Plant Propagation

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- Plant Propagation – is the technique of making two or more plants where previously there was one. By using various methods we can produce exact replicas that perpetuate much loved varieties or we can create entire new plants that may become favorites of the future.

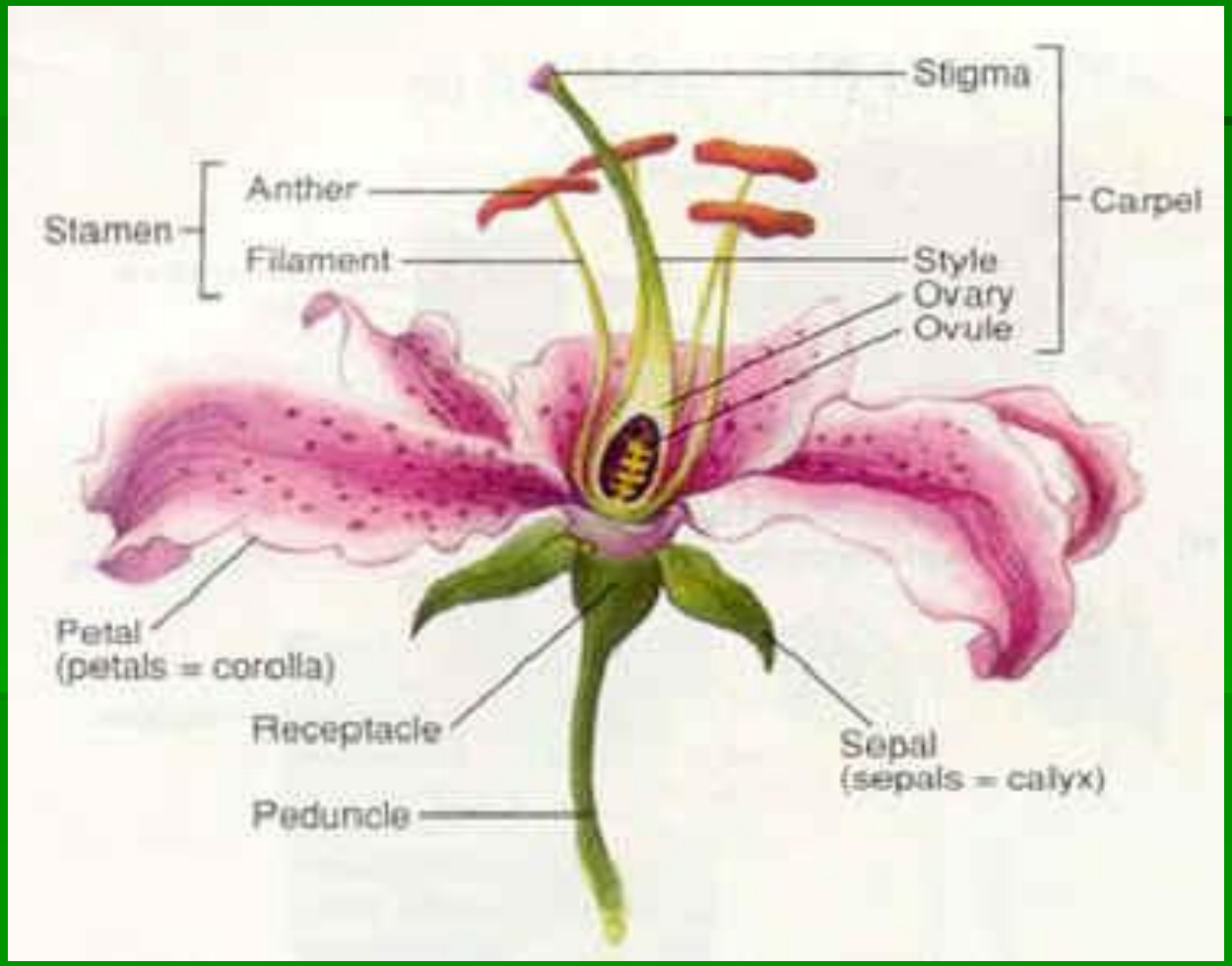
Types of Plant Propagation

- Sexual Propagation
  - Recombination of genetic materials to form uniquely genetic individual through the formation of seed
- Asexual Propagation
  - Use of vegetative organs to create plantlets genetically identical to parent plant (clone)

Reasons for Sexual Propagation

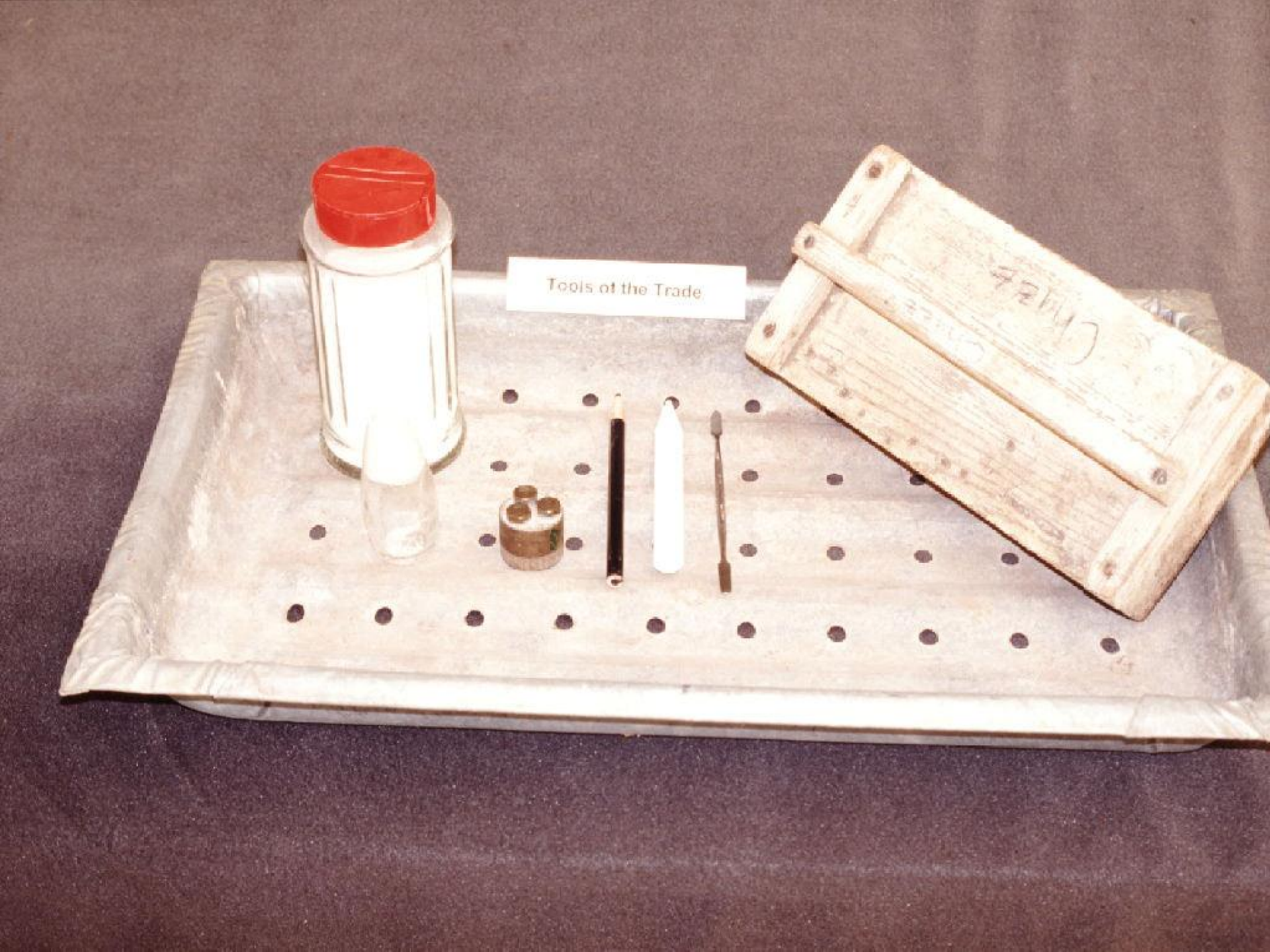
- Create new varieties
- Create resistance to insects and disease
- Create new flower and/or foliage color
- Create new form and texture

Parts of a Flower

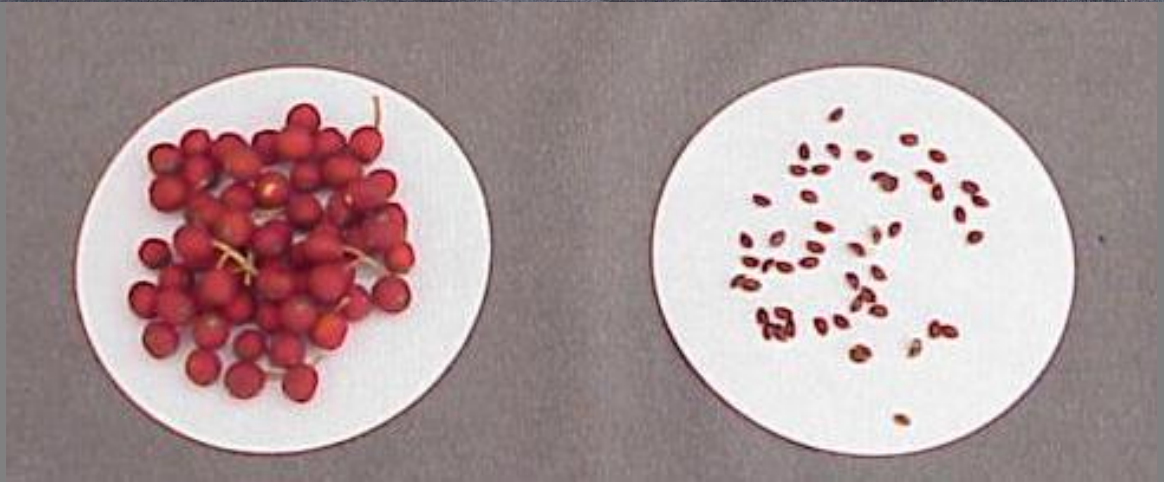



Squash
Coconut
Marigold
Begonia
(Unpelleted Seed)
Begonia
(Pelleted Seed)
Pansy


LIBERTY


Tools of the Trade


PEAT MOSS
BARK
COMMERCIAL MEDIA
VERMICULITE
PERLITE
SAND




#3
#2

Obtaining Seed

- Buy from a dealer
- Do your own hybridizing
- Collect naturally occurring seeds

Seed Storing

- Keep cool and dry
- Warm and moist conditions are the greatest enemies of stored seed
- Keep seed in paper verses plastic bags

Germination of Seeds

- Viability
- Purity percentage
- Germination percentage
- Pure live seed = Purity % x Germination %

Pure Live Seed

Example: A sample of seed is 95% pure with a germination rate of 85%

.95 x .85 = 80.75 PLS

Breaking Dormancy

- Stratification – exposing the seed to cold
- Scarification – abrading the seed coat
- Soaking – use moderately warm, not boiling, water
- Acid Soak – tough seed coats require mild acid solution to soften the seed coat

Germination Requirements

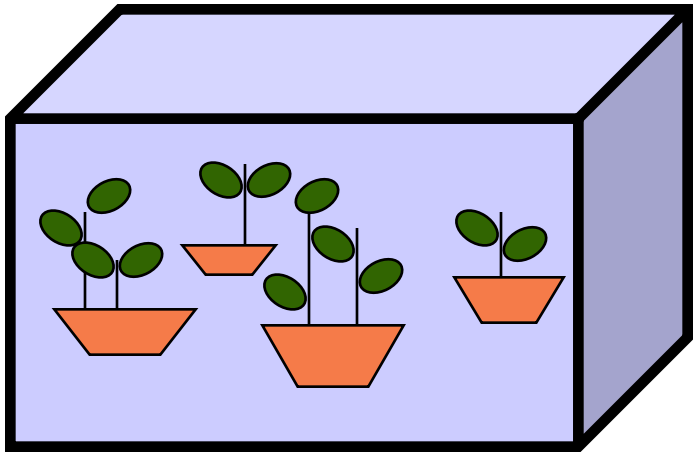
- Optimum temperature range
- Light requirement
- Moisture requirement
- Information charts exist for most plants

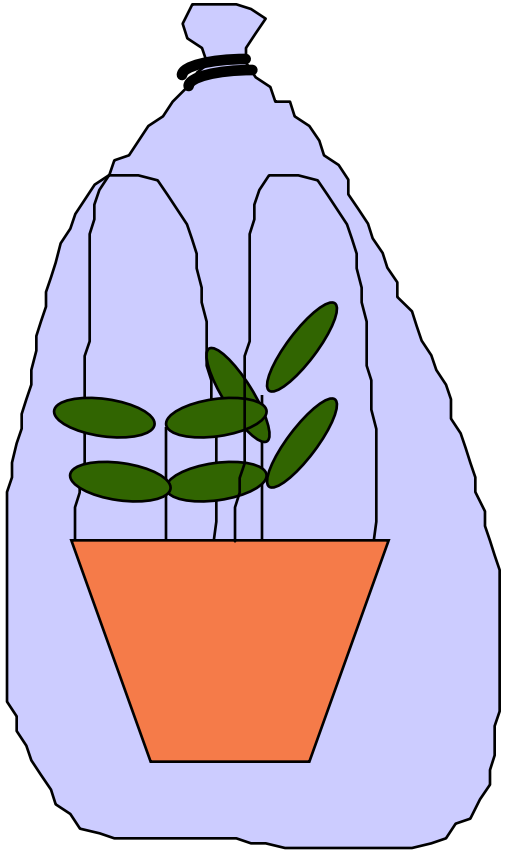
To Cover or Not To Cover

- Seeds come in a wide range of sizes and shapes, which affects how they are sown
- Some seeds need light to germinate and must not be covered others need darkness and must be covered
- For those that need to be covered a good rule is to cover the seed to just it's own depth


Can see where
you've sown seed

Simple Methods for Improving Success





Commercial Seed Production

Commercial growers use a method called

Plug Production

What Happens Next?

- Seed imbibes water and swells
- Seed coat splits
- Radical appears
- Seed leaves appear
- First true leaves appear
- Monocot vs. Dicot

Germination Aftercare

- If seed flats have been covered, uncover the seedlings by gradually raising the cover and then finally removing it
- Good ventilation combined with a mild fungicide should control most dampening off diseases
- A mild all purpose liquid fertilizer will keep them happy
- Once seedlings have their first true leaves it is time for transplanting

Reasons for Asexual Propagation

- Clone desirable specimens
- Propagate difficult to germinate plants
- Create larger plants
- Save desirable plants from disease
- Maintain genetic trait

Types of Asexual Propagation

- Cuttings
- Division
- Layering
- Grafting
- Special Techniques
  - Scaling
  - Tissue Culture
  - (Micropropagation)

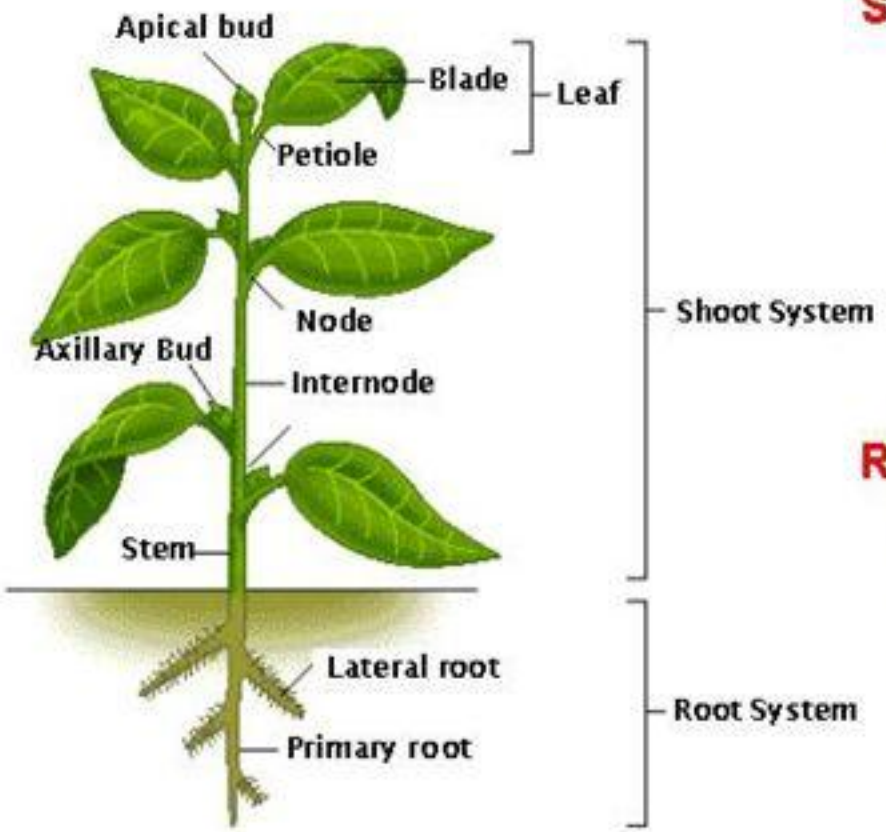
Cuttings

- Vegetative plant part which is severed from the parent plant in order to regenerate itself, thereby forming a whole new plant

The Miracle of Meristems

- Meristems are stem cells
- Apical Meristems cluster at stem and root tips
- Lateral Meristems cells are known as the cambium layer and increase stem size
- Lateral Meristems can produce Apical Meristems which can produce roots, stems, leaves, and flowers

The Plant Body Consists of the Shoot System and the Root System



Shoot System - Functions

- Photosynthesis
- Reproduction
- Storage
- Transport
- Hormones

Root System - Function

- Anchorage
- Absorption
- Storage
- Transport
- Hormones

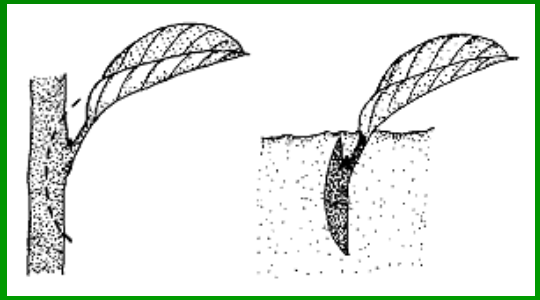
Cuttings

- Auxin:
  - Plant hormone responsible for root formation
- Adventitious Roots:
  - Root growing in an unusual location

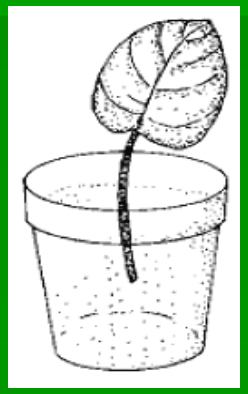
Adventitious Roots

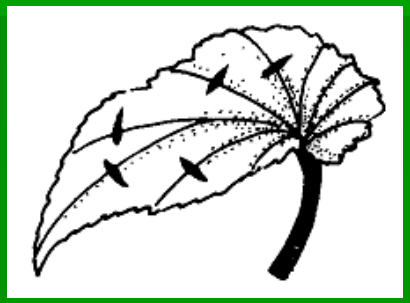
Cuttings

- Shoot Cuttings
  - Regenerate roots



- Leaf Cuttings
  - Regenerate roots & shoot





- Root Cuttings
- Energy for growth?

Cutting techniques

- Types of cuttings
  - Stem
    - Hardwood
      - Deciduous
      - Narrow-leaved evergreens
    - Semi-hardwood
      - Broad-leaved evergreens
      - Leafy deciduous plants in summer
    - Softwood
    - Herbaceous
    - Rhizome/Stolon


Softwood Cutting
Herbaceous Cutting
Leaf Cutting


Hardwood, mallet cutting
Hardwood Cutting (Deciduous)
Hardwood, heel cutting
Hardwood Cutting (Narrow-leafed Evergreen)

Cutting techniques

- Hardwood (deciduous)
  - Mature, firm, dormant (after leaf drop)
  - 4 - 30” cuttings
  - Basal cut just below a node & top cut just above a node
  - Stick 2 - 3” into rooting mix
  - Can wax tops or place in high humidity

Cutting techniques

- Hardwood cuttings (narrow-leaved evergreens)
  - Slow to root, Low-growing species root easiest Upright growing often difficult to root (firs, hemlock, pines, spruce)
  - Take late fall to late winter
  - Include 4 - 8” of last years growth
  - High humidity
  - Prefer sand or peat/perlite
  - Bottom heat

Cutting techniques

- Semi-hardwood (greenwood)
  - Broad-leaved evergreens or
  - Leafy deciduous plants in summer
  - Taken in summer after a growth flush
  - 3 - 6” cuttings
  - Trim large leaves to reduce transpiration
  - Collect cutting in early morning (turgid)

Cutting techniques

- Softwood
  - soft, succulent new Spring growth
  - Deciduous or evergreen species
  - Taken DURING a growth flush
  - Sometimes root easier
  - Prone to disease and water stress


Starrett
4/1601

Cutting techniques

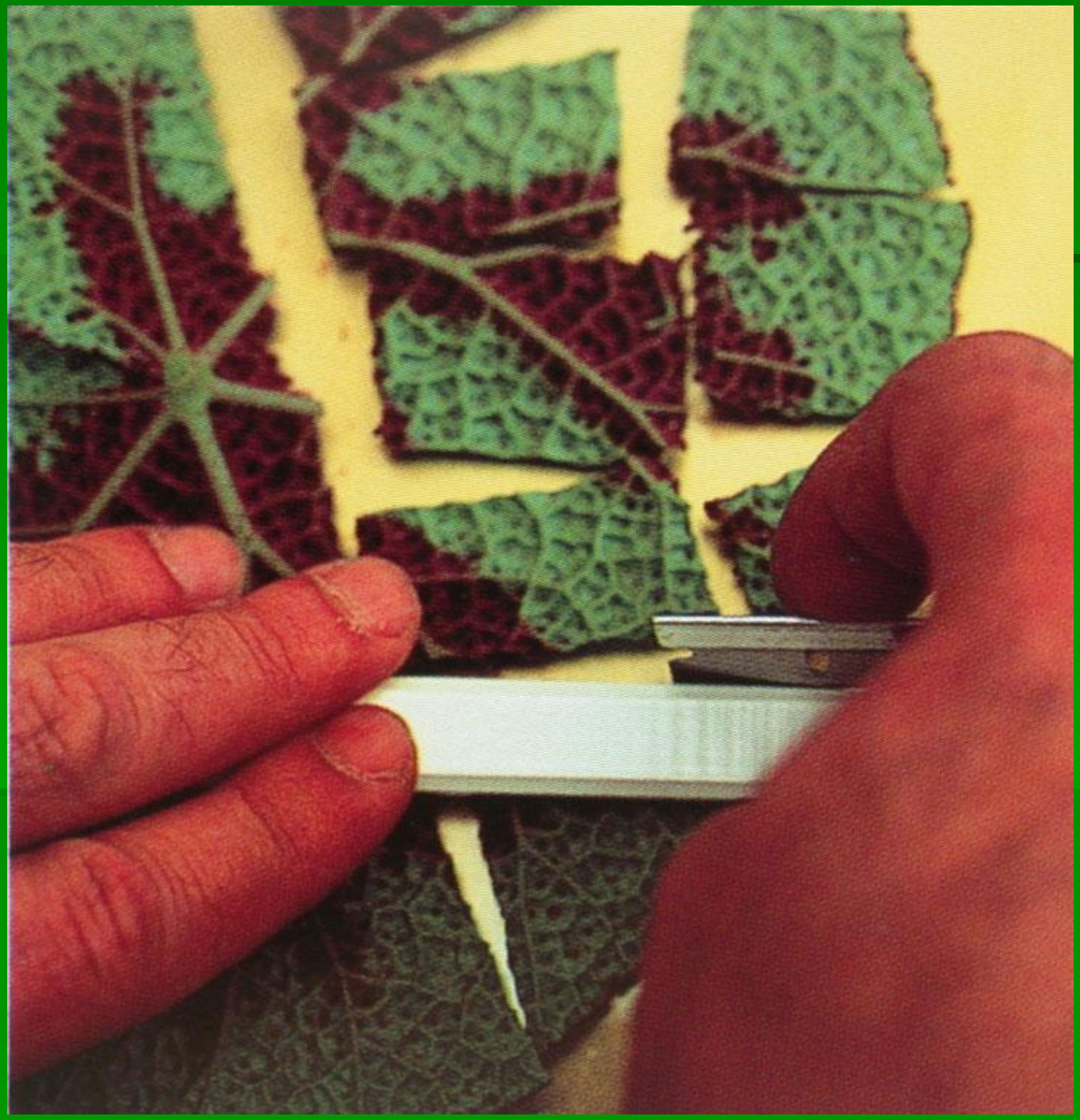
- Herbaceous cuttings (different than softwood!)
  - From succulent, non-woody plants (Coleus, geraniums, mums)
  - 3 - 5” cuttings
  - Leaves kept on top (remove any that would go below the surface of the rooting mix)

Leaf Cuttings

- Leaf - stem cuttings
- Leaf sections
- Leaf slashing

Cutting techniques

- Leaf cuttings
  - Leaf blade with or without petiole attached
  - Buds/shoots and roots must form
  - Limited # of species will respond to produce shoots
    - Begonia
    - African violet
  - Plants develop along the leaf margin
    - Kalanchoe
    - Piggyback plant



Cutting techniques

- Leaf-bud cuttings (single eye or single node)
  - Leaf blade, petiole, & stem piece with auxiliary bud
  - Only adventitious roots need to form
  - Camellia, maples, rhododendron, tropical shrubs
  - Insert stem 1/2 - 1” into rooting mix

Cutting techniques

- Root cuttings
  - From young stock plants in late winter/early spring
  - High in CHO's
  - Polarity is important… proximal end up
  - Or can lay horizontally in the mix
  - Cover lightly, 1/2" maximum

Cutting techniques

- Ways to improve rooting of cuttings
  - Proper rooting medium
  - Wounding
    - Stripping
    - Girdling
  - Auxins
    - IBA best or a combination of IBA & NAA
    - K-IBA (talc or water solution) for softwood & semi-hardwood

Rooting Hormones

- IAA = Indoleacetic Acid
- NAA = Naphthaleneacetic Acid
- 2,4-D = 2,4 Dicholophenoxyacetic Acid

10,000 ppm KIBA

Hormodin® 2
(0.3% IBA)


GREEN LIGHT
RooTone
brand F
Rooting Hormone
with Fungicide
Faster, healthier rooting from cuttings
KEEP OUT OF REACH OF CHILDREN
CAUTION
See Additional Precautionary Statements Inside Booklet
NET WEIGHT: 2 OZ.

Cutting techniques

- Disease prevention while taking cuttings
  - Start with disease-free stock plants
  - Apply fungicides
    - In auxin talc or solution
    - Drench medium after sticking
  - Sterilize workspace/tools
    - Bleach (10%) Water (90%)

Sanitation
You can't be too careful

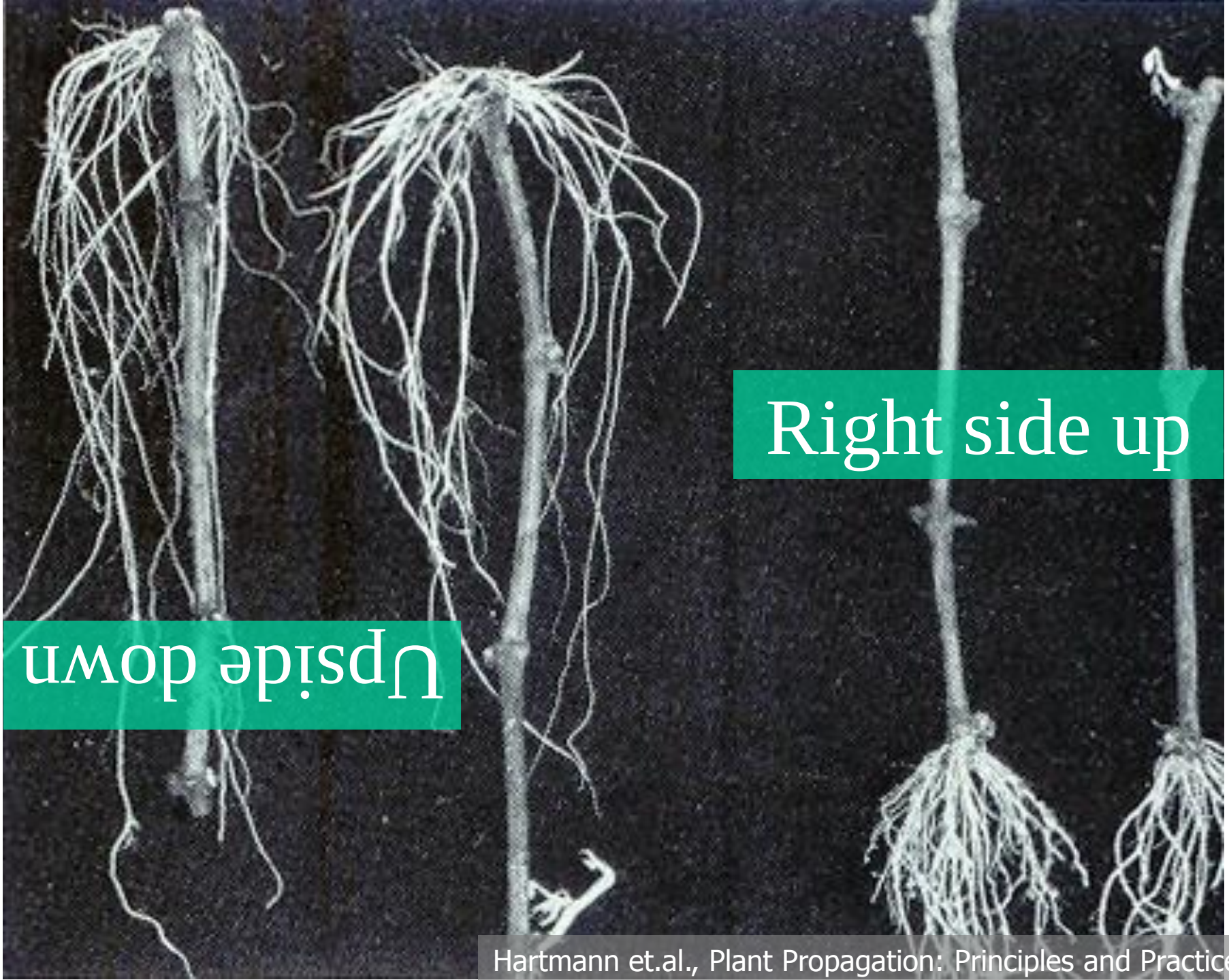
- Clean work benches
- Clean tools
- Clean trays, pots, cell packs, etc.
- Clean mist benches
- Clean equipment
- Use sterilized soil
- Wash your hands
- Use newspaper or plastic sheeting


Prescription Treatment
Green-Shield

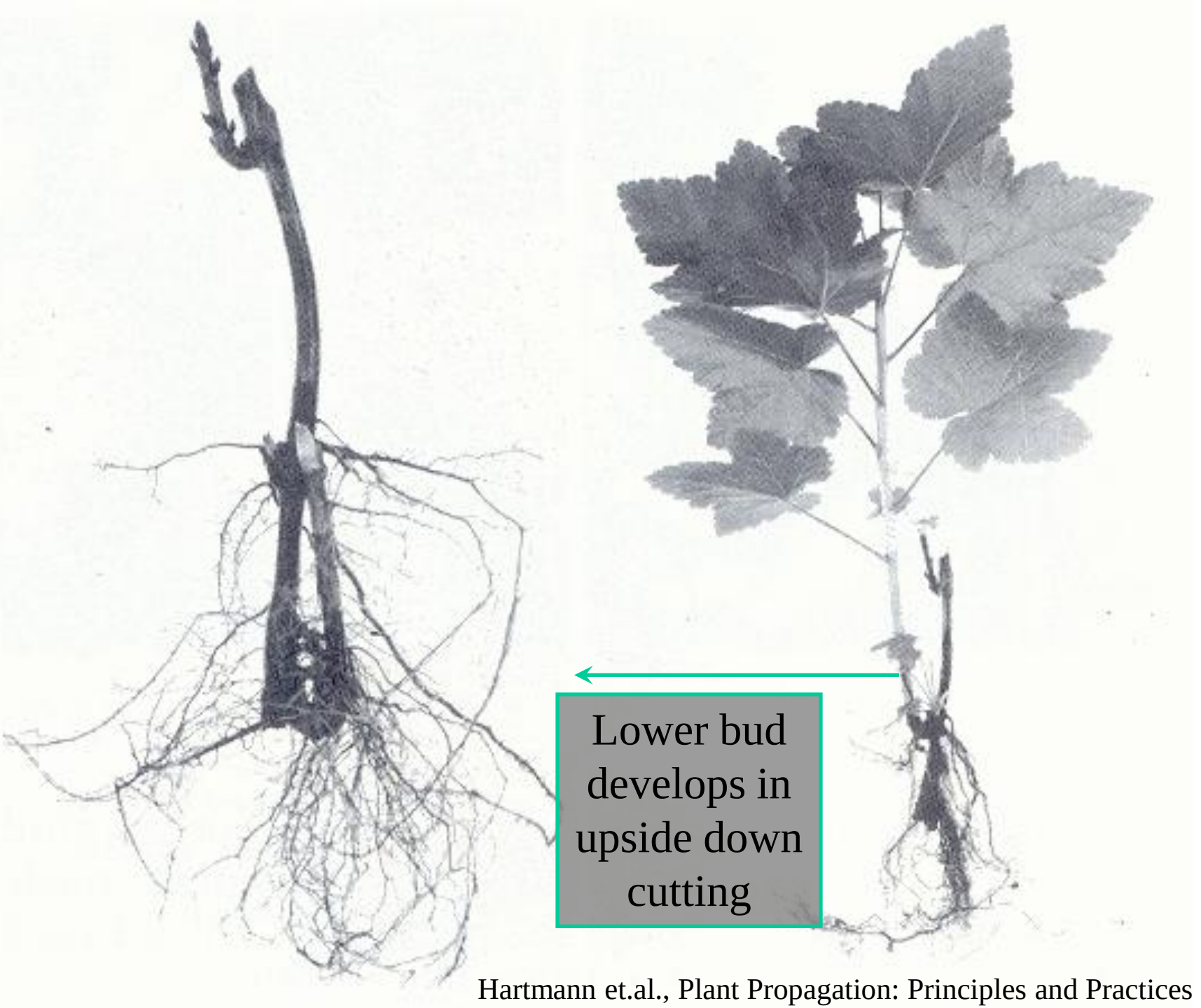
Cutting techniques

- Hardening-off:
  - The process of gradually acclimating rooted cuttings from high humidity to reduced humidity
  - First reduce mist frequency
  - Finally, remove from mist, pot up and keep in an area out of excessive sun and wind


PEAT MOSS
BARK
COMMERCIAL MEDIA
WATER
VERMICULITE
PERLITE
SAND



Hartmann et.al., Plant Propagation: Principles and Practices



Hartmann et.al., Plant Propagation: Principles and Practices

Which Way is up?

Best chance of success if a node is in contact with media

Root Cuttings

- Remove young fleshy roots near the crown
- Trim any fine side – shoots away from the roots
- Use only white, not brown, discolored, or diseased portions
- Trim roots to 4 – 6 inches when kept outside; trim to 2 inches if placed on heated propagation units

Root Cuttings

- Insert cuttings vertically leaving flush with the soil line. Top cuttings with sand or perlite
- Always keep the proximal end of the root facing up
- Do not use rooting hormones on root cuttings

Final Comments on Cuttings

- Don’t store cuttings submerged in water
- Stick cuttings soon after cutting – exceptions do exist. Let the cut on geraniums dry before sticking
- Butterfly the leaves of large leafed plants when making cuttings
- Disbud most all cuttings
- Single stem cuttings work best
- Monitor cuttings often

FYI

To reduce transpiration of the leaves on cuttings to a minimum, the vapor pressure of the water in the atmosphere surrounding the leaves should be maintained nearly equal to the water vapor pressure in the intercellular spaces within the leaf

FYI

Light is needed for photosynthesis for cuttings with leaves. Full sun light is about 10,000 foot candles. Light sources as low as 150-200 foot candles have given good rooting for some cuttings.

Division

Grafting

- Method that joins plant parts so they will grow as one plant
- Used to propagate cultivars that will not root as well as cuttings or whose own root systems are inadequate / weak
- Induce growth form (dwarfing)

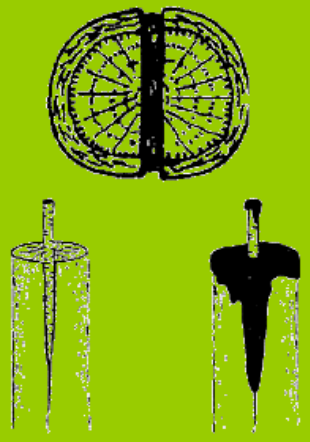
Grafting

Photo Credit: Mike Maddox, Horticulturist, Dane County UW-Extension

Grafting Techniques

Bark Graft

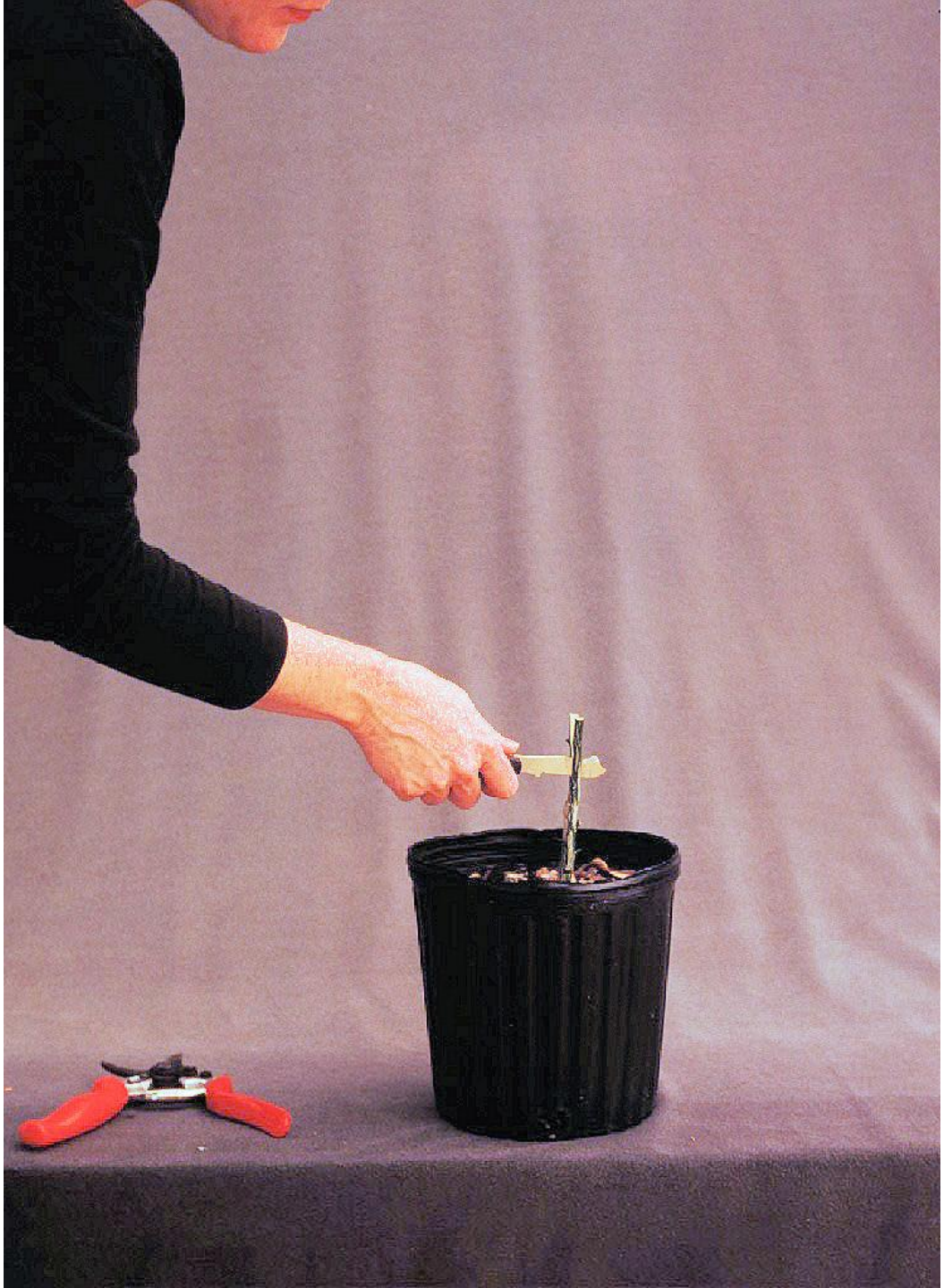
Whip or Tongue Graft

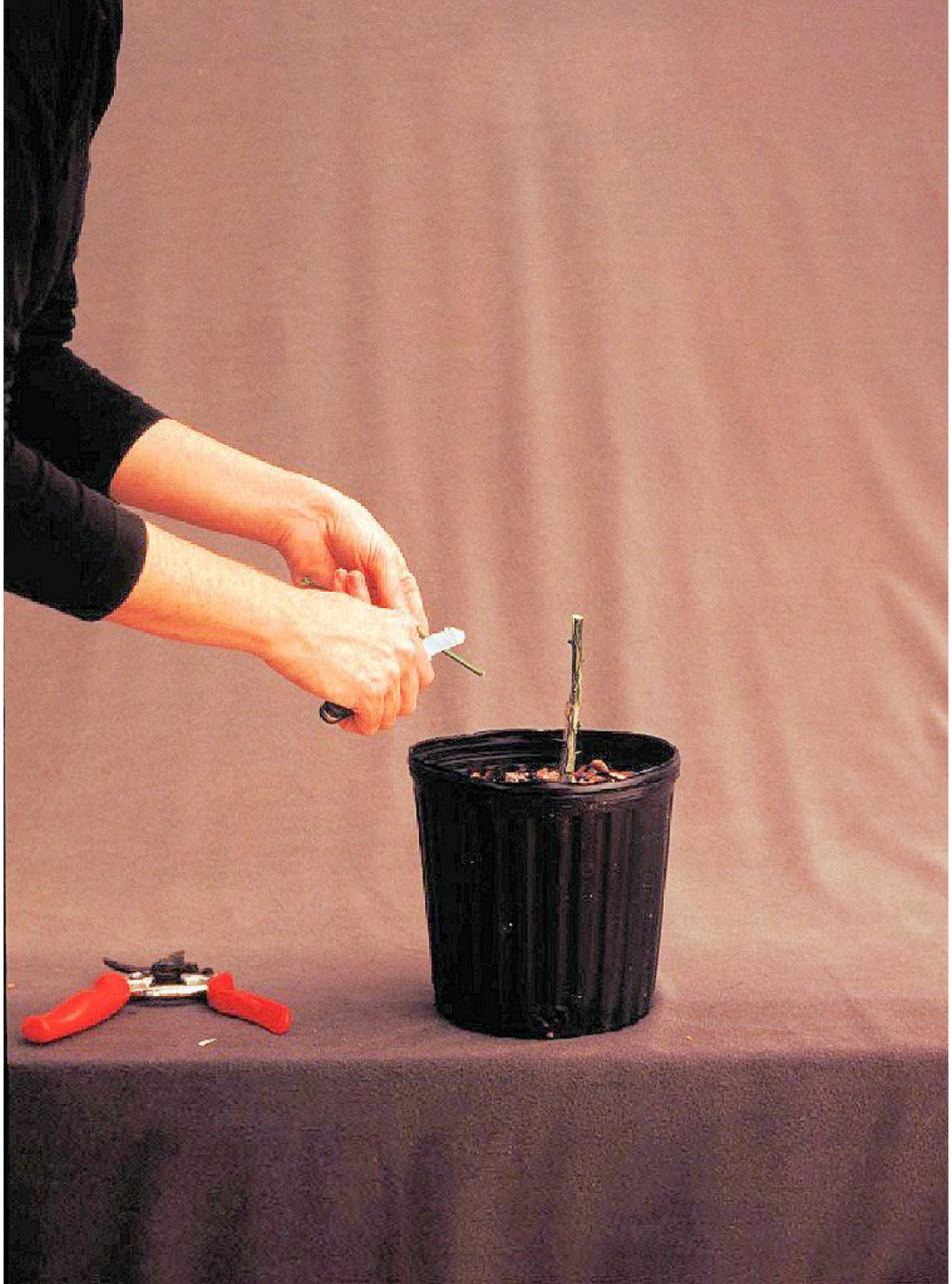


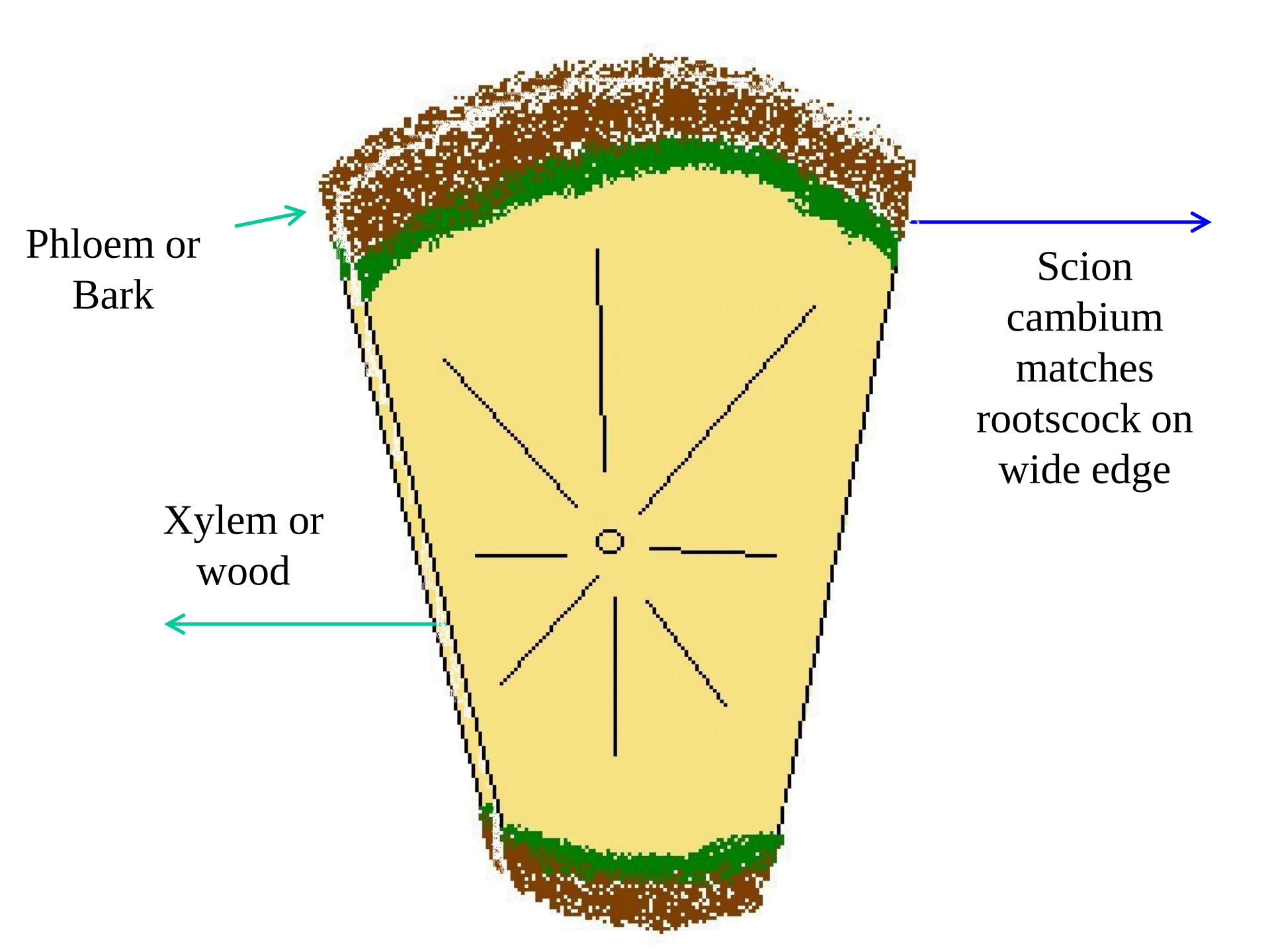
Cleft Graft

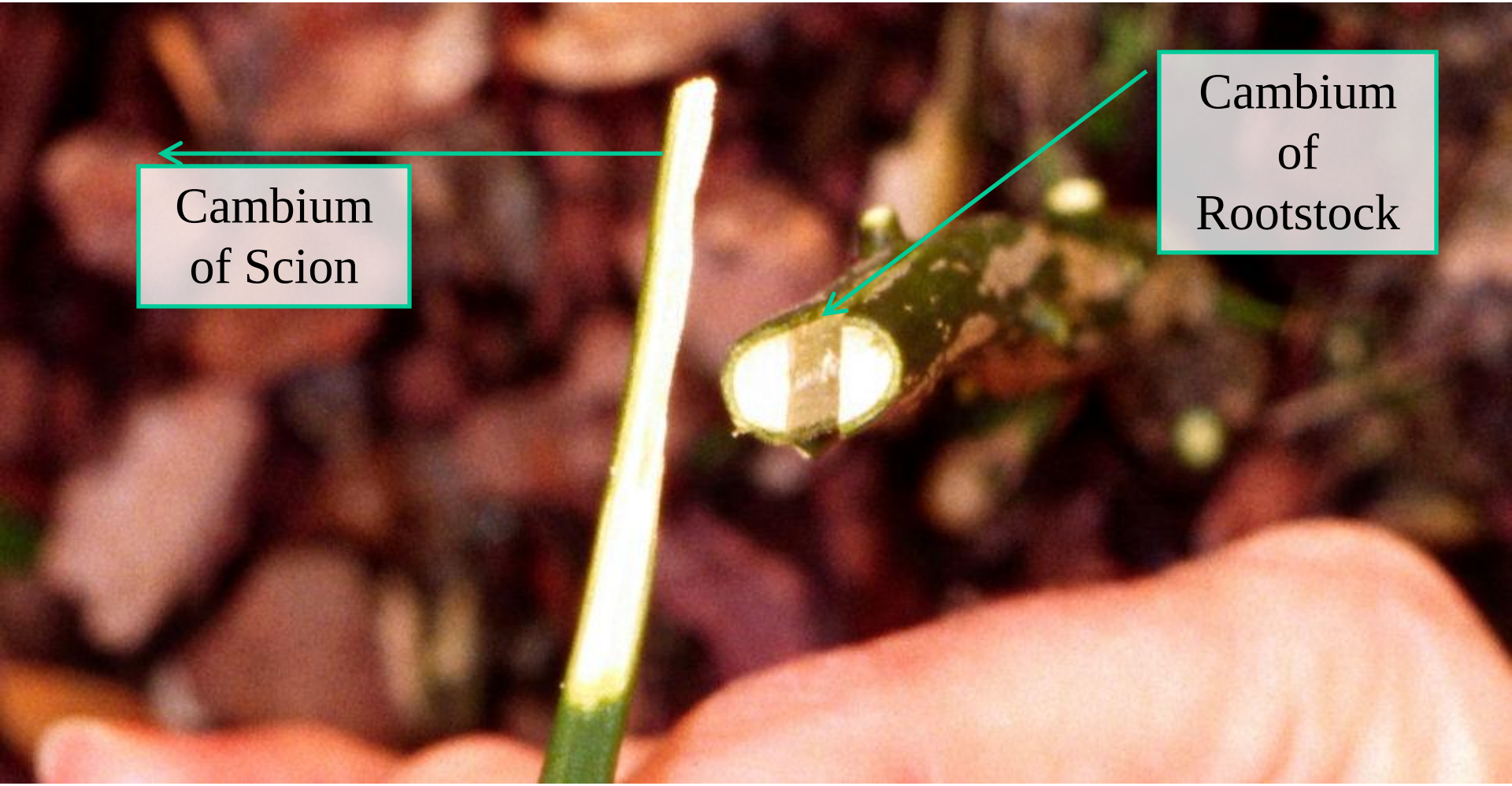
Cleft Graft

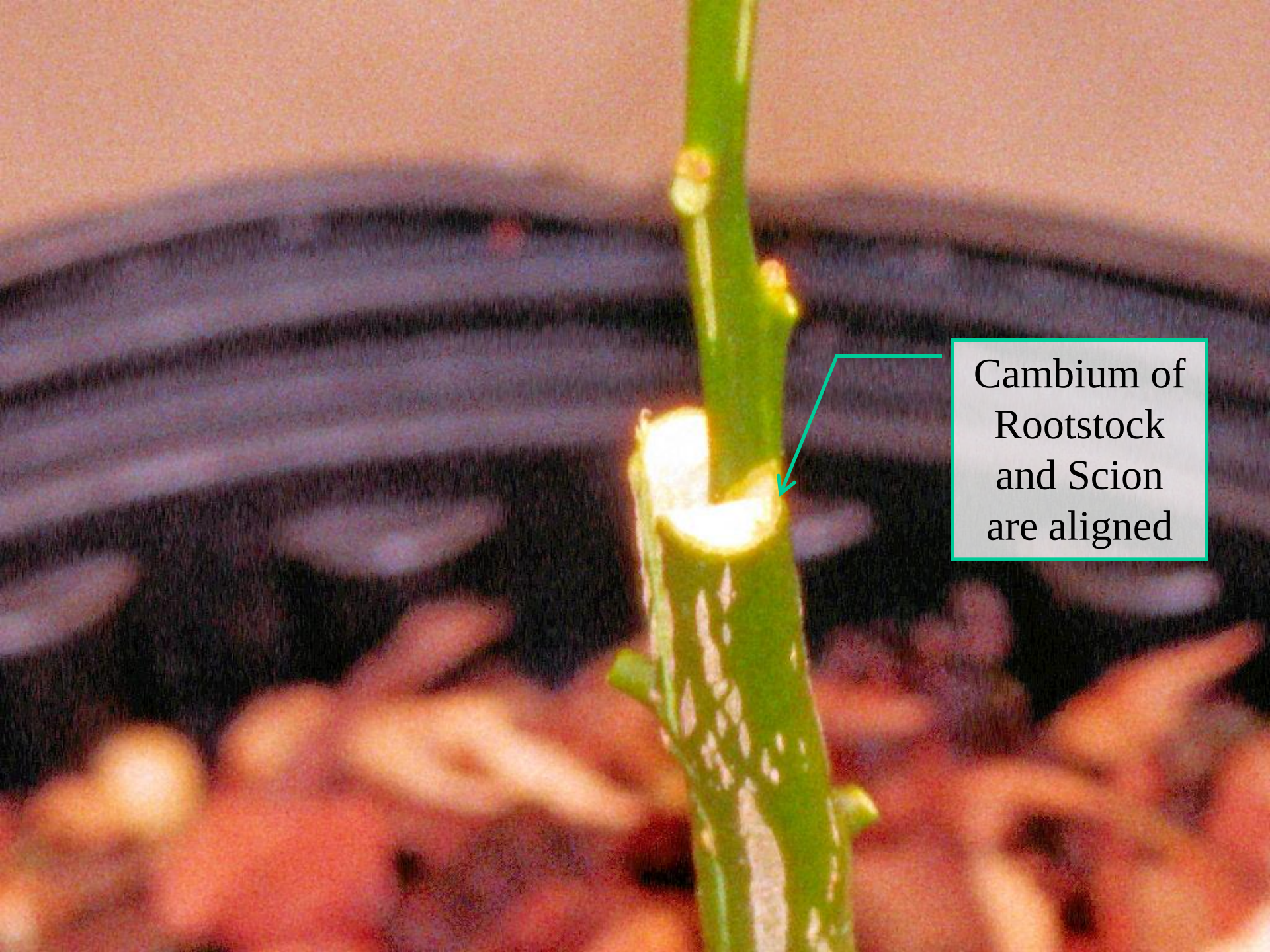
Tools of the Trade





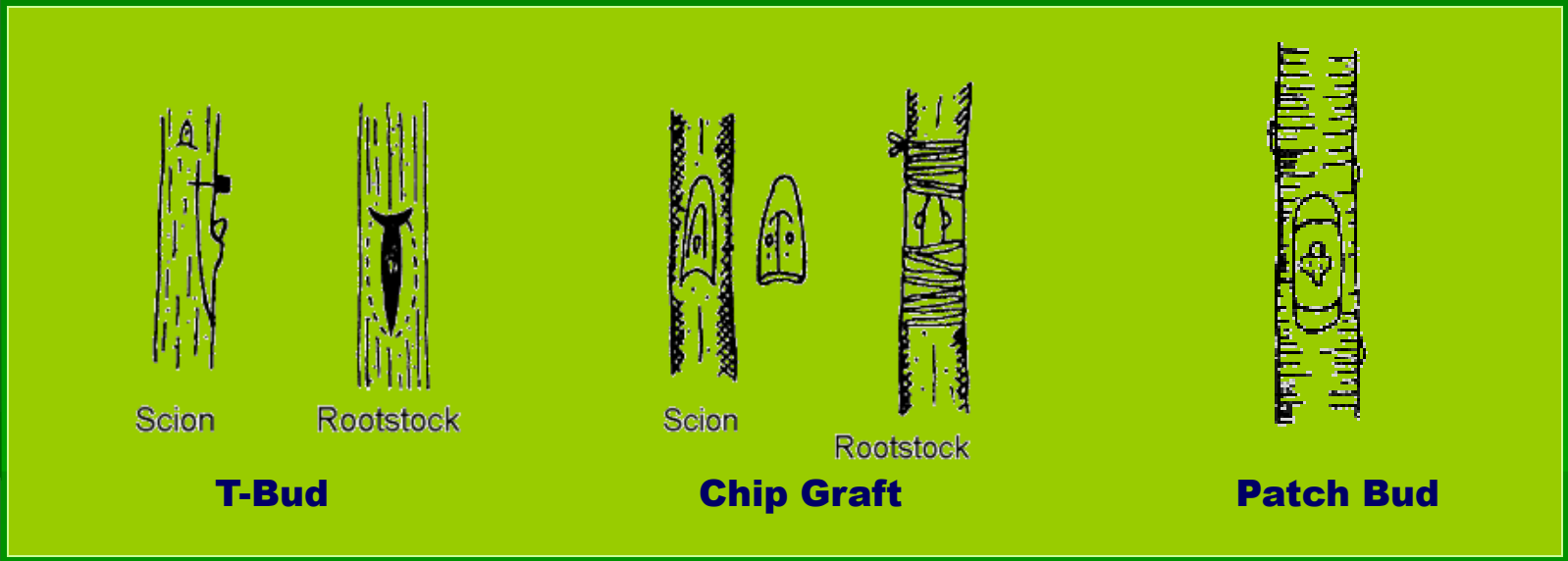

Phloem or Bark
Scion cambium matches rootscock on wide edge
Xylem or wood


Cambium
of Scion
Cambium
of
Rootstock

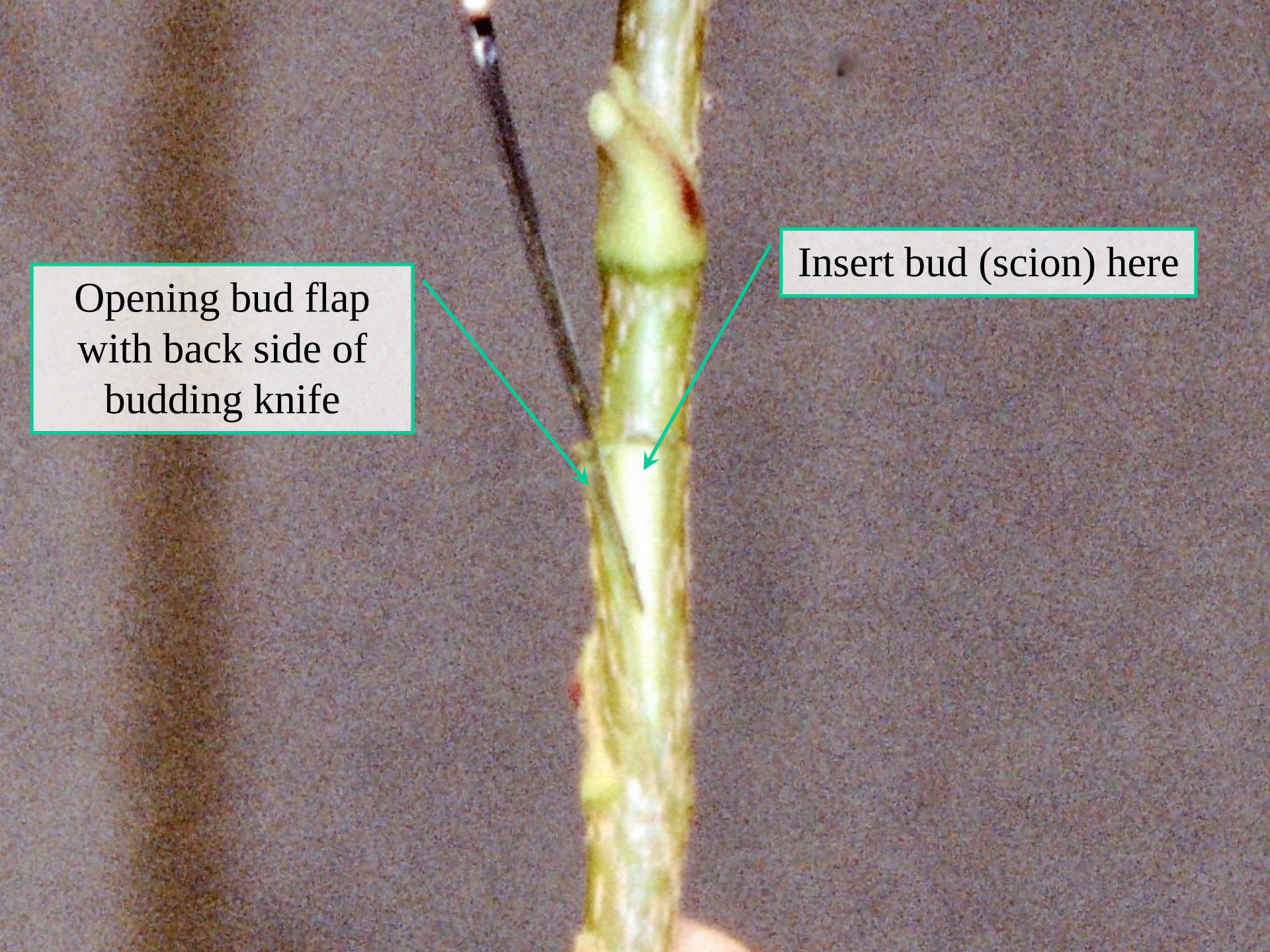

Cambium of Rootstock and Scion are aligned

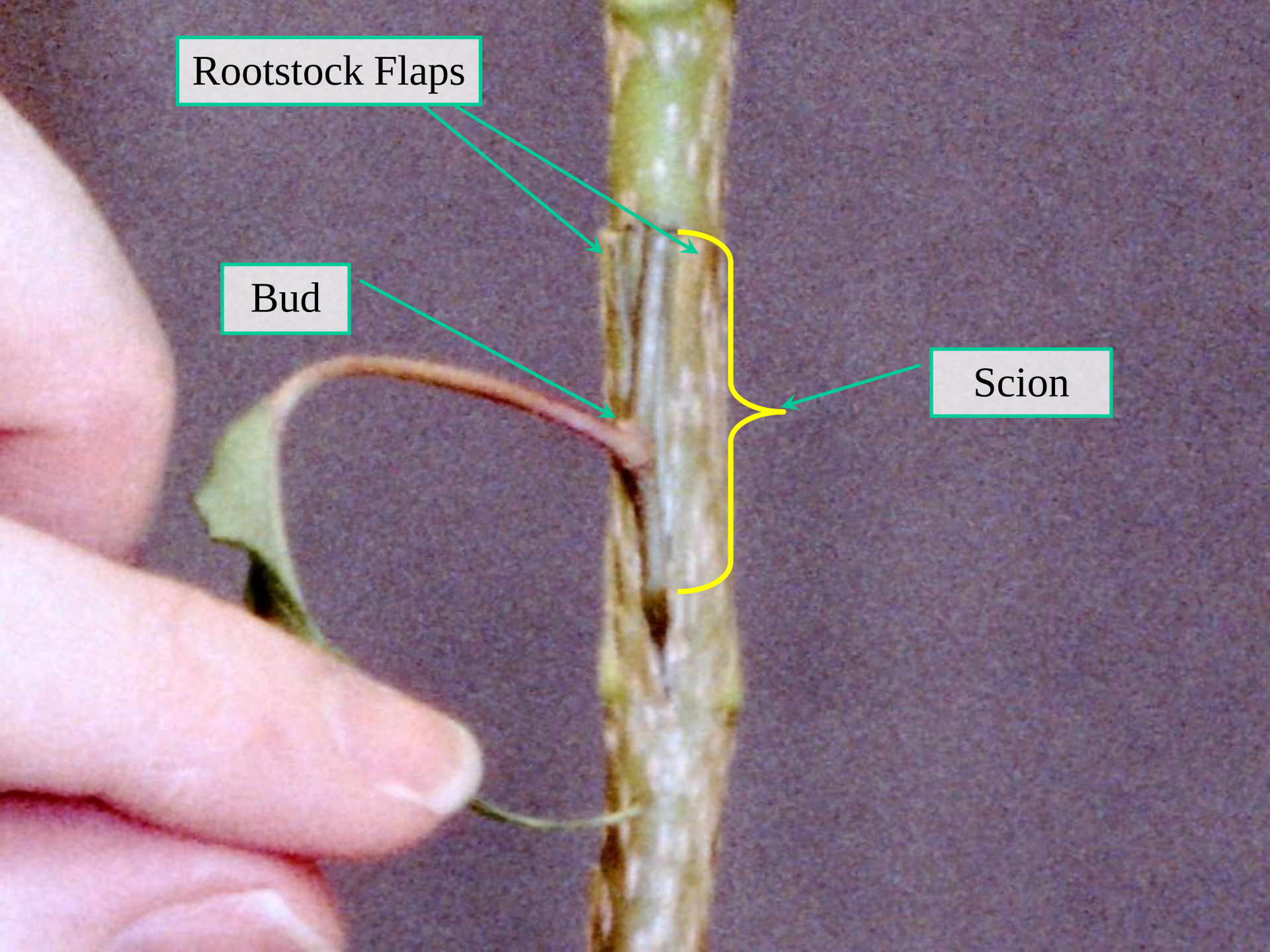

250ml

Budding Techniques



“T” or June Budding

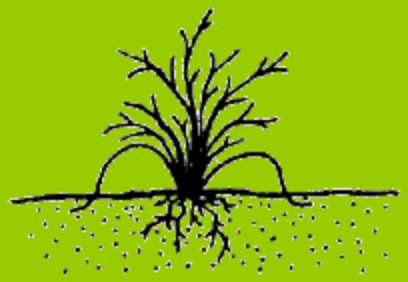

Opening bud flap with back side of budding knife
Insert bud (scion) here


Rootstock Flaps
Bud
Scion

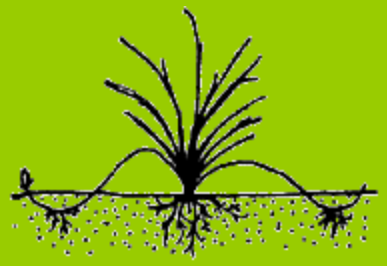
Layering

- Stems still attached to their parent plant may form roots where they touch a rooting medium
- Severed from the parent plant, the rooted plant becomes a new plant

Layering Methods



Tip Layering



Simple Layering

Compound Layering

Mound Layering

Air Layering

Stolons & Runners

Tip Layering

Air Layer

- Useful procedure on leggy plants
- Wound stem and cover with moist medium to induce rooting

Figure 1. Materials needed to air layer.


Handi-Wrap
Aluminum Foil
STRONG & FLEXIBLE
75 SQ FT
TOP CREST

Air Layering

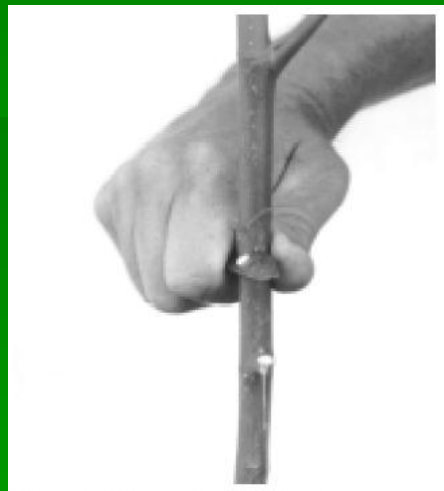


Figure 2. Wounding the plant.

Figure 3. Placing a toothpick in the cut.

Figure 4. Placing sphagnum moss around the wounded area.

Figure 5. Wrapping plastic around the sphagnum moss.

Figure 6. Securing the wrap with twist ties.

Figure 7. Air-layered stem ready to cut off and pot.

Propagation of Bulbs

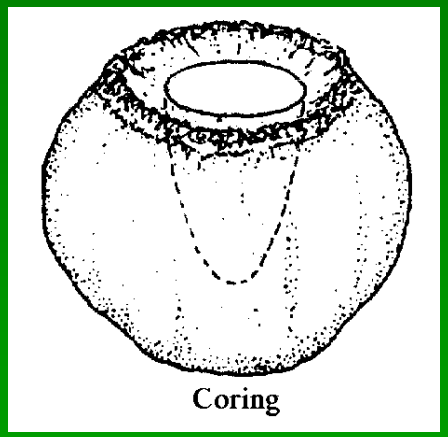
- Growing point surrounded by layers of fleshy leaf bases and are attached to a compact stem—basal plate

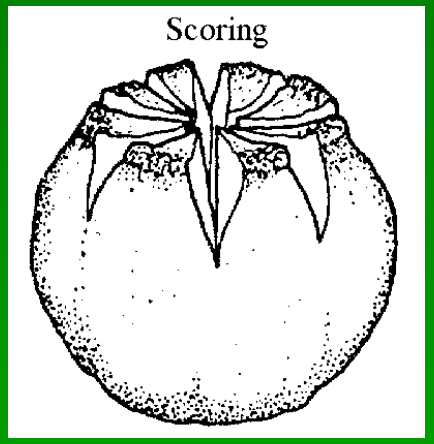
- Tunicate Bulbs (non-scaly):
  - Onion
  - Hyacinth
  - Amaryllis
  - Tulip
  - Daffodil

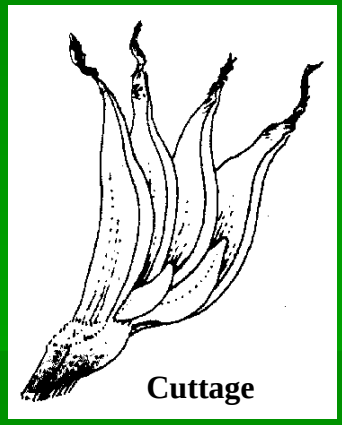
- Non-tunicate Bulbs (scaly):
  - Lily

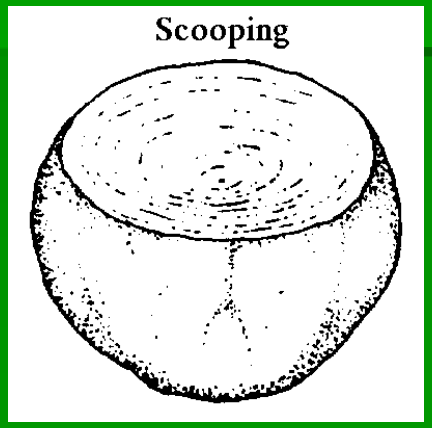
Propagation of Bulbs

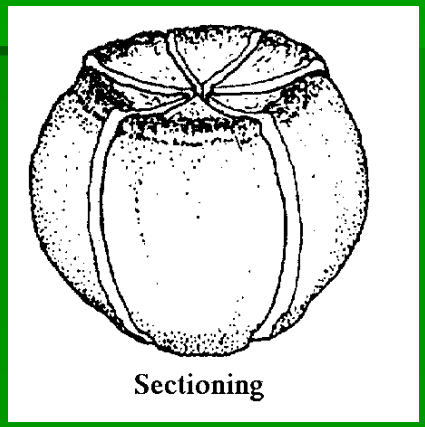
Propagation of Tunicate Bulbs











Propagation of Non-Tunicate Bulbs

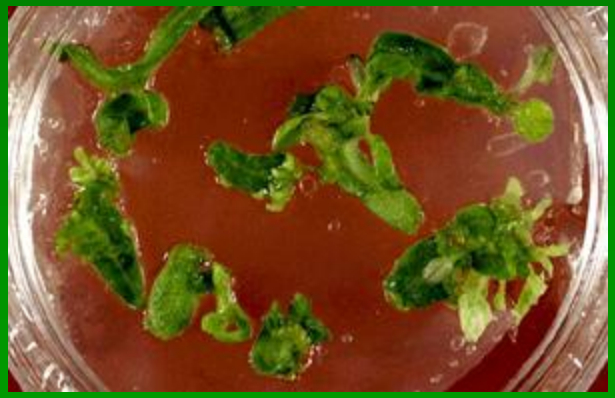
- Scaling
  - Specialized propagation technique
  - Modified leaves of non-tunicate bulbs
  - Regrow roots, shoots

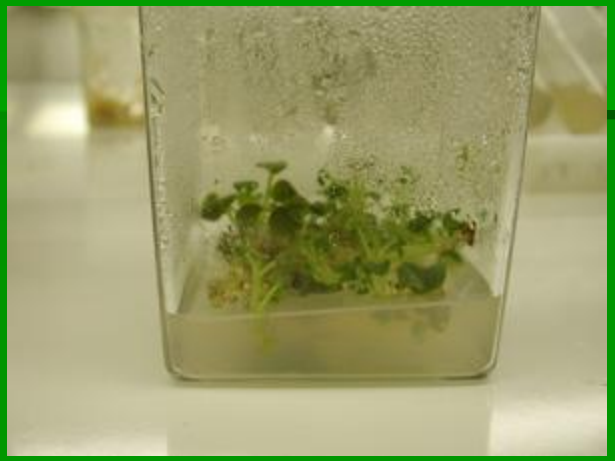


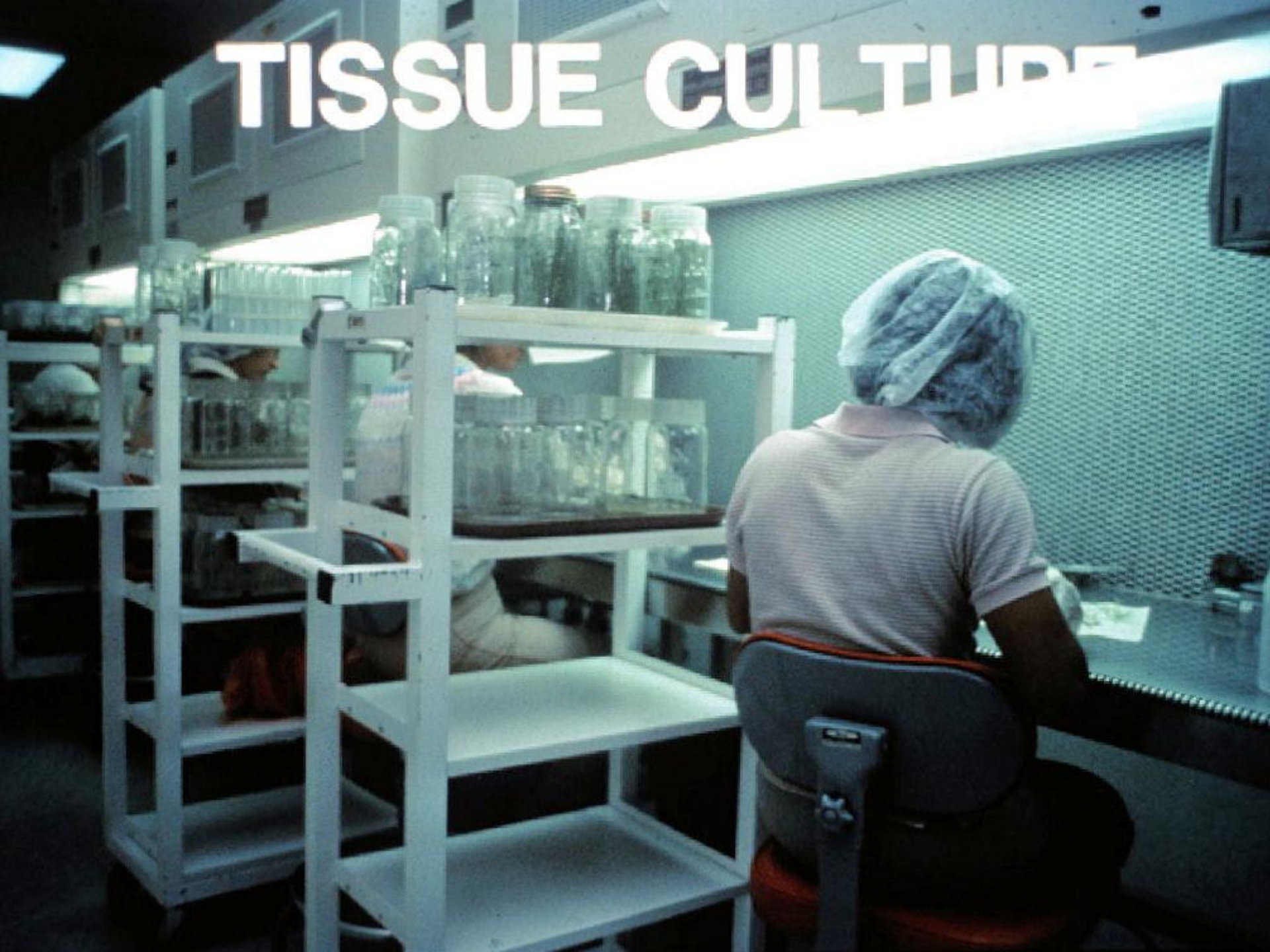

Tissue Culture

- Utilizing our knowledge of plant biology in order to propagate plant *in vitro*
  - Able to produce large numbers of plants in small amount of space
  - Use plant growth regulators to manipulate growth
  - Sugar-rich semi-solid agar medium in sterilized container

Tissue Culture






TISSUE CULTURE

Amelenchier sp.

15 shoots per culture jar

1524 culture jars

4 week rotation

1 round = 22,860 shoots

1 year = 297,180 shoots


Agrostis gracilescens

Making it Work

- Controlling the propagation environment
  - Medium selection
  - Environmental factors
    - Light, moisture, temperature
  - Disease
- Plant Selection
  - Species
  - Mature vs. Juvenile

The End