Basics of High Tunnel Caneberry Production

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Introduction

• What are high tunnels?
  – passively heated and ventilated, plastic-covered structures
  – that provide an intermediate level of environmental protection and control compared to open field conditions and heated greenhouses. (Source: Hightunnels.org)
Differences between high tunnels and greenhouses

High tunnels

Greenhouses
## Differences between high tunnels and greenhouses

<table>
<thead>
<tr>
<th>High tunnels</th>
<th>Greenhouses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Simple-low cost structure</td>
<td>Higher initial investment in structure, utilities and equipment</td>
</tr>
<tr>
<td>Passively heated and ventilated</td>
<td>Heaters, fans and cool cells</td>
</tr>
<tr>
<td>Usually one layer of plastic</td>
<td>Higher R-values</td>
</tr>
<tr>
<td>Relatively low R-value</td>
<td>Glass, multi layers of plastic with inflation</td>
</tr>
<tr>
<td>Used for season extension</td>
<td>Year round production</td>
</tr>
<tr>
<td>In ground production</td>
<td>Typically container production</td>
</tr>
<tr>
<td>Low operating cost</td>
<td>High energy consumption</td>
</tr>
<tr>
<td>Site may or may not need leveling</td>
<td>Higher maintenance operating cost</td>
</tr>
<tr>
<td></td>
<td>Site will likely need leveling and/or construction of a pad</td>
</tr>
</tbody>
</table>
Advantages of high tunnels for berry production

• Season extension/off season production
  – Advanced spring production by 2-3 weeks
  – Extend fall production by 3-4 weeks
• Reduced moisture on foliage
  – Lower disease potential
  – Reducing berry loss from rain damage
• Increased growth rates
  – Increased heat unit accumulation and retention
  – More even light distribution
  – Reduced plant stress
• Exclude insect pests
  – Screening for spotted wing drosophila

☑ Higher quality berries and increased yield
Site selection considerations

• Available space (dimensions)
• Direction of prevailing winds
  – Natural and man made wind breaks?
• Sunlight and shade
  – Incidence of sun’s rays
  – Tree lines and other structure
• Soil structure
  – Rock may prevent or alter installation of ground anchors

➢ Locate tunnel over soil with adequate texture, fertility and internal drainage
Site selection considerations

• Slope and external drainage
  – Prevent water infiltration from runoff
  – Will the site need to be leveled?
  – May choose high tunnel type that follows contour of the land

• Access to water for irrigation

• Ease of access to site
  – Transporting materials to and from the tunnel
  – Access to site and inside tunnel with equipment
Site Preparation and Construction
Tools and equipment

- Cordless screwdriver, hammer drill and bits
- Sledge hammer
- 100’ to 300’ tape measure
- String level or transit
- Ladder
- Auger
- Level
- Lift or tractor bucket

- Pry bar
- Skill saw
- Metal cut off saw
- Nylon string
- Ratchet and appropriate sockets
- Duct tape
- Bracing
- Trailer for flat work surface and bench
Components of high tunnels

• Three structural elements:
  – **Steel hoops** covered by greenhouse grade plastic
  – **Passive ventilation** through roll-up side curtains
  – Sited on **field soil**

http://www.hort.cornell.edu/hightunnel/structures/index.htm
Grower decisions

- **Types of tunnels**
  - Stationary vs. movable
  - Single bay vs. multi-bay
  - Architecture types
  - Manufacturers

- **Plastic**
  - Advantages vs. costs of various types

- **Ventilation**
  - Side walls (curtains)
  - End walls
High tunnel types

• **Stationary Tunnel**
  – Fixed location
  – Long term

• **Movable Tunnel**
  – Relocate
  – Seasonal rotation considerations
High tunnel types

Quonset (hoop-house) tunnels

• Single bay 12-40 feet wide
• Rounded steel arches
  – 11-12 gauge steel spaced 4-6 feet apart
• Two types of arches:
  1. Beginning at ground level give the tunnel a rounded structure
  2. Sit on straight, 4-6 foot-tall sidewalls
     ➢ Add height and allow taller crops to be grown in the rows along the walls

http://www.hort.cornell.edu/hightunnel/structures/index.htm
High tunnel types

Gothic style tunnels

• Single bay
• Peaked roofs
  – steeper roofs help manage snow loads
• Tend to be taller than Quonset tunnels
  – creates a more stable temperature regime during warmer months
• Require additional bracing (purlins) to withstand winds

http://www.hort.cornell.edu/hightunnel/structures/index.htm
High tunnel types

Multi-bay

- Used to cover larger acreages
- Several spans of arches connected by gutters at the roof seams
- No purlins or braces
- Not designed to withstand snow loads or high winds
  - Require removal of plastic during potential wind storms and offseason during periods of snow
- Tall enough to cover fruit trees
- Accommodate tractors and other large equipment
- Popular in Europe and California

http://www.hort.cornell.edu/hightunnel/structures/index.htm
http://farmtek.wordpress.com/2012/03/15/reasons-you-should-own-high-tunnel
## Pros and cons of high tunnel architectures

<table>
<thead>
<tr>
<th>Type</th>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quonset</td>
<td>• Least expensive</td>
<td>• Snow accumulation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Less space for equipment and crops next to side walls</td>
</tr>
<tr>
<td>Gothic</td>
<td>• Designed to handle snow loads</td>
<td>• More susceptible to wind damage</td>
</tr>
<tr>
<td></td>
<td>• More space for equipment and growing next to side walls</td>
<td>• More expensive than Quonset type</td>
</tr>
<tr>
<td>Multi-bay</td>
<td>• Best for large scale production</td>
<td>• Plastic roof cannot be left on year round</td>
</tr>
<tr>
<td></td>
<td>• Can accommodate tree fruits</td>
<td>• Expensive</td>
</tr>
<tr>
<td></td>
<td>• Enough space for equipment access</td>
<td></td>
</tr>
</tbody>
</table>
What type of material should you use for the roof?

- 4-6 mil, 4-year, greenhouse-grade poly
- Infrared light additives
  - provide excellent diffusion and
  - absorb and re-radiate infrared heat back down to the crop during the evening hours
- Different types of poly
  - Standard types can range in light transmission 80-90%
  - Anti-condensate film is ideal for preventing water droplets from dropping on plants
    - Drip control additive is incorporated throughout the film
    - Prevents water droplets from falling on plants (disease)

http://www.growerssupply.com/farm/supplies
High tunnel temperature control

- Ventilation
- Tunnel with Heat Conservation/Addition
- Frost Protection

Sunrise | Mid-Day | Sunset | Sunrise
---|---|---|---
80° | | | |
50° | | | |
30° | | | |
Frost protection

- A single layer of poly provides one hardiness zone of protection
- More protection may be needed

Tunnels-in-tunnels

Burners

Blankets
Ventilation

1. Manually rolled side walls
2. Roll-up side walls
3. Drop-down side walls

• Requires constant monitoring
• Temps can spike rapidly with sun
Temperature for Blackberries and Raspberries

• Ideal temp for growth: 55 – 80°F
• HT rules thumb
  • Over 50°F and sunny → OPEN
  • Under 50°F and overcast → KEEP CLOSED
  • Under 50°F and sunny → MONITOR
Temperature modification

- **Misting system – evaporative cooling**
  - Needs to be fine mist to not wet leaves
- **Shading (50% shade)**
  - Lowered blackberry yield
  - Increased raspberry yield by 30%
High Tunnel Weed Management

- Weed control
  - Weed barrier
  - Clean cultivation
- Reducing encroachment
High Tunnel Pest Management

• Screening for exclusion
  – Very effective control for Spotted Wing Drosophila
  – Increased temps
  – Decreased air flow

• Releasing beneficials

• HT Pests
  – Aphids, whiteflies, mites
Conclusions

• Evaluate tunnel costs and revenue by the sq. ft.
• Consider crop type(s), management and revenue potential
• High tunnels are NOT greenhouses
• Natural Resource Conservation Service (NRCS) EQIP Program
  – Allows growers to apply for cost-share of high tunnels
  – Must meet requirements (no guarantee)
• Structural integrity
  – Snow and wind
When disaster strikes!

http://www.extension.org/pages/18358/introduction-to-high-tunnels

http://3x3aquaponics.blogspot.com/2011/02/poor-mans-greenhouse-aka-high-tunnel.html
Manufacturers

Ledgewood Farm Greenhouse Frames
Rte 171
Moultonboro, NH 03254
603-476-8829

Rimol Greenhouse Systems Inc.
Northpoint Industrial Park
40 Londonderry Turnpike
Hooksett, NH 03106
877-746-6544

Greenhouse Supply Inc.
12 Acme Road, Suite 212
Brewer, ME 04412
800-696-8511

Haygrove Tunnels
694 Kraybill Church Road
Mount Joy, PA 17552
1-866-HAYGROVE
717-492-4955
harry.edwards@haygrove.com

Farm Tek
1440 Field of Dreams Way
Dyersville, IA 52040
1-800-327-6835

Walker Bros., Inc.
105 Porchtown Rd
Pittsgrove NJ, 08318
856-358-6493

Tunnel Tech
1925 Windham Rd. 19
La Salette, Ontario N0E 1H0
519-582-4424

Four Season Tools
9615 Grand View Rd.
Kansas City, MO 64137
816-444-7330
steve@smallfarmtools.com

Other high tunnel suppliers
M. Leonard (Piqua, Ohio)
Atlas Greenhouse Systems, Inc. (Alapaha, Georgia)
Conley’s Greenhouse Mfg. (Montclair, California)
CropKing, Inc. (Seville, Ohio)
GothicArch Greenhouses (Mobile, Alabama)
Grow-It Greenhouse (West Haven, Connecticut)
Hoop House Greenhouse Kits (Mashpee, Massachusetts)
Hummert International (Earth City, Missouri)
International Greenhouse Company (Georgetown, Illinois)
Jaderloon (Irmo, South Carolina)
Keeler Glasgow (Hartford, Michigan)
Ludy Greenhouses (New Madison, Ohio)
Poly-Tex Inc. (Castlerock, Minnesota)
Speedling Inc. (Sun City, Florida)
Stuppy Greenhouse Mfg. (Kansas City, Missouri)
Turner Greenhouses (Goldsboro, North Carolina)
XS Smith (Eatontown, New Jersey)
Zimmerman’s Welding (Versailles, Missouri) 573-378-4770