

PGR University

Goals & Other Benefits of PGRs

Brian Whipker, NCSU

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e-GRO Electronic Grower Resources Online

fine

11:00 to 11:25 Eastern

GOALS AND OTHER BENEFITS OF PGRs



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NC STATE UNIVERSITY


BMPs for PGRs




PGRs

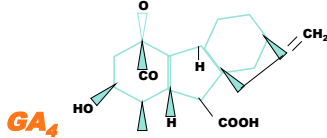
- A tool to make growing easier

Useful to understand how they work to control excessive plant stretch



Gibberellin (GA) Metabolic Pathway

- Chemical chain of events, which leads to the production of Gibberellins.
- The hormone Gibberellin stimulates cell elongation in plants.
 - Thus controlling GA, controls excessive stretching



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PGR Classifications

- Type II - Cell Elongation Inhibitors
 - Retard growth by inhibiting the production of the hormone Gibberellin
 - Therefore plants are shorter

Cell Elongation Inhibitors

- Influence cell expansion

Applying GA increases cell elongation.

Balloon Flower with stalled growth (left).

GA No GA

Cellular Action (Type II)

- Expansion (size) varies
- *Not cell number!*

PGR Results: Smaller Plants

Smaller Sized Leaves

PGRs Which Control the GA Pathway

Chemical	Trade Names
Ancymidol	Abide, A-Rest
Chlormequat chloride	Citadel, Chlormequat E-Pro, Cycocel
Daminozide	B-Nine, Dazide
Fluprimidol	Topflor
Pacllobutrazol	Bonzi, Paczol, Piccolo, Piccolo 10XC, Downsize (<i>drenches only</i>)
Uniconazole	Concise, Sumagic

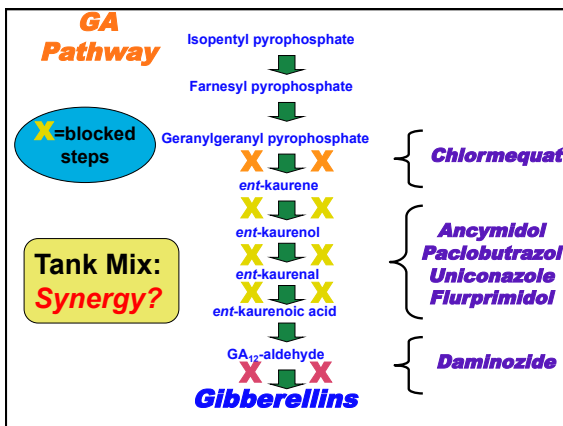
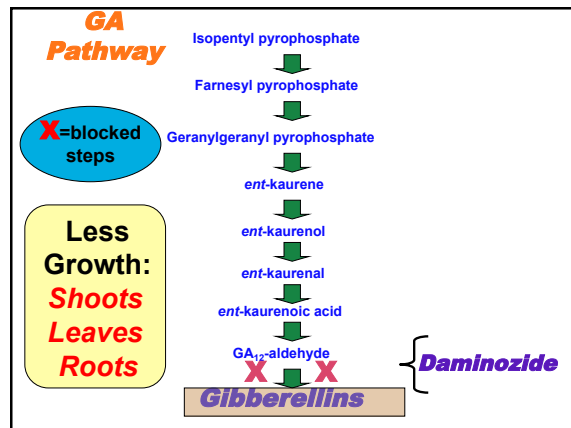
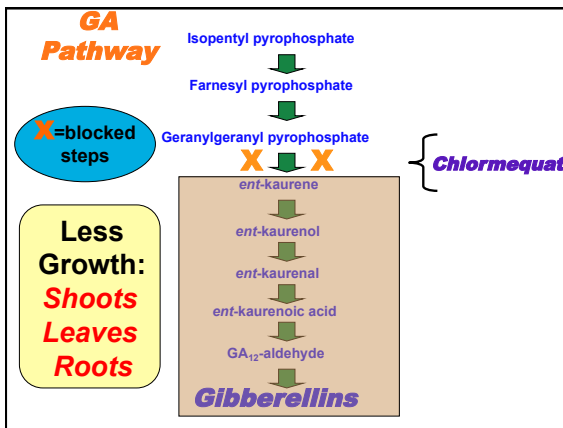
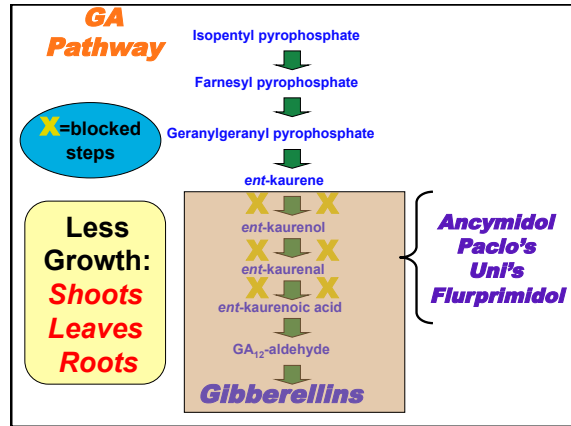
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Type II PGRs

- Type II - Cell Elongation Inhibitors
 - Group A
 - Chloromequat (Cycocel/Citadel)
 - Group B (N - containing heterocyclic compounds)
 - Ancymidol (Abide/A-Rest) [pyrimidine]
 - Flurprimidol (Topflor/Cutless) [pyrimidine]
 - Paclobutrazol (Bonzi/Piccolo/Paczol) [triazole]
 - Uniconazole (Sumagic/Concise) [triazole]
 - Group C
 - Daminozide (B-Nine/Dazide)



Summary: GA Pathway

- GA is a plant hormone which influences cell elongation.
- The Anti-GA PGRs block the pathway and thus limit the amount of cell elongation.
 - Blockage point varies
 - Synergy possible with multiple blockage sites

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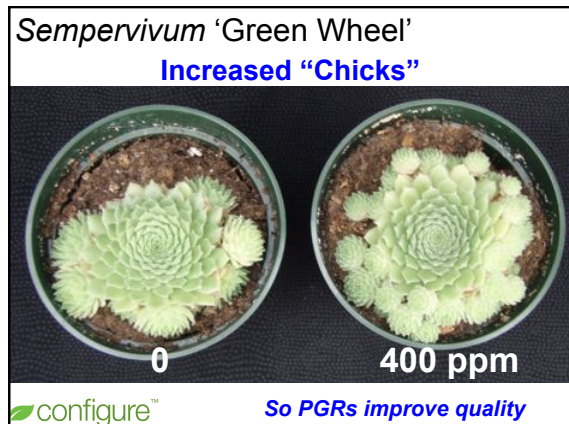
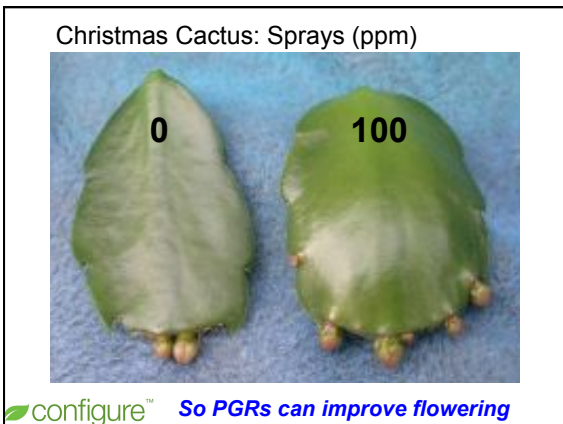
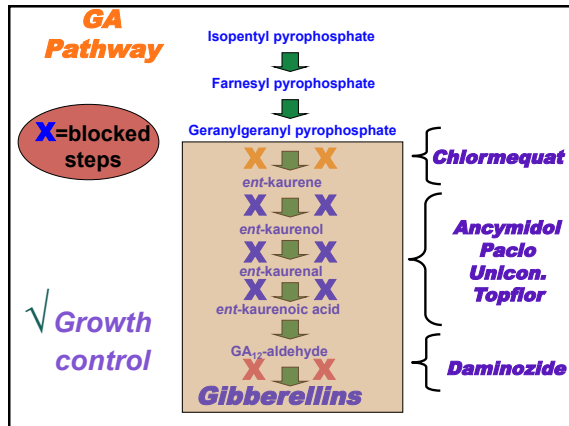
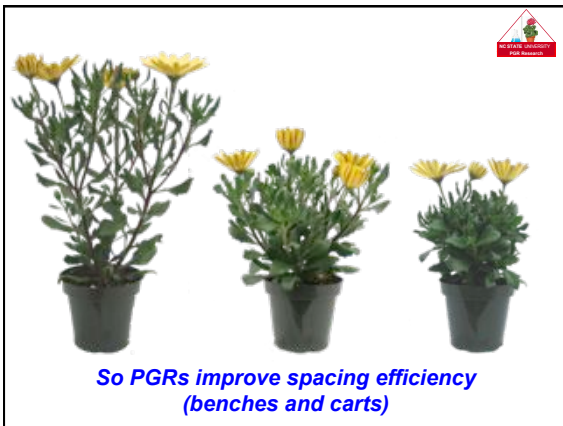
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How PGRs Work



PGR BMPs


- PGRs offer a wide array of plant growth management tools.
 - Growth management
 - Shorter / Smaller Diameter
 - Taller
 - Flowering
 - Improved plant architecture/form




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 **PGR BMPs**

- Added benefits
 - Greener color
 - Disease fighting boost
 - Improved water efficacy?
 - Improved post harvest life?
 - Improved nutrient utilization?



So PGRs improve leaf color and marketability



So PGRs improve disease suppression


GA Pathway

Isopentyl pyrophosphate
 Farnesyl pyrophosphate
 Geranylgeranyl pyrophosphate
 ent-kaurene
 ent-kaurenol
 ent-kaurenal
 ent-kaurenoic acid
 GA₁₂-aldehyde
Gibberellins

Squalene
 Canosterol
 Campesterol
 Chitoesterol (in fungi)

Phytyl
 Chlorophyll

✓ Healthier
 ✓ Greener
 ✓ Growth control

 **PGR BMPs**

- Added benefits
 - Greener color
 - Disease fighting boost
 - Improved water efficacy?
 - Improved post harvest life?
 - Improved nutrient utilization?

Series of studies conducted at NC State University by Iftikhar Ahmad, Brian Whipker, and John Dole

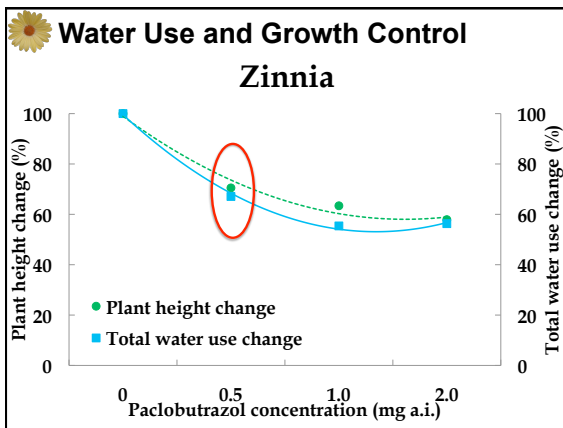
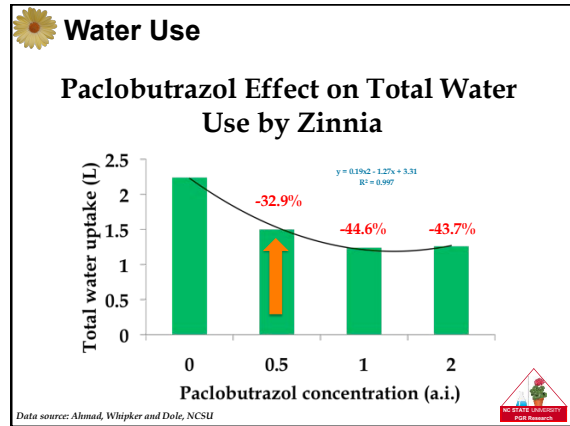
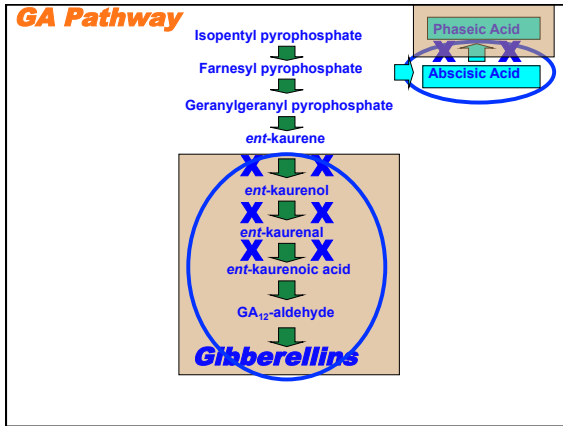
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Do PGRs Improve Water Use Efficiency?

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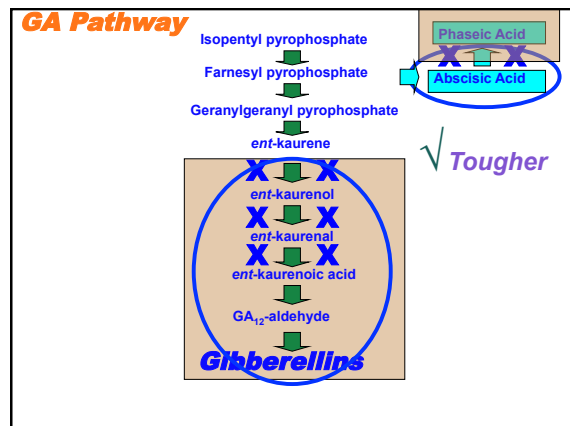
Water Use

- PGR applications at concentrations suitable for greenhouse production, decreased water use by 33%.
- As a general rule, the percentage control of plant growth equals the percentage decrease of water use.

So PGRs improve water use efficiency

Water Use: Landscape Plantings

- With less water use, plants have an extended time until wilt, which helps improve establishment in the landscape.



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Do PGRs Improve Shipping Shelf Life?

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Post-Harvest

Effect of Piccolo 10XC on 'Magellan Pink' zinnia growth and post-harvest quality after simulated shipping.

Piccolo Conc. (mg a.i.)	Plant Height (cm)	Plant Diameter (cm)
0	32.6 a	29.7 a
0.5	20.8 b	22.7 b
1.0	18.1 c	21.1 c
2.0	16.3 d	18.7 d
	<0.0001	<0.0001

Data source: Ahmad, Whipker and Dole, NCSU

Post-Harvest

Effect of Piccolo 10XC on 'Magellan Pink' zinnia growth and post-harvest quality after simulated shipping.

Piccolo Conc. (mg a.i.)	Plant Height (cm)	Plant Diameter (cm)	Storage Height Change (cm)	Leaf Color	Days Until First Wilt	Days Until Second Wilt
0	32.6 a	29.7 a	5.8	4.0 c	3.8 d	2.3 d
0.5	20.8 b	22.7 b	2.6	4.6 b	6.4 c	3.4 c
1.0	18.1 c	21.1 c	2.2	5.0 a	7.7 b	4.3 b
2.0	16.3 d	18.7 d	2.1	5.0 a	8.4 a	5.3 a
	<0.0001	<0.0001		<0.0001	<0.0001	<0.0001

Data source: Ahmad, Whipker and Dole, NCSU

Post-Harvest: Ethylene

Ethylene

No Ethylene

0 1 2 4

Piccolo 10XC (mg a.i.)

Data source: Ahmad, Whipker and Dole, NCSU

Post-Harvest: Ethylene

- PGR applications did not offset the negative effects of exogenous ethylene exposure.
- During simulated shipping, PGRs aid plants in:
 - retaining dark green leaf color, and
 - flower retention

So PGRs improve shipping quality

Do PGRs Improve Nutrient Use Efficiency?

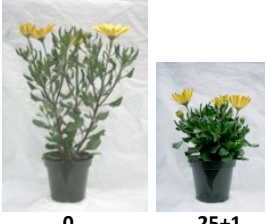
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Nutrient Use Efficiency

- Osteospermum experiment with Bonzi drenches (25 ppm early + 1 ppm late).
 - Only 3 plants of each treatment analyzed for nutrient levels.



0 25+1
Bonzi (ppm)

Nutrient Use Efficiency

Effect of PGR drenches on plant shoot nutrient concentration.

Element	Conc. Untreated Control	Conc. Bonzi Drench
N %	4.59	7.74
P %	0.34	0.52
K %	2.29	3.22
Dry Wt (g)	13.0	6.2

Bonzi drench of 25 ppm early and 1 ppm added after the chilling period.

Nutrient Use Efficiency

Effect of PGR drenches on plant shoot nutrient concentration.

Element	Conc. Untreated Control	Conc. Bonzi Drench	Percent Change
N %	4.59	7.74	162
P %	0.34	0.52	152
K %	2.29	3.22	140
Dry Wt (g)	13.0	6.2	48


Other macro- and micro-elements responded in a similar fashion.

Nutrient Utilization

- PGR applications resulted in a higher concentration of nutrients in the plant.
 - Thus can fertilization level be dropped by 23-33% to obtain the similar growth results?

So appears PGRs improve nutrient use efficiency

Questions





piccolo®
10 XC

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Coming Up Next:
11:30 to 11:55 Eastern

How Anti-GA PGRs Work

Brian Whipker
NC STATE UNIVERSITY

Time	Topic
12:00 to 12:30	Branching Agents
12:30 to 12:55	Lunch Break