The
“High Tunnel”
for cold season crops
Joseph Masabni
Shane Bogle
University of Kentucky
UKREC
Princeton, KY

Joe Masabni
Dr. Emery M. Emmert
1948-1955

www.uky.edu/Ag/Horticulture/anderson/emmert.htm
Cost of construction

Dimensions = 10’X40’

Material per square foot = $0.45

Plastic/irrigation per square foot = $0.05

Total cost per square foot = $0.50

Joe Masabni
Raised beds with plastic mulch and trickle irrigation OR bareground

Planting of desired crop can be done with a waterwheel setter before high tunnel construction OR by hand after high tunnel construction
Simple Construction

- Our design is 10 ft wide, 40 ft long, and about 7 ft tall
- Other sizes are possible. Build frame to a size that fits your needs and space
- Plastic can be put on tunnel ends before building structure (see photo).
Supplies and Construction

• Use 1” by 3 ft galvanized pipe as anchors
• Space anchors at 3 or 4 ft intervals
Insert 1 ½” (PVC Schedule 40) Pipe in anchors on both sides.
Supplies and Construction

- Place tunnel ends
- Run rope around each hoop the length of the tunnel.
- 2 rope runs can be used for bigger tunnels.

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Supplies and Construction

Anchors are placed at both ends and two on either side for improved anchoring in windy conditions.

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4-mm clear plastic is cut to 5 additional feet than tunnel length to allow for attaching to ends. (about 45’ long)
Supplies and Construction

Plastic is pulled tight and attached to metal channels on the end frames with wiggle wire.
Supplies and Construction

When sides are pulled tight and ends attached, sides are held down by piling soil on excess plastic to keep cover tight.

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Objectives:

1. Demonstrate benefit of a high tunnel set in western Kentucky.

2. Test the benefit of an additional small tunnel inside the high tunnel.
High Tunnel Experiment
UKREC, Princeton

• High tunnel built on Dec 5, 2003 on top of 2 plastic rows inside.

• Lettuce, Kale, and Spinach were transplanted on Dec 10, 2003.

• 2 additional plastic rows were laid and transplanted outside the high tunnel for comparison. One was covered with a small covered, the other not covered at all.
The additional small tunnel is on the right and partially uncovered to show differences in plant growth.

Sensors record air T, soil T, and intercepted light.

Another sensor was placed outside the high tunnel.
View on Dec, 11, 2003
Spinach – Feb 3, 2004
High and Small Tunnel
Initial Observations

Outside rows, with or without Small Tunnel:

• Lettuce did not survive the winter.

• Spinach and Kale survived but started growing in March.

• First harvest on Mar 29, 2004, 45 days after the first harvest inside the High Tunnel.

• Small tunnel alone doubled spinach yields than no tunnels at all.
Initial Observations

Inside High Tunnel:

- All 3 crops survived.
- All crops grew continuously throughout winter.
- Plants under 2 tunnels grew faster than the other row.
- Plants on 2 tunnels generally yielded higher than those of only the high tunnel.
February Soil and Air Temperatures

Inside

Outside

Air Temp.  Soil Temp.
March Soil and Air Temperatures

Inside

Soil Temp. Air Temp.
In general, inside Light was about 78% of outside.
High Tunnel – Spinach Yields

<table>
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<tr>
<th>Date</th>
<th>Spinach + Small Tunnel</th>
<th>Spinach - Small Tunnel</th>
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<tbody>
<tr>
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<td>2</td>
<td>0</td>
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<tr>
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<tr>
<td>3/6/2006</td>
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</tr>
<tr>
<td>4/10/2006</td>
<td>3</td>
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</tr>
</tbody>
</table>

Legend:
- ⬤ Spinach + Small Tunnel
- ▲ Spinach - Small Tunnel
High Tunnel

Yield (lb)

Date
2/13/2006
2/20/2006
2/27/2006
3/6/2006
3/13/2006
3/20/2006
3/27/2006
4/3/2006
4/10/2006

Kale + Small Tunnel
Kale - Small Tunnel
February’s Air Temperatures
Percent at each Temp. Range

Inside: 28% of time above 60F
Outside: 7% of time above 60F

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Inside
Outside
March’s Air Temperatures
Percent at each Temp. Range

Inside: 45% of time above 60F
Outside: 22% of time above 60F
February’s Soil Temperatures
Percent at each Temp. Range

Inside: 65% of time above 60°F
Outside: 24% of time above 60°F
March’s Soil Temperatures
Percent at each Temp. Range

Inside: 51% of time above 60F
Outside: 21% of time above 60F
More Information

aunatureelfarm.homestead.com
ag.arizona.edu/ceac/research/archive/structures.htm
plasticulture.cas.psu.edu
www.ceinfo.unh.edu/Common/Documents/hightunln.htm
horticulture.unh.edu/text/high_tunnels/high_tunnels.pdf
www.bae.uky.edu/ext/PlansList/Horticulture/

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- Crops are harvested from October through April and sold direct to subscribed customers. The cost of a 20x96 structure runs between $2000 and $2500 ($1-$1.3/sq.ft).
- The only continuing cost is electricity for a small inflation fan and replacement plastic every 4 years.