Low Cost Season Extension

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Early cabbage protected from frost and insect pests
Why use row covers?

• Retain heat to enhance plant growth and extend the growing season
  – Protect delicate crops from light frosts
• Reduce wind damage
• Exclude Pests
  – Protect crops from insect-borne diseases
Pest exclusion

- Cabbageworms
- Flea beetles
- Squash bugs
- Colorado potato beetles
- Root maggots
- Leaf miners
- Deer

- Rabbits
- Birds
- Cucumber beetles
- Army worms
- Grasshoppers
- Squash vine borers
Row cover weight

- **Light**
  - Excellent light and water transmission
  - Pest exclusion
  - Little frost protection
  - Tear easily (single season use)

- **Medium**
  - Good light transmission (75-85%)
  - Good frost protection
  - Durable (several seasons)

- **Heavy**
  - Poor light transmission (50%)
  - Excellent frost protection
  - Very durable (4+ years)
Heavier row covers protect cool-season crops well into winter.
Row covers can be anchored with bricks, boards, rebar, soil...
Can float, or support with hoops (low tunnels)

Connie Lemley's Farm, near Frankfort, KY
High Tunnels

- Unheated greenhouses
- Frame of metal struts
- 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>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td><strong>Budget Plus Series</strong></td>
<td>$3,600.00</td>
</tr>
<tr>
<td></td>
<td><strong>30 x 96</strong></td>
<td></td>
</tr>
</tbody>
</table>

- **Posts:** 2.197 12 Gauge Column Post
- **Bows:** 1.900 14 Gauge
- **Purlins:** 3 Runs 1.315 x 17 Gauge
- **Trusses:** 1.315 Top Brace every other Bow
- **Side Wall Height:** 4 Feet
- **Bow Spacing:** 4 Feet
- **Hardware:** Complete Hardware Package for Frame Assembly
- **Gutter:** N/A
## Fixed Costs
(30’ x 96’ tunnel = 2,880 sq. ft.)

<table>
<thead>
<tr>
<th>Construction</th>
<th>Materials</th>
<th>Labor</th>
<th>Life (years)</th>
<th>Cost/year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frame</td>
<td>$3,000</td>
<td></td>
<td>10</td>
<td>$300</td>
</tr>
<tr>
<td>Hardware</td>
<td>$600</td>
<td></td>
<td>10</td>
<td>$60</td>
</tr>
<tr>
<td>Plastic</td>
<td>$800</td>
<td></td>
<td>4</td>
<td>$200</td>
</tr>
<tr>
<td>Construction</td>
<td>$800</td>
<td>$800</td>
<td>10</td>
<td>$80</td>
</tr>
<tr>
<td>Plastic application</td>
<td></td>
<td>$100</td>
<td>4</td>
<td>$25</td>
</tr>
<tr>
<td>Total</td>
<td>$4,300</td>
<td>$900</td>
<td></td>
<td>$665</td>
</tr>
</tbody>
</table>

$665 / 2,880 sq. ft = 21¢ per sq. ft. per year

Adapted from [Cornell High Tunnel Sample Budgets](#)
## Cost & Return

<table>
<thead>
<tr>
<th></th>
<th>Mixed Winter Greens</th>
<th>Tomatoes</th>
<th>Colored Peppers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seed/plants</td>
<td>$127</td>
<td>$240</td>
<td>$200</td>
</tr>
<tr>
<td>Supplies</td>
<td>$285</td>
<td>$484</td>
<td>$150</td>
</tr>
<tr>
<td>Production</td>
<td>$180</td>
<td>$672</td>
<td>$360</td>
</tr>
<tr>
<td>Harvest</td>
<td>$360</td>
<td>$288</td>
<td>$108</td>
</tr>
<tr>
<td>Marketing</td>
<td>$240</td>
<td>$48</td>
<td>$120</td>
</tr>
<tr>
<td>Fixed Cost</td>
<td>$665</td>
<td>$665</td>
<td>$665</td>
</tr>
<tr>
<td>Total Cost</td>
<td>$1,857</td>
<td>$2,397</td>
<td>$1,603</td>
</tr>
<tr>
<td>Income</td>
<td>$6,000 (1,000 lb @ $6/lb)</td>
<td>$9,000 (6,000 lb @ $1.50/lb)</td>
<td>$1,780 (1,000 fruit @ $1.78)</td>
</tr>
<tr>
<td>Return</td>
<td>$4,143</td>
<td>$6,603</td>
<td>$177</td>
</tr>
</tbody>
</table>

Adapted from [Cornell High Tunnel Sample Budgets](https://example.com)
Budgeting

• Use sample budgets as a guide to build your own. Don’t assume that others’ experience will match yours.

• Keep track of your costs and returns. Use them to build your own budget.

• High tunnels can make money or lose money. Keeping track of costs and returns helps inform management decisions.
Organic Price Premiums

- Premiums range from 50-150% at large wholesale markets
  - Rodale Organic Price report updated weekly
- Farmers market premiums closer to 50% in urban markets
- Little or no premium in rural markets.

Compare prices for Lettuce: Butterleaf across all markets

Choose a product...

Week of January 12, 2012

<table>
<thead>
<tr>
<th>Location</th>
<th>Qtv</th>
<th>Certified</th>
<th>Conv</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boston, MA</td>
<td>PQ</td>
<td>24 Ct</td>
<td>$41.25 $18.00</td>
</tr>
<tr>
<td>Los Angeles, CA</td>
<td>PQ</td>
<td>24 Ct</td>
<td>$37.00 $12.00</td>
</tr>
<tr>
<td>Philadelphia, PA</td>
<td>PQ</td>
<td>24 Ct</td>
<td>$41.25 na</td>
</tr>
<tr>
<td>San Francisco, CA</td>
<td>PQ</td>
<td>24 Ct</td>
<td>$34.00 $15.00</td>
</tr>
<tr>
<td>Seattle, WA</td>
<td>PQ</td>
<td>24 Ct</td>
<td>$36.95 $21.00</td>
</tr>
</tbody>
</table>

http://www.rodaleinstitute.org/Organic-Price-Report
NRCS EQIP: Seasonal High Tunnel Initiative

- $2.57 per sq. ft. up to 2,178 sq. ft = $5,597
- High tunnel must be steel framed, from recognized vendor
- High tunnels may be fixed or portable
- Crops must be grown in soil
- 4 year contract
- Separate pool for organic growers
- Program ranking dates:
  - February 3rd,
  - March 30
  - June 1
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?

The graphs show the temperature variations inside and outside the KSU tunnel over a period from February 2006 to June 2007. The temperature is measured in °C and varies widely throughout the year, with both inside and outside temperatures fluctuating significantly. The graphs highlight periods of frost, marked as 'Last freeze' and 'First freeze', indicating the onset and end of frost periods inside the tunnel.
What about frost?
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
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)

Paul Wiediger, Smith’s Grove, KY
Soil Amendment

- “The producer must manage plant and animal materials to maintain or improve soil organic matter content in a manner that does not contribute to contamination of crops, soil, or water by plant nutrients, pathogenic organisms, heavy metals, or residues of prohibited substances.”
  -- NOP standards

- Not all ‘organic’ fertilizer can be used for certified organic production. Look for OMRI seal or check with your certifier.
Compost

- NOP requires C:N between 25:1 and 40:1 and temperature between 131 and 170°F for 15 days.
- Sufficient to reduce human pathogen levels below detectable limits
Ventilation

Joe O’Daniel, Smiths Grove, KY
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

![Germinating sclerotia (%)](chart.png)
Sliding tunnels
# Sample Cool Season Transplants

<table>
<thead>
<tr>
<th></th>
<th>Kale</th>
<th>Head lettuce</th>
<th>Cole crops</th>
</tr>
</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
- Mesclun:
  - Oct. – Nov. and mid Feb. – Apr:
    3 weeks to harvest, re-cut weekly
  - Dec. – Feb.:
    6 weeks to harvest, 3 weeks between cuttings
- 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>Bell peppers</th>
<th>Cucumbers</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Spring</td>
<td>Fall</td>
<td></td>
</tr>
<tr>
<td>Seed</td>
<td>Jan. 15</td>
<td>Jun. 1</td>
<td>Jan. 15</td>
</tr>
<tr>
<td>Trans-plant</td>
<td>Mar. 15</td>
<td>Aug. 1</td>
<td>Apr. 1</td>
</tr>
<tr>
<td>First Harvest</td>
<td>May 15</td>
<td>Nov. 1</td>
<td>Jun. 1</td>
</tr>
<tr>
<td>Remove</td>
<td>Jul. 15</td>
<td>Dec. 15</td>
<td>Aug. 1</td>
</tr>
</tbody>
</table>
Tomato season

- **Spring high tunnel**
  - Transplant production
  - Growth
  - Harvest

- **Fall high tunnel**
  - Transplant production
  - Growth
  - Harvest

- **Field**
  - Transplant production
  - Growth
  - Harvest

- **Greenhouse**
  - Transplant production
  - Growth
  - Harvest
Questions?

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