Potential Evapotranspiration: A Practical Approach to Irrigating Cotton

Bob Glodt
Agri-Search, Inc.
Plainview, Texas
Will PET Irrigation Management Be Beneficial If…

1. I have unlimited irrigation resources?  
   YES!

2. I do not or cannot irrigate and rely solely on rainfall to meet crop demand?  
   YES!

3. I have only limited ability to apply supplemental irrigation?  
   YES!
Undeniable Truth

There Is No Good Reason Not to Manage Irrigation Resources and/ or Track Water Demand
Question # 1

How much water does it take to make one bale per acre?

A. Planting date?
B. Rainfall and irrigation data in relationship to the crop developmental stage?
C. Weather data?
D. Soil water holding capacity?
Question # 2

Does it take twice as much water to make two bales per acre as it does to make one bale per acre?
# Yield Versus Water

Irrigating At A Given % of PET

<table>
<thead>
<tr>
<th>% PET</th>
<th>Inches Total Water</th>
<th>Expected Yield</th>
<th>Pounds of Lint/Inch</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rainfed</td>
<td>Unknown</td>
<td>Unknown</td>
<td>Extremely variable</td>
</tr>
<tr>
<td>30%</td>
<td>9 -12</td>
<td>700 - 900</td>
<td>60 - 90</td>
</tr>
<tr>
<td>60%</td>
<td>12-18</td>
<td>1200 - 1500</td>
<td>90 - 120</td>
</tr>
<tr>
<td>90%</td>
<td>22-28</td>
<td>1200 - 2000</td>
<td>60 - 90</td>
</tr>
</tbody>
</table>
HYPOTHETICAL WATER USE CURVE FOR COTTON (INCHES PER DAY)

Days After Planting

- emergence
- first square
- first bloom
- first open boll
- maturity

Inches Per Day

- 0.35
- 0.3
- 0.25
- 0.2
- 0.15
- 0.1
- 0.05
- 0

0 20 40 60 80 100 120 140
Will yields increase if you supply water above 100% of potential evapotranspiration?
Irrigation Management Aids

CAPACITANCE PROBES

IRT TECHNOLOGY
Undeniable Truth

There is nothing that comes in a cardboard box that will help you understand cotton irrigation better than learning to track daily potential evapotranspiration!
How Do You Get Started?
Criteria For Irrigating Based on Potential Evapotranspiration

1. Must have access to a PET network that uses local weather data.
2. [www.tawcsolutions.org](http://www.tawcsolutions.org)
3. You must understand your capacity to irrigate based on peak crop demand.
4. You must know the soil water holding capacity for your soil type.
5. The irrigation system must be efficient.
Determining Your Capacity to Irrigate at any given % of PET

1. Assume you can apply 1.25” of irrigation per week.

2. Assume peak demand for one week is 0.3” per day or 2.1” per week.

3. 1.25” divided by 2.1” = 0.59%
To manage irrigation effectively, you must understand the soil water holding capacity of the soil type in which the crop is being grown.
# Soil Moisture Holding Capacity (Inches/foot)

<table>
<thead>
<tr>
<th>Texture</th>
<th>Field Capacity</th>
<th>Permanent Wilting Point</th>
<th>Plant Available Water</th>
<th>Initiation of Stress</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clay Loam</td>
<td>4.8</td>
<td>2.4</td>
<td>2.4</td>
<td>1.3</td>
</tr>
<tr>
<td>Loam</td>
<td>4.2</td>
<td>2.1</td>
<td>2.1</td>
<td>1.1</td>
</tr>
<tr>
<td>Sandy Loam</td>
<td>3.6</td>
<td>1.8</td>
<td>1.8</td>
<td>0.9</td>
</tr>
<tr>
<td>Loamy Sand</td>
<td>2.4</td>
<td>1.2</td>
<td>1.2</td>
<td>0.8</td>
</tr>
</tbody>
</table>
Determining Moisture by Feel
Most growers do not have enough water to compensate for an inefficient irrigation system.
Maximizing the Water You Have

1” @ 50% = 0.5”
1” @ 80% = 0.8”

12” @ 50% = 6”
12” @ 80% = 9.6” applied

= 3.6” difference

3.6” x 80 pounds = 288 pounds of lint per acre.
<table>
<thead>
<tr>
<th>Date</th>
<th>Growth Stage</th>
<th>100% Daily PET</th>
<th>Effective Rain</th>
<th>Acc. Irr. Needed</th>
</tr>
</thead>
<tbody>
<tr>
<td>7/20</td>
<td>EB</td>
<td>0.27</td>
<td>0</td>
<td>0.16</td>
</tr>
<tr>
<td>7/21</td>
<td>EB</td>
<td>0.26</td>
<td>0</td>
<td>0.32</td>
</tr>
<tr>
<td>7/22</td>
<td>EB</td>
<td>0.28</td>
<td>0</td>
<td>0.49</td>
</tr>
<tr>
<td>7/23</td>
<td>MB</td>
<td>0.30</td>
<td>0</td>
<td>0.67</td>
</tr>
<tr>
<td>7/24</td>
<td>MB</td>
<td>0.31</td>
<td>0</td>
<td>0.86</td>
</tr>
<tr>
<td>7/25</td>
<td>MB</td>
<td>0.31</td>
<td>0</td>
<td>1.05</td>
</tr>
<tr>
<td>7/26</td>
<td>MB</td>
<td>0.28</td>
<td>0</td>
<td>1.22</td>
</tr>
<tr>
<td>7/27</td>
<td>MB</td>
<td>0.29</td>
<td>.75</td>
<td>0.64</td>
</tr>
<tr>
<td>7/28</td>
<td>MB</td>
<td>0.30</td>
<td>0</td>
<td>0.82</td>
</tr>
</tbody>
</table>
STRATEGIC IRRIGATION STRATEGY

Inches Per Day

Days After Planting

- emergence
- first square
- first bloom
- first open boll
- maturity
# DP 0924 B2RF - 2009

<table>
<thead>
<tr>
<th>% ET</th>
<th>RF</th>
<th>30%</th>
<th>60%</th>
<th>90%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Irrigation</td>
<td>0”</td>
<td>4”</td>
<td>8”</td>
<td>12”</td>
</tr>
<tr>
<td>Effective</td>
<td>9.4”</td>
<td>13.4”</td>
<td>17.4”</td>
<td>21.4”</td>
</tr>
<tr>
<td>Yield/ Ac</td>
<td>475</td>
<td>1111</td>
<td>1849</td>
<td>1934</td>
</tr>
<tr>
<td>Loan Value/ Ac</td>
<td>$246.25</td>
<td>$612.80</td>
<td>$1027.40</td>
<td>$961.34</td>
</tr>
<tr>
<td>Yield Per Inch</td>
<td>50.5</td>
<td>82.9</td>
<td>106.3</td>
<td>90.4</td>
</tr>
</tbody>
</table>
2010 AGRI-SEARCH FARM
60% PET – 2.8 BALES/AC
QUESTIONS?