



Trial Results and Significance to Greenhouse and Nursery Operations

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2009 Cold Tolerance Container Trials – Trial Details

- Pageant applications (8 oz/100 gals) were applied to several annual varieties in 4 to 4.5-inch pots at various intervals prior to exposing them to freezing temperatures.
- Application intervals were:
 - 1 day before cold event
 - 2 days before cold event
 - 4 days before cold event
 - 14 days and 1 day before
 - 14 days and 2 days before
 - 14 days and 4 days before



Dbl Impatiens at 1st application

Cold Tolerance Container Trials – Results

Double Impatiens ‘Rockapulco’

- 4 hours 33 minutes
below 32° F (29.8° F Average)
- Pageant (8 oz /100 gals)
applied at 2 days and 2 & 14
days prior to the cold event
exhibited the least injury
- Untreated - 25% injury
Pageant 2 days - 0% Injury

9 Days After Cold Event



Untreated

Pageant 8 oz
2 & 14 Days
Before Cold

Cold Tolerance Container Trials – Results

Zonal Geranium

9 Days After Cold Event

- 3 hours 48 minutes below 32° F (30.3° F Average)
- Pageant applied at 14 days and 1 & 14 days prior to the cold event exhibited the least injury
- Untreated - 16.3% injury
Pageant 14 days - 0% Injury
Pageant 1 and 14 days - 3.1% Injury



Untreated

Pageant 8 oz
1 & 14 Days
Before Cold

New Guinea Impatiens

9 Days
After
Cold



Untreated

Pageant Applied 1 Day
Before Cold

Cold Tolerance Trials Rooted Liners Evaluation and Results

0 - 4 Cold Injury/Marketability Rating Scale

4 = No Injury – Salable

3 = Slight Injury – Salable

2 = Moderate Injury – Not Salable

1 = Severe Injury – Not Salable

0 = Death



- Each replication was assigned an injury/marketability rating 28 hours following the cold treatment.

Cold Tolerance Trials Rooted Liners Improved Cold Tolerance

Variety	Pageant	Untreated
Calibrachoa 'Callie Deep Yellow'	4	3
Lantana 'Bandana Cherry'	3	2
Lobelia 'Techno Heat Violet'	4	3
Fuchsia 'Swing Time'	4	2
Lobelia 'Techno Heat White'	4	3
New Guinea Impatiens 'Sonic Pink'	2.5	1.5

Two Trials

- 5.75 to 8 hours below freezing inside the boxes
- 26.2°, 28.7°F Low temperatures

Grower Applications as Result of Cold Tolerance Trials

Duwaynes Greenhouses (MI) – Cooperator

- Ships liners in boxes via FedEx and ground to growers across the country in the late winter.
- Delivery methods are not temperature regulated.
- General rule - No shipping occurs if $< 25^{\circ}$ F
- Delaying shipping often increases work load the rest of the week.
- As result of the trials, all liners are sprayed with Pageant within 1 wk of shipping.

Credits are down since this was implemented!!!

Grower Applications as Result of Cold Tolerance Trials

Kurtz Farms (CT) – PSC Client

- Moved pansies in flower from a heated greenhouse outside in late March.
- Below freezing temperatures were expected a few days later.
- Discussed options, shared past cold tolerance results, and BASF contact info.
- Grower applied Pageant (12 oz/100 gals as spray) two days before cold event.
- Low temps reached 26-27° F for 3.5 hours
- No injury observed following cold event. Injury was observed on combo pots containing pansies in the same outside production site. Shipped the next day. **(Saved the crop!)**

Pot Mum Drought Tolerance Trials

Trial Details

- Three Cultivars Tested –
 ‘Butterfield’, ‘Durango’, ‘Point Pelee’
- URCs direct stuck into 4.5-inch pots on June 15, 2010
- Moved to growing environment (gutter connect greenhouse) and short days provided after they were rooted.
- Pageant spray applied on August 21, 2010 (8 and 12 oz per 100 gallons) to budded plants, applying 2 quarts/100 sq feet
- Final irrigation on August 22, 2010 (subirrigation)
- Plants placed on pallets to prevent additional irrigation applications.



Pot Mum Drought Tolerance Trials

Evaluation and Results

- Each replication was assigned drought ratings based on plant appearance and the extent the individual plants were wilted.
- The following scale was used to demonstrate the extent of water stress these plants received.

0 – 4 Drought Rating Scale

0 = None

1 = Slight Wilting

2 = Moderate Wilting

3 = Severe Wilting

4 = Death



Rating 2



Rating 3

- Drought ratings were assigned to each replication at least once daily from August 26th to August 30th.

Pot Mum Drought Tolerance Trials Evaluation and Results

- The last three days of this study were considerably hotter than the conditions these plants were accustomed to growing at.
- The outside high temperatures were 84.7, 91.0, and 89.6° F each of the last three days (warmer inside the greenhouses); the normal highs for this location during the month of August average 80.4° F.
- With these temperatures, there was more heat stress experienced by the plants which required more transpiration and water consumption; therefore, the plants dried out at a faster rate than under more 'normal circumstances'.

Pot Mum Drought Tolerance Trials

Time to Severe Wilting

Average Days to Severe Wilting (Drought Rating 3)

Treatment	Butterfield	Durango	Point Pelee
Untreated	6.625	6.25	6.8125
Pageant 8 oz	6.5625	6.375	6.9375
Pageant 12 oz	6.875	6.8125	7.0

- Pageant at the 12 oz rate increased the amount of time until severe injury symptoms were observed with all cultivars.
 - ‘Point Pelee’ 4.5 hours longer than untreated plants
 - ‘Butterfield’ 6 hours longer than untreated plants
 - ‘Durango’ 13.5 hours longer than untreated plants
- Although 4.5 to 13.5 hours may not seem that significant, for a grower or a retailer, even an extra hour or two would be incredibly significant for them.

Pot Mum Drought Tolerance Trials

Marketability Ratings

- Each replication was assigned a marketability rating at various intervals over the course of these trials.

1 - 5 Marketability Rating Scale

5 = Excellent, Salable (no injury - no chlorosis, optimum top growth)

4 = Good, Salable (slight injury - slight chlorosis or slightly damaged flowers)

3 = Moderate, Marginal Salable (moderate injury - chlorosis and/or damaged flowers)

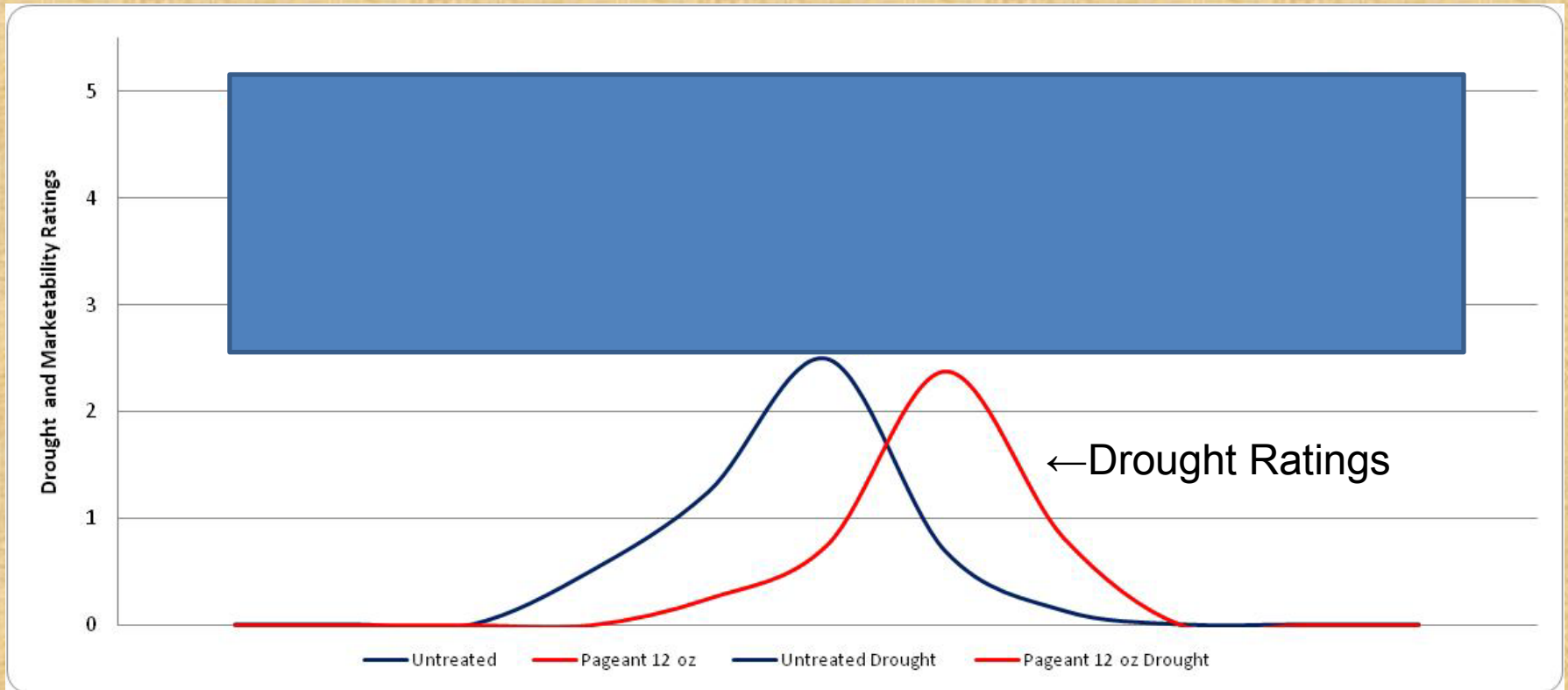
2 = Poor, Unsalable (severe injury - severe chlorosis and flower injury)

1 = Death, Not Salable

- The marketability ratings were greatly influenced by the appearance of the plants when the ratings were assigned to each replication. For example, the replications that were under drought stress and appeared wilted received lower ratings than a 'normal appearing plant' and as the wilting lessened, the marketability ratings increased.

Pot Mum Drought Tolerance Trials

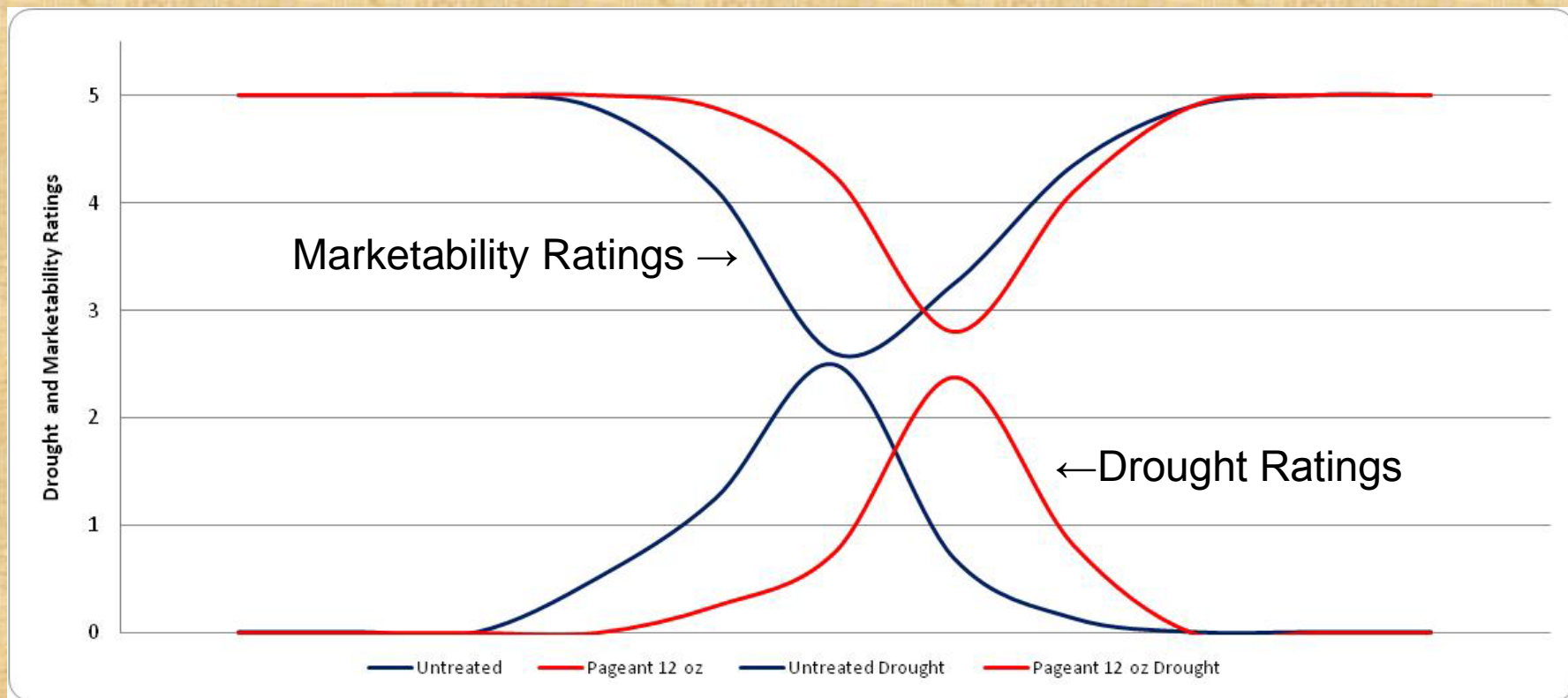
Pot Mum 'Durango' Marketability Ratings



Plants treated with 12 oz Pageant prior to the drought event took slightly longer to express symptoms.

Pot Mum Drought Tolerance Trials

Pot Mum 'Durango' Marketability Ratings



Plants treated with 12 oz Pageant prior to the drought event took slightly longer to express symptoms and recovered faster than untreated plants.

Increased Drought Tolerance with Pageant

- The ability to extend shelf life or delay the need for irrigation is very useful for growers while shipping plants long distances or for retailers who cannot always be there the minute a plant needs to be watered.
- Extending the time for severe wilting will allow growers more flexibility with how they need to prioritize their daily activities (not recommending growers use this as a water management tool during production).

Pageant Retail Study - Garden Mums

- Pageant (12 oz/ 100 gals) was applied to 3 garden mum cultivars on August 25, 2011.
- Untreated and treated plants were identified with colored stickers and randomized in shuttle trays.
- On August 31, 2011, the garden mums were shipped to and received Home Depot in Alpena, MI.



Pageant Retail Study - Garden Mums

Irrigation Benefits Observed

- All of the plants were watered when they were received at the store.
- Untreated plants required water every 2 days.
- Pageant treated plants did not require water until day 7.
- 2nd watering for Pageant treated plants was 4 days later (weather was about 10 degrees warmer than the first week).
- 1st 11 days at the store -
 - Untreated watered 5 times.
 - Pageant treated plants watered 2 times.

Pageant treated plants received 60% less irrigations

Pageant Retail Study - Garden Mums

Drought Recovery

Merchandiser comments:

‘Had one mum that was completely wilted, I watered it good and it bounced right back, not something a mum normally does. Mums are not a forgiving plant when they dry out, they do not bounce back, have injured leaves, and sometimes die’



Pageant Retail Study - Garden Mums

2 weeks after shipping, the untreated plant on the left had a significant amount of brown, senescing flowers and was no longer marketable. The plant on the right was treated with Pageant, had no brown flowers and was still highly marketable 14 days after it was received by the store.

Increased Shelf Life



Untreated

Pageant 12 oz

Grower Applications as Result of Pageant Retail Trial

Micandy Gardens (MI) – Cooperator

- As a result of the trials, the grower replicated this study on their own using a larger container size.
- Their results were similar to those observed in the initial study.
- Next year Micandy Gardens plans to apply Pageant to all of their garden mums prior to shipping.
- They also are interested into looking for opportunities with other crops.

Perennial Solutions

2012 Pageant Intrinsic Trials

- Post Harvest Benefits with Pageant – Annuals
- Reducing Transplant Stress with Pageant on Shrubs
- Enhanced Root Development with Pageant – Stock Plants
- Enhanced Root Development with Pageant – Unrooted Cuttings

Reducing Transplant Stress



Untreated

Pageant Applied 6 Days
Before Transplanting

30 Days After
Transplanting

Stock/Prop. Trial

Quince (*Chaenomeles speciosa*)



Untreated



Pageant 12 oz Applied to
Stock Plants 3 Days Before
Harvesting Cuttings

9 Days After Sticking

Lilac

Syringa 'Bloomerang Purple'



Untreated

Pageant 12 oz
Applied to Stock
Plants 3 Days
Before Harvesting
Cuttings

39 Days After Sticking



Untreated

Pageant 12 oz Applied
to Stock Plants 3 Days
Before Harvesting
Cuttings

Lilac

Syringa 'Bloomerang Purple'



Untreated

Pageant 12 oz
Applied to Stock
Plants 3 Days
Before Harvesting
Cuttings

52 Days After Sticking



Untreated

Pageant 12 oz Applied
to Stock Plants 3 Days
Before Harvesting
Cuttings

Verbena – URC Trial



Untreated

Pageant
4 oz/100 gals
Applied After Sticking

Pageant 4 oz/100 gals
Applied 4 Days After
Sticking

7 Days After Sticking

Verbena – URC Trial



Untreated

Pageant
4 oz/100 gals
Applied After
Sticking

7 Days After Sticking

Verbena – URC Trial

Untreated



Pageant
4 oz/100 gallons
Applied At
Sticking

16 Days After Sticking

Evolvulus URC Trial

7 Days After
Sticking



Untreated

Pageant 4 oz/100 gals
Applied After Sticking

Pageant 4 oz/100 gals
Applied 4 Days After
Sticking

Evolvulus URC Trial

7 Days After
Sticking

Untreated - Top Row



Pageant 4 oz/100 gals Applied After Sticking- Bottom Row

Evolvulus URC Trial

16 Days
After
Sticking

Untreated



Pageant
4 oz/100 gals
Applied After
Sticking

Repeated Verbena and Evolulus Trials

Week 31

Week 32

Verbena Week 31 URC Trial

Untreated

Total Root Length
7.54 Inches
Per Cutting



12 Days
After
Sticking

Pageant
4 oz/100 gals
Applied After
Sticking

Total Root Length
16.27 Inches
Per Cutting
+115%

Verbena Week 31 URC Trial



15 Days
After
Sticking

Untreated

Pageant
4 oz/100 gals
Applied After
Sticking

Growth Index	0.7083	1.25
		+76.47%

Growth Index = (Length + Widest Width + Width Perpendicular)/3

Evolvulus Week 31 URC Trial

Untreated

Total Root Length
5.354 Inches
Per Cutting



12 Days
After
Sticking

Pageant
4 oz/100 gals
Applied After
Sticking

Total Root Length
5.75 Inches
Per Cutting

+8.24%

Evolvulus Week 31 URC Trial

Untreated

Total Root Length
23.6 Inches
Per Cutting



19 Days
After
Sticking

Pageant
4 oz/100 gals
Applied After
Sticking

Total Root Length
33.53 Inches
Per Cutting

+42.05%

Perennial Solutions

Pageant Intrinsic Trial Summary

- Drought studies
 - All trials produced favorable results
 - Increased time for drought symptoms to develop
 - Better, full recovery from drought
- Cold tolerance studies
 - Increased tolerance to cold often observed
 - Results vary by variety tested, temperature during cold event, and duration of cold
 - Plants recover from cold faster than untreated plants

Perennial Solutions

Pageant Intrinsic Trial Summary

- Additional Observations
 - Reduces the development and/or magnitude of symptoms following stress events (Wilting, leaf yellowing, shattering of flower petals)
 - Treated plants recover from stress and resume a normal rate of growth faster than untreated plants
 - Results vary from trial to trial and sometimes are not duplicated

(maybe related to environmental factors or the health of the plant at the time of application)

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Pageant Intrinsic Trial Summary

- Pageant Intrinsic brand fungicide
 - Offers growers excellent disease control
 - Enhances plant health
 - Helps to decrease plant stress
 - May be useful to improve cold tolerance
 - Shipping, light frost events, when moving plants from greenhouses to outdoor sites
 - May provide drought tolerance
 - Beneficial for shipping and retail situations

Pageant Intrinsic Benefits

Where to Begin

- **Plant Health Benefits Established Plantings**
 - Benefits commonly observed at 8-12 oz per 100 gallons
 - Sprays @ 12 oz/100 gallons - Excellent Starting Point
- **Propagation Benefits**
 - Benefits observed at 4-8 oz per 100 gallons
 - Sprays @ 4 oz/100 gallons - Rooting Benefit Only
 - Sprays @ 8 oz/100 gallons – Rooting Benefits + Disease



Perennial Solutions Consulting

Thank You!!!
Questions?

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Contract Research

On-site and Remote Consulting Services Available