High Tunnel Production of Organic Specialty Vegetables

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Content

1. Introduction
2. Results
3. How we did the research
4. Lessons learned and some take home messages
Why High Tunnels?

• Controlled environment plant production is more resource efficient and with higher yield than field production; however the initial investment can be high…;
• Extend growing seasons;
• Prevent some weather related damage;
• Grow specialty crops which are difficult to grow in the field;
• Can be used to reduce pests…;
• Can be movable;
• Light, humidity, Temperature can be controlled to some extend;
• ….
Project History and Participants’ Expertise
Huge difference between tunnel and field plants on July 23
Cherry Tomato -- Sarina Hybrid
Yield loss of field tomato from animals, hail, and disease
Bitter Melon—Canton Green F1
Happier bitter melons in the warmer high tunnels

How many fruits have you found on the plant?
Glebionis coronaria
edible chrysanthemum
Tonghao
PEA PODS (China 6 snow pea)
Pea shoot ‘HO LAN DOW’
Pea shoots yield (g m$^{-2}$)

- Open field
- High tunnel
- High tunnel + insect netting

The graph shows the yield of pea shoots for different cultivation methods. The highest yield is observed in the high tunnel + insect netting condition, followed by the high tunnel and then the open field.
Intercropping

Tonghao yield (kg m⁻²)

<table>
<thead>
<tr>
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<th>Open field</th>
<th>High tunnel</th>
<th>High tunnel + insect netting</th>
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</thead>
<tbody>
<tr>
<td>Oasis</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Tong Hao</td>
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</table>
How we did the trials?

Transplanting dates

May 6-8, 2015
Jun 3-4, 2015
Planting density

- Bitter melon: 1.9 plants/m$^2$
- Tomato: 2.4 plants/m$^2$
- Pea pod: 15 plants/m$^2$
- Tonghao (edible mums): 15gseeds/m$^2$
Plant Management
Lessons Learned
End Walls

- Careful construction is essential to proper functioning and tight-fitting doors (jig)
- Don’t scrimp on latch hardware
- Need for securing propped-open doors on hot and windy days
Winter Storage of Poly

- Full roll-up sides is a unique design
- Clean, on-site storage
- Can be easily rolled down in spring to begin warming/drying soil
Environment Measurement and Control
## Average Temperatures

<table>
<thead>
<tr>
<th></th>
<th>Field</th>
<th>Unscreened Tunnel</th>
<th>Screened Tunnel</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Air Temperature Season</strong></td>
<td>19.3</td>
<td>20.2</td>
<td>21.7</td>
</tr>
<tr>
<td><strong>Air Temperature June</strong></td>
<td>17.5</td>
<td>19.1</td>
<td>20.4</td>
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<tr>
<td><strong>Air Temperature July</strong></td>
<td>20.3</td>
<td>21.1</td>
<td>22.9</td>
</tr>
<tr>
<td><strong>Air Temperature August</strong></td>
<td>19.1</td>
<td>19.7</td>
<td>21.1</td>
</tr>
<tr>
<td><strong>Soil Temperature Season</strong></td>
<td>18.9</td>
<td>20.0</td>
<td>21.0</td>
</tr>
</tbody>
</table>

Additional Degree Days for High Tunnels, Compared to Field (for 107 days – May 26 to Sep. 11, 2015)
- Unscreened Tunnel: 101 degree days
- Screened Tunnel: 259 degree days
Solar Radiation

• Average solar radiation (season):
  – Field: 231 W/m²
  – Unscreened: 171 W/m²
  – Screened: 163 W/m²

• Transmissivity of glazing ~ 70-75 %
  – Complicated by presence of plants later in season.
Early Season Frost Protection Inside Tunnels: Overnight May 13, 2015

- Temperature (°C)
  - Air inside tunnel
  - Air under black tent
  - Air under clear tent
  - Soil under black tent
  - Soil under clear tent

Δ 4.9 °C
Δ 7.3 °C
Below - 2 °C for ~3 hr
Summary

High tunnel improved crop yield possibly due to:

• extended production period;
• Reduced yield loss from disease, animals and severe weather (e.g., hail, heavy rain);
• Created a better microclimate for crop production.

More work is needed for environmental control and on other species.
THANKS

Katherine Vinson, Nora Alsafi, Patrick Kelly, Amy Kong and many more!