Effect of row covers on high tunnel soil temperature

Michael J. Ward, Michael K. Bomford, Anthony F. Silvernail, Jonathan C. Cambron
MES Program
Kentucky State University

April 2011
High Tunnels

- High Tunnel = passive solar hoop house
- Uses Plastic to trap IR heat
- Low Energy Input
- Out-of-season growing
- Daily temperature swings: High in day, low at night
Row Covers

- Translucent polyester blanket (‘Reemay’) 
- Retains heat 
- Potential to enhance season extension in high tunnels
Methods

- Randomized Complete Block Design
- Two treatments
  - Covered
  - Uncovered (Control)
- Three crops, direct seeded and transplanted
  - Kale (*Brassica napus pabularia*)
  - Beet (*Beta vulgaris*)
  - Spinach (*Spinacia oleracea*)
- Four replicates
Randomized Complete Block Design

- **I**
  - K (Kale)
  - B (Beets)
  - S (Spinach)

- **II**
  - K (Kale)
  - S (Spinach)
  - B (Beets)

- **III**
  - K (Kale)
  - B (Beets)
  - S (Spinach)

- **IV**
  - B (Beets)
  - S (Spinach)
  - K (Kale)

- **Pad**
  - (110 Sq ft)

- **Fallow**
  - 75 sq ft

- **Row Covers**
  - (55 ft²)
**Temperature**

- Soil temperatures (top 15 cm) logged hourly
  - Average, Maximum and Minimum
- Two sampling periods:
  - March 2-May 18, 2010 (77 Days);
  - Jan 24-March 4, 2011 (71 Days)

**Yield**

- Aboveground fresh weight of 2 m² subsample recorded for each plot
- All crops and plantings pooled
Daily Soil Temperature Fluctuation: 2010

- Covered
- Uncovered
Daily Soil Temperature Fluctuation: 2011

- Row covers moderate daily soil temperature flux
- No significant effect on average soil temperature
Relationship between daily minimum soil temps with and without row covers

\[ y = 0.8491x + 2.6695 \]

\[ R^2 = 0.9765 \]

Covers warm soil more at cool temperatures
Covered soil does not freeze
Relationship between daily minimum air temps with and without row covers

Covers warm air more at cool temperatures

\[ y = 0.849x + 2.9439 \]

\[ R^2 = 0.9783 \]
Daily Minimum Air Temperature, 2011

- Air - Covered
- Air - Uncovered

No frost under covers after Feb 12
Shorter periods of frost under covers
Soil - Covered
Soil - Uncovered

No freezing soil under covers
Yield: Fresh weight, 2010-11

- Row covers increase yield
- Year and replicate have no significant effect
Analysis

- Row covers moderate temperature but do not affect average soil temperature
  - Warmed soil at cool temps
  - Cooled soil at warm temps

- Rows covers extended frost free period inside high tunnel

- Row covers increased yield of spring-grown cool season vegetable crops
Discussion

- Row covers offer both protection from frost and a harvest advantage in high tunnels
- Recommended for high tunnel growers