ARS-USDA Floriculture Research Alliance: A New Model for Applied Research

Jonathan Frantz – USDA-ARS Toledo

John Erwin – Minnesota

Paul Fisher – Florida

Jim Faust – Clemson

John Dole – NC State

Erik Runkle – Michigan State

Industry Challenge:

The number of Universities and faculty, and the funding to conduct and communicate findings has decreased dramatically.

Industry Changes

- Bedding plants are the largest and most profitable sector in the floriculture industry.
- Many bedding plant growers purchase seedlings or vegetative liners.
- New cultivar introduction is faster using vegetative propagation. As a result, the cutting producer and tissue culture industries have increased.

A number of research groups have emerged nationally to independently address local and national needs of the bedding plant industry. Three of those groups (P^3, Young Plant Center, and MSU Floriculture) formed the Floriculture Research Alliance.

CLEMSON UNIVERSITY

NC STATE UNIVERSITY

P3

Focuses on stock plant management and the shipping, storage and propagation of cuttings

- **Research partners**
  - –Ball FloraPlant
  - –Ecke Ranch
  - –Metrolina Greenhouses
  - –Oro Farms
  - –Smithers-Oasis/Floralife
  - –Syngenta
  - - Innovaplant

University of Florida
University of Minnesota

Young Plant Research Center

Focuses on issues related to the production of young plants (seedlings) and/or rooted liners.

- AgriStarts, Knox, Twyford (FL)
- Altman Plants (CA/AZ/FL)
- Four Star, Mast Young Plants, Spring Meadow (MI)
- Pleasant View Gardens, D.S. Cole Growers (NH)
- Nurseryman's Exchange (CA)
- Oro Farms (CO)
- Kube Pak, Lucas (NJ)
- Smith Gardens (WA/OR/WA)
- Welby Gardens (CO)
- Wagners (MN)
- Blackmore Co., Ellegaard, Fafard, Greencare, Jiffy Products, Pindstrup, Premier Horticulture, Quality Analytical Laboratories, Sun Gro Horticulture

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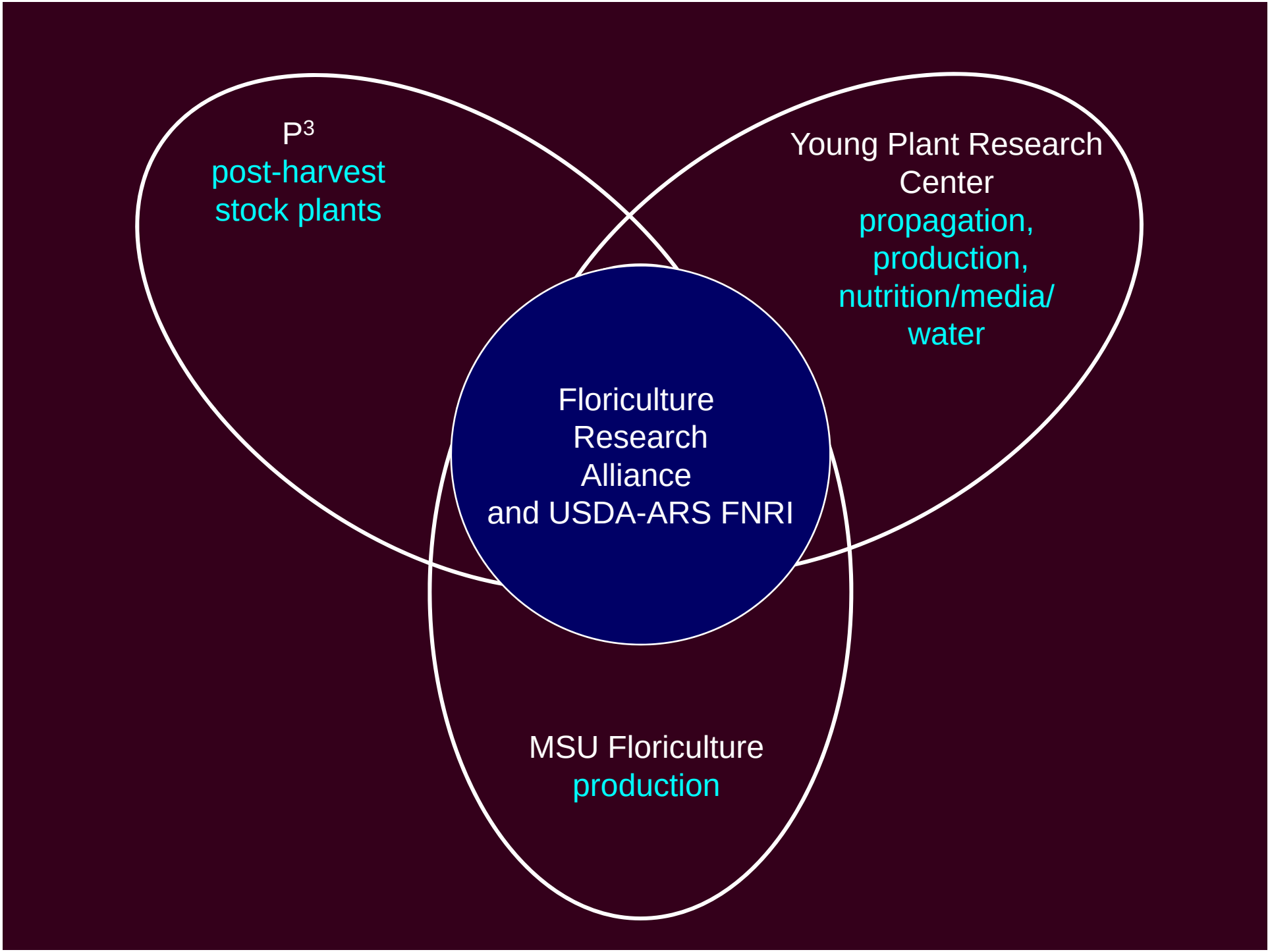
MSU Floriculture

Focuses on factors affecting finishing of bedding plants and perennials.

- Ball Horticulture
- C. Raker and Sons
- Henry Mast
- Kalamazoo Growers
- Kalamazoo Specialty Plants
- Oro Farms
- Pearlstein Family Foundation
- Post Gardens

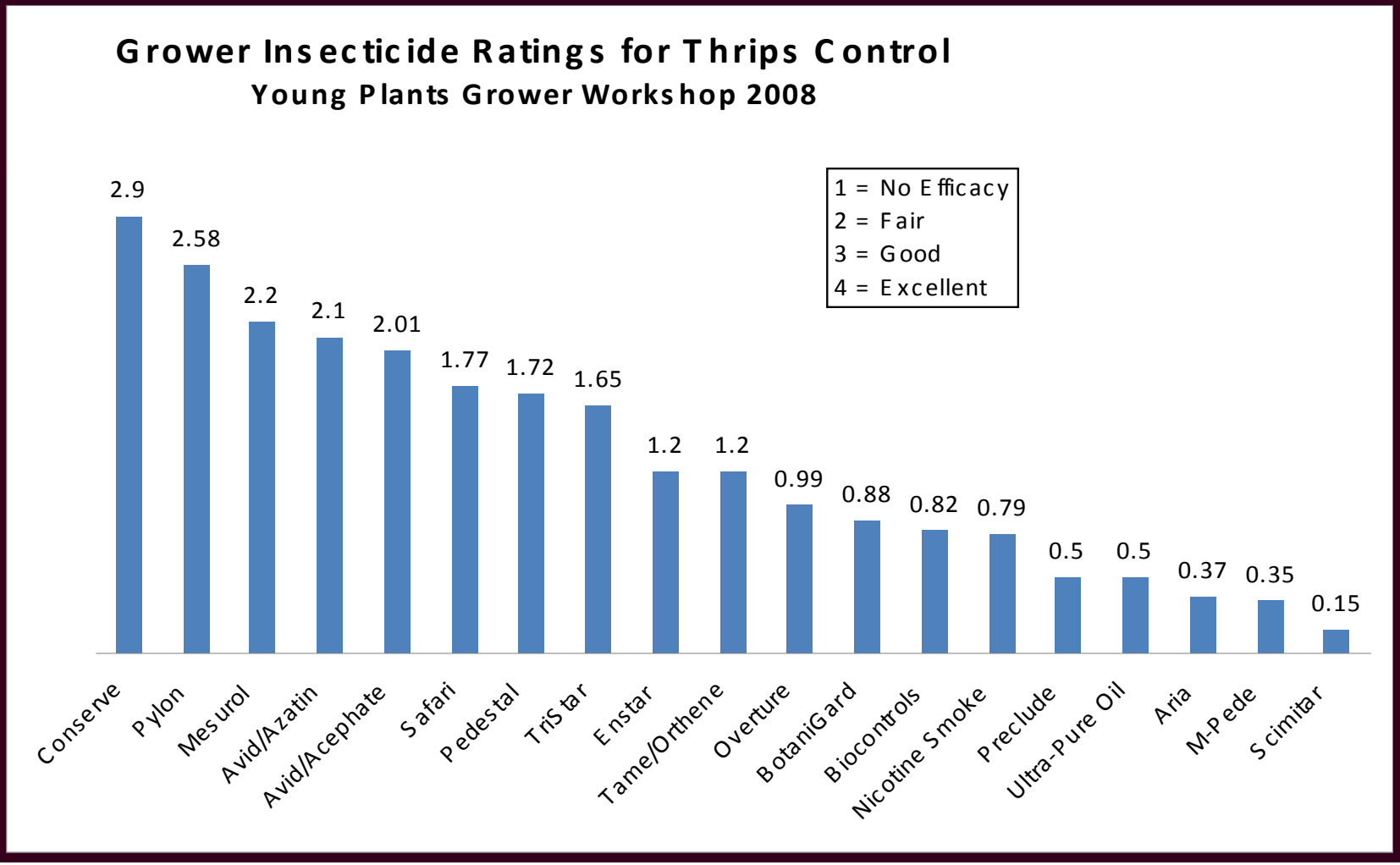

P3
post-harvest
stock plants
Young Plant Research
Center
propagation,
production,
nutrition/media/
water
Floriculture
Research
Alliance
and USDA-ARS FNRI
MSU Floriculture
production

Group Goals...

- National networking among scientists and grower/owners
- Identify common issues and research priorities
- Conduct that research to solve real world problems quickly, effectively, and collaboration collaboratively
- Communicate that information quickly in different forms throughout the US.

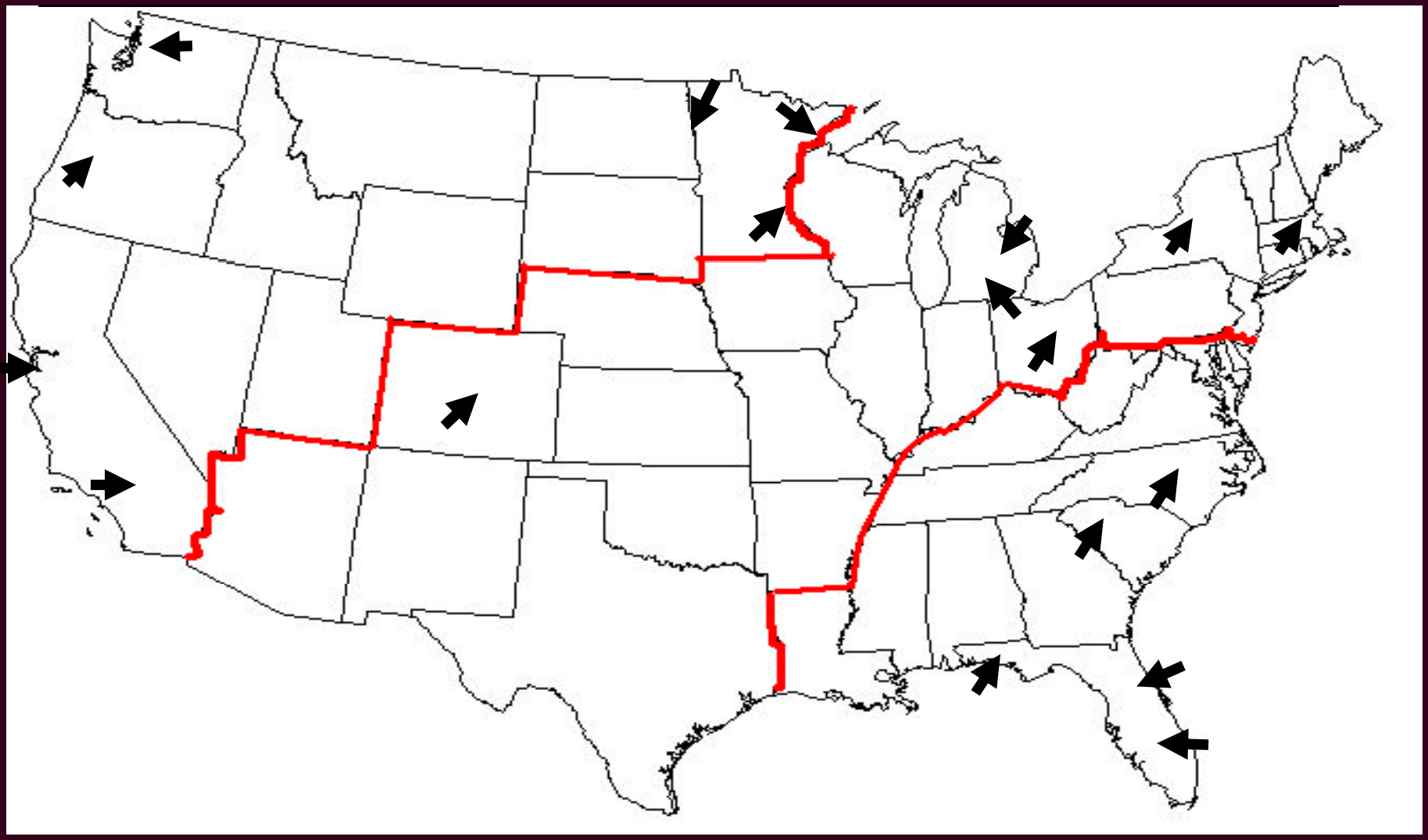
Example benefits of collaboration - National research projects

Example benefits of collaboration - National input and shared expertise



Example benefits of collaboration

- National coordinated dissemination of results



Funding Model

- Each group (P^3, Young Plant Center, MSU Floriculture) receives an annual donation from each industry partner (minimum of $10,000/yr).
- The benefits of that donation differ between groups, but often includes on-site visits, early access with our stakeholders, and input into future research directions.
- Research results are not proprietary.

What is unique with this collaborative model?

- Growers help identify annual research priorities
- Grower facilities are used as laboratories for national experiments. We are developing research capacity at each company.
- A mixture of cooperation and competition. . . . ‘coopetition’.
- Emphasis is placed on rapid communication.

How does FNRI Interact with the Floriculture Research Alliance

- We match FNRI Support with direct grower support.
- FNRI is invited to our annual grower feedback meeting.
- We initiated an FNRI Session in conjunction with OFA at the Ohio Short Course to give the FNRI increased exposure.
- We will start publishing a FNRI series of articles in grower magazines in 2010.
- We are organizing a website for information distribution (floriculturealliance.org).

Examples of Current Research Efforts Related to FNRI

Energy-Efficient Production of Greenhouse Ornamentals

Erik Runkle, Associate Professor
Ryan Warner, Assistant Professor

MICHIGAN STATE UNIVERSITY

Petunia Easy Wave 'Coral Pink'

38 days from transplant at (°F):

57	63	68	73

86	45	33	28

56	35	27	24

Predicted days to flower from transplant

Estimated Energy Consumed for Flowering Petunia at Different Growing Temperatures

Estimated heating cost (US$) using Virtual Grower to produce ½ an acre of greenhouse crop in Grand Rapids, MI for two market dates.

April 1 finish				May 15 finish			
57 °F	63 °F	68 °F	73 °F	57 °F	63 °F	68 °F	73 °F
14,601	11,560	9,859	8,958	6,597	4,885	4,228	4,104

Calculations performed with Virtual Grower 2.0 software with constant temperatures. Greenhouse characteristics: 8 spans each 112 ft × 24 ft, triangular 12 ft roof, 9 ft gutter, polycarbonate bi-wall ends and sides, forced air unit heaters burning natural gas at $1.00 per therm ($10.24 MCF), 45% heater efficiency, no energy curtain, and air infiltration rate of 1.0.

Estimating Greenhouse Heating Costs

A software program developed by the USDA-ARS in Toledo, Ohio has been developed to estimate energy costs for greenhouse heating based on:

- Greenhouse location
- Time of year
- Greenhouse characteristics
- Energy type and cost
- Heating setpoints

Visit www.virtualgrower.net for more information

Michigan State Impacts

- Identified temperature effects on development of >25 bedding plant species.
- Using Virtual Grower, predicted energy requirements of those same species for different marketing dates.
- Evaluated the efficiency of using cyclic high pressure sodium lamps for photoperiodic manipulation.

John Dole and Brian Whipker

- Postharvest handling and storage of cuttings.
- Plant growth regulators.
- Plant nutrition
  - Samples analyzed in Toledo by ARS

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Controlled Atmosphere Storage of Unrooted Cuttings

- Balanced concentrations provided consistently good results
- Extremes performed poorly

	O_2 (%)					
		0	1	5	10	21
CO_2 (%)	0	✗	✓	-	-	✗*
	5		-	✓	✓	
	10		-	✓	✓	
	20		✗			

* Atmosphere 21% O_2 0.03% CO_2

Propagation Environment

- Mist
- White plastic tents
- White plastic covers
- Remay covers

Nutritional Disorders of Floriculture Crops: Determining the Symptomology and Tissue Values

Jared Barnes and Brian Whipker, NC State University
Jonathan Frantz, USDA-ARS Toledo

Species Grown

Cyclamen, Cineraria, Primula, Mum, Poinsettia, Exacum, Pot Rose, Exacum, Gerbera, Easter lily, and 6 additional

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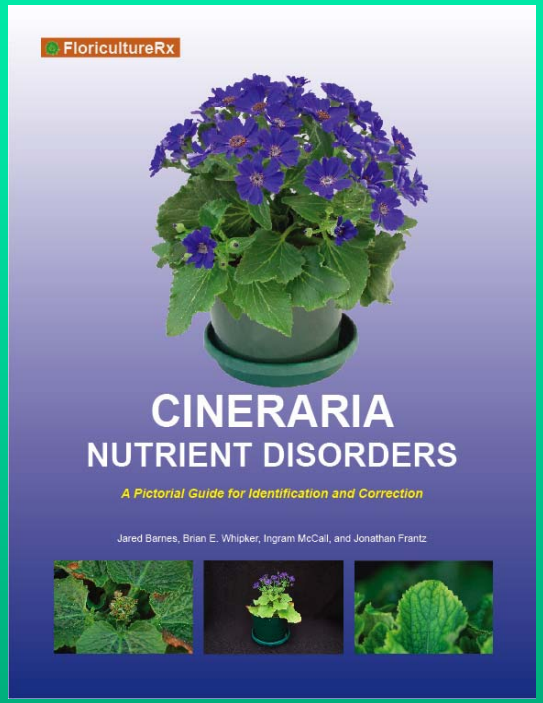
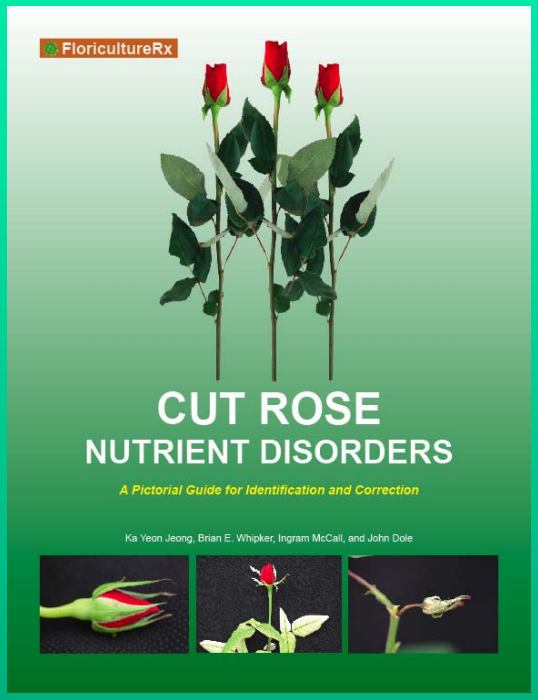
Impacts Disorder Study

Determined critical tissue levels when disorders occurred.

Photographed initial and advanced symptoms of each disorder.

Publications





Impacts Propagation Study

Initial Phase (Year 1) of Study.

Determined the effects of increasing storage length and propagation environment on cutting quality.

Determined the optimal propagation environment for rehydrating shipped cuttings to improve rooting.

Jim Faust
Clemson University

- Stock Plant Management (Vegetative cutting production)
- Post-harvest Physiology & Packaging (unrooted cuttings)
- Propagation Methods
- Flowering Physiology

Unrooted Cutting Physiology

Chilling sensitivity of Heliotrope is affected by
time of harvest and stock plant light environment

90 % shading | No shade

90 % shading | No shade

Stored at 2.5 °C for 35 h

9 am Harvest

4 pm Harvest

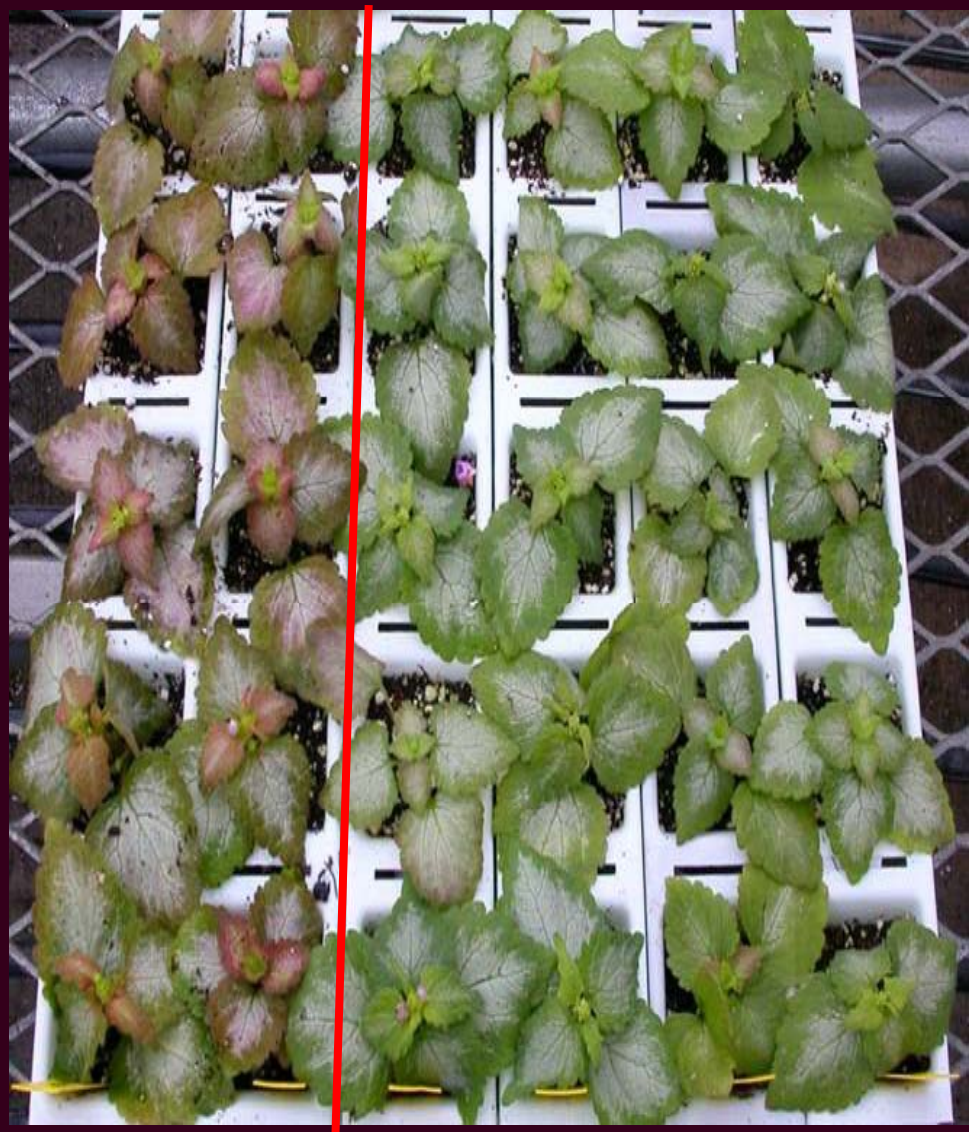
24 h after insertion

Propagation: Mist Management

Catharanthus

No Mist Low Mist High Mist

Lamium



Mist No mist

Propagation:

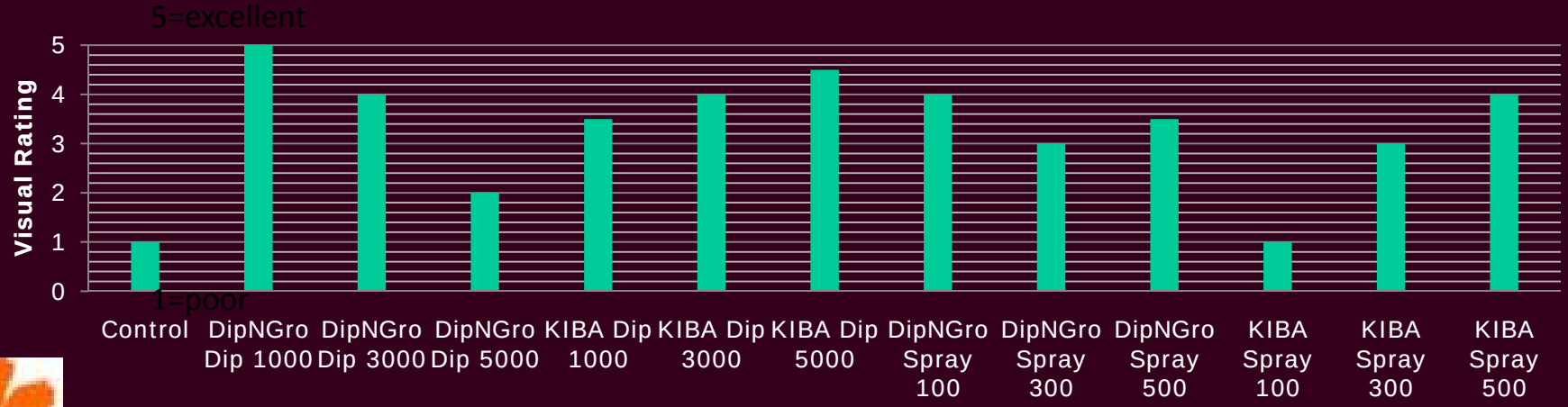
Alternative application methods for rooting hormones

Control

1000 DnG Dip

100 DnG Spray

Bracteantha



Impacts for Clemson

- Increased use of foliar rooting hormone applications to cuttings in propagation to reduce labor required to perform stem dips.
- Helped one grower replace all boom mist nozzles to hit the target mist volume we identified for propagating cuttings.

University of Florida

- Paul Fisher
  - Nutrition/Media
  - Water Management
- Sonali Padhye (growth, flowering)
- Rosanna Freyre (new crops)

Nutrition / Media

- Nutrition and leaching in propagation
- pH management – lime, fertilizer and water quality

- Example impact: 10 commercial media companies using protocols to improve lime rates and selection for buffered media at their target pH.

Water Treatment Technologies

- Selection and monitoring of water treatment technologies
- To manage pathogens, algae, biofilm, and nutrition

- Example impact: One grower supported in this research reduced disease losses in liners by >$125K per year through improved water treatment design. Developed as an online training case study.

Water Education Alliance for Horticulture

- Outreach program set up as university/industry alliance
- Help educate growers about water quality, treatment and recycling.
  - Website
  - Workshops
  - Webinars
  - Article series

www.watereducationalliance.org

Young Plant Research Center

University of Minnesota

- PGR/Fungicide/Pesticide Efficacy
- Temperature and Light Management
- New Crop Development

Marigold

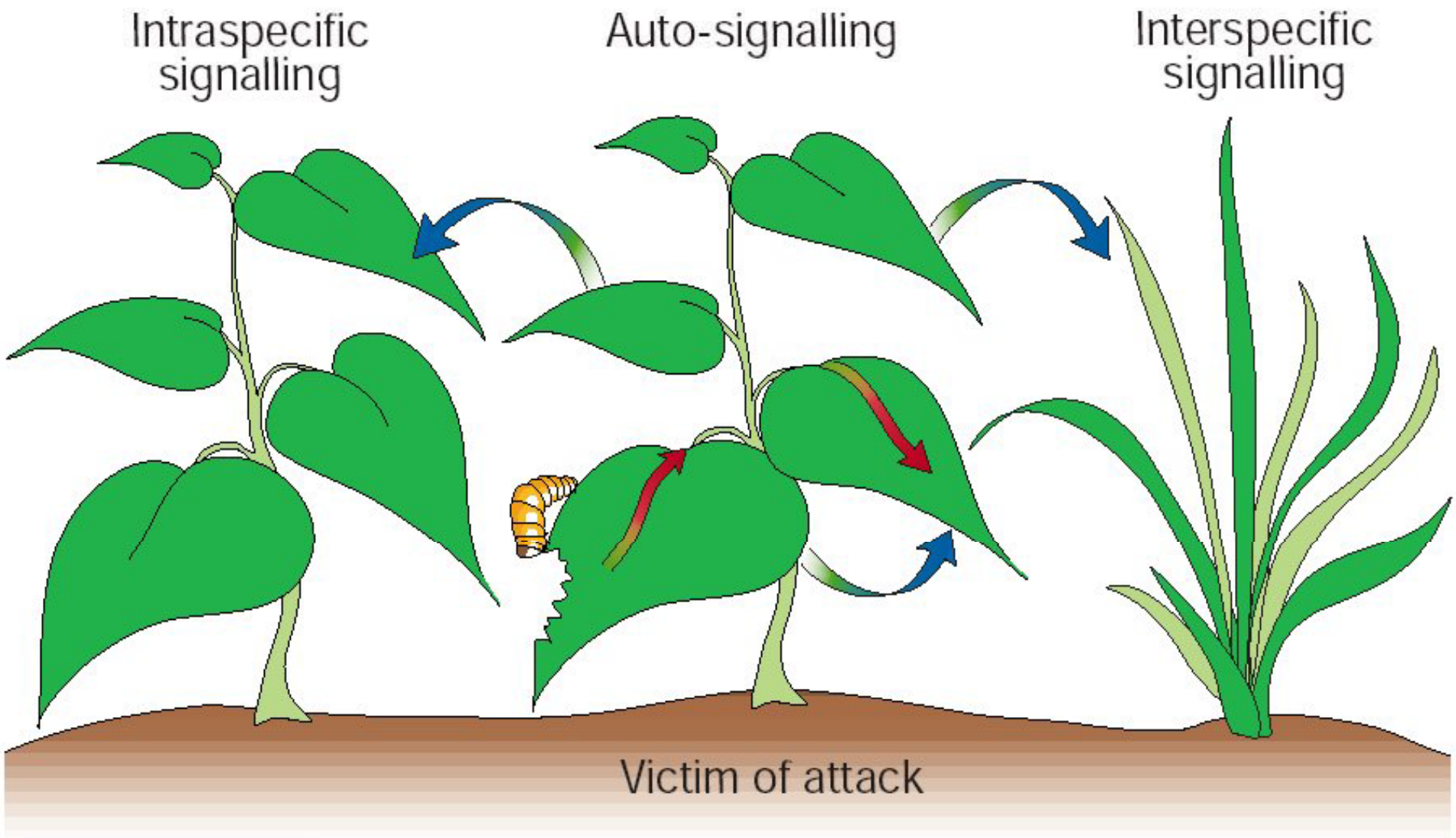
Fast-drying

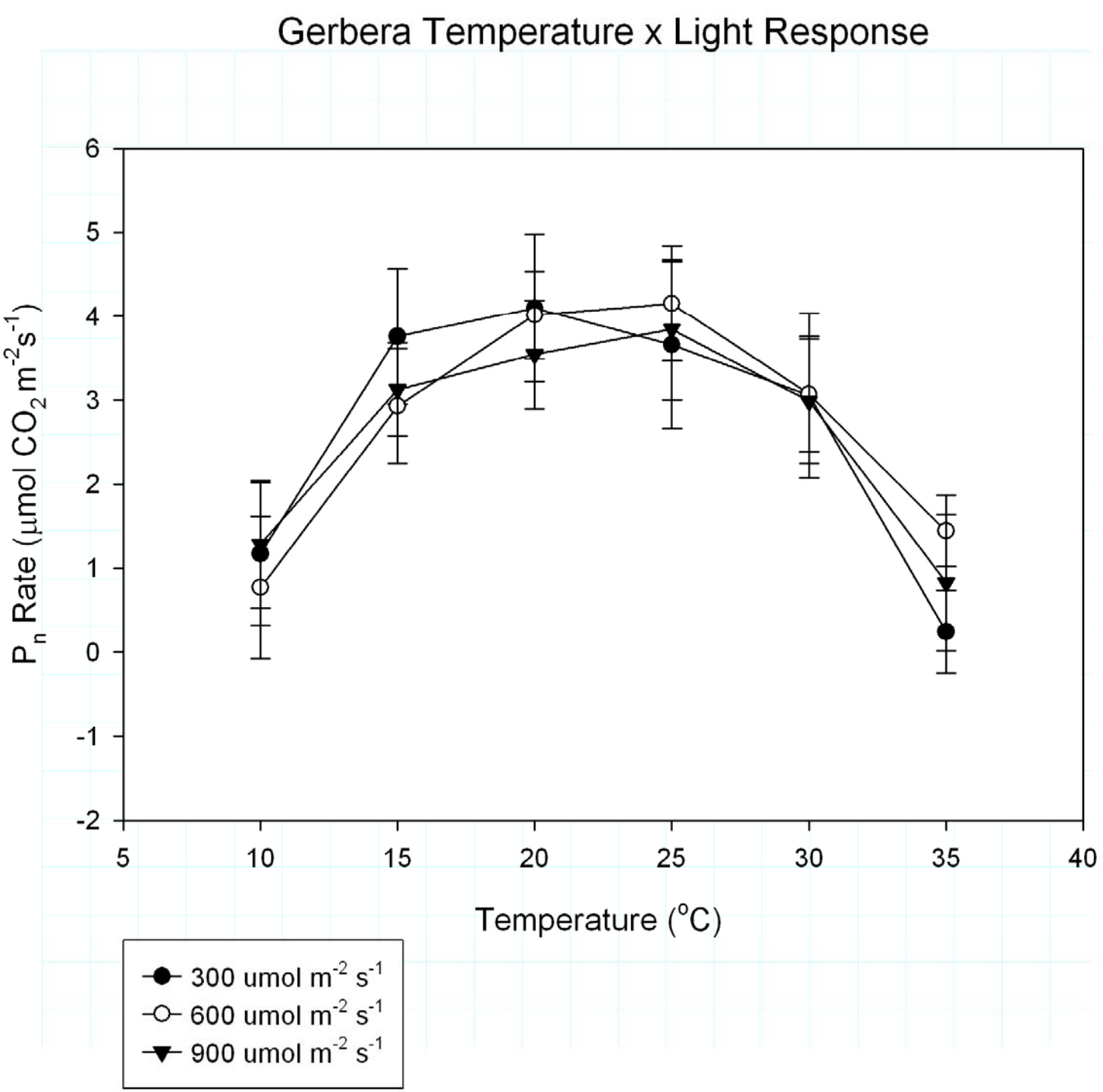
(86 F/ 45% RH)
Afternoon

Slow-drying

(59 F/ 85% RH)
Morning

Airborne interplant signalling for plant defence




Gerbera Temperature x Light Response
6
5
4
3
2
1
0
-1
-2
P_n Rate (µmol CO_2 $m^{-2}s^{-1}$)
5
10
15
20
25
30
35
40
Temperature (°C)
300 umol m^{-2} s^{-1}
600 umol m^{-2} s^{-1}
900 umol m^{-2} s^{-1}

Potted Plants?

Garden Plants?

K. glaucescens

K. manginii

K. uniflora

Photoperiod (hrs)

Green Roofs

Univ of Minnesota Impacts

- Identified irradiance, carbon dioxide, and temperature photosynthetic response response curves for >15 species.
- Identified liner drench strategies that have dramatically reduced losses in the field.
- Identified re-wetting strategies that have increased the efficacy of PGR applications.

Impacts for USDA-ARS Toledo: Jonathan Frantz

- Virtual Grower 2.5 released July 11, 2009. This version incorporated new data from the Floriculture Research Alliance. Software is downloaded 5 times/day (>6,500 times since release).
- Continued to collaborate with University faculty and ARS scientists across the country with Virtual Grower and nutritional analysis.

Challenges/Changes

- Expectations of participants – openness and willing to share information.
- We targeted the owners from the growers and have 2 separate meetings
- Gifts are not considered equivalent to competitive grants with respect to promotion and tenure.
- How does new USDA-ARS perspective fit into an established project?

Opportunities

- Amazing potential for national evaluations and trials outside of our immediate group.
- Real potential to increase direct funding.
- Real potential to leverage grower money to acquire government funding.
- Greatly increase USDA-ARS FNRI exposure to the industry.