High Tunnel Technology
A Tool for Economic Development, Job Creation, and Increased Quality of Life through Urban Agriculture

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How We Got Into High Tunnels-Blame it on Dr. Otho Wells!!
High Tunnel Technology

What am I talking about?

High tunnels fall under Season Extension Technology which is part of the broader technology of Plasticulture or the use of plastics in agricultural production systems.
Plasticulture Technology

What am I talking about?
Plasticulture Technology

- Plastic Mulches
- Drip Irrigation
- Fertigation
- Soil Sanitation
- Windbreaks
- Stand Establishment Technology

- Season Extension Technology-Row Covers and High Tunnels
- Pest Management-Weed, Insect and Disease Control
- Cropping Strategies
- Marketing
- Disposal of the Used Plastics
Definition of a High Tunnel

A high tunnel is generally quonset-shaped, although we recommend a peak, constructed of metal bows that are attached to metal posts which have been driven into the ground about 20 inches. They are covered with a single layer of greenhouse grade 6-mil plastic, have no permanent heating or ventilation system but do have water for irrigation.
High Tunnels- a “Poor Man’s” Greenhouse!!

Reporter’s Headline!!

A high tunnel, although resembling a greenhouse is an entirely different technology and price range. High tunnels are also considered non-permanent structures and should be taxed accordingly. They are definitely economic development units that can create jobs and income and improve the quality of life and health of a community through Urban Agriculture.
What Are the Different Sizes of High Tunnels?

Single units not multi-bay units.

High tunnels normally range from 14 feet to 30 feet wide and from 20 feet to 96 feet in length. A recommended commercial size high tunnel would be 21 feet wide and 96 feet long. One can start out with a 21 foot wide by 48 feet long and then extend the length by purchasing additional bows that are placed 4 feet apart.
Penn State High Tunnel Research and Education Facility

This research and education facility was started nine years ago with 8 (17 feet wide by 36 feet long) high tunnels and has grown to 36 high tunnels ranging in size from 14 feet by 20 feet to 30 feet by 96 feet. Research is conducted on all phases of production of vegetables, small fruits and cut flowers. Education is accomplished through field days, workshops and tours.
They just kept multiplying!!
Topics to Discuss

- Construction of Tunnels
- Equipment Used
- Growing systems
- Ventilation
- Supplemental Heating
- Row Covers/Thermal Blankets
- Irrigation
- Fertility and Soil Health
- BioControl
- Vegetables
- Small Fruits
- Cut Flowers
- Marketing
Construction of a High Tunnel

A 17 foot wide by 36 foot long high tunnel can be constructed and ready to plant in a day and a half.
Special Equipment

• 21 HP 4 wheel drive Ford tractor.
• Rototiller for tractor.
• Bucket loader for tractor.
• Small plastic mulch/drip tape application machines.
Special Equipment

• Small plastic mulch/drip tape application machines.
Special Equipment

- 21 HP 4 wheel drive Ford tractor.
- Rototiller for tractor.
Growing Systems
Recommended Growing Systems for the Urban Environment

Given the level of potential contamination of the soil in many urban settings I would recommend using raised permanent wood beds (2 by 12’s) for the production of crops. A sheet of 6-mil thick black plastic can line the inside of the bed and corrugated drain pipe should be placed in the center of the bed. New soil mixed with compost can then be put in the bed.
Recommended Growing Systems for the Urban Environment
Ventilation in High Tunnels

High sided tunnel

Very Critical

Low sided tunnel

Vent from Ken-Bar, Inc.
Supplemental Heating in High Tunnels
Row Covers and Thermal Blankets
Fertility and Soil Health
Irrigation in High Tunnels

Only use Drip Irrigation - Why?
BioControl and Disease Management in High Tunnels
Organic Production of Crops in High Tunnels

High tunnels are great for organic growers!!

Dr. Elsa Sanchez in the Horticulture Department has four high tunnels that she is certifying organic.
Marketing from High Tunnels
What do you think is the most frequently asked question about high tunnels?
What crops should I grow in a high tunnel?
The answer is market driven!!

You can grow almost anything in a high tunnel but can you sell it at a profit.
Vegetable Crops
Potatoes, Onions, Sugar Snap Peas
Tomatoes
Tomato Economics

Assumptions:
Costs for tunnel (17’ x 96’) same as for any high tunnel crop
Other costs same as for field production (trellis, fertilizer, trickle irrigation, etc.)
Breakeven cost is $0.36/lb.
# Profit Sensitivity

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<th>$/lb</th>
<th>$0.20</th>
<th>$0.40</th>
<th>$0.80</th>
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<td><strong>Lbs of Tomatoes</strong></td>
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<td><strong>Tunnel/yr</strong></td>
<td><strong>Profit/tunnel/yr</strong></td>
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<td>4200</td>
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<td>-$6.27</td>
<td>$1673.73</td>
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<td>-$766.27</td>
<td>$153.73</td>
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<td>-$686.27</td>
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Bramble Economics

Yield:
- Year 1 – 0.75 lb/ft of row
- Year 2 to 8 – 2.1 lb/ft of row
Life of planting is 8 years
Price received is $2.50/half-pt

Then profit is $942/tunnel, or $20,357 per acre
Bramble Economics

Assumptions:

Costs for tunnel (17’ x 96’) same as for any high tunnel crop

Other costs same as for field production (trellis, fertilizer, trickle irrigation, etc.)

Big cost – harvest labor at $0.50 per half-pint
# Profit sensitivity

<table>
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<tr>
<th>Half pts/ tunnel/yr</th>
<th>Profit/tunnel/yr</th>
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<tr>
<td>938 1.5 lb/ft</td>
<td>-$308</td>
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<tr>
<td>1250 2.1 lb/ft</td>
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<td>1563 2.5 lb/ft</td>
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<td>1875 3.1 lb/ft</td>
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$/half-pt: $2.00 $2.50 $3.00
Cut Flower Crops

Excellent Quality!!
Tree Fruit Crops

Potential for sweet cherries in tunnels but need to use a large single bay tunnel or a multi-bay tunnel.
Energy recovery of used agricultural plastics to heat a high tunnel
Other options for high tunnels

Taking a Model T Ford and making it a Cadillac…
Penn State Center for Plasticulture website:
http://plasticulture.cas.psu.edu
Publications available from the Penn State Center for Plasticulture:

High Tunnel Production Manual
Implementation of a BioControl Program for Insect Control in High Tunnels
Production of Vegetables, Strawberries, and Cut Flowers Using Plasticulture
Thank you and are there any questions!!

Bill
Kathy
Mike

Demo High Tunnel Next to the Franklin County Cooperative Extension Office