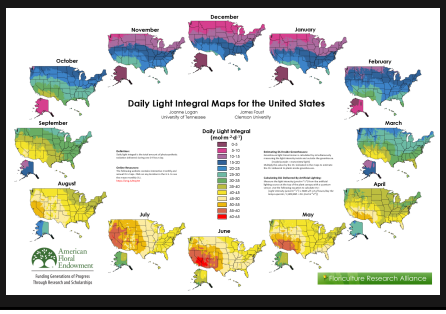
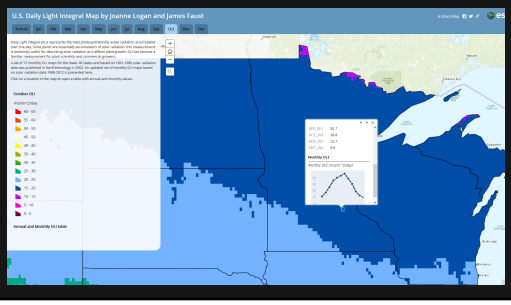
Clemson Research Update
2018

DLI Maps (posters)

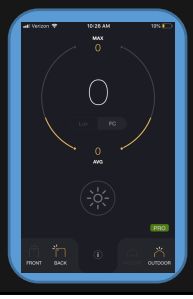


Interactive DLI Maps



Using Cell Phone Apps as Light Sensors

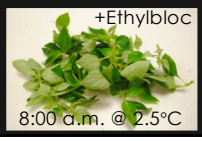
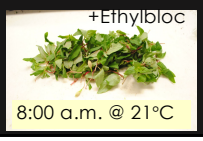
Michael Tierney



URC Postharvest Performance

Kelly Lewis

Mary Vargo

	NGI	Fuchsia
	8:00 a.m. @ 2.5°C	8:00 a.m. @ 21°C
+Ethylbloc	 8:00 a.m. @ 2.5°C	 8:00 a.m. @ 21°C

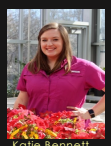
The Cost of Consumer Performance

$0.0007/6-pack
14 grams
17 flowers

$0.0066/6-pack
38 grams
41 flowers

Jiwoo Park

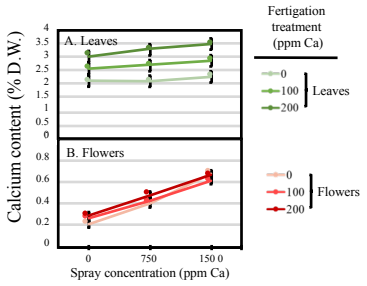
Calcium Update


Katie Bennett

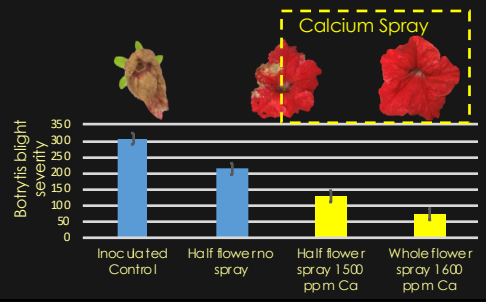
Calcium and Silicon Sources
Calcium Chloride (Lab grade and Cor-Clear)
Calcium Nitrate
Calcium Metalosate®
Calcium EDTA
Calcium Silicate
Potassium Silicate (AgSil® 16H)

1. Effectiveness
2. Phytotoxicity

What is the best way to get more calcium into plant tissue?



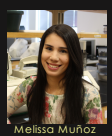
Translocation of Calcium within Flower Petals



Botrytis Fungicide-Resistance Management

Where do fungicide-resistant spores originate?

	Probability
1. Offshore URCs	Low
2. Domestic RCs	High
3. Your Greenhouse	
• Propagation area	High
• Finished plant area	Low-Med


Melissa Muñoz

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

	Offshore	Domestic
Captan	x	
Chlorothalonil	x	x
Mancozeb	x	x
Thiram	x	
Ziram	x	

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).

Single-site Fungicides

	Trade Name	Active Ingredient	FRAC Code	Likelihood of resistance development	Current Efficacy
	Cleary's 3336, etc...	Thiophanate-methyl	1	High Risk	Not Effective
	Chipco	Iprodione	2	Medium to High Risk	Low
1	Astun	Isofetamid	7	Medium Risk	Medium to High
1	Broadform	Fluopyram +	7 (+11)		Medium to High
1	Mural	Solatenol +	7 (+11)		Medium to High
1	Pageant	Boscalid +	7 (+11)		Low to Medium
1	Orkestra	Fuxapryoxad +	7 (+11)		Medium to High
2	Palladium	Fludioxonil, Cyprodinil	12 (+9)	Low to Medium Risk	Medium to High
2	Medallion, Spirato	Fludioxonil	12		Medium to High
	Decree	Fenhexamid	17	Low to Medium Risk	Low to Medium
3	Affirm	Polyoxin D zinc salt	19	Medium Risk	Medium to High

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 retail
  - Do not repeat FRAC codes on a crop

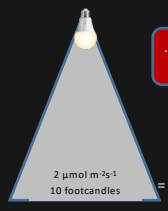
Tank mix with Calcium

Strategies to Minimize Fungicide Resistance

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

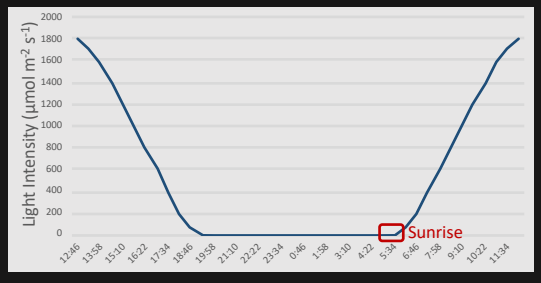
Photoperiod Perception in Poinsettia

What light intensity do poinsettias perceive?

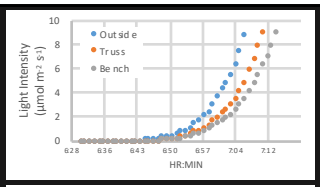


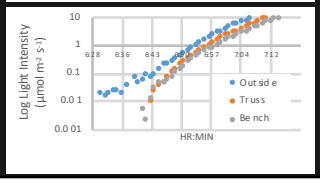
…but what about light intensities from 0 to 2 µmol $m^{-2}s^{-1}$?

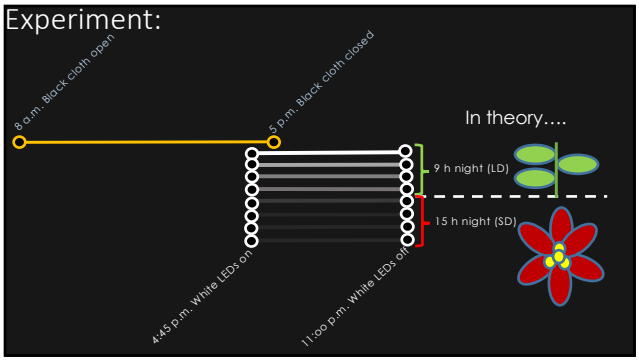
= prevents perception of darkness

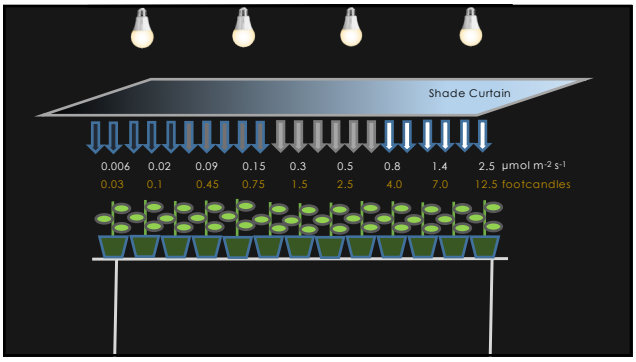


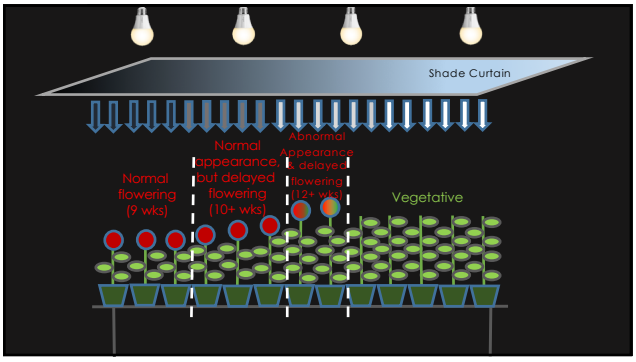
Sunrise

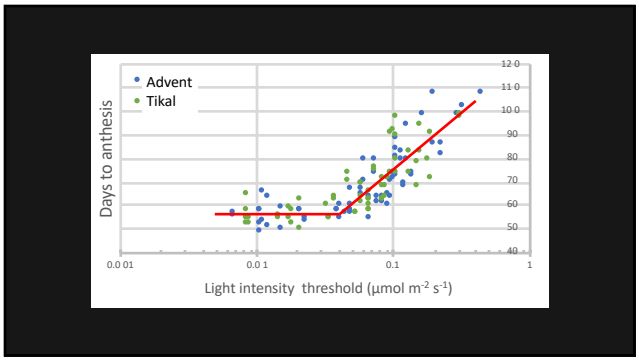


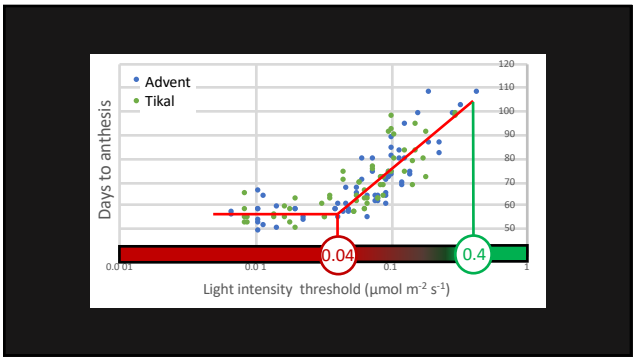


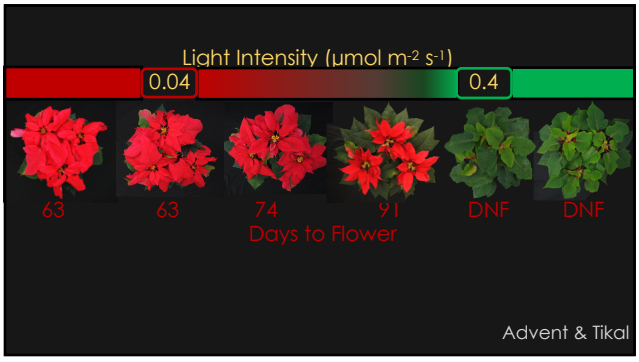

Experiment:
8 a.m. Black cloth open
5 p.m. Black cloth closed
In theory....
9 h night (LD)
15 h night (SD)
4:45 p.m. White LEDs on
11:00 p.m. White LEDs off

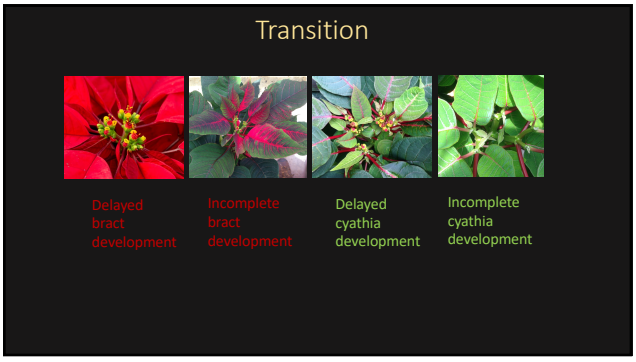

Shade Curtain
0.006 0.02 0.09 0.15 0.3 0.5 0.8 1.4 2.5 µmol m-2 s-1
0.03 0.1 0.45 0.75 1.5 2.5 4.0 7.0 12.5 footcandles

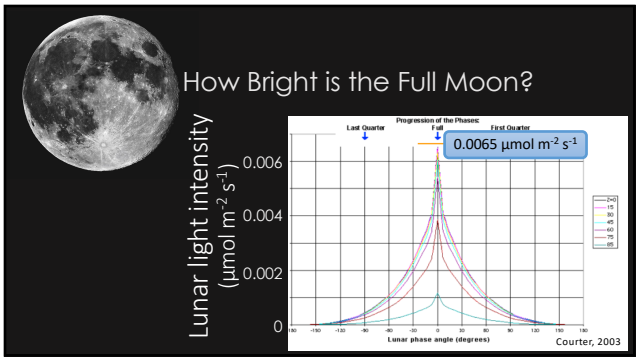

Shade Curtain
Normal flowering (9 wks)
Normal appearance but delayed flowering (10+ wks)
Abnormal Appearance & delayed flowering (12+ wks)
Vegetative

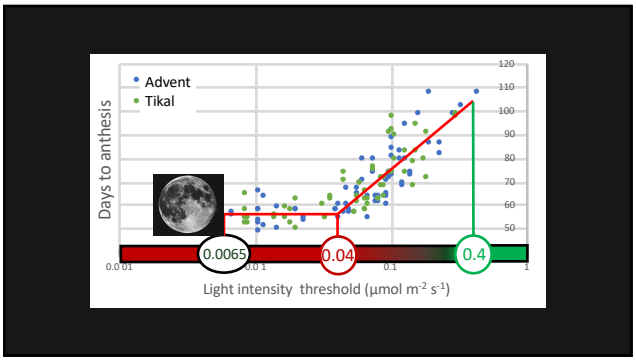

Advent
Tikal
Days to anthesis
Light intensity threshold (µmol m-2 s-1)

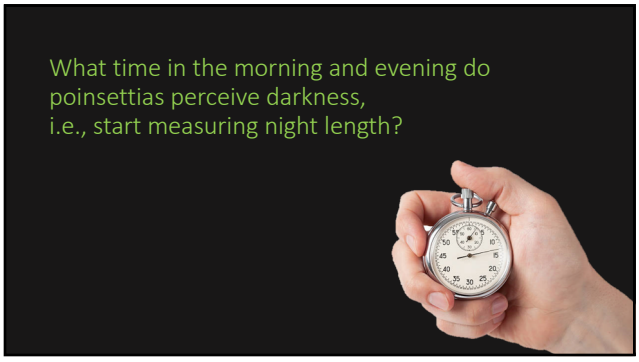

Advent
Tikal
Days to anthesis
0.04
0.4
Light intensity threshold (µmol m-2 s-1)


Light Intensity (µmol m-2 s-1)
0.04
0.4
63
63
74
91
DNF
DNF
Days to Flower
Advent & Tikal

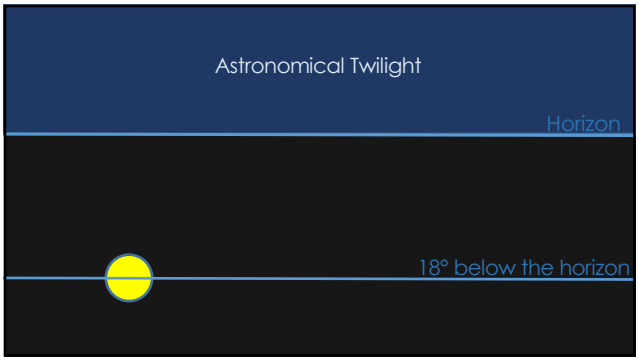

Transition
Delayed bract development
Incomplete bract development
Delayed cyathia development
Incomplete cyathia development

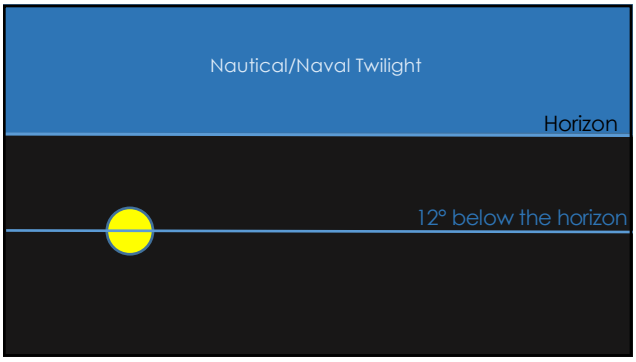

How Bright is the Full Moon?
Lunar light intensity (µmol m-2 s-1)
0.006
0.004
0.002
0
Progression of the Phases:
Last Quarter
Full
First Quarter
0.0065 µmol m-2 s-1
Lunar phase angle (degrees)
Courter, 2003


Advent
Tikal
Days to anthesis
120
110
100
90
80
70
60
50
0.0065
0.04
0.4
0.001
0.01
0.1
1
Light intensity threshold (µmol m-2 s-1)

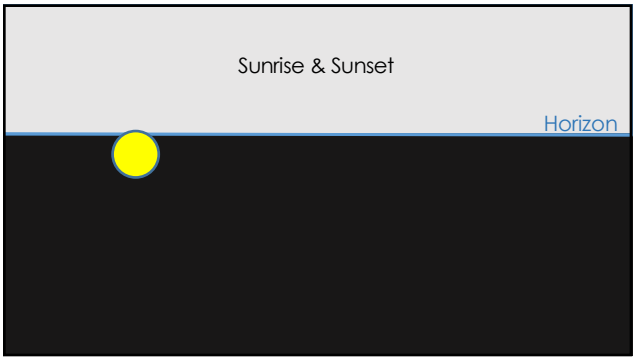

What time in the morning and evening do poinsettias perceive darkness,
i.e., start measuring night length?

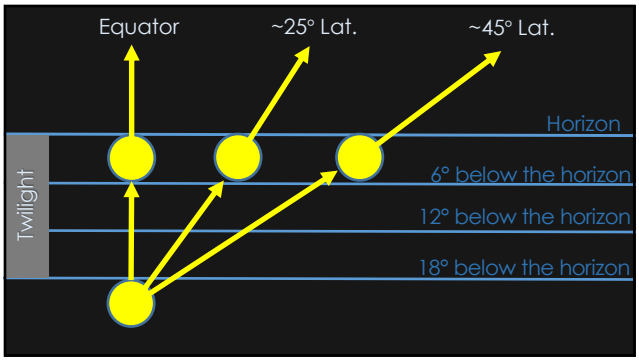
Night
Horizon
18° below the horizon

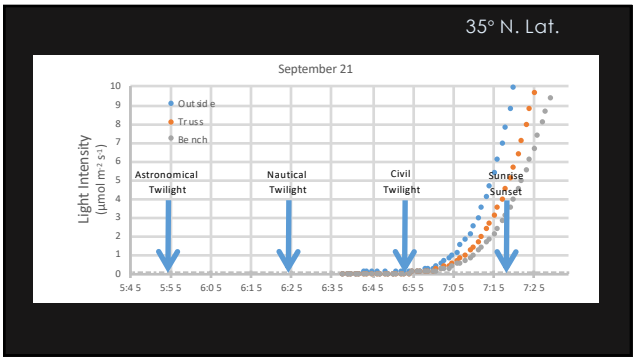

Astronomical Twilight
Horizon
18° below the horizon

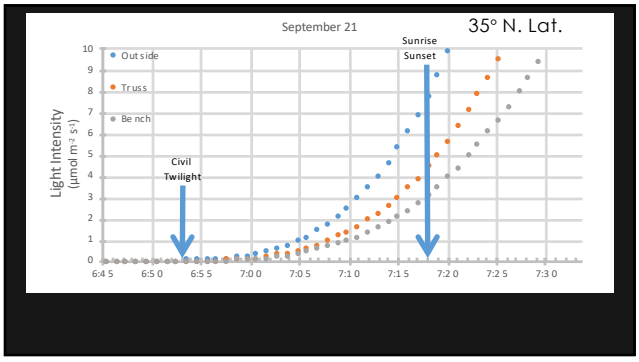

Nautical/Naval Twilight
Horizon
12° below the horizon

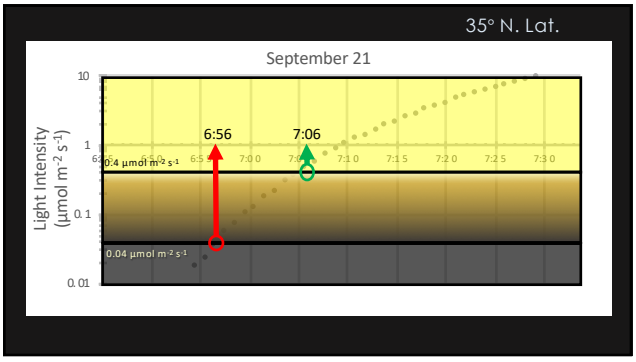
Civil Twilight
Horizon
6° below the horizon

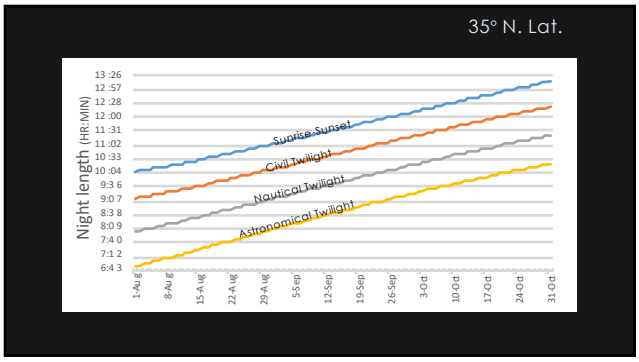

Sunrise & Sunset
Horizon

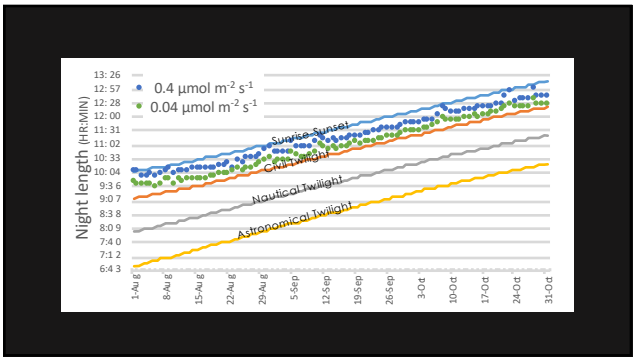

Equator
~25° Lat.
~45° Lat.
Horizon
6° below the horizon
12° below the horizon
18° below the horizon
Twilight

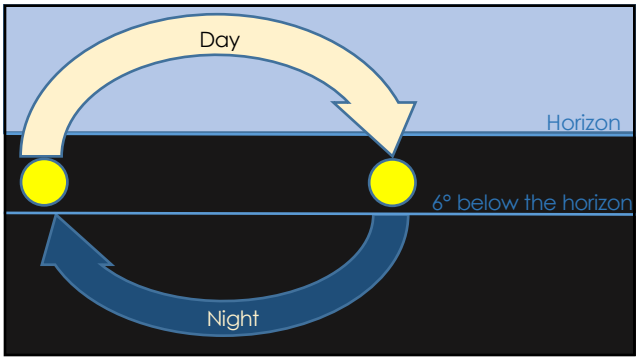

35° N. Lat.
September 21
Outside
Truss
Bench
Light Intensity (µmol m⁻² s⁻¹)
Astronomical Twilight
Nautical Twilight
Civil Twilight
Sunrise
Sunset


September 21
35° N. Lat.
Outside
Truss
Bench
Light Intensity (µmol m⁻² s⁻¹)
Civil Twilight
Sunrise
Sunset


35° N. Lat.
September 21
Light Intensity (µmol m⁻² s⁻¹)
6:56
7:06
0.4 µmol m⁻² s⁻¹
0.04 µmol m⁻² s⁻¹







Conclusion

	Photoperiod perception begins (minutes before sunrise & after sunset)
25° N. Lat. (Miami, FL)	10-18
35° N. Lat. (Clemson, SC)	11-20
45° N. Lat. (Minneapolis, MN)	13-23

Calculation:
Nightlength calculated with sunrise/sunset times - Minutes (above) x 2 = Actual night length perceived by poinsettias

Thank you for your support!!

Floriculture Research Alliance

American Floral Endowment
Funding Generations of Progress Through Research and Scholarships

Floriculture & Nursery Research Initiative

Ball FloraPlant
Battlefield Farms
Dummen-Orange
Fluence Bioengineering
Metrolina Greenhouses
Smithers-Oasis/Floralife
Syngenta

Future Directions

- URC Disorders
  - Stock…Postharvest…Propagation
- Botrytis
  - Predicting infection risk…improve fungicide application timing
  - Resistance management
- Calcium
  - Rates of uptake, Timing of applications
  - Other Botrytis-sensitive species (Gerbera)
- Heat delay (in poinsettia)

Take-home

- Light intensities of 0.04 µmol m^{-2} s^{-1} (~0.2 ftc) for several hours will delay poinsettia flowering.
- Light intensities of 0.4 µmol m^{-2} s^{-1} (~2 ftc) 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 cvrs
  (perhaps >13 h night length is beneficial at high temperatures)