Excessive Plant Height

- Common problem
- Undesirable tall plants
- Damage during shipping
- Increased shipping costs
- Decreased sales
Early Spring Production

- Low light levels
- Warm temperatures
- High humidity
- High plant densities on bench
- This promotes stem elongation
- Plant growth regulators are often used
Plant Height Control

How do you control plant height?

- Physical
  - Pinching
  - Shaking/brushing

- Biological
  - Cultivar selection
  - DIF
  - Fertilization
  - Light
  - Water Stress

- Chemical
  - Plant Growth Regulators
Temperature can be used to control height.

DIF

DIFference between day temperatures (DT) and night temperatures (NT)

(DT - NT) = DIF
Plant Growth Regulators

- Control Plant Height
  - Maintain high quality plants
  - Plant proportional to the pot size
  - Shipping
  - Customer specifications
  - Hold finished plants

- Control Flowering
  - Timing
  - Prevention
  - Abortion
Plant Growth Regulators (PGRs)

- Valuable tool in your grower’s tool box
- Can make you lots of money
- Can make you loose money if you’re lazy
Regulation of Growth

Lack of the growth hormone auxin causes abnormal growth
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Cell Division Inhibitors
Cell Division Inhibitors

- Cell Division Inhibitors
- Florel
- Configure
Cell Division Inhibitors

- Stops terminal growth
- Promotes lateral shoots
Cell Division Inhibitor - Ethylene Generator

- Florel - Ethephon
  - Keep plants vegetative
    - Stock plants
  - Flower delay 6-8 weeks
  - Timing of flowering
  - Enhance branching
    - Ivy Geraniums
    - Florel "Sandwich"
      - 3-4 days before pinch
      - 1 week after pinch
    - Use caution with low vigor cultivars and cold finish
Florel – Ethephon

- Foliar Spray
  - Promotes lateral branching, reduces elongation, aborts flowers, improves stock plant branching & cutting yield
  - Use early in crop cycle to increase branching & remove early flowers (6-8 weeks before flowering).
  - Induces flowering of bromeliads
  - Reduces height & stem topple of potted daffodils & hyacinths
  - pH of spray solution = 5.0
  - No drench activity
  - Use within 4 hours of mixing
Cell Division Inhibitors

- Florel (cont’d)
  - Apply as a foliar spray
  - Need to pH balance
    - Lower your water pH to 4.0 to 5.0
    - Activity decreases at higher pH
  - Add a wetting agent
    - Capsil 1 oz/gallon
  - 48 hour REI
Cell Division Inhibitors

Configure

- Application time is critical
- Produces more vegetative breaks
  - When applied during vegetative growth
- Produces more flower buds
  - When applied during floral initiation

Echinacea

0 ppm

900 ppm
Cell Division Inhibitors

- Configure (2% 6-BA)
  - Christmas cactus
  - Hostas
  - Echinaceae
  - Tropicals
  - Annual & perennial flowering & foliage plants
  - 0.3 to 18 fl oz per gallon
  - 12 hour REI
Cell Elongation Inhibitors

- Same number of cells
- Smaller cells
- Effects Gibberellic Acid Pathway
Cell Elongation Inhibitors

- Chloromequat (Citadel, Cycocel)  Group 1
- Ancymidol (Abide, A-Rest)  Group 2
- Flurpimidol (Topflor)  Group 2
- Paclobutrazol (Bonzi, Piccolo)  Group 2
- Uniconazole (Sumagic, Concise)  Group 2
- Daminozide (B-nine, Dazide)  Group 3
Gibberellic Pathway

Group 1: GA precursors → GA1 → Ent-kaurene

Group 2: GA12 → GA9

Group 3: GA20ox → GA3ox → GA4

Bioactive GAs
Group 3 PGRs

- Triazoles may cause darker green foliage
Plant Growth Regulator Activity

- Abide
- A-Rest
- B-Nine
- Citadel
- Cycocel
- Dazide

B-Nine (Dazide) + Cycocel (Citadel) Tank Mix

Bonzi Piccolo

Concise Sumagic

Less

More

Topflor
Group 1 – Chlormequat Chloride

- Citadel & Cycocel
- Short-term inhibition (1-3 weeks)
- Compact, darker green, thicker leaves, stronger stems
- Poinsettias, geraniums, bedding plants, hibiscus, azaleas, woodies, mums etc.
- Spray or drench
- Apply when plants are elongating
- 0.22 to 4.34 fl. oz. per gallon
- 12 hour REI
Group 2 - Ancymidol

- Abide & A-Rest
- Absorbed by roots, leaves, stems
- Mums, poinsettias, woodies, bedding plants
- Spray or drench
- Chemigation
- 3 to 50 ppm
- 12 hour REI
Group 2 - Uniconazole

- **Concise & Sumagic**
- **Bedding plants, bulbs, geraniums, Easter lilies, poinsettia, mums, azaleas, woodies, hibiscus, ixora**
- **Spray, drench, dip or media spray**
- **Longer lasting results, dark green, thicker leaves, stronger stems, stress tolerant, increase flower number & size**
- **0.26 to 19.2 fl. oz. per gallon**
- **12 hour REI**
Group 2 - Paclobutrazol

- Piccolo & Bonzi
- Xylem PGR
- Spray, drench, bulb soak, liner dip
- Azaleas, bedding plants, plugs, mums, geraniums, annuals/perennials, poinsettia, herbaceous, woodies etc.
- Compact & darker
- Chemigation
- 0.032 to 6.4 fl. oz. per gallon
- 12 hour REI
Group 2 - Flurprimidol

- **Topflor**
- Reduces internode elongation
- Increases color, thicker leaves, decreases water loss

- Sprays, drenches, chemigation
- Absorbed through foliage, stems and roots
- Poinsettia, bedding plants, plugs, bulbs, foliage, perennials, woodies
- 0.02 - 6.46 fl. oz. per gallon
- 12 hour REI

Foliar sprays of Topflor controlled growth of New Guinea impatiens. The rate response curve is above and the left photograph compares the untreated control, Topflor at 5 ppm and Topflor at 80 ppm. Southeastern U.S. growers should begin with 2.5 to 5 ppm sprays. Rates may vary by location and cultivar.
Group 3 – Daminozide

- Dazide & B-Nine
- Shorter-term inhibition
- Azaleas, bedding plants, plugs, mums, foliage, hydrangeas, poinsettias
- Compact, stronger plants with additional buds
- Tank mix synergy
- 4/5 to 6 TBS per gallon
- 24 hour REI
Plant Growth Regulators

Applied as:
- Foliar sprays
- Substrate drenches
- Pre-plant bulb soaks
- Liner dips
Foliar Spray

- Ancymidol
  - (Abide, A-Rest)
- Daminozide
  - (B-Nine, Dazide)
- Chlormequat
  - (Cycocel, Citadel)
- Flurprimidol
  - (TopFlor)
- Paclobutrazol
  - (Bonzi, Paczol, Piccolo)
- Uniconazole
  - (Concise, Sumagic)

Wear proper PPE
Check label
Key to Foliar Sprays

- ½ gallon per 100 ft²
- Even coverage
- Pay attention to the weather
  - Spray in the evening
  - Spray on a cloudy day
- Longer drying times = better results
Keys to Foliar Sprays

Know your PGR

- Mobile in plant
  - Ancymidol
  - Chloromequat
  - Daminozide

- Not mobile (must contact the stems)
  - Flurprimidol
  - Paclobutrazol
  - Uniconazole
Keys to Foliar sprays

- Apply
  - To well watered plants
  - On cloudy days or in evening
  - Allow as much drying time as possible
Use the Correct Sprayer
Keys to Substrate Drench

- Pot size and drench volume
  - 2 oz per 4” pot
  - 4 oz per 6” pot
- Consistency
  - Careful dosing
  - ChemDoser Dramm
Keys to Substrate Drenches

- **Moisture level**
  - Moderate moisture
  - Don’t water right away

- **Timing**
Application Liner Dip

- Great for combo planters
  - Allows for individual control
  - Treat vigorous species
- Ancymidol – Abide, A-Rest
- Chlormquat – Cycocel, Citadel
- Flurprimidol – Topflor
- Paclobutrazol – Bonzi, Piccolo
- Uniconazole – Concise, Sumagic
- Moderately dry – 10 seconds to 2 minutes
Bulb Soaks

- Ancymidol (Abide, A-Rest)
- Chlormequat (Cycocel, Citadel)
- Flurprimidol (Topflor)
- Paclobutrazol (Bonzi, Piccolo)
- Uniconazole (Concise, Sumagic)
- 2 to 40 minutes
- Up to 7 days before planting
- Solution @ 46F
- Dispose by drenching another crop
http://www.ces.ncsu.edu/depts/hort/floriculture/software/PGRCALC.htm
Other PGRs

- Indole-3-butyric acid (IBA) – Rooting hormone
- Naphthalene-acetic acid (NAA) – Rooting hormone
- Gibberellic acid – Increases cell division & elongation
Canned Labs & Lessons

- Carolina Biological Plant Tissue Culture kit
- $686
- 30 Tubes Auxin (2-4-D) Medium
- 30 Tubes Cytokinin Medium
- 30 Tubes Auxin (IAA) Medium
- 30 Tubes High Auxin/Low Cytokinin Medium
- 30 Tubes High Cytokinin/Low Auxin Medium
- Tools & supplies
Possible Lab Demonstrations

- Florel (pt. $14.40) – ethylene generator, cell division inhibitor
- FlorGib (gal $84.50) – increases cell division & elongation
- Contrast the two products affects on growth as compared to a control plant
Thank you. Questions?

Julius von Sachs
German Botanist
October 2, 1832 - May 29, 1897

• First suggested chemical substances create organs, control growth