Current Research on Freeze Protection for Strawberry and Blueberry Production

Bielinski M. Santos, GCREC
Teresa Salame, GCREC
Alicia Whidden, Hillsborough Co. Ext.
David Moore, GCREC
Sink holes are not a joke!!

- Exterme cold winter in 2010 and 2011.
- Growers facing a problem of public perception.
Strawberry Freeze Protection

- Sprinkler irrigation.
  - 10-14 h.
  - 4-6 freezing or near freezing events/season.
  - 2 to 3 acre-inch/acre/night.

- Row covers.

- Protected culture.
Freeze Protection

Row covers
Freeze Protection

High tunnels
Freeze Protection

Objective

- Determining the effects of diverse freeze protection alternatives on strawberry growth and yield.
Freeze Protection

- Control (4.5 gpm sprinklers).
- Reduced sprinkler irrigation (3.5 gpm).
- Heavy covers (0.9 oz/yd$^2$) on canopy.
- Heavy covers (0.9 oz/yd$^2$) with 2-ft loop hoops.
- Light covers (0.6 oz/yd$^2$) on canopy.
- Light covers (0.6 oz/yd$^2$) with 2-ft loop hoops.
- 16-ft high tunnels.
Freeze Protection

- Early and total yield.
- Plant number and survival.
- Temperature.
- Water volumes.

- 13 nights $\leq 34^\circ F!!!
## Freeze Protection

<table>
<thead>
<tr>
<th>Freeze protection</th>
<th>Plant number</th>
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<tbody>
<tr>
<td></td>
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<tr>
<td>Control</td>
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<td>187 a</td>
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<tr>
<td>Heavy cover w/o hoops</td>
<td>191 a</td>
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<tr>
<td>Heavy cover w/ hoops</td>
<td>188 a</td>
<td>186 a</td>
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<tr>
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<td>191 a</td>
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<tr>
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<td>188 a</td>
<td>187 a</td>
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<tr>
<td>High tunnels</td>
<td>192 a</td>
<td>192 a</td>
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<tr>
<td>Significance ($P&lt;0.05$)</td>
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# Freeze Protection

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<thead>
<tr>
<th>Freeze protection</th>
<th>Min. temp</th>
<th>Water use</th>
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<tr>
<td></td>
<td>°F</td>
<td>acre-inch/acre</td>
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<tr>
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<tr>
<td>Heavy cover w/ hoops</td>
<td>34</td>
<td>0</td>
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<tr>
<td>Light cover w/o hoops</td>
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<tr>
<td>Light cover w/ hoops</td>
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<td>0</td>
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<tr>
<td>High tunnels</td>
<td>33</td>
<td>0</td>
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<tr>
<td>Freeze protection</td>
<td>Early yield</td>
<td>Total yield</td>
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<tr>
<td>-----------------------------------</td>
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<tr>
<td></td>
<td>ton/acre</td>
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<tr>
<td><strong>Control</strong></td>
<td>3.2 b</td>
<td>12.1 b</td>
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<tr>
<td><strong>Reduced sprinklers</strong></td>
<td>3.2 b</td>
<td>12.2 b</td>
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<td><strong>High tunnels</strong></td>
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<td>15.1 a</td>
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<tr>
<td><strong>Significance (P&lt;0.05)</strong></td>
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Significance level: *P* < 0.05
Summary

- Row covers cost: $850-1000/acre.
- Row cover labor: $120-150 per freeze.
- Tunnels: $25 to 35K/acre.
- Water savings: 2-3 acre-inch/acre per freeze.
- Sprinklers could be reduced to 3.5 gpm.
Freeze Protection: What Do We Know?

- **Low volume sprinklers:**
  - Reducing orifice diameter or heads: Relatively low-cost change.
  - Microjets and wobblers: Higher cost and risk when there are high winds.
  - Some growers are already testing these.
  - From 4 gal/min $\rightarrow$ 2 gal/min.
  - Light windy freezes?
Freeze Protection: What Do We Know?

- **Row covers:**
  - Effective freeze protection.
  - About $1000/acre + hoops + sandbags + labor.
  - Labor: 1 acre/man for 8 h (x 2 for uncovering).
  - Reusable.
  - Thickness (1, 1.5, and 2 lb).
  - Cumbersome and slow for large fields.
  - Food safety concerns (?).
Freeze Protection: What Do We Know?

- **High tunnels:**
  - No or very little water used for freeze protection.
  - Relatively high capital investment.
  - Commitment to intensive agriculture.
  - 2009: <3 acres.
  - 2011-12: About 300,000 plants.
Performance of Blueberry Cultivars under High Tunnels

Bielinski M. Santos and Teresa Salamé
Gulf Coast Research and Education Center
IFAS, University of Florida
High tunnels

- Unheated, plastic covered structures.
- Passive ventilation (roll-down side walls).
- Temporary structures.
- $20-30K/acre.
Why Blueberries in High Tunnels?

- Freeze protection (water savings)
- High early yields
- Increased revenues
Blueberry Prices

Harvest season north Fla.: April 1 to May 15
Objective

To compare early yield of two blueberry cultivars grown under high tunnels and in open fields.
Materials and Methods

- Experimental Site
- Commercial Farm, Waldo, Florida.
- 2010 & 2011 seasons.
- Fine sand soil.
- Pinebark beds.
- Black row covers.
Materials and Methods

- Production systems: Open fields and high tunnels.

- Tunnels: 16-17 ft high.

- Two blueberry cultivars.
  - ‘Snow Chaser’
  - ‘Springhigh’
Materials and Methods

- **Freeze protection:**
  - Open fields
    - (sprinklers: 120 gal/min/acre)
  - High tunnels
    - (nozzles: 60 gal/min/acre)

- Turn on water at 34-33°F.
Materials and Methods

- Ventilation of high tunnels.
## Temperatures

<table>
<thead>
<tr>
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<th>2010</th>
<th>Days under 33F</th>
<th>Min. Temp. (F)</th>
<th>Max. Temp. (F)</th>
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<tr>
<td>High tunnel entrance</td>
<td>8</td>
<td>29.3</td>
<td>97.0</td>
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<td>High tunnel center</td>
<td>2</td>
<td>31.7</td>
<td>97.0</td>
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<th>2011</th>
<th>Days under 33F</th>
<th>Min. Temp. (F)</th>
<th>Max. Temp. (F)</th>
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<tr>
<td>Open field</td>
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<td>20.6</td>
<td>115.5</td>
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<tr>
<td>Open field</td>
<td>32</td>
<td>20.6</td>
<td>114.6</td>
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<td>High tunnel entrance</td>
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<td>31.7</td>
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<td>High tunnel center</td>
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<td>32.5</td>
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Blueberry Freeze Protection
Water Savings

Open Fields:
- $60,000 \times 25\text{ days} = 1,500,000\text{ gal/acre}$

High Tunnels:
- $30,000 \times 8\text{ days} = 240,000\text{ gal/acre}$
Blueberry Yield 2010

11 Harvests from Feb 8 to May 4
Summary

- Blueberry production under high tunnels started earlier than open field production.
- ‘Snow Chaser’ was earlier than ‘Springhigh’.
- Higher revenues due to high early yields.
- Identify appropriate areas for tunnels.
- Water savings.
Thanks!
Straughn Farms
FDACS
SWFWMD
NASGA
bmsantos@ufl.edu
813-468-6322