Cotton Maturity and Plant Growth Regulators

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Popular PGR Questions

• Why did I have low micronaire last year?
• Will I have high micronaire in 2018?
• If I irrigate properly, do I even need PGRs?
• It’s August 20, and my cotton is tall and still growing. Can I rein it in with PGRs?
What is Cotton Maturity?

• Vegetative/reproductive maturity
  • Combination of variety, management, environment
  • Based on node production, fruit production, fruit retention

• Fiber maturity
  • How far has an individual fiber progressed through the processes of elongation, secondary cell wall development, and maturation?
  • Combination of fruit production, environment within which the boll develops
  • Based on conditions experienced by individual bolls during developmental stages
Does water deficit increase or decrease fiber maturity?
Phases of Boll Development

• Fiber initiation: -1 to 2 days after anthesis
• Fiber elongation/expansion: 3 days to 3 weeks after anthesis
• Secondary cell wall synthesis and fiber maturation: begins 15-20 days after anthesis, continues to open boll (45+ days)
Why did I have low micronaire last year? Will I have high micronaire in 2018?
New Deal
Average 2009-2016
We typically get between 2000 and 2500 GDD60s in a growing season.*
Flowering

- Every node: behind 2-3 days
- Every position: behind 5-6 days
- Node 6 position 1 to Node 17 position 1: 25-30 days
- Node 6 position 1 to Node 15 position 2: 25-30 days
Indeterminate Growth

- Cotton has several fruit at differing stages at any given moment.

[Diagram showing stages of plant growth from Cotyledons (0) to Flowering/Initiation, with labels for vegetative branch, secondary wall synthesis, maturation, elongation, and fruiting position.]
Texas Cotton: High boll retention, relatively compact fruiting habit
“Typical Year”

- On May planted cotton, upper nodes are at risk of immaturity.
- On June planted cotton, most of the nodes are at risk of immaturity.
Why Cotton Grows Tall: Gibberellins

- Gibberellins have a number of effects on plant development. They can:
  1. Stimulate rapid stem and root growth
  2. Induce mitotic division in leaves
PGRs in Cotton

- **Purpose:** decrease crop growth
- **Gibberellin inhibitors**
  - Decreased internode length
  - Decreased leaf area
  - Decreased node number
  - Increased fruit retention on lower nodes
  - Earlier maturity
Plant Growth Regulators

- When water and nitrogen are plentiful, cotton height increases dramatically over time.

Source: Irish Pabuayon
Plant size increases exponentially with height.

Source: Irish Pabuayon
Dry Mass (g/m²)

Days After Planting

First Square
First Flower
Peak Bloom

Source: Irish Pabuayon
Spray Rate

• If you spray at flowering, the plants are 2-3x as big. At peak bloom, the plants are 3-4x as big.

• If dosage is based on biomass, 18 oz during flowering is equivalent to 6 oz at squaring

• 24 oz at peak bloom is equivalent to 6 oz at squaring
If I irrigate properly, do I even need PGRs?

• Dr. Wayne Keeling, September 11, 2018: “I think that plant growth regulators are a mask for poor irrigation management.”
In-Season Plant Growth Regulators vs Irrigation

• PGR mode of action:
  1. Inhibits gibberellin synthesis
  2. Shorter internodes, smaller leaves
  3. More energy to fruit
  4. Shorter plants, boll set lower on the plant

• Water deficit:
  1. Shorter internodes, smaller leaves
  2. More energy to fruit
  3. Shorter plants, more compact boll set
Irrigation as PGR

• Emergence to 1st square: 1.5 inches in 5 weeks (soil storage)

• 1st square to first flower: 2.5 inches in 3 weeks (0.8 inches per week)

• Irrigation at flowering can be up to 2 inches per week

Table 1. UGA Checkbook Cotton Irrigation for Full Season

<table>
<thead>
<tr>
<th>Growth Stage</th>
<th>Days after Planting</th>
<th>Weeks after Planting</th>
<th>Inches per Week</th>
<th>Inches per Day</th>
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<td>Emergence to First Square</td>
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<td>First Square to First Flower</td>
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</table>
Late Season PGR

- Large biomass – would require heavy application
- Would only affect actively growing tissue (uppermost 3-4 nodes)
- Bolls: major carbohydrate sink (natural growth regulator), gibberellin inhibitors probably not great for fiber elongation
When Do I Use PGRs?

- Wet weather early (especially prior to 1st flower)
- Long internodes (normal: 2 fingers between adjacent nodes)
- Wet weather in forecast
- Delayed fruiting
- Vigorous cultivar
Popular PGR Questions

• Why did I have low micronaire last year?
  • Cool, wet weather \(\rightarrow\) fewer heat units and more rank growth \(\rightarrow\) poor fiber maturity

• Will I have high micronaire in 2018?
  • Yes

• If I irrigate properly, do I even need PGRs?
  • Heat units/cultivar/rainfall

• It’s August 20, and my cotton is tall and still growing. Can I rein it in with PGRs?
  • Good luck!
Questions?