

Basic Plant Propagation

Sexual vs. Asexual (Clonal/Vegetative) Reproduction

- Sexual Reproduction is when genetic material from two parents is combined to create new offspring.
 - Meiosis occurs and the resulting plant is genetically different from the parent
 - Advantages:
 - Many seeds can be collected and stored
 - Seeds are small and easy to transport
 - Seeds produce a taproot
 - Traits from different varieties can be combined to create new varieties
 - Disadvantages:
 - The genetic variability of seeds requires that time and resources be expended before the product/fruit is produced and evaluated
- Asexual/Clonal/Vegetative Reproduction is taking a plant part – root, leaf, or stem – and inducing it to develop a plant of its own. Examples of asexual propagation include division, cuttings, air layers, and grafts.
 - The resulting plant is genetically the same as the parent – a clone
 - Advantages:
 - Rapid multiplication of individual plants
 - Uniformity as the resulting plants are clones of the original plant
 - Ability to generate large plants quickly
 - Possibly the only option available for some species or cultivars
 - Disadvantages:
 - Lack of a taproot
 - Increased transmission of disease

Sexual Reproduction – Tree Seeds

- Seed Storage
 - In general, if a tree loses its leaves in the dry or cool season, then the seeds can be stored
 - Example: Annona, persimmon, guava
 - If the tree is evergreen, then the seeds need to be planted right away
 - Example: avocado, mango, jackfruit, lychee, cola, wax jambu, mangosteen, loquat
- Seed Dormancy
 - Heat treatment
 - Brief exposure to heat (40 C)
 - Hot water soak (Example: Acacia)
 - Scarification – damaging the seed coat allows water to enter so germination can begin
 - Stratification – storing seeds in a cool, moist place breaks dormancy
 - Example: persimmon, apple
 - Soaking – removing the chemicals that inhibit germination
 - Germination rest – some seeds are dormant for a certain amount of time
 - Example: Annona
- Media and containers: fertility and drainage
- Appropriate techniques: bags, root trainers, seed beds, compost

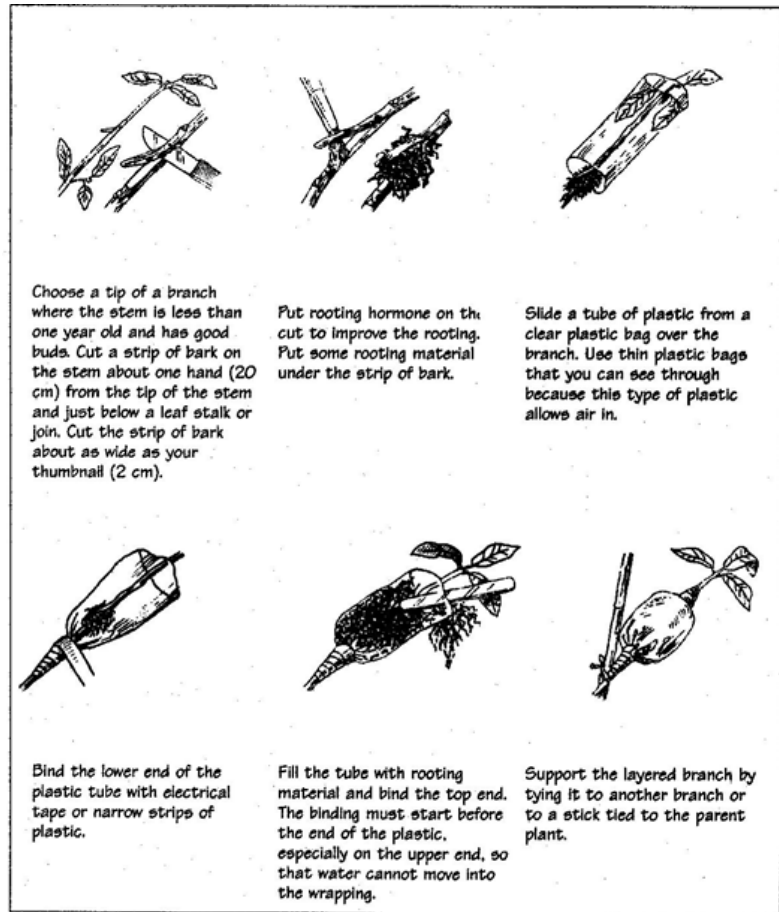
Asexual Reproduction – Cuttings

- Why take cuttings?

- Usually fast and easy
- You get many plants from just a little material
- Hardwood – taken in late winter/early spring using the last season's growth
 - 15-30 cm in length
 - These cuttings don't lose much moisture and don't need a humid environment
 - Examples: grape, mulberry, olive, fig, pomegranate
- Softwood – young leafy shoots, after flush of growth
 - Requires high humidity conditions and some leaves retained
 - Example: passionfruit (3 nodes), chayote, Malabar spinach, sweet potato
- Semi-hardwood – best cuttings are taken following a flush of new growth
 - 10-15 cm in length
 - Requires high humidity conditions and some leaves retained
 - Examples: coffee, mombin, mulberry, feijoa, lychee, macadamia, pomegranate
- Root cuttings - taken in late winter/early spring
 - Young root pieces 2.5 cm -1.3 cm long
 - Several pieces several cm in diameter
 - Shoots will form after 1-2 months
 - Examples: guava, breadfruit
- Appropriate techniques
 - Propagator box
 - Clear bag over a nursery bag or pot

Asexual Reproduction – Airlayers (Marcotting)

- Why airlayer?
 - To get a big tree fast without having to prune it down to be a cutting
 - Prunes the parent tree
 - Allows for energy storage in the new plant
- Downside:
 - Time – it takes a few months for rooting through hardening
 - No tap root
 - Examples: lychee, longan, jackfruit, guava, Barbados cherry, pomegranate, citrus
- Appropriate techniques
 - Coconut coir, palm core, or anything else absorbent
 - Wrappings:
 - Plastic bags, black plastic, clear plastic



Asexual Reproduction - Grafting

- Why graft?
 - The influence of adult wood means a shorter juvenile period which leads to earlier production of fruit
 - Growth habit will be more bushy rather than straight up
 - Combines the best qualities of a root system and the best qualities of the branches
 - Rootstock qualities
 - Seedling rootstock has a taproot
 - Resistance to disease, better nutrient uptake, dwarfing
 - Budwood qualities: specific cultivar, fruit quality, growth habit
- Terms:
 - **Grafting** - The process of connecting two pieces of plant tissue together so that they will combine and develop as a single plant.
 - **Budding** – “Joining the stem of one plant with buds from another so that they grow together as one plant.” (Propagating Plants: An Organic Approach)
 - **Vascular Cambium** – A thin layer of cells between the phloem and xylem that is capable of cell division (produces new xylem and phloem tissue) and is what combines when the rootstock and the scion are joined together. A good match and close contact between these tissues on the scion and rootstock is critical for a successful graft.
 - **Stock (Rootstock)** – The lower portion of the grafted plant, almost being entirely made up of the root system, and generally, but not always, planted from seed.

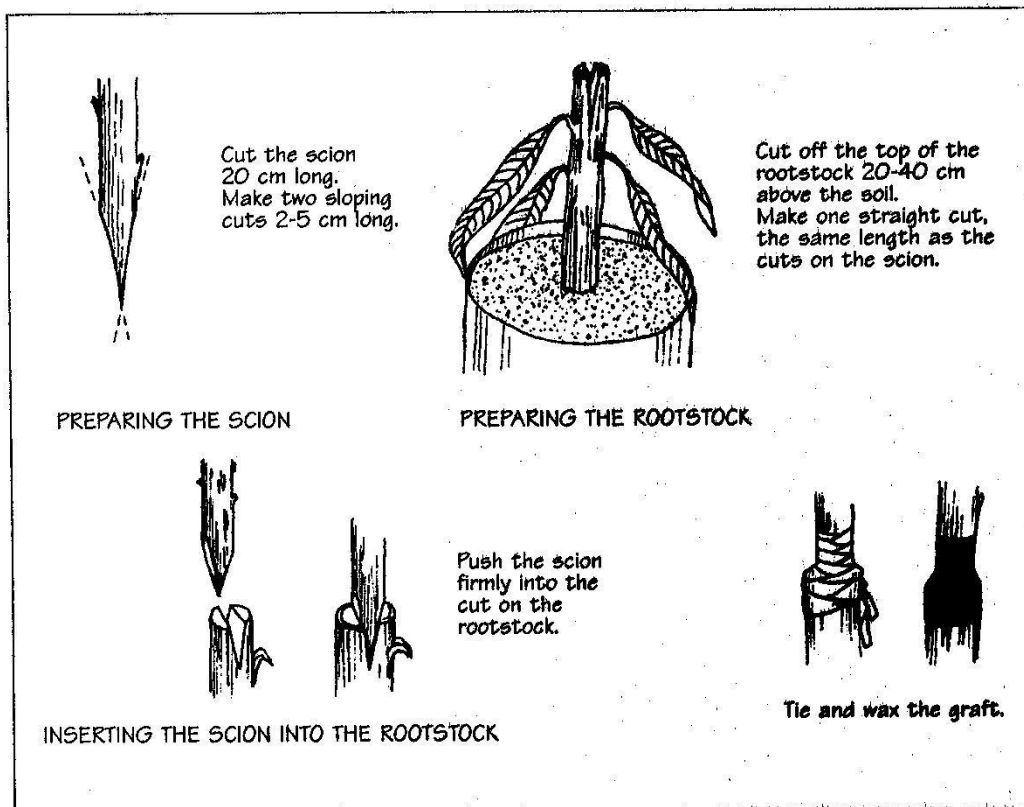
- **Scion (Budwood)** – “A short piece of detached shoot containing several dormant buds from which, when united with the stock, comprises the upper portion of the graft and from which will grow the stem or branches of the grafted plant. It should be of the desired cultivar and free from disease.”
- **Major Methods**
 - **Cleft**
 - Budwood and rootstock diameter need to match
 - Mostly used on rootstocks that are still at a pliable stage and not yet woody
 - Examples: canistel, sapodilla, avocado, jujube, guava, black sapote
 - **Side Veneer**
 - Used when the rootstocks get too big for budwood, woody stems
 - Examples: canistel, mango, annona species, white sapote, carambola
 - **Chip Budding**
 - Use buds that are about to push
 - Examples: carambola, persimmons, Annonas
 - **T - Budding**
 - Use buds that are about to push
 - Graft after a flush of growth when the bark still slips
 - Examples: Citrus, mango
- **Minor Methods**
 - **Approach Grafting**
 - Used with trees that are difficult to graft
 - One or both plants needs to be in a container
 - **Wedge grafting, whip and tongue, patch budding, etc.**
- **Rootstock Selection**
 - Vigor
 - Graft only healthy rootstock
 - Age – desired thickness
 - Not too tender or root bound
- **Budwood Selection**
 - Buds are swollen, but have not pushed
 - Potential budwood has hardened off – the leaves are no longer tender
 - Take budwood from healthy trees known to give good fruit
- **Aftercare for grafted trees**
 - Maintain cool, humid environment
 - Keep grafts under plastic bags, in the shade, in a mist house or poly propagator
 - Do not let the budwood dry out
 - Do not let the rootstock dry out – even if the graft has taken at that point, a dry spell could kill the new graft
 - Suppress the rootstock
 - Remove rootstock shoots, cut off or bend the main trunk (side veneer)
 - This is an ongoing process
 - Gradually transition the healing graft from its protected environment to full sun - quick adjustments can shock the graft and kill it
- **Appropriate techniques**
 - Wrappings:
 - Wire
 - Inner tube elastic
 - Plastic strips

- Razor blade knife – razor blade, knife, wire

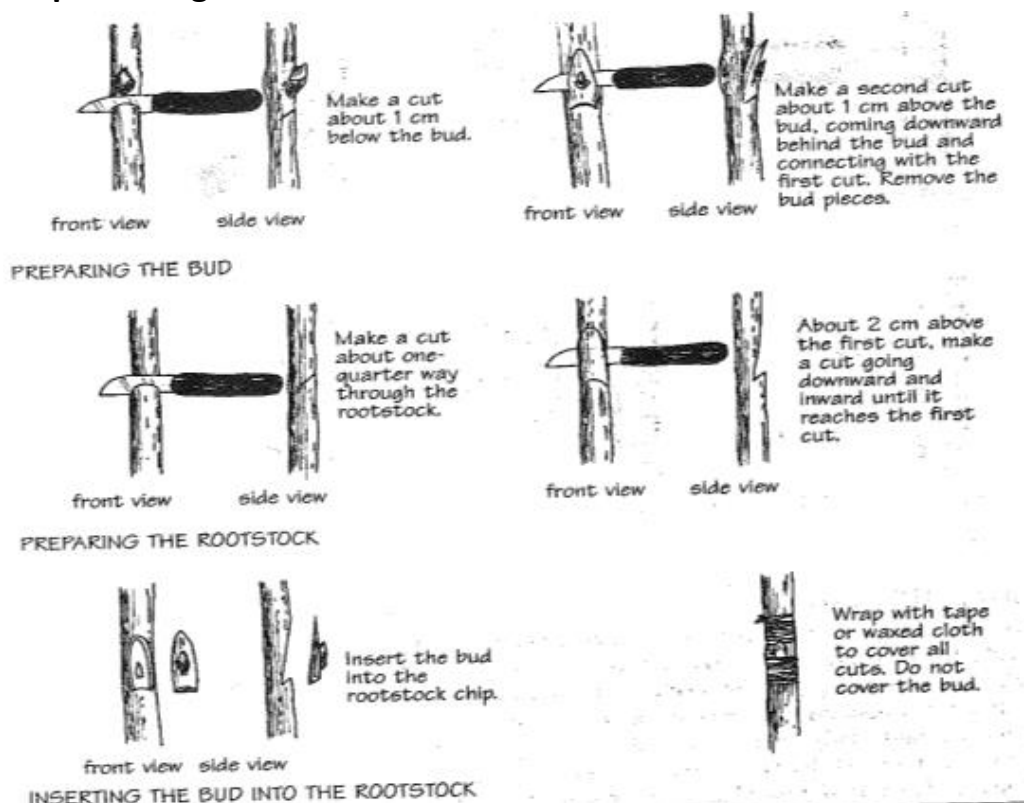
The importance of timing –

- Learning to time propagation to seasons and conditions
 - When is the rootstock available or at a good grafting age?
 - When is the budwood ready?
 - Coordinating the best times for rootstock and budwood

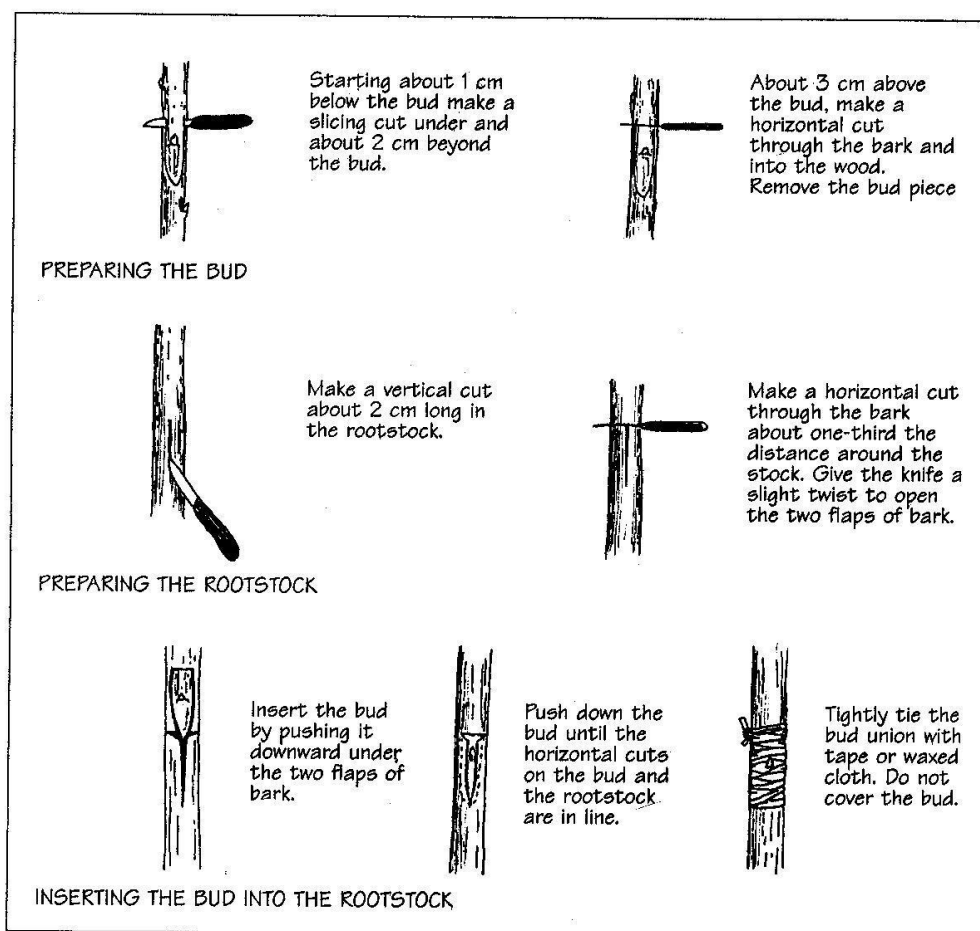
Cleft Graft



Chip Budding



T - Budding



Images from Propagating plants: An Organic Approach. Fambidzanai Permaculture Centre, 1998. Livai Matarirano, Director.

Side Veneer

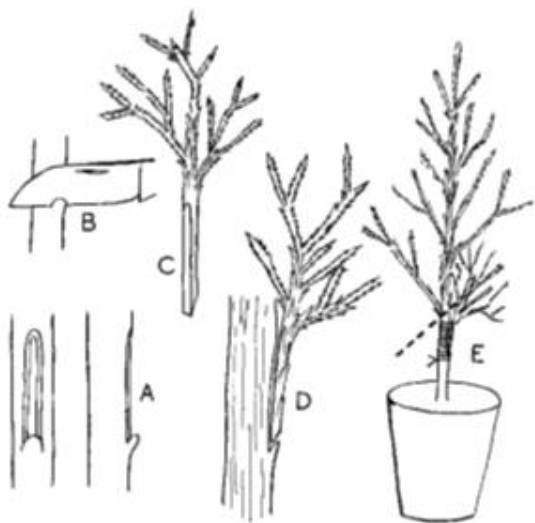


Image from R.J. Garner. 1988. The Grafter's Handbook. In association with The Royal Horticultural Society. Cassell, London.