Plant Propagation PLS 3221/5222

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Chapters 9 & 10

Principles and Techniques of Cutting Propagation Part 2

Chapters 9-10 Objectives
Student should be able to:

6. Discuss how cuttings are prepared for propagation and treatment of cuttings to improve rooting success.
   - Storage
   - Rooting Hormones (auxins)
   - Cutting nutrition
   - Wounding

Chapters 9-10 Objectives
Student should be able to:

7. Describe how the propagation environment is managed and how to manipulate the rooting environment to improve rooting of cuttings.
   - Water relations – humidity control
   - Temperature
   - Light (quality, quantity and photoperiod)
8. Describe how cuttings are managed after rooting.
9. Identify management practices utilized in propagation.

Types of cuttings

Stem cuttings	Leaf-bud cuttings
• Hardwood – Deciduous – Narrow-leaved evergreen • Semi-hardwood • Softwood • Herbaceous	• **Single node stem cuttings**
	Leaf cuttings • **Leaf blade** • **Leaf blade & petiole**
	Root cuttings

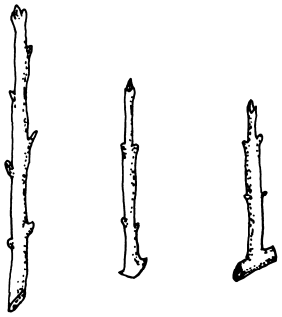
Hardwood Cuttings (Deciduous species)

Hardwood Cuttings

Narrow-leaved evergreen species

- **Mature wood**
- **Dormant wood**
- **Firm wood**
- **Collected during dormant season**
- **May also need older wood for success**

Hardwood Cuttings



- Straight cutting
  - Does not include older wood
- Heel cutting
  - Includes only a small piece of older wood
- Mallet cutting
  - Includes a short stem section of older wood

TYPES OF CUTTINGS

(a)

(b)

(c)

(d)

Figure 10–4 (a and b) Hardwood cuttings of narrow-leaved evergreens being prepared for sticking. (c) Bundled cuttings ready for propagating. (d) Quick-dipping (arrow) cuttings in auxin rooting solution.

Semi-hardwood cuttings (greenwood cuttings)

- Woody, broad-leaved evergreen species
  - Partially mature wood from summer to early fall
  - Collected just after a flush of growth
- Deciduous plants
  - Leafy summer and early fall wood

Semi-hardwood cuttings (greenwood cuttings)

Blueberry

TYPES OF CUTTINGS

Figure 10–6 Semi-hardwood cuttings of (a and b) Magnolia and (c and d) hibiscus.

Hartmann and Kester's Plant Propagation Principles and Practices 8e
Hudson Hartman, Dale Kester, Fred Davies and Robert Geneve

Softwood cuttings

- Succulent, nonwoody stems with leaves retained at the upper end.
- Auxins may be required at lower concentrations and may be used to gain uniformity in rooting and development of heavier root systems.

TYPES OF CUTTINGS

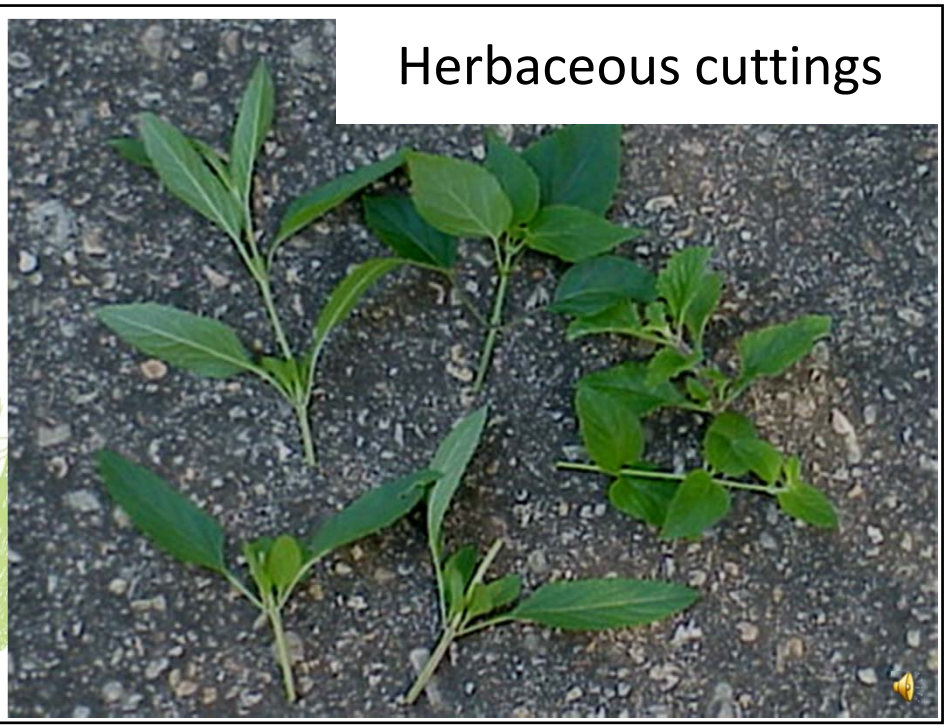
(a) (b)

Figure 10–8 Hydrangea quercifolia 'Snow Queen' propagated by softwood cuttings. (a) Mist propagation bed. (b) Rooted liner.

Herbaceous cuttings

- Cuttings collected from the soft, succulent, new spring growth of deciduous or evergreen species.
- Auxins are generally not required but may be used to gain uniformity in rooting and development of heavier root systems.

Herbaceous cuttings



TYPES OF CUTTINGS

Figure 10–12 Herbaceous carnation (Dianthus caryophyllus) cuttings. (a) Greenhouse stock plants. (b and c) Harvesting and preparing cuttings. (d) Carnation cuttings ready for sticking. (e) Sticking cuttings. (f) Propagating under mist.

TYPES OF CUTTINGS

Table 10–1
PROPAGATION SYSTEMS WITH DIFFERENT TYPES OF CUTTINGS

Cutting type	Hardwood (Deciduous)	Hardwood (Evergreen)	Semi-hardwood	Softwood	Herbaceous	Leaf	Root	Leaf-bud (Single eye or node)
Description	Mature, dormant, or quiescent hardwood stems; woody species.	Mature Hardwood stems; woody species.	Partially mature wood on current season's growth; woody species.	New, soft succulent growth; woody species.	Succulent stems from nonwoody plants.	Leaf blade or leaf blade and petiole; generally from non-woody, herbaceous plants.	Root pieces from thin to fleshy roots; woody and herbaceous plants.	Leaf blade + petiole + short piece of stem with attached axillary bud; woody and herbaceous plants.
Season propagated	Dormant season: late fall to early spring.	Dormant season: late fall to late winter.	Late spring to late summer.	Spring to early summer.	Year-round—with greenhouse-forced, and/or tropical field production.	Year-round—as long as leaves are available.	Take in late winter or early spring when roots contains stored carbohydrates—but before new shoot growth.	Generally during growing season; year-round for tropical plants.
Propagation system	Field propagated; also greenhouse propagated with light intermittent mist, fog, humidity tent, or contact polyethylene.	Light intermittent mist, fog, humidity tent, or contact polyethylene.	Intermittent mist, fog, humidity tent, or contact polyethylene.	Intermittent mist, fog, or humidity tent.	Intermittent mist, fog, or humidity tent.	Intermittent mist, fog, or humidity tent.	Depending on species, directly planted into field or direct planted in flats, and covered with contact polyethylene, or stuck in containers and held in dormant storage.	Intermittent mist, fog, humidity tent, or contact polyethylene.
Cutting length	10–76 cm (4–30 in); normally at least two nodes with basal cut just below the node; mallet, heel, and straight (most common) cuttings used; longer cuttings for rootstocks.	10–20 cm (4–8 in)	7.5–15 cm (3–6 in)	7.5–12.5 cm (3–5 in)	7.5–12.5 cm (3–5 in)	Varies with species, and leaf size, e.g., *Sansevieria* 7.5–10 cm (3–4 in); other species just use section of leaf.	Small, delicate roots—2.4–5.0 cm (1–2 in); somewhat fleshy—5.0–7.5 cm (2–3 in); large roots—5–15 cm (2–6 in)	2.0–7.5 cm (1–3 in); bud may sometimes be placed 1.3–2.5 cm (0.5–1.0 in) below the surface.

Sources of cutting material

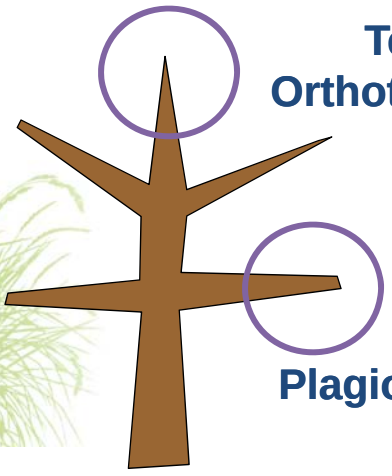
- Stock Plants
  - Hedging, Mounding, Stooling, Banding
- Nursery plants in production as they are trimmed and shaped
- Tissue culture produced liners
- Plants growing in landscapes, parks, etc.

Selection of Cuttings from Stock Plants

Type of wood selected from stock plants

- Lateral vs terminal
  - Plagiotropic (horizontal growth)
  - Orthotropic (upright growth)
- Developmental order
  - terminal vs secondary or second order
- Flowering vs Vegetative

Lateral or Terminal

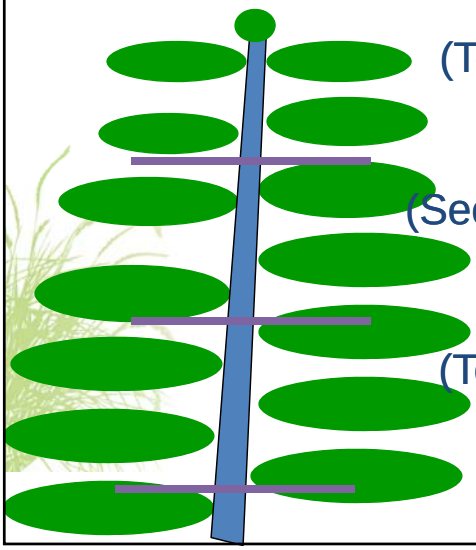


Terminal cutting
Orthotropic shoot growth

Lateral cutting
Plagiotropic shoot growth
Topophysis

Topophysis

Developmental order



(Terminal stem section)

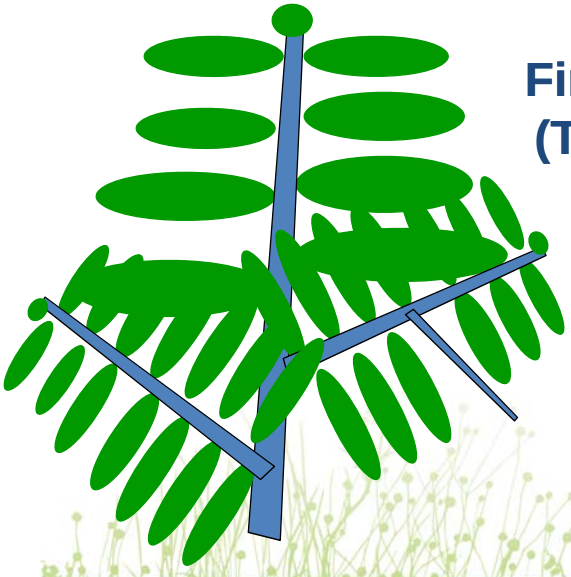
Least mature

(Secondary Stem section)

(Tertiary Stem section)

More mature

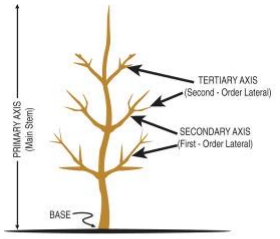
Developmental order



First Order (Terminal)

Second Order (Branch)

MANAGEMENT OF STOCK PLANTS TO MAXIMIZE CUTTING PROPAGATION



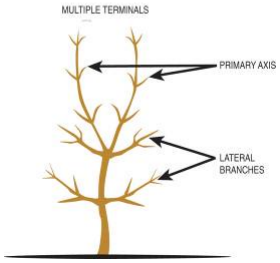


Figure 9–29 The line drawing shows the location where cuttings were taken on stock plants of Frasier fir (Abies fraseri). Top: A schematic of the branch order. Bottom: Demonstrates multiple terminals used as cuttings. Cuttings from lateral branches root readily, but have an undesirable horizontal growth habit (plagiotropic) after rooting. Cuttings taken from the tips of primary axes (main stem) produce symmetrical, upright (orthotropic) trees.

Flowering wood vs Vegetative wood

- Flowering is complex process and may serve as a competing sink to the detriment of rooting.
- With many ornamental species it is commercially desirable to remove flower buds from cuttings for more rapid root development.

Seasonal Timing

- With many species there is an optimal period of the year for rooting.
- The optimal time to take cuttings is more related to the physiological condition of the plant than to any given calendar date.

Seasonal Timing

- Deciduous hardwoods
  - –Fall
- Broad leaved evergreens
  - –Spring to late fall
- Narrow-leaved evergreens
  - –Late fall to late winter

Storage of Cutting Material

- Collect cuttings early in the day.
- Mist to reduce transpiration.
- Hold overnight in refrigeration
  - –(40 to 48 F)

- Rules –

Minimize dry matter losses

Minimize presence of pathogens

Wounding

- Stripping of leaves
- Light wounding – one to four cuts down each side of a cutting through the bark into the wood.
- Heavy wounding – removal of a thin slice of bark from the base on two sides of the cutting.

Wounding

Wounded tissues are stimulated into cell division and production of root primordia

- Accumulation of auxins and carbohydrates in the wounded area
- Increase in respiration in the wounded area ("new sink")
- Injured tissues produce ethylene

Wounding

- Destruction of cell compartments leading to release or synthesis of catabolic enzymes.
  - breakdown products are called *wounding related compounds*
  - act to enhance the receptivity to auxin

Wounding

- May permit greater absorption of applied growth regulators
- May remove a physical barrier to new emerging roots (sclerenchyma)

WOUNDING

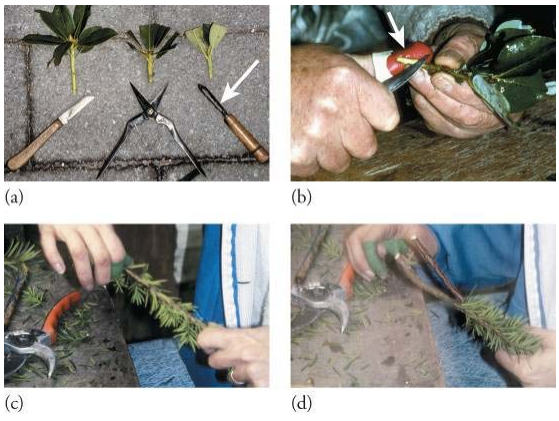
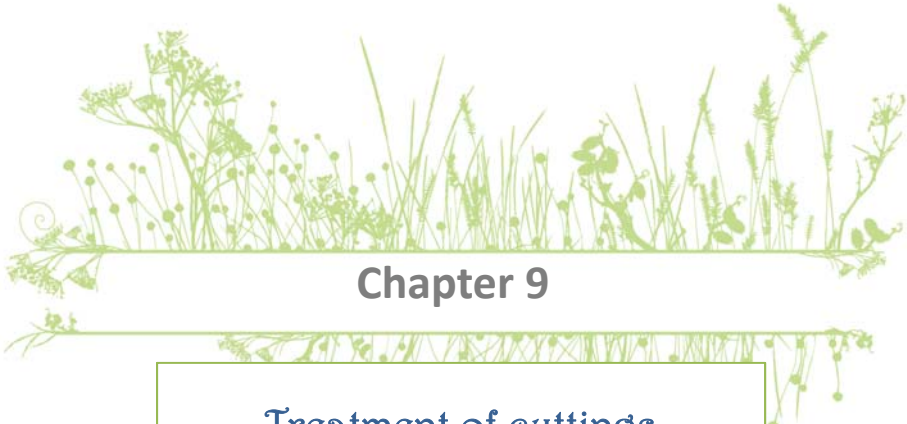


Figure 10–28 Wounding and stripping of cuttings: (a) A potato peeler (arrow) is used for wounding rhododendron cuttings—part of the leaf surface area has been removed by the pruning shears. (b) Wounding a cutting with a knife—notice the thumb protection (arrow) for the propagator. (c and d) Preparing a Thuja cutting by stripping off the lower needles.

Treatment of Cuttings

"A cutting that is barely good enough is never good enough"

"Propagation is the foundation upon which production horticulture hinges"



Chapter 9

Treatment of cuttings
The Propagation Environment

Treatment of Cuttings

- Propagation substrates
- Rooting compounds
- Disease management

Rooting Media (Substrates)

- Hold the cutting in place during rooting.
- Provide moisture for the cutting.
- Permit air exchange at the base of the cutting
- Create a dark environment by reducing light penetration to the cutting base.

ROOTING MEDIA

Table 10–4
SUGGESTED CHEMICAL AND PHYSICAL STANDARDS FOR ROOTING MEDIUM

Property	Comments
Chemical	
pH	4.5–6.5; 5.5–6.5 preferred
Buffer capacity	As high as possible
Soluble salts	400–1,000 ppm (1 media: 2 water by volume)
Cation exchange capacity	25 to 100 meg/liter
Physical	
Bulk density	0.3–0.80 g/cm^3 (dry) or 0.60–1.15 g/cm^3 (wet)
Air-filled porosity	15–40% by volume, ideally 20–25% range
Water-holding capacity	20–60% volume after drainage
Particle stability	Materials should resist decomposing quickly; decomposition can alter other media components

Source: Maronek, Studebaker, and Oberly (99).

Media (substrates)

- Organic components
  - Peat, sphagnum moss,or softwood and hardwood barks.
- Course mineral components
  - Perlite, vermiculite, expanded shale, course sand or grit, pumice, polystyrene and rockwool.

Propagation substrates

- Good water management is the key to success!
- Pest management – damping off organisms
  - Pythium - Pestalotiopsis
  - Phytophthora - Glomerella
  - Rhizoctonia - Botrytis
  - Peronospora

Rooting compounds

- Commercial preparations
  - Talc
  - Concentrated liquid formulations that can be diluted with water.
    - Potassium salt formulations
    - K-IBA and K-NAA
  - Acid formulations that need to be dissolved initially in alcohol, etc.

Solvents

- Alcohol
  - Isopropyl, ethanol,or methanol
- Acetone
- Other carriers for higher concentrations
  - Polyethylene glycol
  - Propylene glycol

Formulations

- Aryl esters of IAA and IBA and the Aryl amid of IBA are equal or more effective than the acid formulation in promoting root initiation.
- Phenyl indole-thiolobutyrate (PITB) has been approved by the EPA and is as effective as IBA in rooting a wide number of woody species

Talc preparations

Uniformity affected by:

- the amount of talc adhering to the base of cuttings
- amount of moisture at the base of cuttings
- Texture of the stem
- Loss of talc during insertion into medium.

Dilute Solution
Soaking method

- Uses 20 to 200 ppm solutions
- Cuttings are soaked for about 24 hours

- Thought to no longer be commercially popular.

Quick Dip
Concentrated Solution Dip

- 500 to 10,000 ppm solutions
  - Water or 50% alcohol (Isopropyl)
- Basal 1 cm dipped for a short time
  - 3 to 5 seconds or longer

More consistent rooting responses reported with quick dips than talc

Alternative methods of Application

- Foliar spray
  - Auxin is applied as a spray to the whole cutting or cutting base to a point of runoff
- Total immersion of whole cuttings
  - Entire cuttings are immersed into the concentrated solution dip

TREATING CUTTINGS WITH AUXINS

Figure 10–32 (a and b) Liquid auxin quickdips of 1 to 5 seconds. (c) Application of auxin by talc. (d) Spray application at end of day reduces exposure of the propagators to auxin.

TREATING CUTTINGS WITH AUXINS

Table 10–5
PARTIAL LIST OF COMMERCIAL ROOTING COMPOUNDS, SOURCES, FORMULATIONS, AND INGREDIENTS

Trade name	Source	Formulation	Ingredient
C-mone, C-mone K (Chloromone K) C-mone K+	Coor Farm Supply Services, Inc., Smithfield, NC	Liquid (isopropyl alcohol)	1 and 2% IBA,1% K-IBA 1% K-IBA. 0.5% NAA
Dip'N Grow	Dip'N Grow, Inc., (Astoria-Pacific, Inc.) Clackamas, OR (www.dipngrow.com)	Liquid (alcohol—ethanol and isopropyl)	1% IBA + 0.5% NAA + boron
Hormex	Brooker Chemical Corp., North Hollywood, CA	Powder (talc) Liquid	Rooting Powder—0.1 to 4.5% IBA Hormex Concentrate—0.13% IBA + 0.24% NAA + Vitamin B-1
Hormodin	MSD-Agvet (Merck & Co.) Rahway, NJ	Powder (talc)	0.1, 0.3, 0.8% IBA
Hormo-Root	Rockland Chemical Co. Newfoundland, NJ	Powder (talc)	1, 2, 3, 4.5% IBA
Hortus IBA	Hortus USA Corp. Inc., New York, NY (www.rooting-hormones.com)	IBA water-soluble salts Powder and water-soluble tablet forms	Up to 1.0% IBA 0.5 to 1.0% IAA 0.1, 0.3, 0.8% IBA
Rootone	Dragon Chemical Corp. Roanoke, VA (www.dragoncorp.com)	Powder (talc)	0.2% 1-1-Napthaleneacetamide, 4% Thiram (fungicide)
Roots	Sure-Gro IP Inc., Brantford, Ontario, Canada	Liquid	0.4% IBA + ethazol (fungicide)
Synergol	Certis, Amesbury, Wiltshire, Great Britain (www.certiseurope.co.uk)	Liquid	0.5% K-IBA + 0.5% K-NAA + fungicides and other additives
Woods Rooting Compound	Earth Science Products Corp., Wilsonville, OR	Liquid (ethanol)	1.03% IBA + 0.56% NAA

Note: The EPA registration number is on the finished formulation container. If no number is present, the product has not been registered and/or is being sold illegally (45).

Hartmann and Kester's Plant Propagation Principles and Practices 8e
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Auxin suppression of bud-break of cuttings

- Application of high concentrations of auxin to stem cuttings can inhibit bud development.
- Application of auxin to root cuttings may inhibit the initiation and development of shoots.

Preventative disease control

- Disease-free stock plants
- Periodically disinfected pruning shears
  - Physan 20 (benzyl chloride)
  - Isopropyl alcohol
  - Monochloramine

PREVENTATIVE DISEASE CONTROL

(a)

(b)

(c)

(d)

Figure 10–34 Preventative disease control measures: (a and b) Collecting cuttings in buckets containing cups for periodically disinfecting knives and shears. (c and d) Soaking cuttings in a broad-spectrum fungicide and bactericide prior to treating with rooting hormones and sticking. (d) Cuttings put in wire basket and soaked in chemical bucket. (With the current Worker Protection regulations, individuals utilizing chemicals with cuttings are considered to be pesticide handlers and need to be properly trained. Any chemical usage needs to comply with the manufacturer's recommendation; see the OSHA web site, www.osha.gov).

Chemical treatment of cuttings

- Broad spectrum fungicidal dip or drench
  - Agribrom (oxidizing biocide)
  - Agricultural streptomycin (bacteria)
  - Quaternary ammonium products
    - Physan 20
    - Consan

Chemical treatment of cuttings

- Broad spectrum fungicidal dip or drench

Thiophanate methyl

- Topsin M
- Domain
- Cleary 3336
- Sys Tec 1998

Chapters 9 & 10

Manipulation of the Propagation Environment

Environmental Manipulation

Water Relations

– Humidity Control

1. Maintain an atmosphere with low evaporative demand.
2. Maintain acceptable temperatures for the regeneration process at the cutting base and avoid heat stress of leaves.
3. Maintain light levels suitable for photosynthesis and carbohydrate production.

ENVIRONMENTAL CONDITIONS FOR ROOTING LEAFY CUTTINGS

- For successful rooting of leafy cuttings, some essential environmental requirements are:
  - Rooting media temperature of 18 to 25° C (65 to 77° F) for temperate species and 7° C (12° F) higher for most tropical species
  - Atmosphere conducive to low water loss and maintenance of turgor in leaves
  - Ample, but not excessive, light—100 W/m2 with selected temperate woody species (exceptions are with species propagated under full sun irradiance in outdoor mist beds)
  - Clean, moist, well-aerated, and well-drained rooting medium

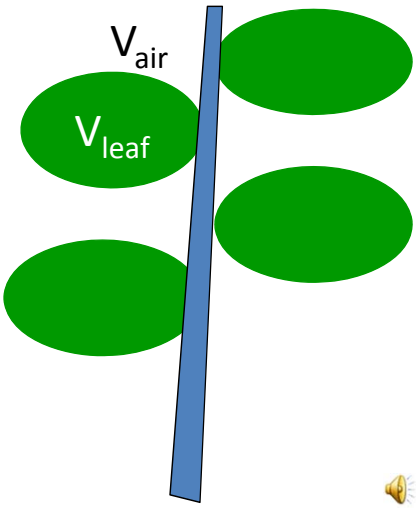
Water Relations – Humidity Control

$V_{air} > V_{leaf}$

no water loss from leaves

$V_{air} < V_{leaf}$

water loss from leaves



ENVIRONMENTAL MANIPULATION OF CUTTINGS

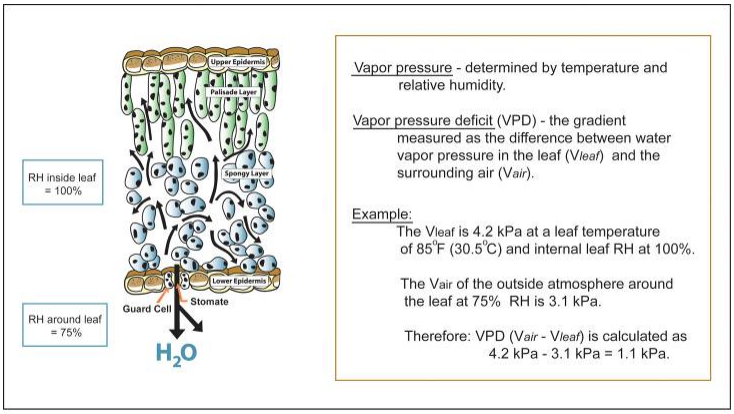


Figure 9–37 Controlling vapor pressure deficit (VPD) during cutting propagation. Leaf cross section with high 100 percent internal relative humidity (RH). Water vapor exits the leaf stomata into the lower RH (lower water potential) of the outside surrounding air.

Mist Control systems

- Static – rely on clocks and timers to manage intermittent mist and fog systems.
- Dynamic – rely on environmental parameters to determine water status of cuttings.

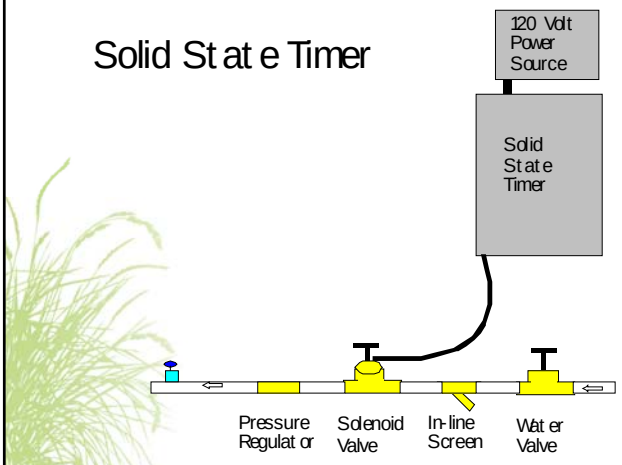
ENVIRONMENTAL CONDITIONS FOR ROOTING LEAFY CUTTINGS

(a)

(b)

Figure 10–41 Static control systems rely on clocks and timers to manage intermittent mist and fog systems. (a) A 24-hour clock (arrow) turns the system on in the morning and off around dusk, or can be adjusted manually. (b) Time clock controlling the minutes between mist interval "on" time and the seconds of actual mist duration is wired to the 24-hour clock.

Mist Controls - Static



ENVIRONMENTAL CONDITIONS FOR ROOTING LEAFY CUTTINGS

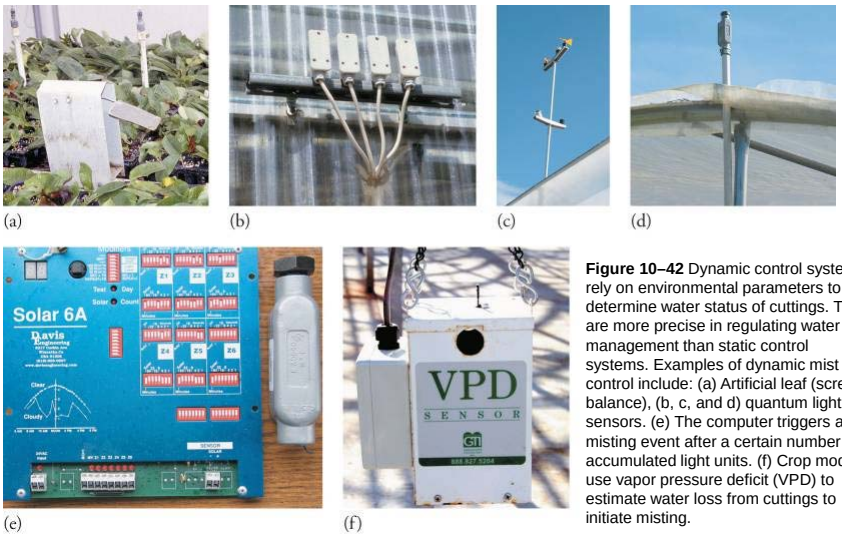
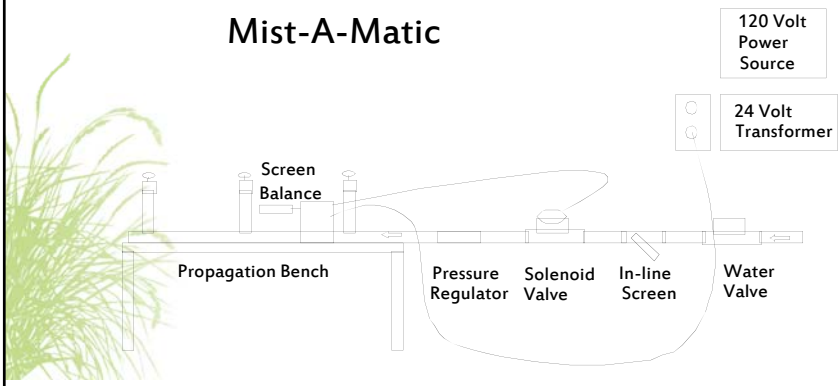


Figure 10–42 Dynamic control systems rely on environmental parameters to determine water status of cuttings. They are more precise in regulating water management than static control systems. Examples of dynamic mist control include: (a) Artificial leaf (screen balance), (b, c, and d) quantum light sensors. (e) The computer triggers a misting event after a certain number of accumulated light units. (f) Crop models use vapor pressure deficit (VPD) to estimate water loss from cuttings to initiate misting.

Mist Controls - Dynamic



Environmental Conditions for Rooting leafy cuttings

- Mist nozzles
  - Pressure jet or whirl-type nozzle
    - Low output (2 to 5 gallons per hour)
  - Deflection or anvil nozzle
    - Uses more water (varies with design)

ENVIRONMENTAL CONDITIONS FOR ROOTING LEAFY CUTTINGS

Figure 10–39 Versatility of mist systems hung from the propagation roof allowing more efficient propagation bench utilization per unit area. (a, b, and c) Netafim plastic impact nozzle system. (b) Netafim sprinkler with a check valve to prevent dripping between misting intervals. (c) Red shade cloth shifts light quality to the red and far-red, which can enhance rooting of cuttings. (d and e) Boom mist propagation system for large propagation areas.

ENVIRONMENTAL CONDITIONS FOR ROOTING LEAFY CUTTINGS

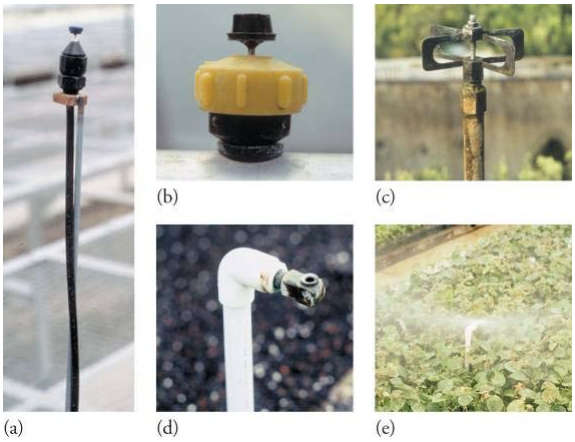


Figure 10–40 Mist nozzle systems: (a and b) Deflectiontype mist nozzles made of hard plastic (Eddy-mist) or (c) metal. (d and e) Parasol, brass pressure jet or whirl-type nozzles.

ENVIRONMENTAL CONDITIONS FOR ROOTING LEAFY CUTTINGS

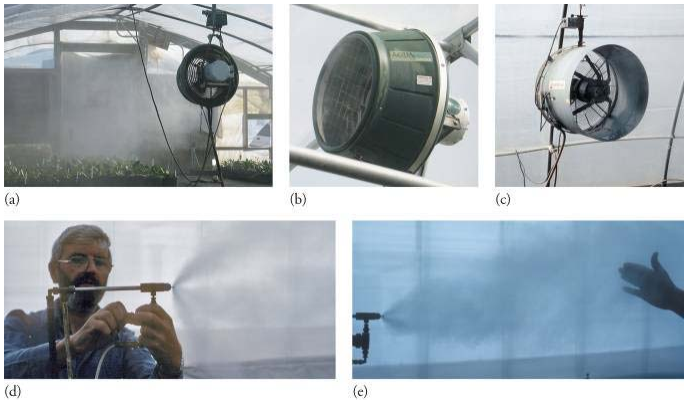
- Fog Systems
  - Fogging Equipment
  - Fogging Controllers

Propagation Water System	Fog	Micromist	Mist	Sprinklers (coarse mist; rainsize drops)
Droplet size range	2–40 μm[1]	2–100 μm	50–100+μm	100+μm
Average droplet size	15 μm	40 μm	>50 μm	>100+μm

[1]Human hair has an average diameter of 100 μm.

Figure 10–44 A comparison of fog, micromist, and mist systems used for propagation (106).

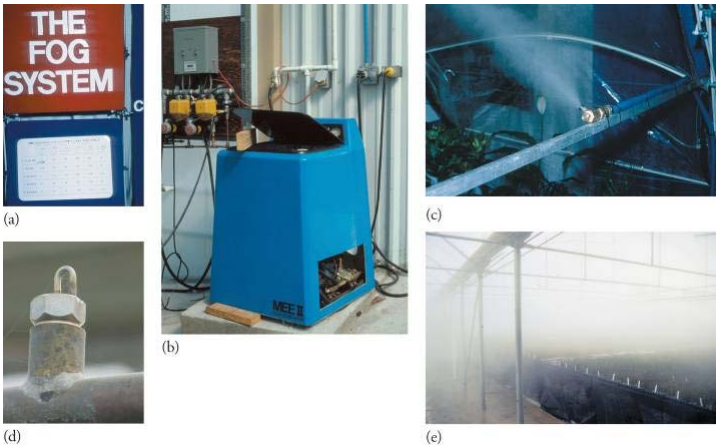
ENVIRONMENTAL CONDITIONS FOR ROOTING LEAFY CUTTINGS



(a) (b) (c) (d) (e)

Figure 10–45 Fog systems: (a, b, and c) Centripetal foggers for ventilated high humidity. (a and b) AquaFog Humidifier (AgriTech). (d and e) Pneumatic or ultrasonic humidifier nozzle systems (Sonicore Ultrasonic Humidifier) have many advantages over intermittent mist, even though they are more expensive.

ENVIRONMENTAL CONDITIONS FOR ROOTING LEAFY CUTTINGS



(a) (b) (c) (d) (e)

Figure 10–46 (a, b, c, d, and e) High pressure fog systems. (b, c, and d) Fog produced by a Mee system that uses a nozzle (d) with very small orifice that generates fog under extremely high pressure.

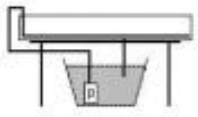
Fog systems

- Dry fog
  - 2 to 40 um droplets (average 15)
  - Remain suspended in the air
- Wet fog
  - Micromist - 2 to 100 um droplets (average 40)
  - Mist - 50 to 100 um droplets (average >50)

Enclosure Systems

- Low polyethylene tunnels
- Cold or hot frames
- Contact polyethylene systems
- Indoor polytents

Alternative systems



- Subirrigation
  - Water is supplied by capillary action through a coarse medium.

ENVIRONMENTAL CONDITIONS FOR ROOTING LEAFY CUTTINGS

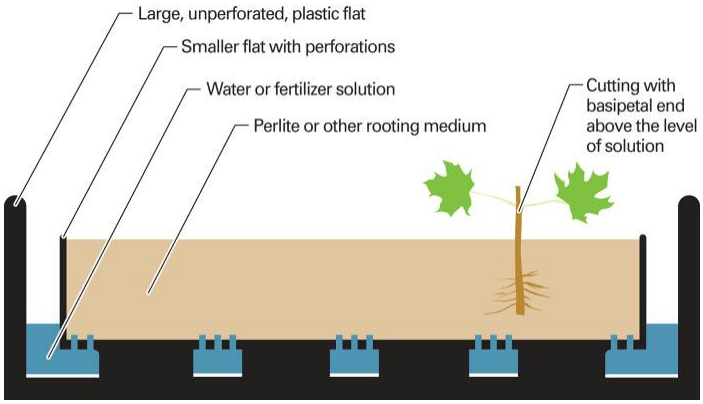


Figure 10–47 A subirrigation propagation system.

Operational management of mist and fog systems (Potential problems)

- Low water pressure (50 psi minimum)
- Sand or debris in water
  - Install inline filters in supply line prior to solenoid valves.
- Dripping from nozzles between cycles
  - pressurized cutoff valves that shut down as they go below 20 psi.

Pathogens, algal growth, mosses and liverworts

- Pathogen control begins with clean propagation water for mist and fog systems.
  - Disinfection or destruction of pathogenic microorganisms
    - Chlorination
    - Bromination
    - Ozonation

Liverwort

Water Quality

Review this topic from Chapter 3 !

- The quality of water used in mist can influence the rooting response!
  - Water analysis
    - pH
    - total soluble salts
    - total carbohydrates
    - electrical conductivity

Care of cuttings during rooting

- Cutting nutrition
- Environmental conditions
- Sanitation and IPM
- Weed Control

Care of Cuttings

Cutting Nutrition

- Most cuttings contain sufficient nutrients to allow rooting.
- Intermittent mist will rapidly deplete nutrients from cutting leaves.
- Until a cutting initiates roots, its ability to absorb nutrients is limited

Leaching of Nutrients

- Easily leached
  - Nitrogen, Manganese
- Moderately leached
  - Calcium, Magnesium, Sulfur, and Potassium
- Leached with difficulty
  - Iron, Zinc, Phosphorus, and Calcium

Care of Cuttings

Cutting Nutrition

- Mist application of nutrients
  - not practical
  - Algae formation on cuttings, etc
    - Reduces light to cutting surfaces
    - Creates a sanitation problem
    - Creates an aeration problem with rooting substrates

Care of Cuttings

Cutting Nutrition

- Slow release fertilizer
  - top-dressed (broadcast) over the top
  - pre-incorporated in the propagation substrate.
    - Osmocote
    - Ficote
    - Nutricote

Care of Cuttings

Cutting Nutrition

- Osmocote 18 - 6- 12
  - 6.8 to 13.8 g/m^2 (2.6 to 5.3 oz/ft^2)

- Supplemental nutrients do not promote root initiation, but improve root development once root primordia formation and subsequent root elongation have occurred.

Care of Cuttings

Environmental conditions

- Maintain humidity as high as possible when rooting leafy cuttings
- Adequate drainage must be provided to allow for excess water drainage and sufficient oxygen in the root zone
- Accelerated Growth Techniques (supplemental CO_2)

Care of Cuttings

Sanitation and IPM

- Pathogens find ideal conditions in humid, closed propagating structures with low light irradiance
- Preventative and scheduled weekly applications, selectively rotating fungicides
- Pests (mites, aphids, and mealy bugs) are controlled by miticides and insecticides and immediate rouging and other IPM.

Care of Cuttings

Weed Control

- use weed free, pasteurized or gas-sterilized rooting media
- keep the perimeters adjacent to the propagation area free of weeds
- herbicide the propagation area
- spot weed by hand as needed

Care of Cuttings

Herbicide use in propagation

- Granular dinitroanaline herbicides can suppress root initiation and development in stem cuttings.
  - Rout 3G
  - OH-2 3G
  - Ronstar 2G
  - Snapshot 2.5TG
  - Southern Weedgrass Control 2.68G

Hardening off
Post-Propagation care

- Hardening off
  - gradually acclimating rooted cuttings from high humidity to low humidity
  - rooted cuttings become more self sufficient
    - absorb nutrients and water through the root system
    - photosynthesize

Overwintering

- A flush of growth (late summer) is essential for some species
- Provides carbohydrates
  - extending photoperiods
  - manipulating fertilizer regimes
- Cuttings must harden off before the onset of winter
- Residual auxin may inhibit bud break

Chapters 9 & 10

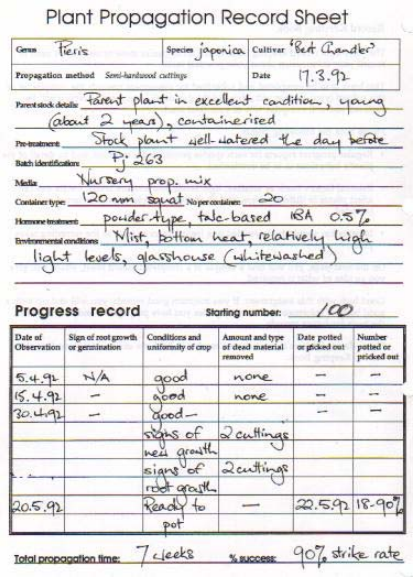
Management Practices
Record Keeping

Management Practices
Record Keeping

- Good record keeping is essential in helping the propagator to hone skills and reduce failures!
  - Written records
    - Computerized or printed
  - Photographs
    - Digital images or color prints
  - Backup copies are essential!

Management Practices

Record Keeping



Plant Propagation Record Sheet

Genus	Species	Cultivar
Pieris	japonica	'Red Chandler'

Propagation method: Semi-hardwood cuttings — Date: 17.3.92

Parent stock details: Parent plant in excellent condition, young (about 2 years), containerised

Pre-treatment: Stock plant well-watered the day before

Batch identification: Pj 263

Media: Nursery prop. mix

Container type: 120 mm square — No per container: 20

Hormone treatment: powder type, talc-based IBA 0.5%

Environmental conditions: Mist, bottom heat, relatively high light levels, glasshouse (whitewashed)

Progress record — Starting number: 100

Date of Observation	Sign of root growth or germination	Conditions and uniformity of crop	Amount and type of dead material removed	Date potted or picked out	Number potted or pricked out
5.4.92	N/A	good	none	—	—
15.4.92	—	good	none	—	—
30.4.92	—	good — signs of new growth	2 cuttings	—	—
		signs of root growth	2 cuttings		
20.5.92		Ready to pot	—	22.5.92	18-90%

Total propagation time: 7 weeks — % success: 90% strike rate

MANAGEMENT PRACTICES

Genus	Species	Cultivar	Patent #(if appropriate)
Nandina	*domestica*	'Gulf Stream'	#5656

Company Catalog No.	Propagation System	Date Propagated
No. 4928	Direct stuck into 3P liner pots	14-Sept-2010

No. Liner Pots (Cuttings) Per Flat; Location Cuttings Taken from Stock Plants

36 liner pots (cuttings) per flat; Cuttings harvested from Section D, Area 1, from 1-gallon plants

Propagator's ID # (to track who propagated the tray)

No. 18

Figure 10–53 Some sample propagation information to be printed on plastic labels and inserted in propagation flats or direct-stuck liner pots in liner trays.

MANAGEMENT PRACTICES

Record Card/File for Cutting Propagation

Cutting
Botanical Name: _____
Common Name: _____
Cultivar: _____
Date Propagated: _____
Date Rooted: _____
Cutting Type (i.e., semi-hardwood, terminal, basal, etc.): _____
Cutting Size (length or number of nodes): _____
Stock Plant Characteristics & Any Pretreatment (shading, banding, etc.): _____
Cutting Treatment (wounding, stripping cuttings, etc.): _____
Auxin(s): Formulation _____ Concentration _____ Method of Application _____
Rooting Medium: _____
Propagating System (mist, fog, contact polysheets, etc.): _____
Environmental Requirements (bottom heat, temperature, special mist conditions, light conditions, etc.): _____
Flat, Bed, or Container Size Planted & Location _____
No. of Cuttings per Flat _____ (or) No. of Direct-Stuck Liner Pots per Flat _____
Source of Cuttings _____
Propagator's Name and ID No. (to correspond with Label No. on propagation flat) ____
Date Rooted Cuttings Potted Up: _____ No. of Liners _____
Area to be Placed, Customer, or Department Shipped to: _____
Results: Total Rooted _____ % Rooted _____
Total Rooted Cuttings Shifted-up Liner Pots _____
% Rooted Cuttings Shifted-up to Liner Pots _____
Total Rooted Liner Pots Shifted-up to One-Gallon Containers _____
% Rooted Liner Pots Shifted-up to One-Gallon Containers _____
Observations & Comments _____

Figure 10–52 A sample record card charting the propagation history in a production cycle of a plant cultivar from propagation through linear production. This is easily computerized.

Daily Propagation Record Sheet

- Date, Species and cultivar
- Quantity propagated
- Source of cutting material
- Type and condition of cutting
- Description of cutting preparation
- Number of personnel
- Total personnel hours

Costing variables

- salaries
- wages
- benefits
- maintenance costs
- grounds upkeep
- depreciation
- equipment

Piecework systems

- **performance rates per worker hour**
- **Cash incentives when daily quotas are exceeded.**

Timing and Scheduling

- Commercial priorities often determine scheduling in a nursery
  - Spring shipping to retailers
  - Availability of propagation space
  - Availability of personnel
  - Optimum biological time for rooting
  - More difficult to root cuttings should be stuck early

Plant Wastage

- poor quality
- poor market demand
- poor propagation and production techniques
- scheduling problems
- poor marketing strategies

Plant residency

- The time from propagation to production to sale of quality, finished plants.
- The shorter the plant residency, the lower the production costs.

Production-led propagation systems

- Traditional system
  - the marketing strategy is constrained by the production process.
  - mass factory production techniques rather than more careful individual selection, can lead to variable quality and high failure rates.

Market-led propagation system

- The producer negotiates with retail outlets the quantity of plants required at particular times during the sales season and can adjust the growing program accordingly to deliver plants, in prime condition as required.

MANAGEMENT PRACTICES

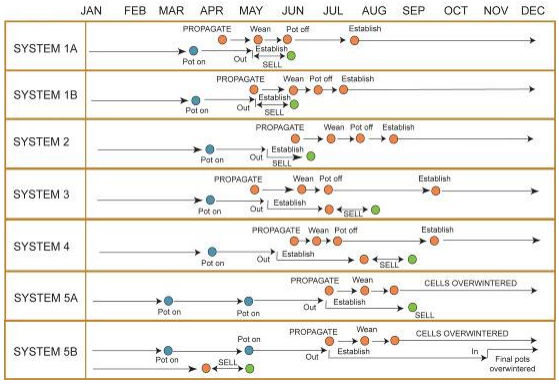


Figure 10–57 An example of a market-driven propagation system for Abelia xgrandiflora in England that more efficiently utilizes propagation facilities and delivers finished plants during designated selling periods. There are seven different propagation periods and seven targeted sales periods that extend the marketing period of the crop (148).

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