Research & Outreach 2019
Indoor growing & Root zone management

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UF IFAS
UNIVERSITY OF FLORIDA

Thank you for your support!

Growers
- Dummen Orange
- Four Star (MI)
- Knox Horticulture (FL)
- Kube-Pak (NI)
- Lucas (NI)
- Mast Young Plants/Neal Mast (MI)
- Pleasant View Gardens (NH)
- Rockwell Farms (NC)
- Speedling (FL, CA)
- Spring Meadow (MI)
- Vivero Internacional (Mexico)
- Walters Gardens (MI)

Allied
- AMA Horticulture
- Blackmore Co.
- BlueLab
- Fine Americas
- Greencare Fertilizers
- Griffin Greenhouse Supplies
- Kalsmann-Deilmann
- Pindstrup
- Premier Tech Horticulture
- Quality Analytical Laboratories
- Sun Gro Horticulture

George Grant
Dr. Eric Yafuso
Sofia Flores
Evel Soils
Esma cúz
Fernanda Travezini
Alec Goff
Mara Paz
Dr. Celina Gómez
Dr. Rosanna Ignere

Outline
1. Labor and Training
2. Plant factory propagation
3. Indoor growing
4. Root zone management

How to access handouts & reports
- After conference, handouts will be uploaded to the floriculturealliance.org website for detailed reports

Remember the secret code: FRA3412

FRA account of Back Pocket Grower
- Go to backpocketgrower.org with your browser
- Looks best on a mobile device
- Sign in: new pw FRA3412
Back Pocket Grower: New apps

- Currently in development

Vote for your priorities

- Container substrates:
  - Soil volume calculator to fill pots (beta version in development)
  - Make your own substrate blend amounts & cost
- Chemical:
  - Chemical spray and drench volume and cost
- Fertilizer:
  - Controlled release fertilizer amount, NPK per pot, & cost
- Light:
  - DLI from constant light source & photoperiod (beta version in development)
  - DLI quick estimator for sunlight (based on peak light, day length, & constant shade)
  - Light unit converter for different sources
- OTHER???

Greenhouse Issues: Labor and Training


Manual & Automatic Transplanting of Plant Cuttings

Priorities from 2018 FRA conference

- Best method for manually sticking cuttings
- Training materials
  - Introducing (drum roll please)...

Stick Olympics!
Training: StickOlympics

• Onsite transplanting competition to
  – Identify the quickest methods to transplant cuttings
  – Provide a fun pre-season tune-up to motivate and train
  – Reward excellence and professionalism
  – $600 in prize money for each of 10 operations sponsored by Blackmore Co. (Thank you!)

Training: Online courses

• Best ROI is to train existing staff
• Greenhouse Training Online (hort.ifas.ufl.edu/training/)

<table>
<thead>
<tr>
<th>Course Title</th>
<th>Dates (Enrollment)</th>
<th>Level</th>
<th>Fee</th>
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<tbody>
<tr>
<td>Greenhouse 101</td>
<td>June 27 (162)</td>
<td>*</td>
<td>$US199</td>
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<tr>
<td>Nutrient Management 1 (Intro)</td>
<td>July 1 (165)</td>
<td>**</td>
<td>$US199</td>
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<td>Nutrient Management 2 (Advanced)</td>
<td>Aug 3 (120)</td>
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<td>$US199</td>
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<tr>
<td>Costing and Profitability</td>
<td>Sept 2 (17)</td>
<td>***</td>
<td>$US199</td>
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<td>Disease Management</td>
<td>Nov-19 (115)</td>
<td>**</td>
<td>$US199</td>
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<tr>
<td>Weed Management</td>
<td>Nov-19 (115)</td>
<td>**</td>
<td>$US199</td>
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<td>Water Quality &amp; Treatment</td>
<td>Nov-19 (37)</td>
<td>***</td>
<td>$US199</td>
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• 2019 American Floral Endowment grant
• Talk with me about discounts, commissions & scholarships for your company and your customers
• Course development in substrates & hydroponics

2. Plant factory propagation

• Greenhouse is not always the ideal environment
• We know this very well for seed germination

Plant factory propagation

• Greenhouse is not always the ideal environment
• Also true for propagating high-valued cuttings

Commercial plant factory installations

Shenandoah Growers  Battlefield Farms  Frontier Lab

“Enhanced Rooting Chambers”

UF Trials: Tissue culture blueberries

4 Weeks After Initial Planting of Vaccinium corymbosum 'Emerald'
UF Trial on light level

4 light levels (35 to 140 micromol/m²/s) from white-red-blue LEDs

Research and commercial Greenhouses

Megh Poudel

UF Trial on light level

- 4 light levels (in micromol/m²/s of PAR light) under LEDs

35 70

105 140

Current UF trial: varying light quality & quantity

At week 4, Plant factory resulted in similar rooting to week 8 in greenhouse

Week 8 shrinkage
4% Plant factory
15% Research greenhouse
17% Commercial greenhouse

Current UF trial: Indoor Fog & Mist Environment

Current UF trial: Light Cart & Dome Environment
Current UF trial: Unrooted cuttings

Indoor Fog and Mist  Light Cart & Dome  Greenhouse

Current UF trial: Woody flowering shrub URCs

Weigela  Week 2

Indoor Fog and Mist  Light Cart & Dome  Greenhouse

Plant factory propagation

• Will it pay?

• Very approximate cost figures:
  • $0.70 to $0.90 per square foot per week
  • $1.20 to $1.60 per tray per week
  • $5 to $7 per tray for 4 weeks

Plant factory – Return on investment

– Reduced shrinkage

Break even number of extra cuttings surviving per tray in PF: $10
17/288 = 6% (blueberries observed 11 to 13% less shrinkage)

17 weeks in PF compared with greenhouse
Value of each rooted cutting: $0.60

– Shorter crop time:

<table>
<thead>
<tr>
<th>weeks in PF</th>
<th>Only in PF</th>
<th>PF then GH</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>weeks in GH</td>
<td>10</td>
<td>4</td>
</tr>
<tr>
<td>$10 extra cost in PF</td>
<td>$8</td>
<td></td>
</tr>
<tr>
<td>Sales price/cutting</td>
<td>$0.60</td>
<td>$0.60</td>
</tr>
<tr>
<td>Tray count</td>
<td>288</td>
<td>288</td>
</tr>
<tr>
<td>Revenue/tray</td>
<td>$173</td>
<td>$165</td>
</tr>
<tr>
<td>Revenue per tray per week in GH</td>
<td>$37</td>
<td>$41</td>
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</table>

Plant factory propagation – key questions

• It looks nice on paper... What is the reality?
  – Cost, scale, labor, & seasonality
  – High-valued crops
  – High shrinkage (PF v. better greenhouse & cutting quality?)
  – Technical: humidity, nutrition, lighting, pest management

• We can optimize the environment & learn physiology that can spin off into the greenhouse in the process
3. Indoor Gardening

Over 77% of U.S. households are involved in gardening activities (NGA, 2018)

30% of those activities take place indoors (NGA, 2018)

Indoor food gardening was recently ranked as one of the fastest-growing trends in horticulture (GMG, 2017)

Commercial vs. Small-scale Plant Production

• Most research focused on:
  • Maximizing profit ($)
  • Reducing inputs
  • Increasing yield

• Lack of information:
  • Plant selection
  • Lighting requirements
  • Plant maintenance
  • Nutrient solution management

Consumer success could increase with low-maintenance, easy-to-use, and robust systems

Data Mining on Reddit: Common consumer questions

Plug and play “resilient” transplants & growing systems
Resilient lighting for indoor home gardeners

- How little light can be provided for consumer success

- Red Leaf lettuce after 4 weeks exposure to daily light integral (DLI) treatments from 4000-K white LED lamps (Expt. 2) or Philips GreenPower LED production modules (Expt. 3).

Value-added plug

- Growcoons (Klasmann-Deilmann) & Growbags (Ellepot USA)

4. Root zone management

- Physical properties testing for communication: use by our partners, and substrate training

Porosity testing

Example: Pindstrup Forest Gold & Peat

<table>
<thead>
<tr>
<th></th>
<th>Air-filled porosity (%)</th>
<th>Water holding capacity (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fine peat</td>
<td>7%</td>
<td>75%</td>
</tr>
<tr>
<td>Medium peat</td>
<td>9%</td>
<td>70%</td>
</tr>
<tr>
<td>Wood fiber</td>
<td>32%</td>
<td>52%</td>
</tr>
<tr>
<td>30% WF + 70% Fine peat</td>
<td>10%</td>
<td>70%</td>
</tr>
<tr>
<td>30% WF + 70% Medium peat</td>
<td>14%</td>
<td>64%</td>
</tr>
</tbody>
</table>

Water – Air distribution: frozen columns

Example: Premier Tech Peat-Coir-Perlite cutting propagation substrate
Water – Air distribution: frozen columns

Example: Sun Gro components and blends

Training: Hydroponics, Water treatment

“WET Center”

Training: Bite-sized videos

• New YouTube channel launching Jan 2020

• Brand: Reliable, quality, science-based, collaborative

• Aim for weekly posts

• Recognize funding sources

Thank you!

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