Welcome to USLGA's Front Porch Event

Hello everyone, we will be your moderators for tonight's session. Let's begin with housekeeping notes:

- To cut down on noise during the presentation, please keep microphones muted until the Q&A session at the end.
- To present a question, please enter it into the Chat box, which is located at the bottom of your screen. If you do not see any buttons, move your mouse over that area and the toolbar will become visible. We will go over Q&A at the end of this presentation.
- For any technical issues, please put a note in the Chat box and we will try to assist you.
- For a copy of today's presentation, please visit our USLGA website, we will post this presentation within 2-3 business days. Also, an email will be sent to members when the Fast Facts overview becomes available.

Tonight's presentation is being recorded for future access on our website, please begin the recording.

Meet Our Educational Sponsor

The content of this presentation is sponsored in part by Joseph Downs, Owner, The Lavender Boutique. The Lavender Boutique, for everything lavender, serves as the Educational Sponsor of USLGA's Front Porch Series and plays a crucial role in the support and program quality of its events.

Starting a Healthy "root"-ine: Lavender Propagation by Cuttings

Front Porch Events

Panelists: Jacob Hurst, M.S.

Lecturer, M.S. Plant Science, Fresno State

PhD student, Tropical Plant and Soil Science, University of Hawaii at Manoa

July 11, 2024

Jacob Hurst, M.S.

Jacob Hurst is a lecturer in the Plant Science Department at California State University, Fresno and PhD student in the Tropical Plant and Soil Sciences Department at University of Hawaii at Manoa. He teaches plant health and propagation courses. His research interests include grafting, propagation of drought tolerant food crops, and development of climate-smart sustainable agroecosystems.

Contact: jhurst@csufresno.edu

Starting a healthy “root”-ine: Lavender propagation by cuttings

Jacob Hurst, M.S.

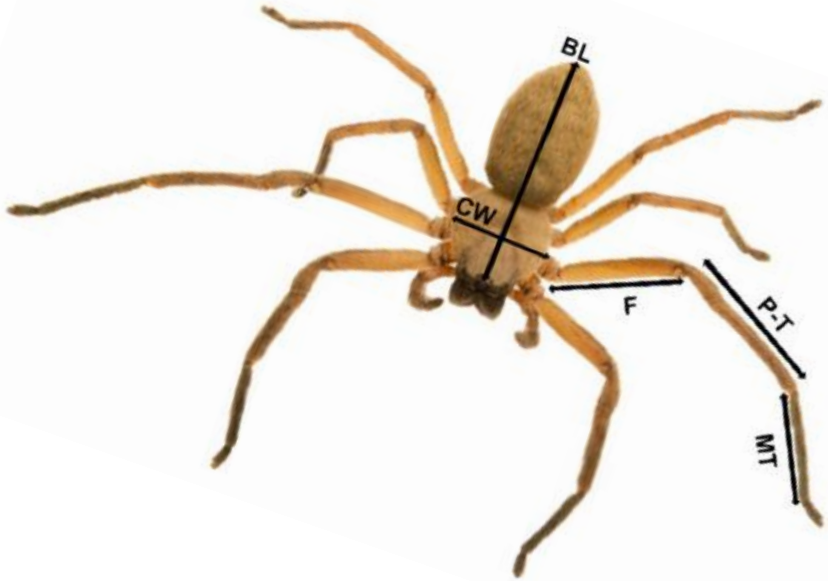
Plant Health Lecturer – Department of Plant Science, California State University, Fresno

What goes into propagation from cuttings?

- **Introduction**
- **How Do New Roots Form?**
- **Care of rooted cuttings: acclimation and nutrition**
- **Healthy stock plants, healthy cuttings**
- **Environmental factors affect rooting success**
- **Regional Challenges**
- **Organic Production Systems**

Introduction

- B.S. Cornell University → M.S. Fresno State → PhD UH Manoa (in progress)



Cornell

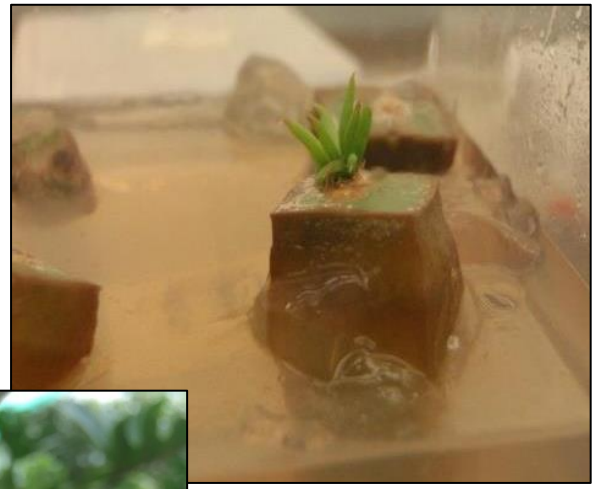
- Entomology and Plant Science

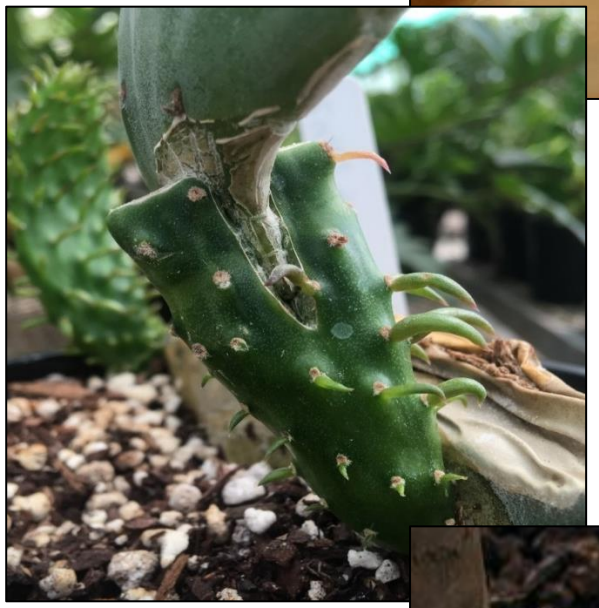
- Spider Functional Ecology Research

- Running speed and sexual size dimorphism in an Australian social huntsman spider (*Delena cancerides*)

Introduction

- CSU Fresno – Development of Propagation Protocols for salt-tolerant Prickly Pear Cactus (*Opuntia ficus-indica*)





- Traditional and *in vitro* approaches

- UH Manoa – Cover cropping with Nānea (*Vigna marina*) for sustainable agriculture.

http://nativeplants.hawaii.edu/plant/view/Vigna_marina/

Connections to Lavender

- Plant Science Dept. – connected with Fresno-area grower
- Richard Gillispie, Lavender Fresh Farm

- Plant Propagation (PLANT 105) at CSU Fresno

- Course-based Undergraduate Research Experience (CURE)
  - Answering real-world research questions of interest to outside stakeholders
  - Preliminary research addressing questions for USLGA

How Do New Roots Form?

- De novo (wound-induced, adventitious) vs preformed root initials
- Lavender does not have preformed root initials
- Stages of root formation 0-4 (Combined production and physiological framework)
- Age of material impacts speed and likelihood of de novo rooting

De novo vs preformed root initials

- Plants with preformed root initials (like *Salix spp.*) have root primordial under the bark, ready to emerge when conditions are right.
- Preformed root initials = very easy to root.
- De novo root formation occurs in response to wounding and/or application of outside (exogenous) rooting hormone(s).

Figure 3. Pre-formed root initials in cherry rootstock COLT (**A**) with a close look at their emergence (**B**) and wound plus auxin-induced roots in peach-almond rootstock GF677 softwood cuttings (**C**).

Roussos (2023)

De Novo Root Formation in Lavender

- Stage 0 – Selection of plant material

- Correct variety
- Free of pests and diseases
- Mineral nutrition and water status
- Stage of development – Can be too young or too mature

De Novo Root Formation in Lavender

Stage 1 – Harvest and Sticking the Cuttings

- Reduce time between harvest and sticking
- Time, temperature, and moisture are critical
- Stripping of leaves and trimming may be needed
- 2/3 leaf retention may improve rooting

(de Bona et al., 2012)

Rooting hormones

- Indole-3-butyric acid (IBA) and naphthalene acetic acid (NAA)

- Can stimulate or inhibit root formation depending on concentration

What is the ideal concentration for rooting lavender cuttings?

- Range of concentrations reported is 1000-8000 ppm IBA
- The lowest effective dose for your cultivar should be used.

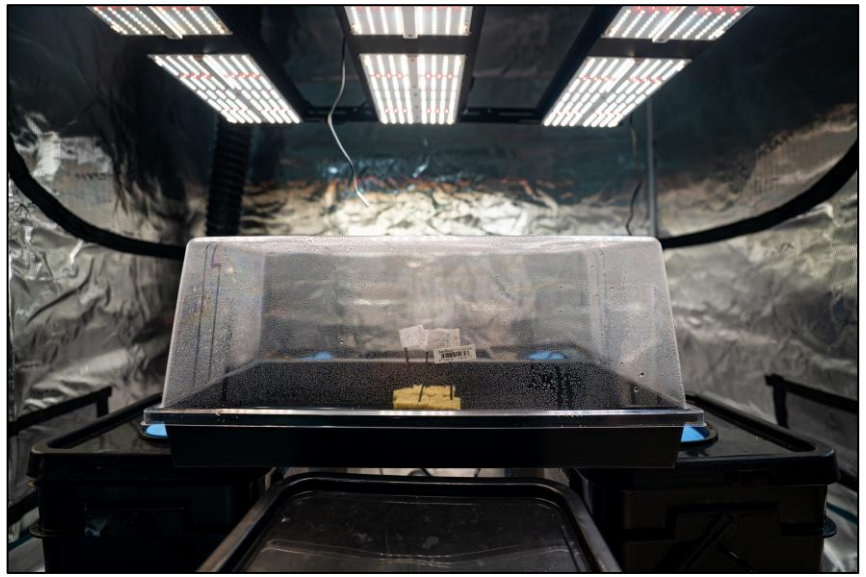
Rooting hormones

- Lavender is generally easy-to-root, so low concentrations are usually quite effective

- ~0.01% IBA (1000 ppm)
- Can be applied as powder, soak, or gel
- Used to encourage fast and uniform root formation

Structures for Rooting of Cuttings

- Humidity domes
- Cold frames
- Greenhouses



De Novo Root Formation in Lavender

- Stage 2 – Early physiological changes
- Not visible, but physiological changes within vascular tissue prepare for root formation.
- Initial response requires competence (ability to respond to hormonal stimulus).

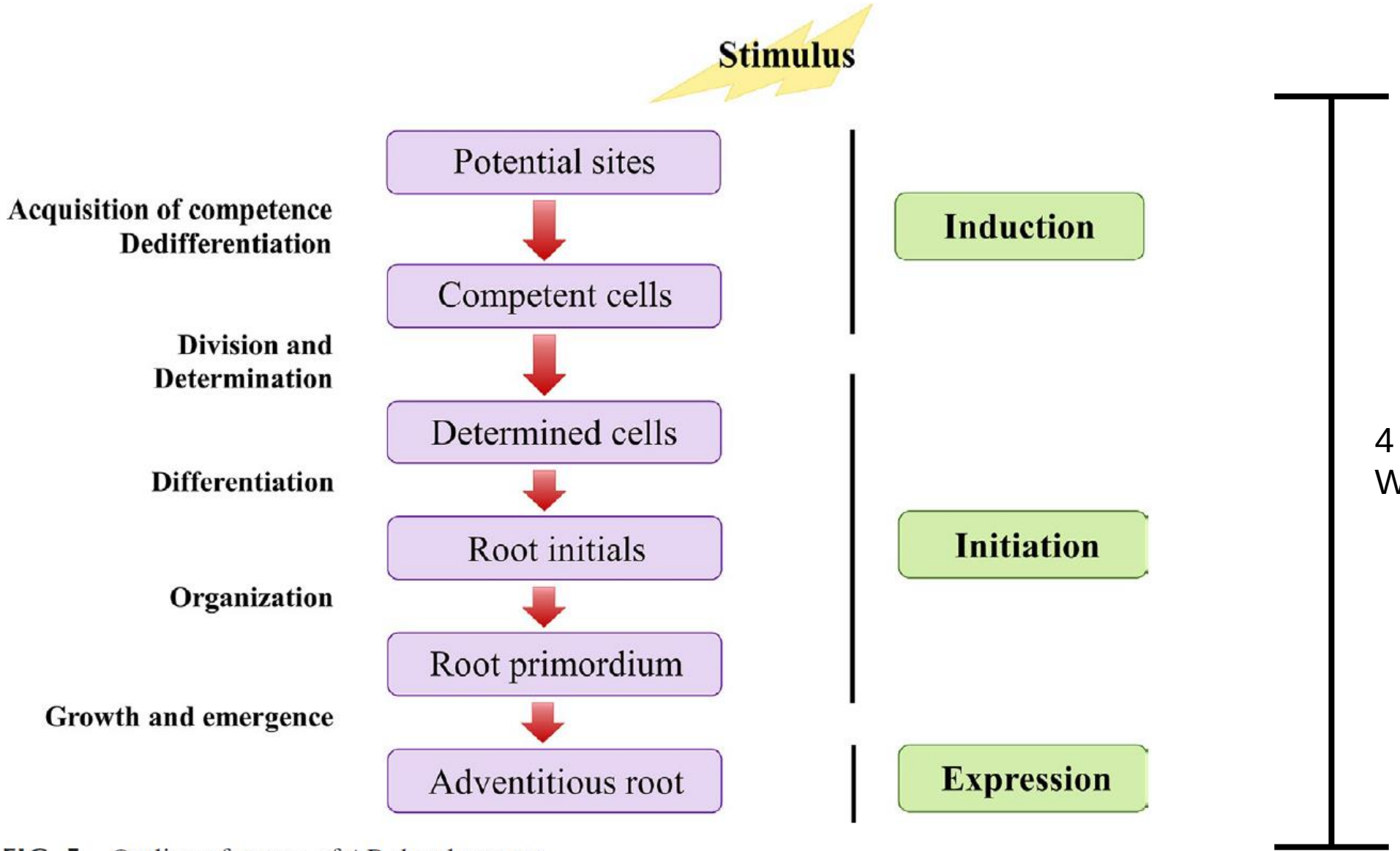


FIG. 5 Outline of stages of AR development.

Tailor et. al (2022)

De Novo Root Formation in Lavender

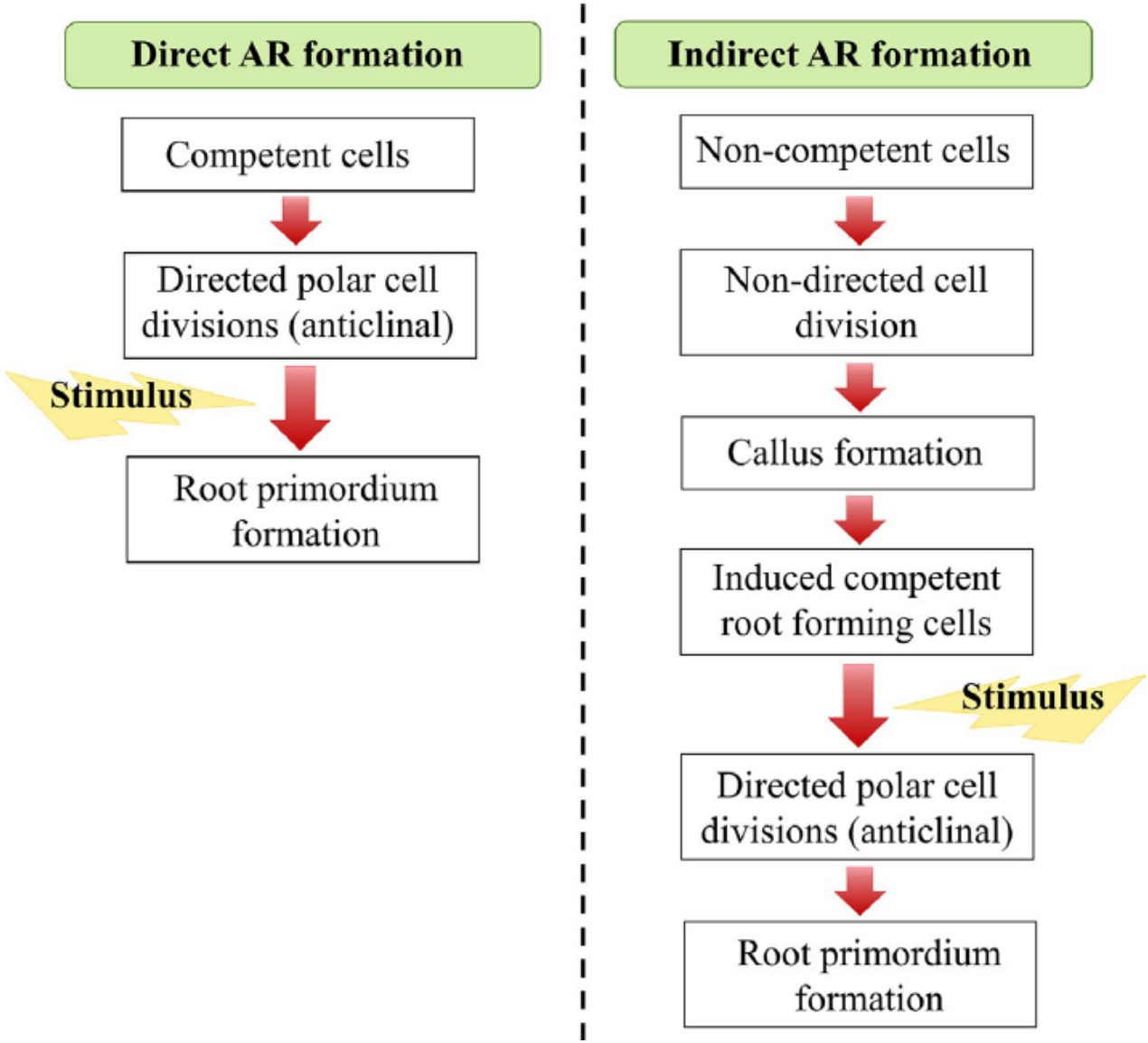
- Stage 3 – Formation of Root initials and/or callus, then root primordia
- Root initials not visible from outside, but could be viewed in cross-section
- Callus is not required for root formation, but forms under similar conditions

De Novo Root Formation in Lavender

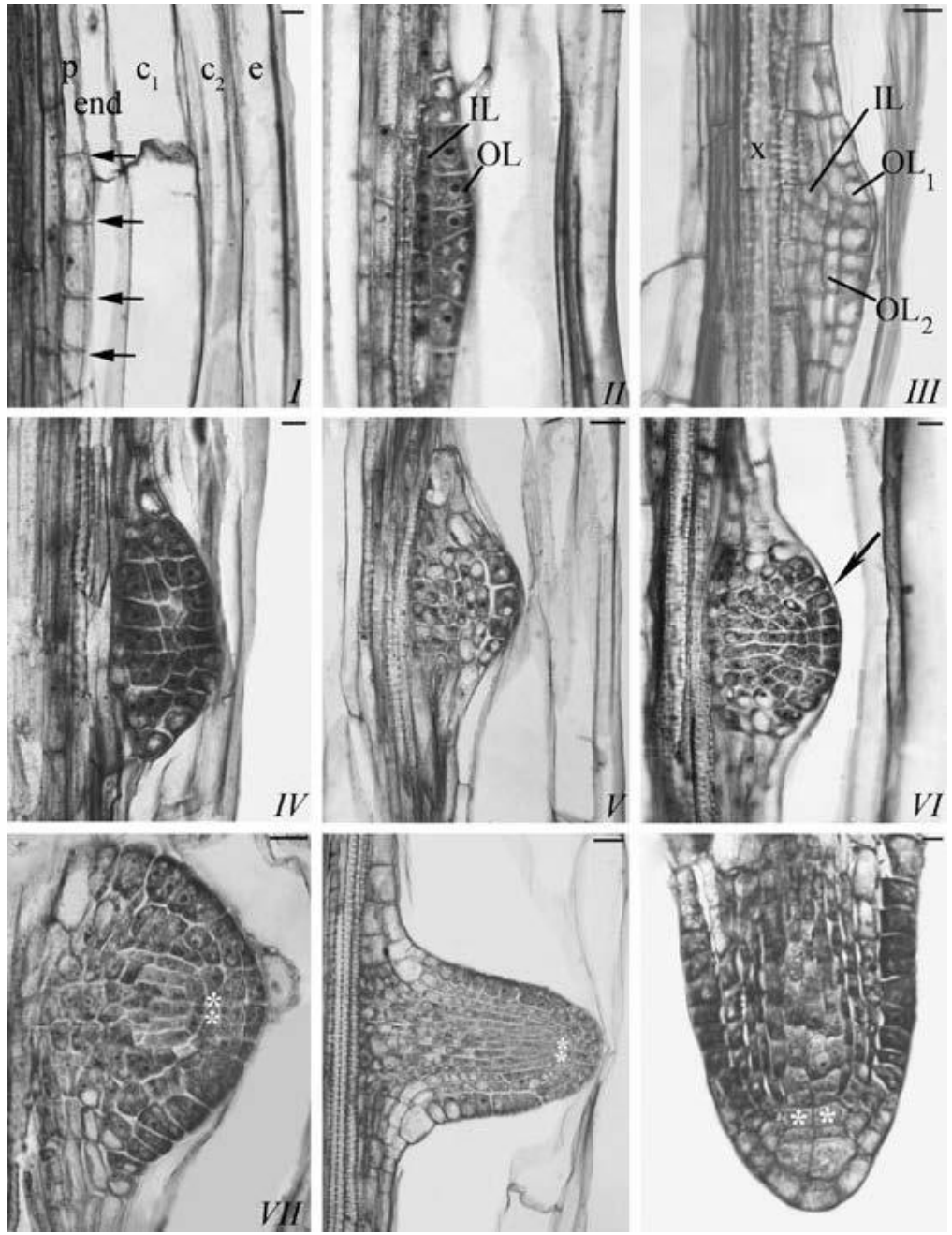
- Stage 3 – Formation of Root initials and/or callus, then root primordia

Direct vs Indirect rooting

- Direct – Forms with a connection to vascular system
- Indirect – Forms in callus and then must develop a connection to the vascular system
- Indirect rooting is a slower process than direct rooting



Tailor et. al (2022)



Rovere et. al (2013)

De Novo Root Formation in Lavender

- Stage 4 – Root elongation/emergence
- Root initials expand, burst out of the stem tissue
- Can begin uptake of water and nutrients
- You have a complete plant! Congratulations!
- Requires acclimatization before transplanting.

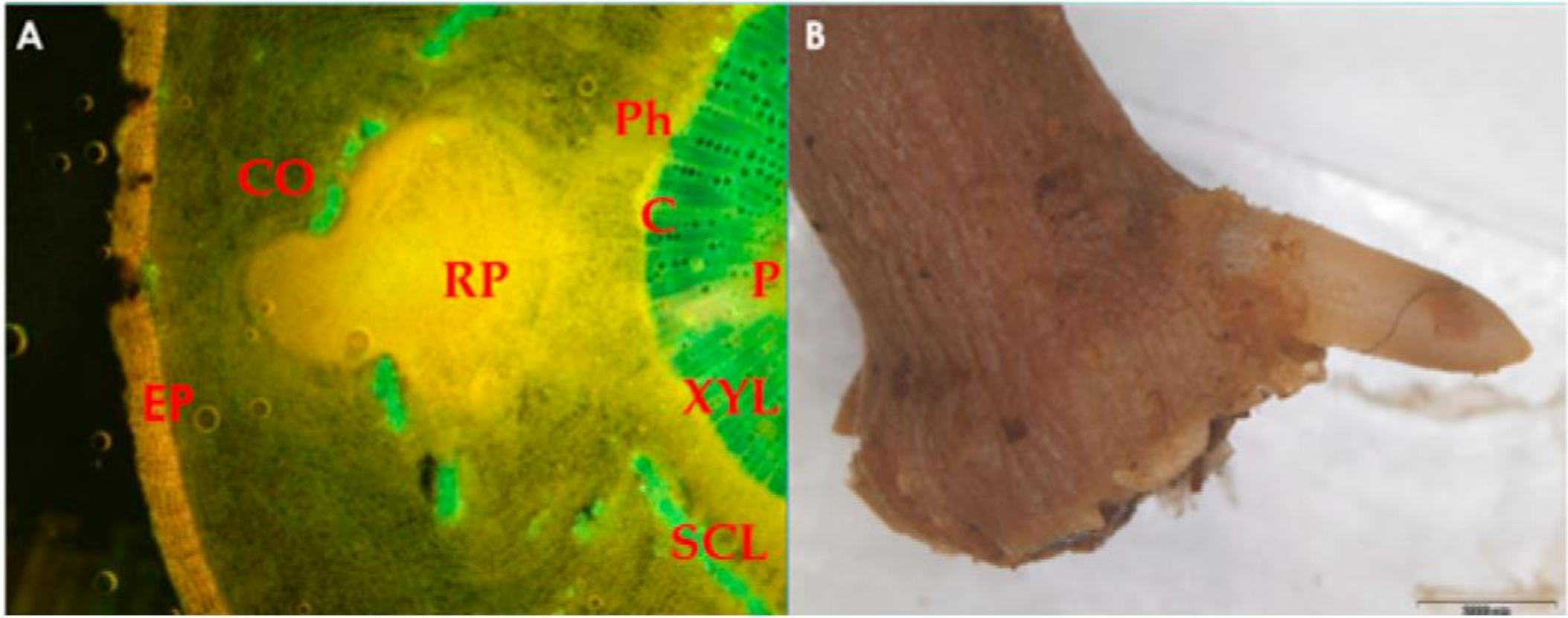


Figure 1. (**A**) Microscopic image of root primordium (RP) development in olive leafy cutting, originating from the area around the cambium (C), which disrupts the continuum of the sclerenchymatous ring (SCL) and passes through the cortex (CO); (**B**) root emergence at the base of olive sub-apical shoot cutting. EP, epidermis; XYL, xylem; P, pith; Ph, phloem. The photo is courtesy of Prof. Nikoleta-Kleio Denaxa.

Care of rooted cuttings: acclimation and fertilization

Acclimation, AKA hardening off

- Decrease humidity, increase light gradually
- Allows tissue to lignify, cuticle to thicken
  - Stronger plants with less water loss

Care of rooted cuttings: acclimation and fertilization

Nutrition

- Before rooting, no need to fertilize
  - Cuttings subsist on stored nutrients, limited photosynthesis

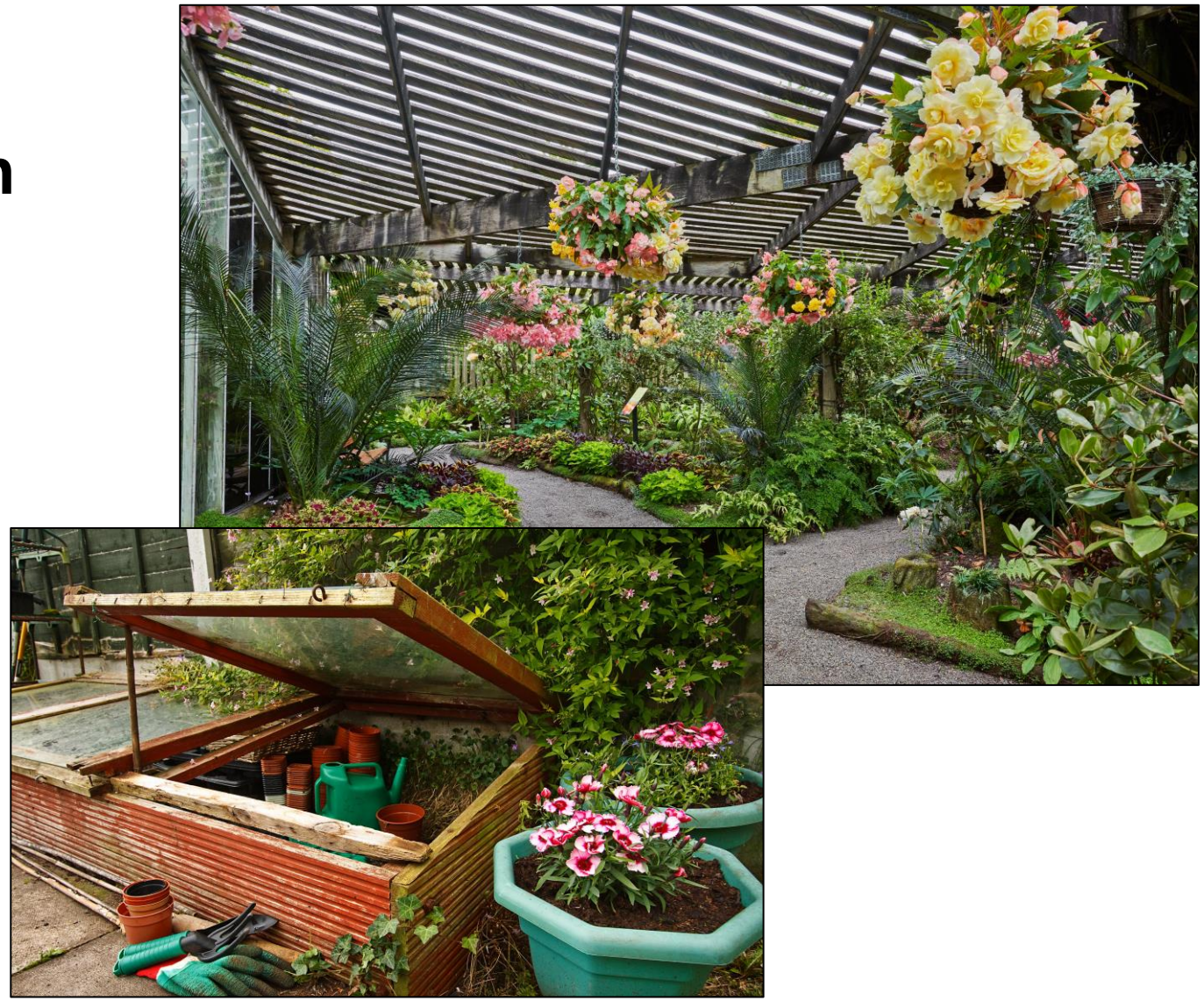
- Rooted cuttings can be lightly fertilized
- Higher humidity + limited root system means uptake is low
- High risk for leaching in mist systems

Care of rooted cuttings: acclimation and fertilization

Structures for acclimatization

- Shade + mild temperature
- Covered cold frames

- Sheltered places outdoors



Maturity of cuttings impacts rooting success

- Juvenile vs Mature cuttings
- Ease of rooting tends to decrease with maturity, due to loss of competence.
- In easy-to-root species this may manifest as slower rooting speed.
- Softwood and hardwood cuttings can be taken at both levels of maturity.

Types of cuttings

- Softwood – Soft, new growth with some lignification
- (Semi)Hardwood – Older, more developed wood
  - Usually not more than 1 year old
- Timing to take cuttings differs with cutting type and location

Softwood cuttings

- Usually tips of shoots
- Avoid shoot tips with flower buds

Hardwood cuttings

- Can be tip or basal cuttings
- Avoid material that is too old/mature
  - Reduces ease of rooting

Cutting Size and Quality

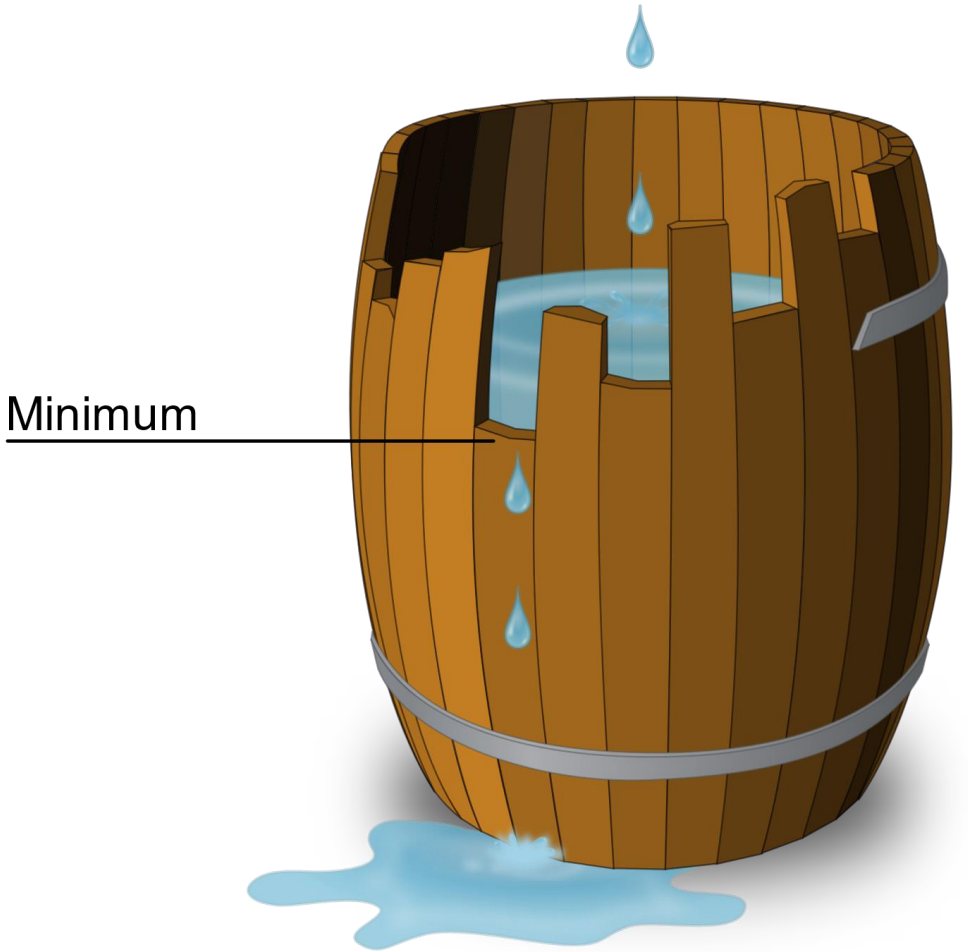
- How small can a cutting be?
- Minimum 1 node, often a trade-off between size/density of cuttings and survival.
- Ideal lavender cuttings are 1- 4 inches long.

Healthy Stock Plants, Healthy Cuttings

- Nutrient Management – fertilize to encourage vegetative growth
- Pest and Disease management – Important to prevent outbreaks in vulnerable cuttings
- Pruning to encourage new growth – important to maximize shoot production
- Field vs greenhouse – Different degrees of control over environment, distinct pros and cons

Nutrient Management

- Lavender is not a heavy feeder, but basic nutrient thresholds must be met to ensure adequate growth.
- Law of the minimum
- Primary Macronutrient (N-P-K) deficiencies lead to stunting
- Fertilization Rate
  - Fertigate at 200ppm N at every watering for potted stock plant management (Schriner and Klett, 2022)



Pest and Disease Management

- Foliar diseases – Septoria leaf spot
- Soil-borne pathogens - *Fusarium, Phytophthora, Pythium* and *Rhizoctonia*
- Pests – mostly piercing-sucking insects
  - Spittlebugs, planthoppers, whitefly, spider mites

Pruning for new growth

- When to prune
  - Spring pruning stimulates shoot production.
  - Harvest of cuttings will spur further shoot production.

- Regular pruning for flower production is compatible with propagation by cuttings.

- Plants used exclusively as stock plants may benefit from removal of flower buds.

Field vs Greenhouse stock plants

- Field – More space, more plants for lower cost
  - Lower cost to maintain plants
  - More space for plant growth/different varieties
  - Availability of cuttings is seasonal

- Greenhouse – more expensive to maintain, but more control
  - More control over environment
  - Possibility for year-round production or season extension
  - Pest and disease issues can rapidly get out of hand if not monitored.

Environmental factors affect rooting success

- Water
- Temperature
- Light
- Rooting medium

Environmental factors affect rooting success

Water

- Mist vs fog – huge difference in droplet size

- Humidity
  - Limit difference in humidity between tissues and ambient air.
  - Around 80% RH is a good target (Peçanha et al., 2023)

Mist

Fog

Environmental factors affect rooting success

Temperature

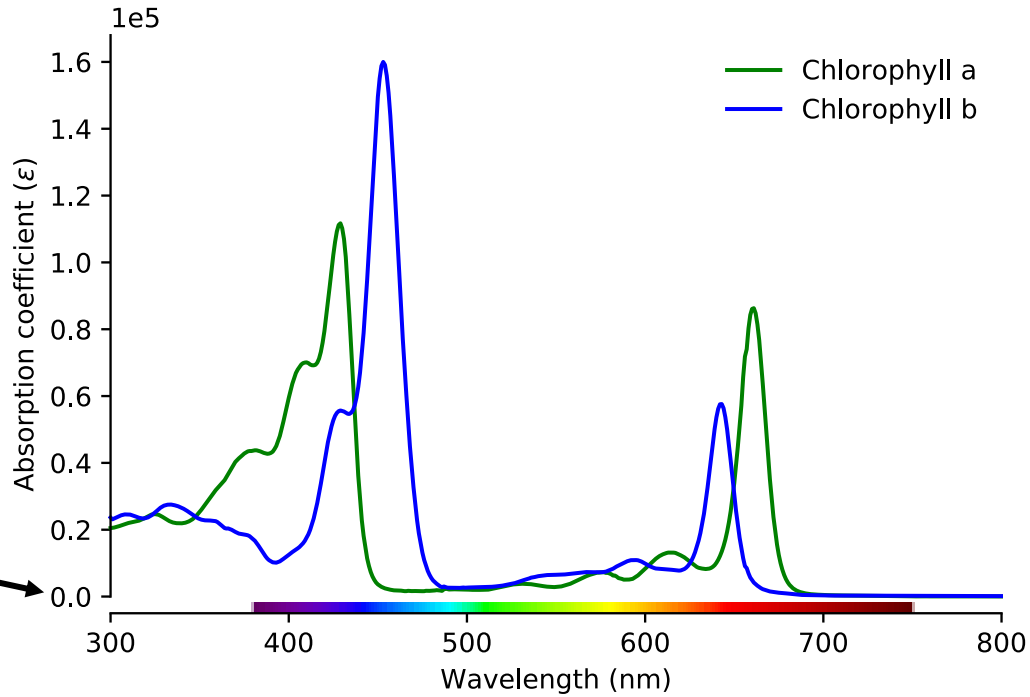
- Minimum and maximum temps

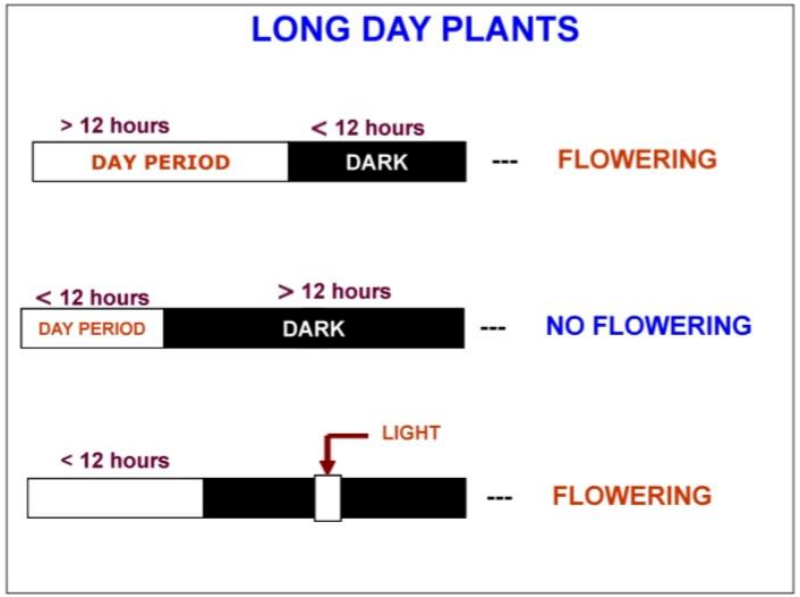
- What is an ideal temperature range?
  - 70-75 F is generally reported for medium temperature
  - Use bottom heat for uniform temperature, rooting (Dole and Gibson, 2006)

- Goal is to encourage rooting in as short a time as possible

Environmental factors affect rooting success

- Light
  - Intensity
  - Quality
  - Duration





Environmental factors affect rooting success

- Rooting Medium
- Balance aeration with moisture retention
- Perlite or vermiculite for drainage, coco coir and/or peat for moisture retention
- Plug tray vs open flats

Regional Challenges

There is immense variability, but generally:

- Northeast – soil type, climate, pests and diseases
- Northwest – climate, pests and diseases
- Southwest – irrigation, pests and diseases
- Southeast – Soil type, pests and diseases
- Midwest – soil type, climate, pests and diseases

- How does this translate to propagation by cuttings?

Regional Challenges

Impact on stock plant management

- Water status is critical, linked to nutrient uptake

Impact on root formation

- Pest and disease issues a bigger concern in more humid regions
- Maintaining good airflow is essential

Regional Challenges

Impact on acclimation

- Acclimation may be less stressful in more humid regions, but with higher risk for disease issues.
- Drier regions may be more stressful for acclimation of rooted cuttings.
- Ultimately, knowing your specific conditions within a region will help you to tailor strategies to prevent/treat problems.

Organic Production Systems

Are rooting hormones allowed?

Synthetic formulations cannot be used in Organic systems

Natural sources of hormones may be allowed

Alternatives to synthetic rooting hormones:

Compost tea
Willow water
Humic acid
Seaweed extract
Beneficial microbes
Coconut water
Honey
Aloe vera
Cinnamon

Rajan & Singh (2021)

Willow water appears to work well, but contamination is a huge concern.

Willow water

- Willow leaves and stems pulverized and steeped in water for 24 to 72 hours.
- A difficult product to standardize
- Contains auxin and potentially other plant hormones (salycilic acid, cytokinin, GA)

Organic Production Systems

Organic management of pests and diseases

Integrated pest management

- Chemical, cultural, biological, physical controls

Good hygiene of production facilities

- Maintain good airflow, clean equipment regularly, cuttings under mist for as short a period as possible, start with disease-free stock plants.

Summary

- Lavender roots easily under the correct conditions
- Stock plant management impacts success of propagation
- Regional challenges affect root formation and acclimation of rooted cuttings.
- Some rooting hormone products are compatible with organic production.

Go establish your own root-ine!

Thank you!

Questions are welcome!

jhurst@csufresno.edu

Audience Participation

Thank you for attending!

For a recording of this presentation, past presentations, or to sign up for future events, visit us at: **uslavender.org/front-porch**

Join us for the Front Porch Event:

Date: August 8, 2024

Time: 5 pm PT/8 pm ET

Topic: Agritourism

Presenter: Scott Debuck, President, NAFDMA

USLGA's Education and Research Committee hosts Front Porch Events to share with, and educate, lavender lovers everywhere. Contact us with questions or suggestions at education@uslavender.org