Vegetable Production in High Tunnels

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High Tunnels

- Unheated greenhouses
- Metal quonset frame
- Plastic cover
- Passive ventilation
- Soil-based production
- Simple
- Cheap
Frame, hardware: $3,500
Plastic: $800
End walls, doors: $700
Cost: $5,000+/-
<table>
<thead>
<tr>
<th>Qty.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Budget Plus Series</td>
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<table>
<thead>
<tr>
<th></th>
<th>Price</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>$3,600.00</td>
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</table>

<table>
<thead>
<tr>
<th>Qty.</th>
<th>Description</th>
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<tbody>
<tr>
<td>30 x 96</td>
<td></td>
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</table>

<table>
<thead>
<tr>
<th>Qty.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Posts: 2.197 12 Gauge Column Post</td>
</tr>
<tr>
<td></td>
<td>Bows: 1.900 14 Gauge</td>
</tr>
<tr>
<td></td>
<td>Purlins: 3 Runs 1.315 x 17 Gauge</td>
</tr>
<tr>
<td></td>
<td>Trusses: 1.315 Top Brace every other Bow</td>
</tr>
<tr>
<td></td>
<td>Side Wall Height: 4 Feet</td>
</tr>
<tr>
<td></td>
<td>Bow Spacing: 4 Feet</td>
</tr>
<tr>
<td></td>
<td>Hardware: Complete Hardware Package for Frame Assembly</td>
</tr>
<tr>
<td></td>
<td>Gutter: N/A</td>
</tr>
</tbody>
</table>
High tunnels vs. greenhouses

• Big (1-50 ac.)
• Energy intensive
• Hydroponic
• Same crop all year

• Small (30 x 96’)
• Energy efficient
• Soil-based
• Seasonal year-round production
Western Lettuce Now Inc., Langley BC

6 acres

8 acres

Wiediger high tunnel
Greenhouse: 2129 MJ/m²/yr

High tunnel:
95 MJ/m²/yr

- natural gas
- electricity: 341
- plastic: 56
- steel: 23
- aluminum: 7.6
- glass
- wood
- concrete: 1750
Tomato season

- Greenhouse
  - Transplant production
  - Growth
  - Harvest

- Field
  - Transplant production
  - Growth
  - Harvest

- Fall high tunnel
  - Transplant production
  - Growth
  - Harvest

- Spring high tunnel
  - Transplant production
  - Growth
  - Harvest
Where should I put my high tunnel?

- Close to house
- Good, well-drained soil
- Full sun
- Relatively level
- Wind for ventilation
- Long side facing south
- Water for irrigation
- Electricity?
Attaching plastic
Double Layer Systems
Why use two layers?
Mean:
\[ y = 0.69x + 6.3, \quad R^2 = 0.95 \]

Minimum:
\[ y = 0.78x + 3.4, \quad R^2 = 0.98 \]

-10 0 10 20 30

Outside temp. (ºC)

-10 0 10 20 30

Inside temp. (ºC)

Daily mean

Daily minimum
What about frost?
Ventilation
Management
(8-10 hours per week)

• Daily
  – Opening and closing tunnel… especially on sunny days
  – Scouting

• Weekly
  – Weeding
  – Watering (Drip system)
  – Seeding and Transplanting
  – Harvesting
Soil Amendment
Sliding tunnels
Transplant production
Transplant production: Solar heat & electric pads
Transplant production: Wood heat
Transplant production: Propane heat & electric pads
Sample Cool Season Transplants

<table>
<thead>
<tr>
<th></th>
<th>Kale</th>
<th>Head lettuce</th>
<th>Cole crops</th>
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</thead>
<tbody>
<tr>
<td>Seed transplants</td>
<td>Aug. 15</td>
<td>Monthly, Aug.-Apr.</td>
<td>Sep. 1</td>
</tr>
<tr>
<td>Transplant into tunnel</td>
<td>Oct. 1</td>
<td>3-5 weeks after seed</td>
<td>Oct. 15</td>
</tr>
<tr>
<td>First Harvest</td>
<td>Nov. 1</td>
<td>4-6 weeks after trans.</td>
<td>Dec. 15</td>
</tr>
<tr>
<td>Remove</td>
<td>May 15</td>
<td>Jul. 1</td>
<td>Feb. 15</td>
</tr>
</tbody>
</table>
Direct-seeded cool season crops

• Arugula: every 3-4 weeks
• Carrots: seed in Oct., harvest in Jan.
• Mesclun:
  – Oct. – Nov. and mid Feb. – Apr: 3 weeks to harvest, re-cut weekly
  – Dec. – Feb.: 6 weeks to harvest, 3 weeks between cuttings
• Scallions: seed in Oct., harvest in Jan.
• Spinach:
  – Pre-germinate in Sept.
  – 5 weeks to harvest.
  – Cut and come again until Feb.
  – Seed in Dec., lasts to Apr.
Sample Warm Season Crops

<table>
<thead>
<tr>
<th></th>
<th>Tomatoes</th>
<th></th>
<th>Bell peppers</th>
<th></th>
<th>Cucumbers</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Spring</td>
<td>Fall</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Seed</td>
<td>Jan. 15</td>
<td>Jun. 1</td>
<td>Jan. 15</td>
<td>Feb. 15</td>
<td></td>
</tr>
<tr>
<td>Trans-plant</td>
<td>Mar. 15</td>
<td>Aug. 1</td>
<td>Apr. 1</td>
<td>Apr. 1</td>
<td></td>
</tr>
<tr>
<td>First Harvest</td>
<td>May 15</td>
<td>Nov. 1</td>
<td>Jun. 1</td>
<td>May 15</td>
<td></td>
</tr>
<tr>
<td>Remove</td>
<td>Jul. 15</td>
<td>Dec. 15</td>
<td>Aug. 1</td>
<td>Aug. 1</td>
<td></td>
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Irrigation

- Space T-tape 12” apart
- Use nozzles to space transplants (12” for lettuce; 24” for tomato)
- Don’t irrigate before cold snaps (water stress enhances frost tolerance)
Beneficial habitat
Sclerotinia sclerotiorum

• Thrives in cool, moist conditions
• Persists in soil as sclerotia

• White mold of lettuce
• Broad host range
• Problem in high tunnels
Solarization

- White mold (*Sclerotinia sclerotiorum*) thrives in cool, moist conditions
- Attacks leaves, roots, stems
- Survives summer as heat-resistant sclerotia
- 4 weeks under clear plastic in August kills sclerotia
Questions?

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