Using Sensors for Better Irrigation Management Decisions... and More....

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Sensor Networks
Production Area / Irrigation Zone

On-farm Weather Station

3G Radio Datalogger (Node)
The Planetary Boundary Layer

**Planetary Boundary Layer**

According to climatologists, the reason for the rapid increase is a band of air close to the ground, called the planetary boundary layer (PBL). This thin layer of the Earth's atmosphere is distinct from the upper layers and changes in thickness over the course of the day-night cycle. At night the solar radiation absorbed by the surface over the course of the day is released into space.

The researchers explain that as more carbon dioxide has been added to the atmosphere from man-made activities, such as burning fossil fuels, this has meant less heat escapes from the atmosphere at night, and the warmer atmosphere heats the thin PBL below. Because the layer is so thin at night, the warming effect is much more pronounced, adding extra energy to the climate system.

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Agricultural Implications of Increased Night Temperatures

1. Increased respiration rates
   - Decrease in yield
   - Decrease in food quality
2. Disruptions in pollination, fruit set
3. Increase in soil temperatures, microbial respiration rates, decrease in organic matter content
4. Increase in relative humidity, fungal disease
5. Increased weed pressure
6. Increased number of pest life cycles

Wolfe et al., 2018 Climatic Change 146: 231-245
Cloud Software Capabilities: AgZoom

Geolocation of Cloud Dataloggers

Dashboard – Single Node Data

Frost Monitoring

- Current frost prediction tool - Sky-Bit (Satellite data)
- Air temperature is not a reliable predictor of frost events
- Canopy temperature should be measured
- Radiative frost: CT << AT on clear and calm nights

Apogee SF-110 Radiation Frost Sensor

- 2 precision thermistors
- Mimic plant leaf and flower bud
- Measurement Range: -50 to 70 °C
- Accuracy: ± 0.1 to ± 0.4 °C
Radiative Frost Sensor

Flower bud and leaf thermistors (indicated with red arrows) on the SF-110 radiation frost sensor deployed within the plant canopy at Shlagel Farms.

Floating Row Cover Use

Growing degree day (GDD) units recorded below and above floating row cover.

Frost Events South Carolina – March 14-16, 2017

Alert Capabilities
Predictive Tools for IPM, Disease Management

### Agricultural Risk Management

Growing Degree Days, Heat Units

The growth and development of plants, insects, and many other organisms is largely dependent on temperature.

1. **Prioritize your issues:** Irrigation, water quality, pests, disease
2. **Monitor with Intent:** Develop a site- / crop-specific strategy
3. **Purchasing:** Make sure any system you buy has all the components you need. Demand quality, Don’t buy cheap
4. **Support:** Consider the time YOU have to invest in any system.
5. **Investment:** Start small, get comfortable, grow at your own pace.

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Geolocated 7-Day Weather Forecast

<table>
<thead>
<tr>
<th>Day</th>
<th>Temperature</th>
</tr>
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<tbody>
<tr>
<td>Monday</td>
<td>78°F</td>
</tr>
<tr>
<td>Tuesday</td>
<td>81°F</td>
</tr>
<tr>
<td>Wednesday</td>
<td>79°F</td>
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<td>Thursday</td>
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<td>Friday</td>
<td>80°F</td>
</tr>
<tr>
<td>Saturday</td>
<td>81°F</td>
</tr>
<tr>
<td>Sunday</td>
<td>83°F</td>
</tr>
</tbody>
</table>

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Dashboard – Single Node Data

Monitoring System Considerations

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Project Information at http://smart-farms.net