U. S. DROUGHT MONITOR WORKSHOP: FORECASTING, MONITORING AND RESPONDING TO DROUGHT IN THE SOUTHEAST

Feb 4-5, Columbia, SC

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Strategies to adapt to drought

• Land management strategies
• Crop Management strategies
• Irrigation management strategies
• Business management strategies
Land management strategies

• Conservation Tillage
• Fallowing land with standing stubble
Crop Management Strategies

- Reducing plant population and using skip-row configurations
- Selecting appropriate crops and crop varieties
- Using crop rotation
- Using opportunity cropping
- Adjusting cropping strategy according to amount and source of water supply
Business Management Strategies

- Trading land and water
- Developing a long-term plan
- Diversifying sources of income
- Minding the budget
Irrigation Management Strategies

- Improving irrigation scheduling
  - Using available tools to make irrigation decisions
  - properly timing supplemental irrigation,
  - eliminating pre-irrigation,
  - adjusting irrigation according to crop and crop variety
- Improving efficiency of surface irrigation systems
- Investing in move efficient irrigation systems
- Reducing water losses in farm storages
Capture more rain and reduce evaporation

- Crop rotation
- Reduced traffic
- Manure application
- Conservation tillage
- Land leveling/terracing
- Crop residue management
- Cover crop
Table 3. Land Use on Farms with Irrigation: 2018

Percent Acres Irrigated in South Carolina in 2018

- All other land: 9%
- Permanent pasture and rangeland: 0%
- Woodland pastured: 3%
- Cropland not harvested or grazed: 3%
- Other pasture and grazing land that could have been used for crops without additional improvement: 0%
- Nursery, greenhouse and other horticulture under protection: 100%
- Cropland harvested in the open: 35%
- Total cropland: 33%
- Land in farms: 26%
Table 1. Irrigated Farms in the Censuses of Agriculture: 2017 and Earlier Censuses

![Graph showing acres irrigated in South Carolina from 2000 to 2018 with a trend line and equation: $y = 7423.7x - 1E+07$, with $R^2 = 0.9841$.](image-url)
Table 13. Energy Expense for All Well Pumps and Other Irrigation Pumps by Type of Energy Used: 2018

<table>
<thead>
<tr>
<th>Farms</th>
<th>Pumps Powered</th>
<th>Acres in the open by water source</th>
<th>Square feet under protection by water source</th>
<th>Expenses</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Water from wells</td>
<td>Water from wells</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Surface water</td>
<td>Surface water</td>
<td></td>
</tr>
<tr>
<td>1,347</td>
<td>3,909</td>
<td>220,332</td>
<td>42,235</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>4,459,916</td>
<td>1,253,000</td>
<td>$10,540,000</td>
</tr>
</tbody>
</table>

Average Energy Expenses:
= $2,696/pump
= $7,825/farm
= $40/acre
<table>
<thead>
<tr>
<th>Farms</th>
<th>Acres irrigated affected by expenditure</th>
<th>Expenditures (dollars)</th>
<th>Average per farm (dollars)</th>
<th>Farms with expenditures of -</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>$1 to $999</td>
</tr>
<tr>
<td>427</td>
<td>12,848 ac</td>
<td>$5,166,000</td>
<td>$12,098</td>
<td>$1000 to $9,999</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>$10,000 to $29,999</td>
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<td></td>
<td></td>
<td>$30,000 to $74,999</td>
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<td>$75,000 or more</td>
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<td>113</td>
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<td>235</td>
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<td>40</td>
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<td>21</td>
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<tr>
<td></td>
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<td></td>
<td></td>
<td>18</td>
</tr>
</tbody>
</table>
Irrigation cost:

Variable cost = $48/ac

Fixed cost = $125/ac

Total = $173/ac

% of Total = 17.3%
Table 35. Crops Harvested in the Open from Irrigated Farms and Irrigated Pastureland: 2018

Irrigated Acres by Crop Type in South Carolina in 2018

- Irrigated pastureland, all types: 4,669
- All other crops 1/: 1,730
- Nursery and other horticultural crops: 18,039
- Land in orchards, vineyards, and nut trees: 8,552
- All berries: 210
- Potatoes, excluding sweet potatoes: 8
- Lettuce and romaine: 4,808
- Tomatoes in the open: 948
- Sweet corn: 42,781
- Land in vegetables: 39,558
- Cotton: 17,791
- Peanuts: 1,445
- All other hay (dry hay, greenchop, and silage): 18,156
- Alfalfa and alfalfa mixtures (dry hay, greenchop, and silage): 3,650
- Rice: 5,200
- Beans, dry edible: 94,386
- Soybeans for beans: 94,386
- Wheat for grain or seed: 18,156
- Sorghum for grain or seed: 3,650
- Corn for silage or greenchop: 5,200
- Corn for grain or seed: 94,386
Methods Used in Deciding When to Irrigate in SC - 2018
(Total farms reporting = 1,489)

- When neighbors begin to irrigate: 1.7%
- Computer simulation models: 0.8%
- Personal calendar schedule: 10.5%
- Scheduled by water supplier: 0.1%
- Reports on daily crop evapotranspiration (ET): 0.5%
- Commercial or government scheduling service: 3.2%
- Plant moisture sensing device: 11.7%
- Soil moisture sensing device: 11.7%
- Feel of soil: 22.4%
- Condition of crop: 89.0%
Variable Rate Irrigation
Response to Irrigation Amount

\[ y_{2006} = -0.0002x^2 + 0.079x + 3.904 \quad (R^2 = 0.99) \]

\[ y_{2005} = -4 \times 10^{-5}x^2 + 0.0216x + 9.056 \quad (R^2 = 0.82) \]

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Irrigation (mm)

Yield (Mg ha\(^{-1}\))

- 2005
- 2006

Yield model for 2006:

\[ y_{2006} = -0.0002x^2 + 0.079x + 3.904 \quad (R^2 = 0.99) \]

Yield model for 2005:

\[ y_{2005} = -4 \times 10^{-5}x^2 + 0.0216x + 9.056 \quad (R^2 = 0.82) \]
Effect of irrigation timing on yield

Maize, Nebraska, 2006
Irrigation = 150 mm

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Yield (Mg/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1</td>
<td>8.5</td>
</tr>
<tr>
<td>T2</td>
<td>11.3</td>
</tr>
<tr>
<td>T3</td>
<td>9.7</td>
</tr>
<tr>
<td>T4</td>
<td>7.6</td>
</tr>
<tr>
<td>T5</td>
<td>9.1</td>
</tr>
<tr>
<td>T6</td>
<td>11.4</td>
</tr>
<tr>
<td>T7</td>
<td>8.6</td>
</tr>
<tr>
<td>T8</td>
<td>9.0</td>
</tr>
</tbody>
</table>
--- Sense the environment
(Soil water balance)

--- Sense the plant

--- Sense the soil
On-Farm Weather Station
South Carolina Crop Water Requirement Calculator

Developed by Dr. Jose O. Payero (Clemson University, jpayero@clemson.edu), 2017.
This application allows users to determine crop water requirements for different crops in South Carolina.
The system uses weather data to estimate crop water use.

Change Inputs:
- Select County: Barnwell
- Select Crop: Cotton
- Select Soil: Sandy Loam
- Select Planting Month: May
- Select Planting Day: 15
- Select Irrigation Efficiency (%): 90
Irrigation Scheduling

https://etcman.shinyapps.io/IrrigSchedCRONOS/

South Carolina Irrigation Scheduling Tool
Developed by Dr. Jose O. Payero (Clemson University, jpayero@clemson.edu), 2017.
This application allows users to perform irrigation scheduling for different crops in South Carolina.
The system uses weather data from the CRONOS database to estimate irrigation requirements.

Please allow some time for weather data to load.
Please, press 'Bookmark' if you want to save your inputs for later use.

Cumulative Rain Since Planting, Barnwell County, Cotton 2019

Change Inputs:
Select County in SC
Barnwell

Select Crop
Peanuts
Cotton
Corn
Soybean
Peanuts
Sorghum
Crop Evapotranspiration, Barnwell County, Cotton 2019

Cumulative Crop Evapotranspiration, Barnwell County, Cotton 2019

Amount for Irrigation 3 (in)
2019-05-15
5

Date for Irrigation 4
2019-05-15

Amount for Irrigation 4 (in)

Date for Irrigation 5
2019-05-15

Amount for Irrigation 5 (in)
Soil moisture monitoring

Watermark Sensor

Radio (LoRa)
Send data to the Internet
Mobile App (ThingView)
Drought and Irrigation Best Practices

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