Irrigation Management for Cotton

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Cotton Extension Associate Professor

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<table>
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<tr>
<th>Variety</th>
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<td>756</td>
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<td>940</td>
<td>1059</td>
<td>1960</td>
<td>833</td>
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</table>
Irrigation Considerations

- Know efficiency of irrigation system (60-95%) and soil water holding capacity (0.6-1.8 inches per foot)
  - High pressure Impact sprinklers (75-85%), Low pressure Spray sprinklers with drop hoses (90-95%) (Vellidis 2014), travelling gun = 50%...maybe 60% (Bednarz)

- Keep close track of growth stages
  - 1st square
  - 1st bloom
  - 1st open boll (length of bloom period may vary)

- Utilization of sensors in concert with weekly checkbook
  - Adjust for soil type and retention of moisture (20-60 kPa) (Vellidis, 2014)
  - Account for rainfall....when to resume irrigation
  - Quantify when stress may be encountered
    - ET, Heat, boll demands, etc
    - Wilting indicates you are WAY too late
Irrigation Considerations

• Split apply weekly rates into 2-3 applications
  – System capacity and time required for application
  – Adjust for rainfall (any meaningful rainfall > 0.2-0.3 inches)
  – Soil uptake, runoff, slope, depth to subsoil
  – Prevent complete depletion of soil moisture
  – Short-lived drought can have significant negative effects on yield
Maximizing root development prebloom relieves stress during bloom – early stress may position the crop for better productivity if stress occurs during the bloom period.
Seedling diseases and nematodes

Seedling diseases affect root development – wilt sooner

Nematodes affect root development and water uptake
In addition to root growth, tillage affects water holding capacity, longevity of rain events (retention), and water availability.
Symptoms of water stress

Wilting – during bloom, also maybe serious if occurs during prebloom

Non-insect-induced square shed - prebloom

Large terminal squares – prebloom
Symptoms of water stress

If you know that you applied adequate nutrients and no leaching has occurred.....
What about......?

• Cloudy weather = severe square shed
• Plant bugs
• Bollworm
• Top Crop (for whatever reason)
Nodes Above White Bloom

Optimal plant growth:

- 8-11 nodes @ 1st bloom
- 7-9 nodes @ peak bloom
- < 5 nodes @ cutout

Affected by:

- Water availability (drought)
- N availability (deficiency)
- PGR applications
### Nodes Above White Bloom

<table>
<thead>
<tr>
<th>Sled weight</th>
<th>Start</th>
<th>Middle</th>
<th>End</th>
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</thead>
<tbody>
<tr>
<td>Light</td>
<td>Fast</td>
<td>Slower</td>
<td>Stopped</td>
</tr>
<tr>
<td>Moderate</td>
<td>Slow</td>
<td></td>
<td></td>
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<tr>
<td>Heavy</td>
<td></td>
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</table>

**Start**

- Light
- Fast

**Middle**

- Moderate
- Slower

**End**

- Heavy
- Stopped
Nodes Above White Bloom

Prebloom drought:

- fewer nodes at first bloom
- boll load quickly restrains terminal growth
- premature cutout if stress is not immediately relieved very soon after first bloom
- poor boll load (↓ yield, ↑ regrowth potential)
  (short staple, high mike)
- square shed if drought is severe
  (squares = lower water demands)
- if stress is mild and relieved by first bloom = better root development, less aggressive plants / vegetative water demands, better growth control, less late-season drought problems
- variety = full season varieties….less distinct cutout, recover from dry periods and form a top crop better than early varieties which fruit up quickly
## Water demands and growth stage

<table>
<thead>
<tr>
<th>Stage</th>
<th>Lint yield/m²</th>
<th>Bolls/m²</th>
<th>Bolls/plant</th>
<th>Lint / boll</th>
<th>Lint / plant</th>
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</thead>
<tbody>
<tr>
<td>Total water</td>
<td>0.34</td>
<td>0.35</td>
<td>0.37</td>
<td>0.12</td>
<td>0.36</td>
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<tr>
<td>Planting to square initiation</td>
<td>-0.32</td>
<td>-0.18</td>
<td>-0.08</td>
<td>-0.24</td>
<td>-0.22</td>
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<tr>
<td>Square initiation to 1st flower</td>
<td>0.73</td>
<td>0.58</td>
<td>0.54</td>
<td>0.65</td>
<td>0.68</td>
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<tr>
<td>1st flower to peak bloom</td>
<td>0.32</td>
<td>0.55</td>
<td>0.23</td>
<td>0.04</td>
<td>0.13</td>
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<tr>
<td>Peak bloom to maturity</td>
<td>-0.43</td>
<td>-0.45</td>
<td>-0.23</td>
<td>-0.56</td>
<td>-0.27</td>
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</tbody>
</table>

(Physiology Today, 1999 vol 11, no. 2)
Effects of prebloom drought

Dry prior to first bloom and soon after

Adequate prebloom soil moisture
Effects of prebloom drought

Dry prior to first bloom and soon after

Adequate prebloom soil moisture
Effects of prebloom drought

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Dry prior to first bloom and soon after Adequate prebloom soil moisture
Effects of prebloom drought

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Effects of prebloom drought

Dry prior to first bloom and soon after

Adequate prebloom soil moisture
Effects of prebloom drought

- Dry prior to first bloom and soon after
- Adequate prebloom soil moisture
Effects of prebloom drought

Dry prior to first bloom and soon after

Adequate prebloom soil moisture
Effects of prebloom drought

Dry prior to first bloom and soon after

Adequate prebloom soil moisture
Effects of prebloom drought

Dry prior to first bloom and soon after

Adequate prebloom soil moisture
Suspended cutout

Dry prior to first bloom but wet soon after
Suspended cutout

Dry prior to first bloom but wet soon after
Suspended cutout

Dry prior to first bloom but wet soon after
Suspended cutout

Dry prior to first bloom but wet soon after
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Suspended cutout

Dry prior to first bloom but wet soon after
Suspended cutout

Dry prior to first bloom but wet soon after
Suspended cutout

Dry prior to first bloom but wet soon after
100 % UGA Checkbook (in/week) – No Irrigation During Squaring
100% UGA Checkbook (in/week) – 2” Per Week During Squaring
Irrigation During Squaring

FM 1944 GLB2

No Irr during squaring
1” per week
2” per week

PHY 499 WRF
2012 Plant Height (in) – PHY 499

LSD \((p \leq 0.05)\) = 3.6

- **First Bloom**: A, B, C, BC
- **FB+2wk**: A, B, BC
- **FB+4wk**: A, B, BC
- **FB+6wk**: A, BC, C

- **2" per week During Squaring fb 100% CHBK**
- **1" per week during squaring (100% CHBK)**
- **No Irr During Squaring fb 100% CHBK**
- **Dryland**
LSD \((p \leq 0.05) = 0.54\)
2012 Lint Yield (lbs/A)

LSD \((p \leq 0.05) = 285\)

PHY 499 WRF

FM 1944 GLB2

LSD \((p \leq 0.05) = 331\)

- **A** indicates a higher yield compared to LSD.
- **B** indicates a lower yield compared to LSD.

- **2" per week During Squaring fb 100% CHBK**
- **1" per week during squaring (100% CHBK)**
- **No Irr During Squaring fb 100% CHBK**
- **Dryland**
Total Water Applied 2012 (in/week)

- 100% CHBK (1 in/week prebloom)
- No Irr During Squaring
- Dryland
Boll demands for water

Peak demands = peak bloom
Demands begins to decrease once bolls reach full size
When to cease irrigation???
SSDI vs OVHD Beyond 1\textsuperscript{st} Open Boll

- FM 1944 GLB2 & PHY 499 WRF
- Irrigated using 100% UGA Checkbook via SSDI throughout season
- Irrigation Treatments from 1\textsuperscript{st} Open Boll until defoliation (regardless of rainfall)
  - None
  - 1” per week applied via SSDI in 0.5” increments
  - 1” per week applied via OVHD in 0.5” increments
Rainfall and Irrigation (in/week) Each Week Beyond 1\textsuperscript{st} Week
Open Boll in Both SSDI and OVHD

- Week 1: Rainfall: 1.8, Irrigation: 1.0, Total Water Applied: 2.8
- Week 2: Rainfall: 1.4, Irrigation: 1.2, Total Water Applied: 2.6
- Week 3: Rainfall: 1.2, Irrigation: 1.4, Total Water Applied: 2.6
- Week 4: Rainfall: 1.0, Irrigation: 1.6, Total Water Applied: 2.6
- Week 5: Rainfall: 1.2, Irrigation: 1.4, Total Water Applied: 2.6

Legend:
- Light blue: Rainfall
- Red: Irrigation
- Green: Total Water Applied
Lint Yield (lbs/A)

LSD ($p \leq 0.05$) = 104
LSD ($p \leq 0.05$) = 280
Uniformity

LSD ($p < 0.05$) = 0.98

LSD ($p < 0.05$) = 0.958

PHY 499
LSD ($p \leq 0.05$) = 0.958

FM 1944
LSD ($p \leq 0.05$) = 0.98
Effects of excessive water during late season

Boll rot, lint mold / discoloration, regrowth, but soil water should be near field capacity to fill out bolls
Resources for You

Cotton Portal Website: http://cotton.ces.ncsu.edu/

NC Variety Calculator: https://trials.ces.ncsu.edu/cotton/

Facebook:
North Carolina Cotton
facebook.com/groups/344058599029946

Twitter:
List: NCSU Cotton
Keith Edmisten: @NCcotton
Guy Collins: @Cotton_Guy
Dominic Reisig: @DominicDReisig