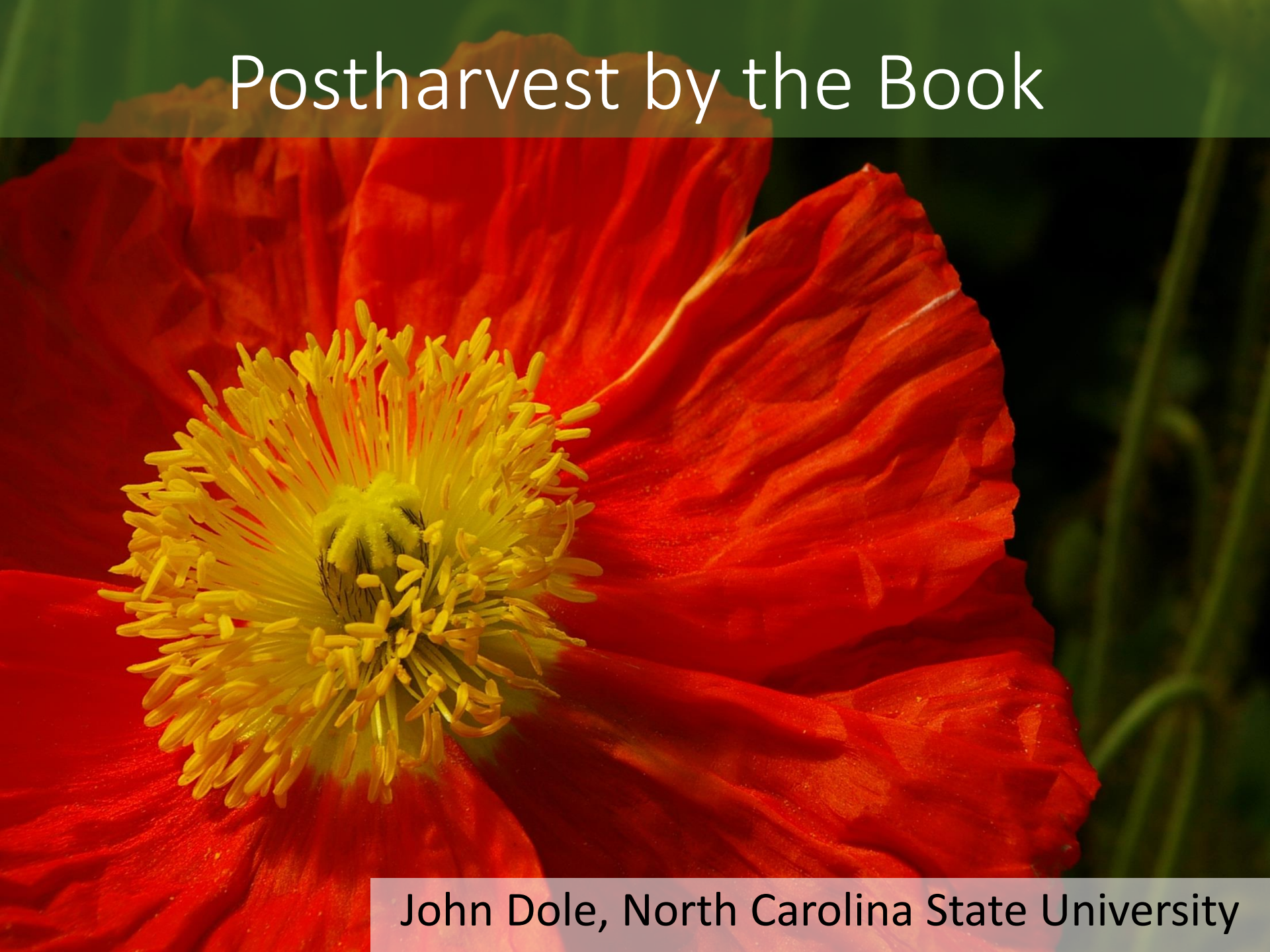
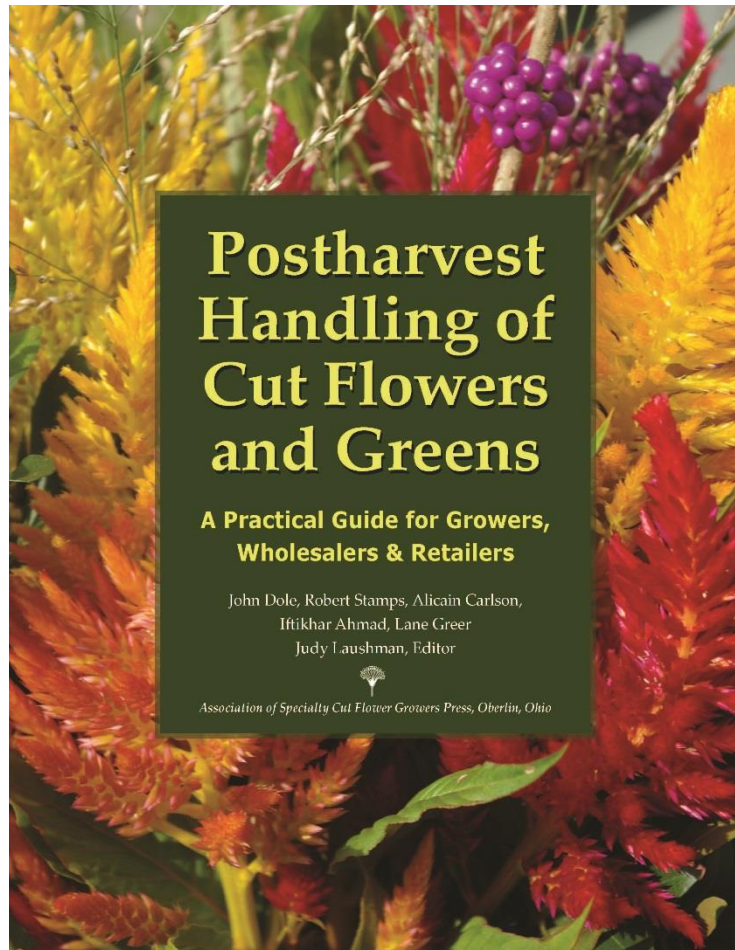


Postharvest by the Book

A close-up photograph of a vibrant red poppy flower. The petals are a deep, rich red with visible veins and a slightly wrinkled texture. The center of the flower is a bright yellow, composed of numerous stamens. The background is dark and out of focus, showing some green foliage.

John Dole, North Carolina State University

Available from ASCFG



2

Agapanthus

General information:

African lily or lily of the Nile (*Agapanthus*) has beautiful white or purple round clusters (umbels) of small flowers held on a long leafless stem. They grow to be about 3 feet tall, blooming in the late summer to early fall and are said to be deer resistant. Some cultivars, especially those of *A. praecox*, are hardy to Zone 7 (maybe even Zone 6), but most are hardy only in Zones 9 to 11. 'Mid-Knight Blue' has been trialed at North Carolina State University with great success.

Expected vase life:

10 days vase life can be expected in plain water and 12-14 days is possible with a sucrose treatment.

Stage of harvest:

Maximum vase life is achieved when harvested with 1/4 of the florets open.

Grower, wholesaler, and retailer treatments:

There is some conflicting information about the effectiveness of holding solutions. Some sources say that commercial holding solutions are not necessary while other research has shown that a 2.5 to 5% sucrose solution significantly reduces floret and bud abscission and improves vase life. This variability in recommendations could be due to the time of harvest. Stems harvested with very few florets open would likely benefit more from the carbohydrate than those harvested with more florets open. A sucrose pulse of 10 to 20% sucrose for 48 hours has been shown to also be effective. A 1 hour pulse of STS reduces shattering caused by ethylene sensitivity. STS treatment would be most beneficial for stems going to wholesalers and retailers rather than direct to the consumer.

Storage and shipping procedures:

Agapanthus can be cold stored for up to 5 days at 36 to 41°F (2 to 5°C).

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Ethylene:

Very sensitive. Shattering due to ethylene exposure is most common on immature buds. STS is effective for improving vase life and minimizing shattering.

Foam:

No information is available.

Comments:

Some of the cultivars approach true blue in color, a rare color in the flower world. There are cultivars that are less prone to flower shattering so be sure to look for those.

Literature used:

Burgo, C.K., F.R. Morgan, J.E. Seelye, C.R. Clark, A. McLachlan, and J.R. Fason. 2010. Prevention of floret abscission for Agapanthus praecox requires an adequate supply of carbohydrate to developing florets. South African Journal of Botany 76:30-36.

Mor, Y., A. Il Hasevy, A.M. Kofranek, and M.S. Reid. 1984. Postharvest handling of lily of the Nile flowers. Journal of the American Society of Horticultural Science 109:494-497.

Stahly, G. 1984. Flower and Plant Care Manual. Society of American Florists, Alexandria, Virginia.

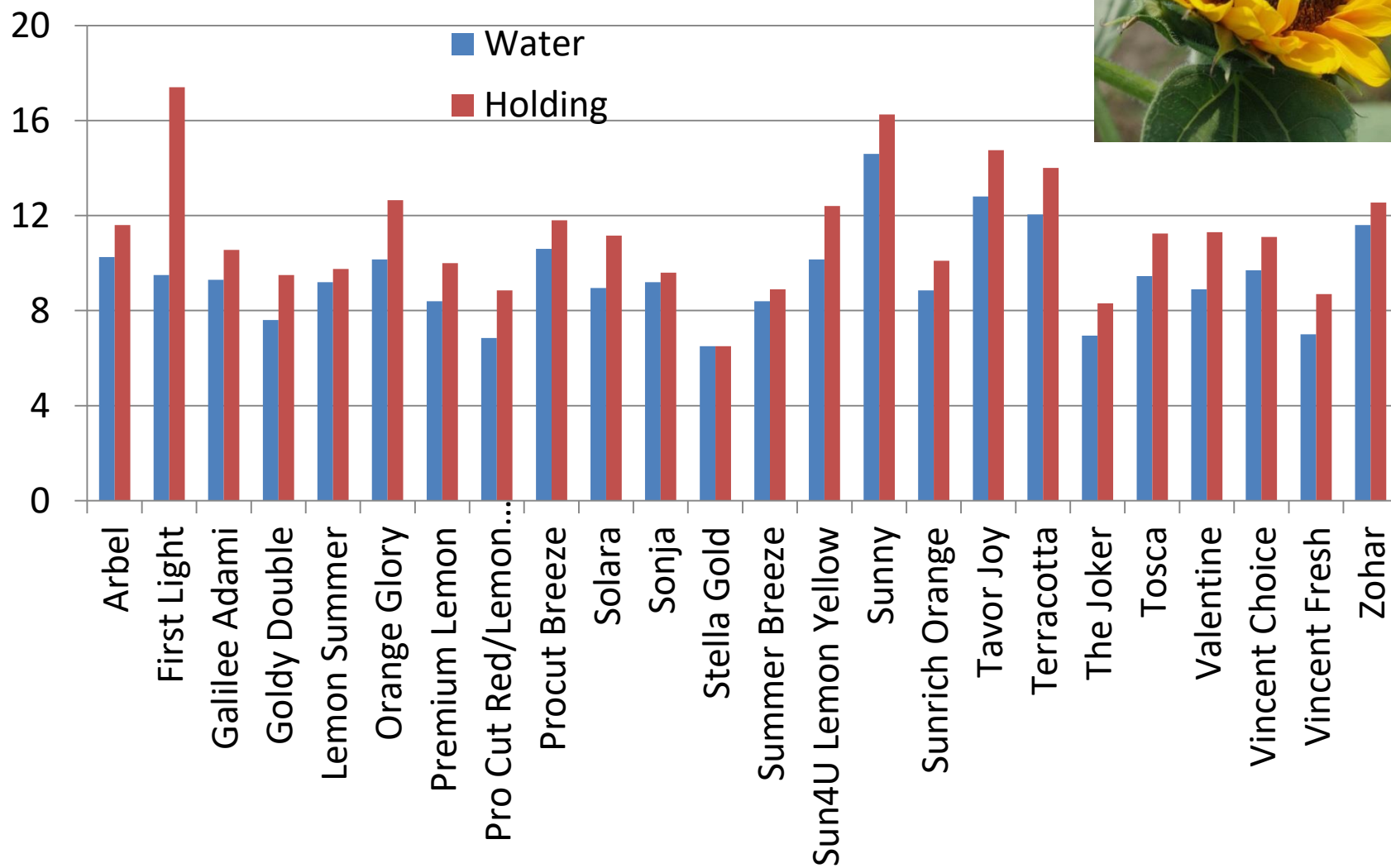
Yoram, M., A.J.I. Hasevy, A.M. Kofranek, and M.S. Reid. 1984. Postharvest handling of lily of the Nile flowers. Journal of the American Society of Horticultural Science 109:494-497.

Maximizing Postharvest Life

- Many factors effect vase life of cut flowers:
 - Pre-harvest
 - Harvest
 - General issues
 - Temperature
 - Botrytis
 - Ethylene
 - Post-harvest



Cultivar



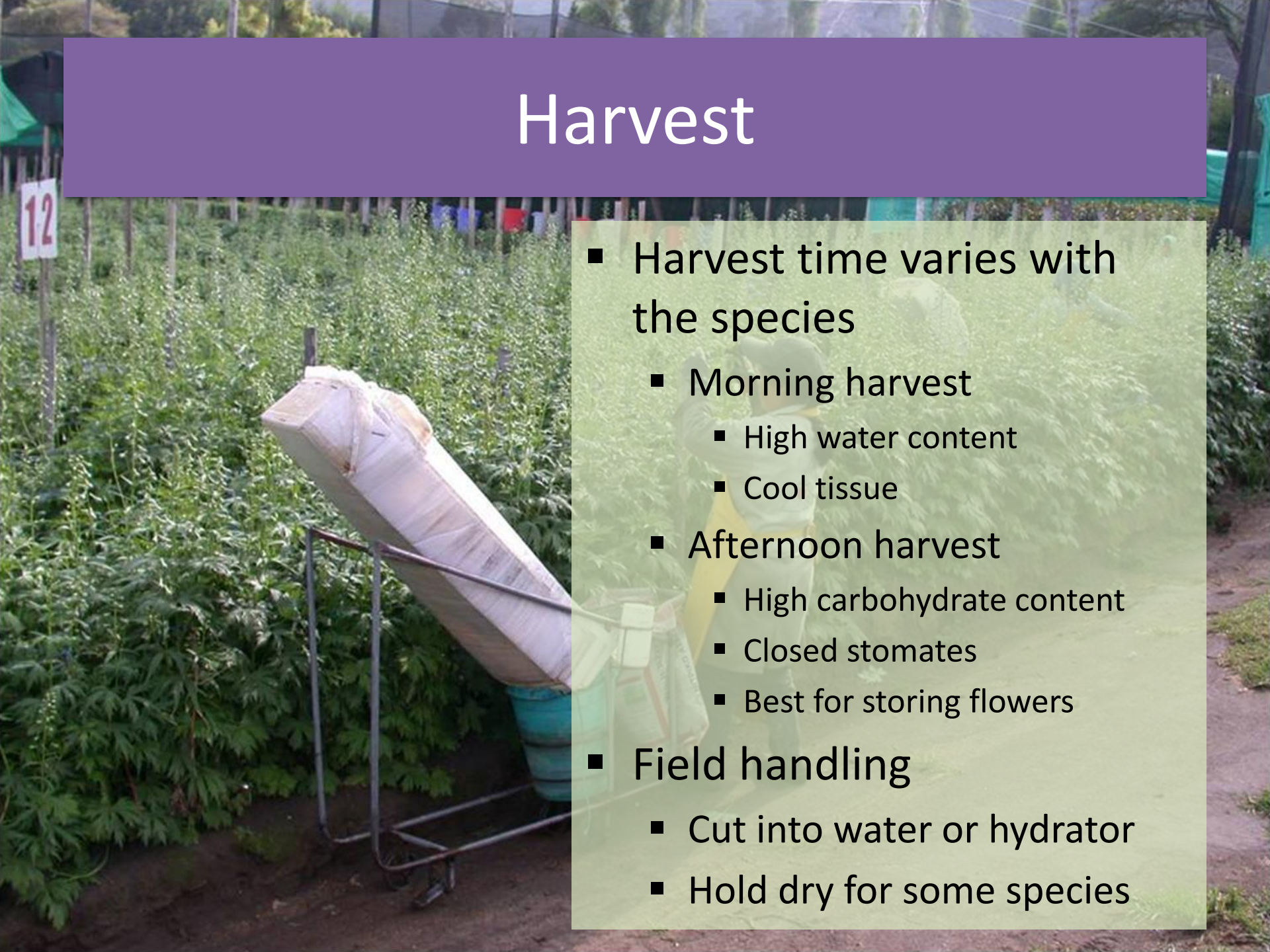
Developmental Stage

- Harvest at optimum stage to maximize postharvest life
- Varies with market
 - Direct to consumer
 - Retailers
 - Wholesalers

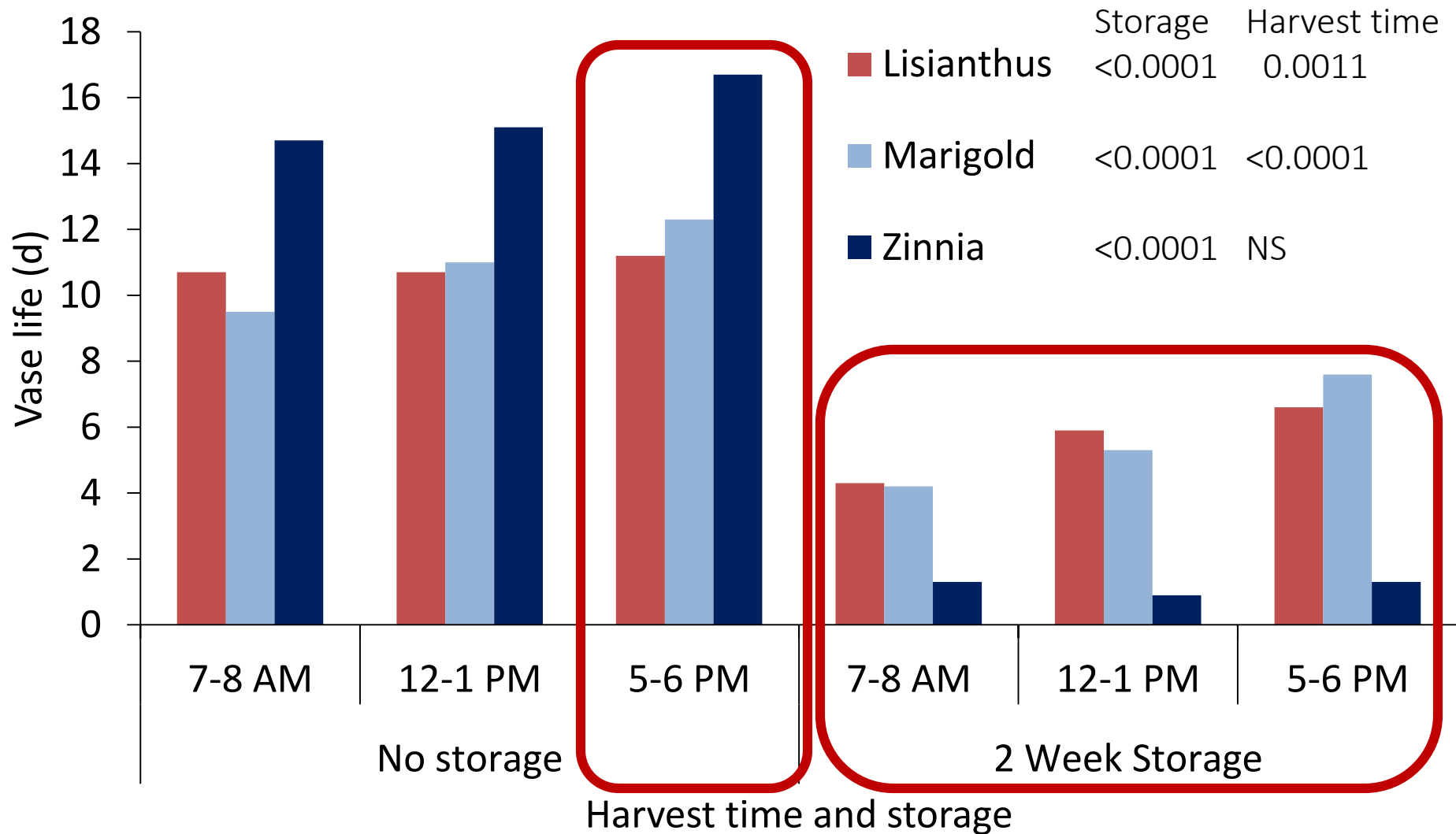


Harvest

- Harvest time varies with the species
 - Morning harvest
 - High water content
 - Cool tissue
 - Afternoon harvest
 - High carbohydrate content
 - Closed stomates
 - Best for storing flowers
- Field handling
 - Cut into water or hydrator
 - Hold dry for some species



Harvest: Time of Day



Temperature

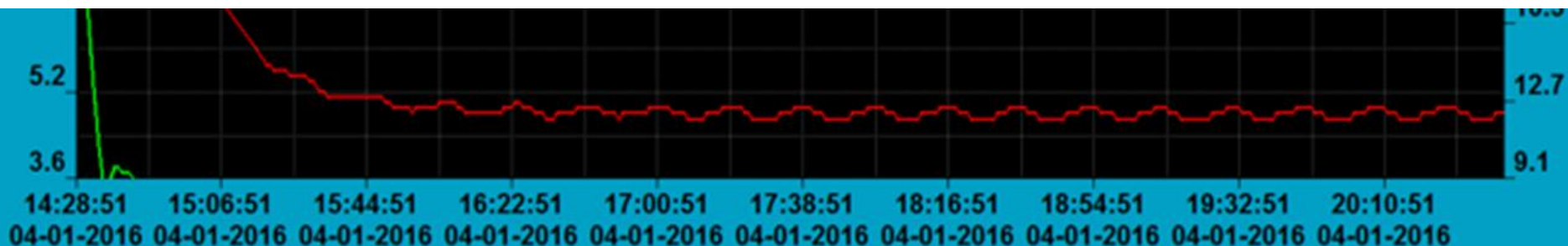
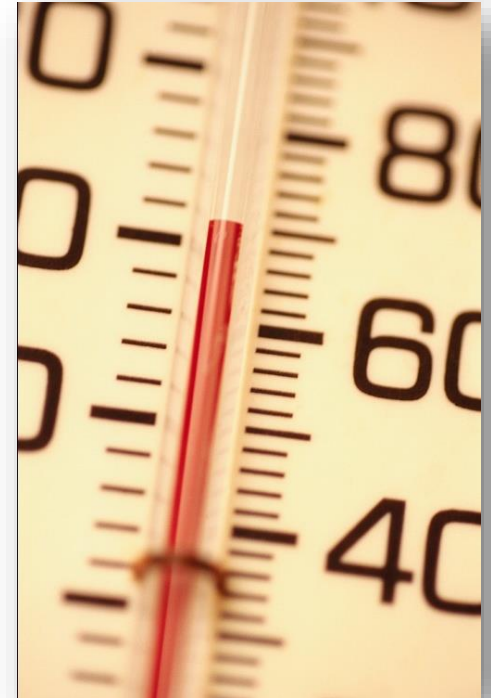


Stem bending in gerbera after storage

- The warmer the temperature:
 - Faster the respiration rate
 - Faster bacteria grow
 - More stems bend after storage

Temperature Drives Respiration

- For every 10°C increase in temperature
 - Respiration rate doubles
 - One day vase life is lost
- Get field heat out ASAP
- Set cooler at 34 to 38°F
 - Close to 32°F is optimum for most species
 - 34-35°F or 34-38°F is more practical
- A few crops are cold sensitive
 - Oriental lilies, zinnias, celosia, tropicals
 - Cool gradually
- Storage take home: Short and cold as possible for species



Botrytis

- Main postharvest disease on flowers and foliage
- Often present during production
- Becomes a major issue during storage and shipping
- Should be controlled during production



Ethylene Exposure



Hydrangea

- Leaf, flower and bud abscission
- Bud abortion
- Epinasty - distinctive curling, drooping of leaves or bracts
- Rapid flower senescence



Lily



Delphinium

Minimizing Ethylene Effects

- Lower temperature
- Apply anti-ethylene agents
 - Ethylbloc (MCP)
 - AVG (STS)
- Remove sources
- Can cut flowers and veggies/fruit be stored together?
 - Almost always no
 - Possibly, if duration is short and temperature is close to 32F



Anti-ethylene Agents

- **STS (AVB)**

- First solution to use immediately after harvest
- Use only once on each batch of flowers
- Protects for entire flower life
- Safe disposal is a major issue

- **1-MCP (Ethylbloc)**

- Non-toxic gas treatment for coolers and trucks
- Also available as sachets for packing boxes
- Protection lasts up to 10 days
- No disposal problems - short re-entry period
- Not as long lasting



Water



STS



1-MCP



Cut Flower Handling

- Decline due to lack of water uptake
- Stems blocked by:
 - Microorganisms
 - Bacteria and fungi naturally on plants and in tap water
 - Build up in buckets or vase solutions



Minimize Cross Contamination



High-polluting Flowers

- Achillea
- Sunflower
- Mums
- Gerbera
- Celosia
- Dahlia
- Zinnia

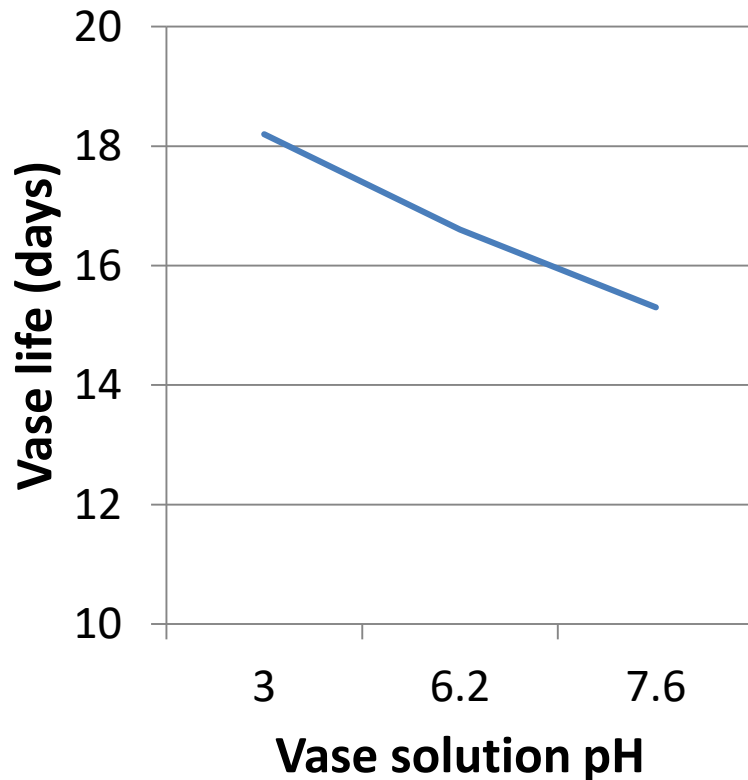


Cut Flower Handling

- Air plugs
 - Form from air drawn into xylem
 - When stems cut or out of water, recut to remove plug
- Physiological blockage
 - Eventual halt of water uptake
 - No way to overcome



Vase solution pH



- Low pH optimum for almost all species
- Tap water usually has too high of pH
- Adjust it!!



Mum 'Naru Lavender'

A B C

Floral Preservatives

Acidifier

Biocide

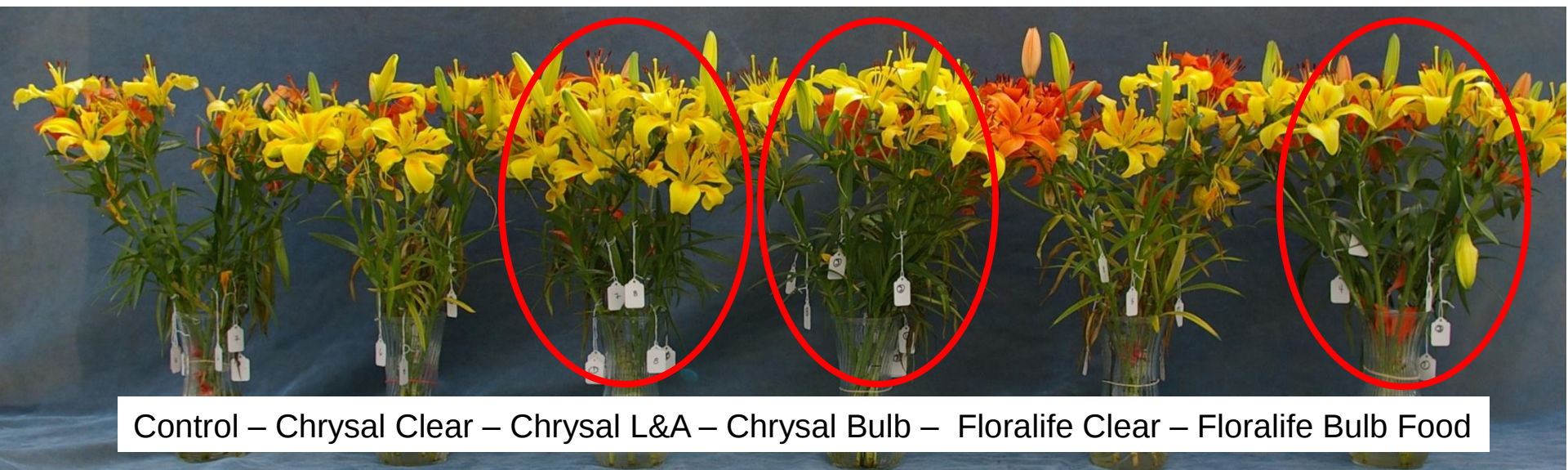
Carbohydrate

- Hydrating
- Holding
- Vase
- Species specific
- Powders
- Liquids
- Pills
- Buckets
- Jugs
- Packets
- Tea Bags



Use Right Solution to Fix Critical Issues

- Wilt-prone flowers
- Bacteria control
- Ethylene protection
- Species-species products
- One size fits most, however,.....



Control – Chrysal Clear – Chrysal L&A – Chrysal Bulb – Floralife Clear – Floralife Bulb Food

.....One Size Fits Most

- Holding (low sugar) formulations
 - A. Provides low pH which boosts water uptake**
 - B. Checks bacteria**
 - C. Provides at least some carbohydrates**
 - D. Active up to 5-6 days
- Carbohydrate effects
 - Open buds
 - Develops, maintains color
 - Extends vase life



NCSU Floral Preservatives Research

Category	Genera (no.)	Cultivars (no.)
Holding – positive	38	125
Holding – negative	15	21
Hydrator – positive		
Hydrator – negative		
Both together – positive		
Both together – negative		

Summary of 16 years of postharvest testing using 213 cultivars
Funded by the American Floral Endowment and ASCFG Research Foundation



Tagetes 'Jedi Gold'/'Jedi Deep Gold'

Marigolds

	Water		Hydrator	
	Water	Holding	Water	Holding
Babuda Deep Gold	9.7	14.5	9.0	13.9
Babuda Gold	12.9	18.7	12.4	18.1
Babuda Yellow	6.0	10.6	6.3	10.7
Jedi Deep Orange	10.9	16.6	11.7	15.7
Jedi Orange	8.1	13.9	8.2	13.0
Narai Yellow	5.7	7.7	6.3	8.5
Optiva	13.9	16.7	13.8	15.6

NCSU Floral Preservatives Research

Category	Genera (no.)	Cultivars (no.)
Holding – positive		
Holding – negative		
Hydrator – positive	12	15
Hydrator – negative	19	37
Both together – positive		
Both together – negative		

Basil 'Cardinal'

Hydrator: 11.5 days

Water: 4.7 days

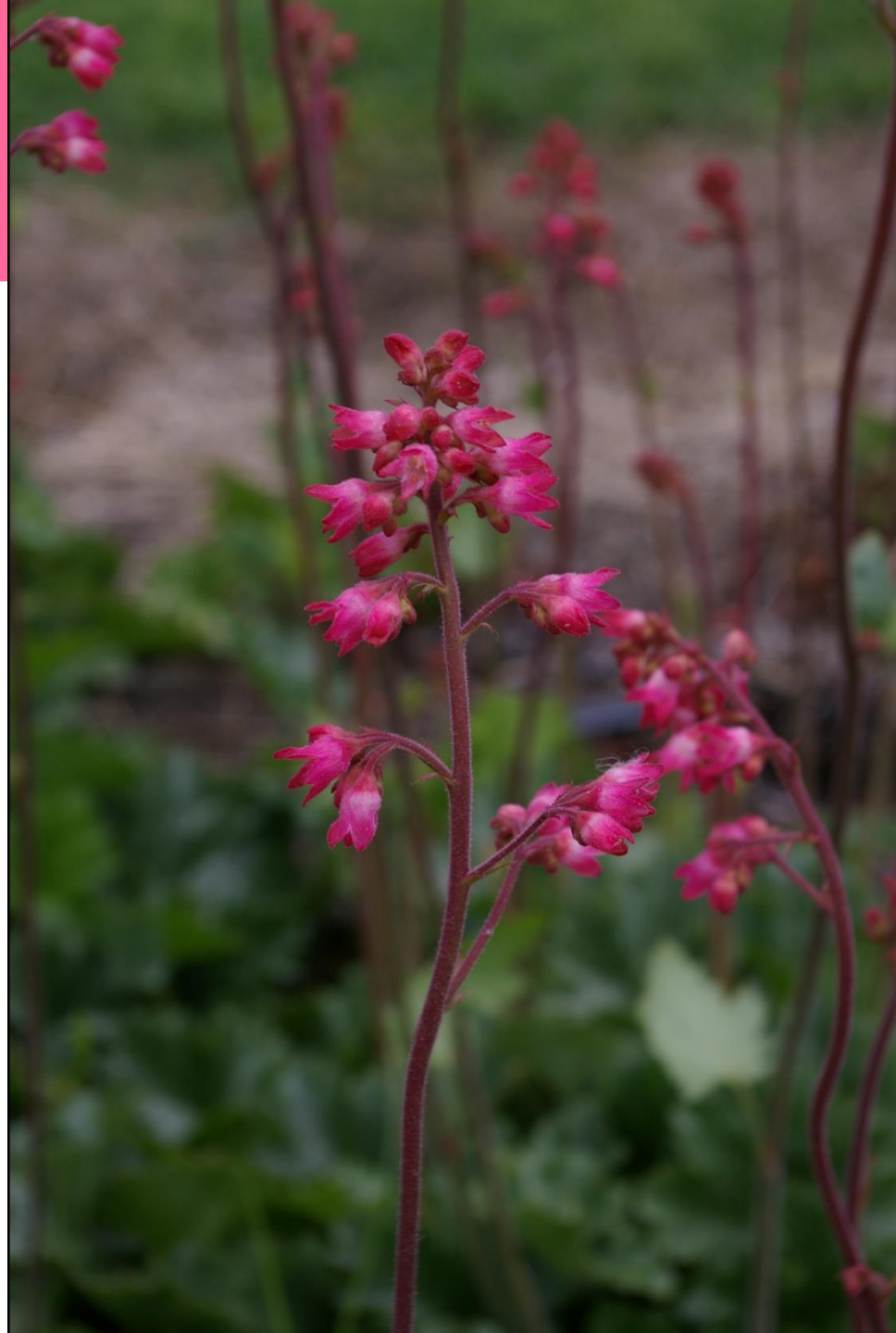


NCSU Floral Preservatives Research

Category	Genera (no.)	Cultivars (no.)
Holding – positive		
Holding – negative		
Hydrator – positive		
Hydrator – negative		
Both together – positive	9	11
Both together – negative	13	16

Heuchera 'Florists' Choice'

- Hydrator + holding: 13 days
- Holding: 11 days
- Hydrator: 7 days
- Water only: 5 days



Eucomis 'Sparkling Burgundy'

- Hydrator + holding: 11 days
- Hydrator: 29 days
- Holding: 17 days
- Water: 42 days



NCSU Floral Preservatives Research

- **High quality water** (possibly with chlorine pills) should be used to hydrate flowers (4 h), commercial hydration solutions should be used for species that need them
- **Commercial holding** solutions (overnight or longer) should be used for **most** flowers, unless you see a problem (uncommon)

Retailing Hints/Cautions

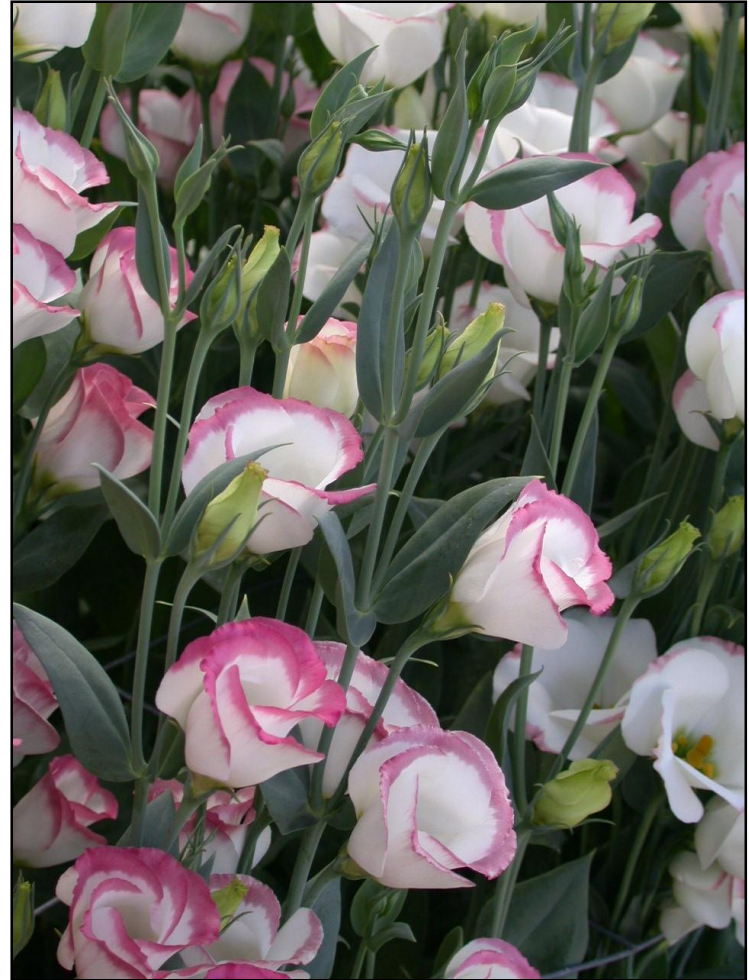
- Stored flowers may appear okay, but die shortly after sale
 - Manage inventory
- Provide flower food packets to customers
- Prevent physical damage
 - Use sleeves
 - Pack loosely
- Keep in water or floral solution

The Take Home Message

- Work clean and dry
- Store and transport as cold as possible (for species)
- Use proper treatments

The Cut Flower Crew

- Nathan Jahnke
- Ben Bergmann
- Ingram McCall
- Cristian Loyola
- Many others over the years:
 - Alicain Carlson
 - Lane Greer
 - Iftikhar Ahmad
 - Erin Moody
 - Erin Regan



Support

- ASCFG Research Foundation
- ASCFG Research Committee
- American Floral Endowment
- Floralife/Smithers Oasis
- Chrysal
- Seed and Plant Suppliers
- Growers
- Coor Farm Supply, Dillon Plastics, Fafard, Berger, Scotts