Clemson Research Update 2018

DLI Maps (posters)

Interactive DLI Maps
Using Cell Phone Apps as Light Sensors

Michael Tierney

URC Postharvest Performance

8:00 a.m. @ 2.5°C

NGI +EthylBloc

8:00 a.m. @ 21°C

Fuchsia +EthylBloc

Mary Vargo

The Cost of Consumer Performance

Jiwoo Park

$0.0007/6-pack

14 grams
17 flowers

$0.0066/6-pack

38 grams
41 flowers

Calcium Update

Katie Bennett

Calcium and Silicon Sources:

- Calcium Citrate
- Calcium Gluconate
- Calcium Pantothenate
- Calcium EDTA
- Calcium Silicate
- Pneussion Silicate (AgSil® 168)

1. Effectiveness
2. Phytotoxicity
What is the best way to get more calcium into plant tissue?

Translocation of Calcium within Flower Petals

Botrytis Fungicide-Resistance Management

Where do fungicide-resistant spores originate?

1. Offshore URCs
2. Domestic RCs
3. Your Greenhouse
   - Propagation area
   - Finished plant area

Probability

- Low
- High
- Low-Med

Understanding Fungicide Resistance

- Multi-site Fungicides
  - Do not penetrate tissues (stay on the surface)
  - Prevent spore germination (not mycelial growth)
  - Protectants
  - Preventative
  - Moderate efficacy
  - Low risk of developing resistance

Fungicides

- Captain
- Chlorothalonil
- Mancozeb
- Thiram
- Ziram

<table>
<thead>
<tr>
<th>Fungicide</th>
<th>Offshore</th>
<th>Domestic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Captain</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Chlorothalonil</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Mancozeb</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Thiram</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Ziram</td>
<td>x</td>
<td></td>
</tr>
</tbody>
</table>
Understanding Fungicide Resistance

• **Single-site Fungicides**
  - Systemic (penetrates tissues)
  - Affect mycelial growth
  - Curative
  - Best efficacy within 24 hr of high risk conditions
  - High efficacy (if no resistance)
  - Moderate to high risk of developing resistance
  - Persistence of resistance varies, but 2-4 seasons or crops are likely necessary for efficacy to be restored (i.e., for resistant strains to die out).

<table>
<thead>
<tr>
<th>Trade Name</th>
<th>Active Ingredient</th>
<th>FRAC Code</th>
<th>Likelihood of resistance development</th>
<th>Current Efficacy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cleary’s 3336, etc...</td>
<td>Thiophanate-methyl</td>
<td>1</td>
<td>High Risk</td>
<td>Not Effective</td>
</tr>
<tr>
<td>Chipco</td>
<td>iprodione</td>
<td>2</td>
<td>Medium to High Risk</td>
<td>Low</td>
</tr>
<tr>
<td>Astun, Broadform</td>
<td>Fludioxonil + thiram</td>
<td>6 (+13)</td>
<td>Medium Risk</td>
<td>Medium to High</td>
</tr>
<tr>
<td>Broadform Muscosan,</td>
<td>Fludioxonil + thiram</td>
<td>6 (+13)</td>
<td>Medium Risk</td>
<td>Medium to High</td>
</tr>
<tr>
<td>Pageant Mural</td>
<td>Fludioxonil + thiram</td>
<td>6 (+13)</td>
<td>Medium Risk</td>
<td>Low to Medium</td>
</tr>
<tr>
<td>Pageant Orkestra</td>
<td>Fludioxonil + thiram</td>
<td>6 (+13)</td>
<td>Medium Risk</td>
<td>Medium to High</td>
</tr>
<tr>
<td>Paladium Medallion,</td>
<td>Fludioxonil + thiram</td>
<td>6 (+13)</td>
<td>Medium Risk</td>
<td>Medium to High</td>
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<tr>
<td>Spirato</td>
<td>Fludioxonil + thiram</td>
<td>6 (+13)</td>
<td>Medium Risk</td>
<td>Medium to High</td>
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<tr>
<td>Decree</td>
<td>Fenhexamid + thiram</td>
<td>9</td>
<td>Medium Risk</td>
<td>Low to Medium</td>
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<tr>
<td>Affirm</td>
<td>Polyoxin D zinc salt</td>
<td>10</td>
<td>Medium Risk</td>
<td>Medium to High</td>
</tr>
<tr>
<td>Decem</td>
<td>Calcium Oxide</td>
<td>11</td>
<td>Medium Risk</td>
<td>Medium to High</td>
</tr>
<tr>
<td>Triathlon</td>
<td>Calcium Oxide</td>
<td>11</td>
<td>Medium Risk</td>
<td>Medium to High</td>
</tr>
</tbody>
</table>

**Strategies to Minimize Fungicide Resistance**

- **Stock Plants**
  - Use multi-site products in a weekly preventative program (on high-risk species)

- **Propagation**
  - Use multi-site products in a weekly preventative program (on high-risk species)

- **Finishing (Flowering)**
  - Use single-site products during periods of high risk (high humidity and condensation)
  - Use single-site products immediately before shipping to market
  - Do not repeat FRAC codes on a crop

- **Sanitation (preventing sporulation)**
  - Use non-fungicide products during periods of low to moderate risk
  - Microbial (Bacillus sp.)
  - Triathlon
  - Companion
  - Cease
  - Botrystop(?)
  - Calcium
  - 1000 ppm Ca weekly (using calcium chloride)
Photoperiod Perception in Poinsettia

What light intensity do poinsettias perceive?

...but what about light intensities from 0 to 2 µmol m⁻² s⁻¹?

2 µmol m⁻² s⁻¹ = prevents perception of darkness

Sunrise

Light Intensity (µmol m⁻² s⁻¹)

Log Light Intensity (µmol m⁻² s⁻¹)
8 a.m. Black cloth open
5 p.m. Black cloth closed
4:45 p.m. White LEDs on
11:00 p.m. White LEDs off
9 h night (LD)
15 h night (SD)

In theory:…

Experiment:

Shade Curtain
µmol m\(^{-2}\) s\(^{-1}\) footcandles
0.006 0.02 0.09 0.15 0.3 0.5 0.8 1.4 2.5

Shade Curtain
Normal
lowering (9 wks)
Normal appearance, but delayed lowering (10+ wks)
Abnormal Appearance & delayed flowering (12+ wks)
Vegetative
Days to anthesis vs. Light intensity threshold (µmol m⁻² s⁻¹)

Days to flower:
- Advent: 63
- Tikal: 63
- Advent: 74
- Tikal: 91
- Days to Flower: DNF
- Days to Flower: DNF

Light Intensity (µmol m⁻² s⁻¹):
- 0.04
- 0.4

Transition:
- Delayed bract development
- Incomplete bract development
- Delayed cyathia development
- Incomplete cyathia development

Advent & Tikal
What time in the morning and evening do poinsettias perceive darkness, i.e., start measuring night length?

Night

Horizon

18° below the horizon
Horizon 18° below the horizon

Astronomical Twilight

Horizon 12° below the horizon

Nautical/Naval Twilight

Horizon 6° below the horizon

Civil Twilight

Sunrise & Sunset
Horizon
-6° below the horizon
-12° below the horizon
-18° below the horizon

Equator ~25° Lat.
~45° Lat.

Twilight

5:45 - 5:55
6:00 - 7:00

Light Intensity
(µmol m\(^{-2}\) s\(^{-1}\))

September 21
Ou tsid e
Tr uss
Be nc h

Astronomical Twilight
Nautical Twilight
Civil Twilight
Sunrise
Sunset

35° N. Lat.

Light Intensity

6:56 - 7:06

0.4 µmol m\(^{-2}\) s\(^{-1}\)
Night length calculations:

\[ \text{Actual night length perceived by poinsettias} = (\text{Minutes (above)} \times 2) \]

Conclusion:

Photoperiod perception begins (minutes before sunrise & after sunset):

<table>
<thead>
<tr>
<th>Location</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>25° N. Lat. (Miami, FL)</td>
<td>10:18</td>
</tr>
<tr>
<td>35° N. Lat. (Clemson, SC)</td>
<td>11:20</td>
</tr>
<tr>
<td>45° N. Lat. (Minneapolis, MN)</td>
<td>13:23</td>
</tr>
</tbody>
</table>
Take-home

- Light intensities of 0.04 \( \mu \text{mol m}^{-2} \text{s}^{-1} \) (~0.2 ft-c) for several hours will delay poinsettia flowering.
- Light intensities of 0.4 \( \mu \text{mol m}^{-2} \text{s}^{-1} \) (~2 ft-c) for several hours will prevent poinsettia flowering.
- Photoperiod perception begins 10-23 min before sunrise and 10-23 min after sunset, depending on latitude.
- Night length perceived by poinsettias on Sept. 21 is ~11:00 to 11:30 hrs.
- When black-clothing, a 13 h night is likely sufficient for all cvs (perhaps >13 h night length is beneficial at high temperatures)