FRA 2017
Clemson Update

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3 Topics

• *Botrytis*
• Improving Retail Performance
• A New Irrigation Strategy
Maximizing calcium uptake to improve host resistance to Botrytis

Katherine Bennett, Guido Schnabel & James Faust
Tissue analysis of petunia flower petals compared to geranium leaves

Calcium content (% D.W.)

Calcium Fertigation Treatment (ppm Ca)

- Petunia Flowers
- Geranium Leaves
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Botrytis management alternatives on cut roses

Melissa Muñoz Agudelo, James E. Faust & Guido Schnabel
Calcium content in rose tissue

- Leaves: 0.00%
- Sepals: 0.50%
- Outer petals: 1.00%
- Mid Petals: 1.50%
- Inner Petals: 2.00%
- Stamens...
- Stems: 0.00%
Post-harvest dipping treatments

- 15 seconds dip
- Treatments:
  - Batine (hydrogen peroxide)
  - Ca 0 ppm
  - Ca 1000 ppm
  - Ca 2000 ppm
Predicting *Botrytis* infection

![Graph showing the relationship between infection risk and temperature with different leaf wetness durations.](#)
Installation of weather stations

• Solar radiation (W/m$^2$)
• Leaf wetness (min)
• Air temperature (°C)
• Relative humidity (%)
• Dew point (°C)
• Leaf temperature (°C)
• Soil temperature (°C)
• Electrical conductivity (mS/cm)
• Water content of soil media (%)
• Wind speed (m/s)
• Wind direction
Predicted vs. Actual Botrytis Incidence

Week
1 3 5 7 9 11 13 15 17 19 21 23 25 27 29 31 33 35

Incidence (%)
0 10 20 30 40 50 60 70 80 90 100

- Actual Botrytis Incidence
- Predicted Botrytis Incidence
Fungicide Resistance Development in *Botrytis cinerea* on cut roses
Petunia Longevity in Retail and Consumer Environments (Sell-Through & Performance)

How do plant nutrition & PGRs impact retail performance?

6-Pack
Easy Wave Pink from 288 Plugs
Growing Fertilization & PGR | Pulse Fertilization | Shipping | Retail | Garden
---|---|---|---|---
35 days | 1.5 days | 2 days | 21 days | 30 days

- **50 ppm N**
  - Bonzi 5 ppm
  - 0 ppm N
  - 300 ppm N
  - 600 ppm N

- **100 ppm N**
  - Bonzi 5 & 7 ppm
  - 0 ppm N
  - 300 ppm N
  - 600 ppm N

- **200 ppm N**
  - Bonzi 5 & 10 ppm
  - 0 ppm N
  - 300 ppm N
  - 600 ppm N

(no starter charge, no leaching)
Day 25 after transplant

Nitrogen Concentration Applied (ppm)

50* 100** 200***

Paclobutrazol drench
*0.30 mg a.i./plant
**0.71 mg a.i./plant
***0.89 mg a.i./plant
Day 35 after transplant:

Nitrogen Concentration Applied (ppm)

50*  
100**  
200***

Paclobutrazol drench
*0.30 mg a.i./plant  
**0.71 mg a.i./plant  
***0.89 mg a.i./plant
Day 35 after transplant

Nitrogen Concentration Applied (ppm)

50*  100**  200***

Paclobutrazol drench
*0.30 mg a.i./plant
**0.71 mg a.i./plant
***0.89 mg a.i./plant
Shoot Growth (Day 35)

Fresh Weight (g/plant) vs. Nitrogen Applied (mg N/plant)

The graph shows a positive correlation between the fresh weight of the shoots and the amount of nitrogen applied, indicating that higher nitrogen application leads to increased shoot growth.
Total Flower Number (Day 56)

Flower Number per Plant vs. Fertilization Treatment (ppm N)
Nitrogen Applied

During Production

During Pulse Treatment

N\text{Applied (mg N/plant)}

Days after Transplant

Pulse N\text{Applied (ppm)}

2.0 \& 4.0 Fertilizer Solution EC
Day 54: After 16 days in Retail

Growing Fertilization
50 ppm N

Pulse Nitrogen Concentration (ppm)
Day 77: 20 days after transplant to ‘garden’
Day 54: After 16 days in Retail

Growing Fertilization

100 ppm N

Pulse Nitrogen Concentration (ppm)
Day 77: 20 days after transplant to ‘garden’
Day 54: After 16 days in Retail

Growing Fertilization
200 ppm N

Pulse Nitrogen Concentration (ppm)

0 300 600
Growing Fertilization N Conc.
200 ppm

Day 77:
20 days after transplant to ‘garden’
Day 87: 30 days after planting

Growing Fertilization N Conc. (ppm)
- 50*
- 100**
- 200***

Pulse Fertilization (N ppm)
- 600 ppm N

Paclobutrazol drench
- *0.30 mg a.i./plant
- **0.71 mg a.i./plant
- ***0.89 mg a.i./plant

Day 87: 30 days after planting
Summary

• High fertility demands high PGR rates that can have a detrimental effect on consumer performance.

• Low fertility also has a detrimental effect on consumer performance unless a pulse fertilization is used to provided nutrients.

• **Bottom line**
  • ~75-100 ppm CLF
  • Just enough PGR to tone growth without stopping plants
  • ~300 ppm N pulse prior to shipping
A New(?) Irrigation Strategy
(for drip systems)

James Faust & Thomas Eitenmiller
Conventional Irrigation Strategy

- Training staff is a challenge
- Requires skill and reliability
- Frequent monitoring (8, 10, noon…)
- Defining ‘dry’
- Volume to apply

Container Mass (g)

Day
Sensor-based Irrigation Strategy

Soil Moisture Sensors

- Cost
- Accuracy
- Representative of entire crop?
- Fragility
- Maintenance
- One grower can supervise a large area with minimal skilled assistance
- Minimal decision-making by low-level workers
- Heavy leaching provided
- Soft growth; No toning
- Constant leaf removal to maintain fixed leaf area (water demand)
Is there another approach that blends the best of these techniques?

**Goals**
- Minimal decision-making by low-level workers
- Easy to supervise
- Provides toned growth
- No leaching
- Minimal cost to implement
The Daily Dose Technique

- Container Mass (g)
- Day

95% Saturation
The Daily Dose Technique

Container Mass (g) vs. Day

- 95% Saturation
- 80% Saturation
The Daily Dose Technique

Container Mass (g)

Day

95% Saturation
80% Saturation
65% Saturation
The Daily Dose Technique

![Graph showing the daily dose technique with container mass on the y-axis and day on the x-axis. The graph includes lines for 95%, 80%, 65%, and 50% saturation over 49 days. Each line represents a different saturation level, with 95% saturation showing the highest mass and 50% saturation showing the lowest.](image-url)
The Daily Dose Technique

- Application timing is pre-determined
- Moisture target is pre-determined
- Volume to apply requires a quick calculation (no judgment required)

Skills

Container Mass (g)

Day

900
800
700
600
500
400
300

0 7 14 21 28 35 42 49
Saturation (% Container Capacity)

- 95%
- 80%
- 65%
- 50%
Pros

• Low skill-level required
• Irrigate the same time daily
  • Easier to supervise waterers
  • Easier to evaluate/adjust soil moisture
• Follow through later to fix/clean drippers
• No leaching
  • Efficient water and nutrient use
• Better growth control(?)

Cons

• Pressure-regulated, drip irrigation only
Summary
Daily Dose Irrigation Technique

• Easy to implement and oversee
• Inexpensive
• Can be performed with low-skill workers
• Error one day is automatically adjusted for the next day
• A model of plant growth is required
• Physical properties of the growing media must be pre-determined
• Requires crop uniformity
• Best for larger containers, forgiving species, large volume production
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