INTRODUCTION

PGRs Knowing and Using

• Growth Controllers
  – Ancymidol
  – Chlormequat
  – Daminozide
  – Flurprimidol
  – Paclobutrazol
  – Uniconazole

• Structural Enhancers
  – Augeo
  – Configure
  – Ethephon
  – GA/BA

Joyce Latimer will cover
In next presentation

Expanding PGR Toolbox

<table>
<thead>
<tr>
<th>Type</th>
<th>Chemical</th>
<th>Products</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anti-GA</td>
<td>Ancymidol</td>
<td>Abido, A-Rest</td>
</tr>
<tr>
<td></td>
<td>Chlormequat chloride</td>
<td>Citadel, Cycocel</td>
</tr>
<tr>
<td></td>
<td>Daminozide</td>
<td>B-Nine, Dazide</td>
</tr>
<tr>
<td></td>
<td>Flurprimidol</td>
<td>Topflor</td>
</tr>
<tr>
<td></td>
<td>Paclobutrazol</td>
<td>Bonzi, Pacol, Piccolo, Piccolo 10X, Downsize (drenches only)</td>
</tr>
<tr>
<td></td>
<td>Uniconazole</td>
<td>Concise, Sumagic</td>
</tr>
<tr>
<td>Structural</td>
<td>BA</td>
<td>Configure</td>
</tr>
<tr>
<td></td>
<td>GA</td>
<td>Florib, ProGibb T&amp;O</td>
</tr>
<tr>
<td></td>
<td>BA/GA</td>
<td>Fascination, Fresco</td>
</tr>
<tr>
<td></td>
<td>Dilegulic sodium</td>
<td>Augeo</td>
</tr>
<tr>
<td></td>
<td>Ethephon</td>
<td>Collate, Floral</td>
</tr>
</tbody>
</table>
**Ancymidol**

- **Abide (Fine Americas) and A-Rest (SePRO)**
  - 0.0264% Solution
- **A softer anti-GA PGR.**
  - Excellent niche is plugs
    - Daminozide does not have substrate activity
    - Does not have yellowing (phyto) like Chlormequat

**Old SePRO Ad (2000)**

- Avoiding over-regulation a plus for plugs

**Ancymidol**

- **Applications**
  - BP Plugs: Sprunch at 2 to 10 ppm
  - Sprays: 7 to 50 ppm
  - Drench: 25 to 50 ppm
  - Liner Soaks: 15 to 25 ppm

**Tips**

- Allow the solution to dry slowly over 4 hours to enhance uptake.
- Other uses
  - Fall pansies at 15 ppm
  - Easter lilies at 50 ppm or 1 ppm drench
    - Uniconazole is being used by most growers
  - Other bulb crops.

**Abide Drenches on Veronica ‘Icicle’**

- Drenches at 2 fl. oz. per quart pot
- Plant ht: Control 23.7 cm vs. 8 ppm drench 8.9 cm
How Anti-GA PGRs Work
Brian Whipker, NCSU

Chlormequat
• Absorption
  – Leaf
  – Substrate drench (root uptake)
    • Used extensively in Europe (higher % a.i. formula)
    • Effective rates 2,000 to 3,000 ppm
    • Increases the substrate EC.
• Tank mix with Dazide
  – 2,500 ppm Dazide + 1,000 ppm Chlormequat (~3:1)

Chlormequat
• Leaf Yellowing (phytotoxicity)
  – Occurs with > 1,500 ppm
  – Occurs on expanding leaves

Chlormequat
• Citadel (Fine Americas) and Cycocel (OHP)
  – 11.8% Solution
• Introduced in 1962 by BASF.
  – Key crops: geranium, poinsettia, hibiscus, osteospermum
  – Activity lasts 2-3 weeks (crop dependent)
  – Spray rates: 750-1500 ppm
  – Apply early in the crop cycle

DAMINOZIDE

1.0 ppm Topflor drench + 0.5
$14.76
1.0 ppm Sumagic drench + 0.5
$6.69

1500 ppm Cycocel spray 2X
$2.79

Control
$2.79
Daminozide
- B-Nine WSG (OHP)
- Dazide (Fine Americas)
- Short term (2-3 wk) control
  - multiple applications generally required
- Relatively safe, no soil activity
- Uptake by leaves; good coverage required; absorbed slowly; apply under long drying conditions; avoid early overhead irrigation
- Rapid translocation after absorbed
- Effective on a wide range of crops

Rudbeckia
- Sumagic >45 ppm
- B-Nine: good control, 5000 ppm x3

Daminozide/Chlormequat Tank Mix
- Increased activity of both products as tank mix
- Synergistic effect – block different sites in GA pathway
- Easy to apply, little soil activity
- Can have very high activity (5000:1500 ppm)
- Safer than triazoles on sensitive plants
- Effective on many annuals and perennials

<table>
<thead>
<tr>
<th>Activity</th>
<th>Daminozide (ppm)</th>
<th>Chlormequat Cl (ppm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very high</td>
<td>5000</td>
<td>1500</td>
</tr>
<tr>
<td>High</td>
<td>2500</td>
<td>1250</td>
</tr>
<tr>
<td>Medium</td>
<td>1250</td>
<td>1250</td>
</tr>
<tr>
<td>Low</td>
<td>800</td>
<td>1000</td>
</tr>
<tr>
<td>Very low</td>
<td>800</td>
<td>800</td>
</tr>
</tbody>
</table>

Gaillardia x grandiflora ‘Burgundy’
- B-Nine/Cycocel Tank mix: 30-35% reductions at 3 WAT, NS at 5 WAT
- Multiple applications may be required

FLURPRIMIDOL
2d
**Flurprimidol**

- **Topflor (SePRO) 0.38% solution**
- Can be used on a wide assortment of plants
- **Applications**
  - Sprays: 5 to 50 ppm
  - Drenches: 0.25 to 2 ppm
  - Liner Soaks: 1.25 to 10 ppm
- Because of its greater efficacy in root uptake, it is a very cost effective PGR drench.

---

**Tips**

- Has leaf, stem and root activity.
- Allow the solution to dry slowly over 4 hours to enhance uptake.

---

**PGR Relative Activity**

<table>
<thead>
<tr>
<th>Material</th>
<th>Plant Tips</th>
<th>Substrate Tips</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ancymidol</td>
<td>Leaf</td>
<td>Leaf</td>
</tr>
<tr>
<td>Daminozide</td>
<td>Stem</td>
<td>Stem</td>
</tr>
<tr>
<td>Chloromequat</td>
<td>Bulb</td>
<td>Bulb</td>
</tr>
<tr>
<td>Flurprimidol</td>
<td>Less</td>
<td>More</td>
</tr>
<tr>
<td>Paclobutrazol</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Uniconazole</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---

**Flurprimidol PGR Relative Activity**

- **Ancymidol**
- **Daminozide**
- **Chloromequat**
- **Flurprimidol**
- **Paclobutrazol**
- **Uniconazole**

---

**Pot Mum: Duluth**

- **Control**
- 25 (1x) 25 (2x)

---

**Summer Sunset**

- **Control**
- **1500 ppm Cycocel spray 2X**
- **$14.76**

---

**Summary**

- 1.0 ppm Topflor drench + 0.5
- 1.0 ppm Sumagic drench + 0.5

---

**Dusty Miller**

- **1203’s**
- Topflor at 20 ppm is about equal to 35 ppm Bonzi or 10 ppm Sumagic
- 0 T-20 T-30

---

**Pot Mum: Duluth**

- **Control**
- **25 (1x) 25 (2x)**

---

**Summer Sunset**

- **Control**
- **1500 ppm Cycocel spray 2X**
- **$14.76**

---

**Summary**

- 1.0 ppm Topflor drench + 0.5
- 1.0 ppm Sumagic drench + 0.5

---

**PGR University**

How Anti-GA PGRs Work

Brian Whipker, NCSU
PGR University

How Anti-GA PGRs Work
Brian Whipker, NCSU

Flurprimidol – Keys to Use

• A cost effective method of controlling growth as a substrate drench.
• Similar efficacy as the Paclos when it comes to foliar sprays.
• Has limited flower delay even at high rates.

Paclobutrazol

• Piccolo (Fine Americas), Bonzi (Syngenta), Paczol (OHP), and Downsize (drenches only, Greenleaf)
  – 0.4% Solution
• Piccolo 10XC (Fine Americas)
  – 4.0% Solution

Paclobutrazol

• Triazole growth regulator activity discovered during fungicide activity screening program for conazole.
• ICI Plant Protection Division paclobutrazol discovered in 1980.
• Bonzi EPA Registration occurred in 1985
  – Uniroyal Chemical lead in introducing Bonzi to the greenhouse industry.

Paclobutrazol

• Excellent stem and root uptake.
• Key crops: poinsettia, bedding plants, perennials, nursery, etc.
• Late drenches will not disrupt blooms/bracts
• Low use rates:
  – Foliar sprays: 5 to 30 ppm
  – Drenches:
    • 0.1 ppm (Ultra-low drench)
    • 0.5 to 5 ppm (plugs have low use rates)

Piccolo Drenches (mg a.i.)
(Percent of control provided in blue)

<table>
<thead>
<tr>
<th></th>
<th>Untreated</th>
<th>1 mg</th>
<th>2 mg</th>
</tr>
</thead>
<tbody>
<tr>
<td>a Plant</td>
<td>100%</td>
<td>61.1%</td>
<td>56.8%</td>
</tr>
</tbody>
</table>

Plant height significant by concentration (P<0.0001), R^2=0.96
How Anti-GA PGRs Work
Brian Whipker, NCSU

Piccolo Foliar Sprays (mg/L)
(Percent of control provided in blue) (LSDs in red)

<table>
<thead>
<tr>
<th>Treatment</th>
<th>100%</th>
<th>81.6%</th>
<th>72.8%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Untreated</td>
<td>a</td>
<td>b</td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>b</td>
<td></td>
<td></td>
</tr>
<tr>
<td>50</td>
<td>b</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Uniconazoles

- **Sumagic** (Valent USA)
- **Concise** (Fine Americas, Inc.)
- Very high activity (10x paclobutrazols)
- Primary uptake by stems and roots
- Soil ACTIVE (not labeled for chemigation)
- Typically very linear rate response, especially with perennials

Concise on *Rudbeckia* ‘Goldsturm’

<table>
<thead>
<tr>
<th>Rate (ppm)</th>
<th>Control</th>
<th>0.5ppm</th>
<th>1.0ppm</th>
<th>1.5ppm</th>
<th>2.0ppm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spray 4 WAT</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Drench 4 WAT</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Concise Drenches

<table>
<thead>
<tr>
<th>Rate (mg active ingredient per pot)</th>
<th>0</th>
<th>0.24</th>
<th>0.32</th>
<th>0.40</th>
</tr>
</thead>
<tbody>
<tr>
<td>mg active ingredient per pot</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

SUMMARY
How Anti-GA PGRs Work
Brian Whipker, NCSU

Expanding PGR Toolbox

<table>
<thead>
<tr>
<th>Type</th>
<th>Chemical</th>
<th>Products</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anti-GA</td>
<td>Ansymidol</td>
<td>Abida, A-Rest</td>
</tr>
<tr>
<td></td>
<td>Chloromequat chloride</td>
<td>Citadel, Cycoel</td>
</tr>
<tr>
<td></td>
<td>Daminizide</td>
<td>B-Nine, Dazide</td>
</tr>
<tr>
<td></td>
<td>Flurprimidol</td>
<td>Top flooring</td>
</tr>
<tr>
<td></td>
<td>Paclobutrazol</td>
<td>Bonzi, Pacol, Piccolo, Piccolo 10X, Downsize (drenches only)</td>
</tr>
<tr>
<td></td>
<td>Uniconazole</td>
<td>Concise, Sumagic</td>
</tr>
<tr>
<td>Structural</td>
<td>BA</td>
<td>Configure</td>
</tr>
<tr>
<td></td>
<td>GA</td>
<td>Florgib, ProGibb T&amp;O</td>
</tr>
<tr>
<td></td>
<td>BA+GA</td>
<td>Fascination, Fresco</td>
</tr>
<tr>
<td></td>
<td>Diketulic sodium</td>
<td>Augeo</td>
</tr>
<tr>
<td></td>
<td>Ethephon</td>
<td>Collate, Floral</td>
</tr>
</tbody>
</table>

Coming Up Next:
12:00 to 12:30 Eastern

Branching Agents
Joyce Latimer

<table>
<thead>
<tr>
<th>Time</th>
<th>Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>12:00 to 12:30</td>
<td>Lunch Break</td>
</tr>
<tr>
<td>1:00 to 1:25</td>
<td>Application Methods: Spray and Drencher Solutions</td>
</tr>
</tbody>
</table>