cleft graft: A scion of 4-5 buds is cut to form a double tapering (top to bottom, and out to in) wedge It is placed in the cleft of the rootstock so that cambium layers line up. The union and tip of the scions are covered with grafting wax.

Bark graft: Scions are placed when cambium is slipping. The bark is cut to accommodate the scion and the scion (cut with a sloping cut) is nailed to the stock.

**When to graft?**

**When to bud?**

Graft in the spring

Collect scions in mid- to late-winter

Store scions in cool - 2-4 °C, moist conditions

Graft just as cambium begins to divide!

Bud in August in cool climates

Collect scions just before budding

Store scions in cool - 2-4 °C, moist conditions

Bud while cambium is still dividing!