Design and Construction

Greenhouse Components - Ground Posts

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Greenhouse Components - Rafters or Bows

Greenhouse Components - Purlins and Ridge Cap
Greenhouse Components-Cross-Bracing
Greenhouse Components-Wind-Bracing
Greenhouse Components-Baseboards and hipboards
Greenhouse Components-Endwalls
Greenhouse Components-Plastic and Additives
Roll-Up Sides
Design Options

Stone Barns Center, NY

If you’re not the Rockefellers

3-Season

Hightunnel
Passive Solar Greenhouse

Site

Shading-Winter vs. Summer

Figure 1. Select location carefully. Note where the shade line occurs in both the winter and summer.

Shading and Spacing

Drainage
Water and Electric

Moveable vs. Stationary
West | Warm Season Crops | Cool Season Crops | East
--- | --- | --- | ---
Overlap at Center | Water Supply | Utilities | Room for tractors or winches
Rotation switches over years

Orientation

Determining Size
Width

Determining Size
Length

Altering Height
Soil Preparation-Cover Crops

Soil Preparation-Compost

Interior Considerations-Bed Layout

Percent Space Usage-60%-85% Range
- 30’ x 96’ = 2880 sq ft
- 8 beds x 2.5’ wide x 90’ long = 1800 sq ft
- 1800 / 2880 = 63% space use
- 8 x 2.5’ = 20’ for beds and 9, 1’ aisles
- or
- 5 beds x 5’ wide x 95’ long = 2375 sq ft
- 2375 / 2880 = 85%
- 5 x 5’ = 25’ for beds and 5, 1’ aisles

Interior Considerations-Inside Tent

Putting it Together
Tools

- Stakes
- Tape Measure
- Post Pounder or Sledge
- Level/Post level
- Transit, Laser or String level
- Electric Drill
- Wrenches and Sockets
- Saw
- Ladders
- Rope
- Tennis Balls

14 Steps to a Better Greenhouse

1) Check Elevation and Drainage

2) Square the Foundation

A Place to Start
3) Space and Pound Ground Posts

Leveling Ground Posts

Possible Sidetracks

Possible Sidetracks

Possible Sidetracks

4) Assemble Rafters
5) Place Rafters

6) Add Cross-Bracing (if needed)

7) Attach Purlins

8) Plumb the Structure and Ends

9) Attach Baseboards

10) Attach Hipboards
11) Build Endwalls, Doors, and Vents

Door Options

12) Install Wirelock or Lathe for Plastic

Attaching Endwalls

13) Cover with Plastic and Install Fan

Vents
Pulling Plastic

Attaching Plastic

14) Install Roll-up Sides

Review
- Be sure to know your:
  - greenhouse parts
  - production techniques
  - site selection and preparation requirements
  - Pythagorean theorem
  - 14 steps
  - physical and mental limits

Thank You!
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High Tunnels: Are They for You?

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High Tunnels: Are They for You?

Background Information
- high tunnel structures
- high tunnel versus other techniques, systems
- specific opportunities, requirements

STRUCTURES

Major HT Characteristics
- metal, wood, and/or PVC frame
- clear plastic cover (1-2 layers)
- soil floor (not required)
- peak height at least 8 ft
High Tunnel Costs
• depend strongly on size, design, features

will continue to change

chassis = frame, plastic, irrigation
High Tunnel Costs
chassis
+ repair/replace
+ climate control
+ labor

High Tunnel Costs
+ climate control
• ventilation
• raised beds, row covers
• sensors
• heating (temporary, permanent)

Major HT Materials Costs
• frame (material, durability, portability, number braces)
• film (number layers, type)
• end-, side-wall design
• climate control

High Tunnel Costs
• depend strongly on size, design, features
... in OH, new materials cost $2.38-7.24 (avg. $3.95/ft²)

High Tunnel Costs
• cannot be insured
• usually not taxed
(depends on local ordinances)
"Do not remove a fly from your friend's head with a hammer." - Chinese Proverb

HIGH TUNNEL VERSUS OTHER TECHNIQUES, SYSTEMS

Season Extension Techniques
- transplanting
- raised beds
- mulches, row covers
- protected culture
What makes high tunnels work?
Light carries heat. Enters, but does not leave HT. When dark, plastic limits heat loss to sky.

Natural Law

\[ \frac{\text{rate at } X + 10 \text{ temp}}{\text{rate at } X \text{ temp}} = 2 \]
OPPORTUNITIES

High Tunnel Use:
... can extend the season
(help farmers "sell high")

DISEASES INSECTS WEEDS
High Tunnels:
• protect crops
• save days

Most Current HT Users …
… also farm open fields
… grow vegetables
(use for other crops increasing)

RURAL, URBAN HT USERS

OH population density
254 people/mi²
High Tunnels: Are They for You?

Success with High Tunnels Requires ...

- system thinking, action

Approach has implications for high tunnel users.

High Tunnel Users

CONVENTIONAL ORGANIC SUSTAINABLE

BASIC REQUIREMENTS

LOW • FARM SIZE, INCOME • HT EXPERIENCE

Also vary in market approach (direct, wholesale, etc.) and location.

images courtesy Ken-Bar, MN Artists, The OSU
Success with High Tunnels Requires …

• system thinking, action
• money (build, maintain)
• fewer days off
• "babysitting": ventilate, irrigate
• specific equipment
• specific varieties, ICM practices

OTHER COMMENTS

Most high tunnel crops are grown in soil. Still, hydroponic and container production are options.

non-circulating, hydroponic, float-bed system

Many crops can be grown in a high tunnel. Some tend to be better suited for the system and more profitable.
Use of Grafted Plants may Enhance High Tunnel Production.

HT Production Profitable? Usually.

Grafting can:
• overcome breeding barriers
  ... time, money, technology

Goal: improve vigor, stress resistance, yield, quality

Grafting combines and secure...
**Grafting Application**
- greenhouse vegetables
- field-based vegetable production in Asia, areas of Europe

**For Wider Application ...**
- post-grafting environment ("take", shipment)
- economics (price, seedling-plant management)

**For Wider Application ...**
- rootstock-scion compatibility
- trait retention, enhancement under varying environments

**New Grafting Project**
"Grafting to improve organic vegetable production in field and high tunnels systems"

**SUMMARY**

*Image courtesy B. Bergefurd, OSUE*
High Tunnels 101

Goal
• balanced, introductory view of the pros and cons of high tunnel production of vegetable, fruit, flower and herb crops

Content – 25 FAQs
1. Factors to consider before buying a high tunnel
2. Preparing to build and building a high tunnel
3. Preparing to grow in a high tunnel

Questions?

First Things First
• Set your goals! How much do you want to sell? What do you want your income to be? How much can you grow?
• Market survey
  – What is our product?
  – Who/Which Market/Advantages/Disadvantage
  – Where
  – When
  – How much
  – Other marketers? How much competition? What kind?
  – Increasing business?
  – Price vs Quality
• Opportunities? What is my niche?

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Thank-you and Good luck!
### Planning, cont.
- What are our strengths?
  - How to maximize
- How close are we to markets?
- What are weaknesses
  - How to minimize?
- Will labor force change – more or less
- What skills do we have now
  - What skills do we need to add/learn

### Labor
- Who?
  - Family?
  - Long term
  - Year round?

### Specific Plan
- Space (available?) Can I Add more?
  - What is cost?
- Crop rotation
- Succession planting
- What my soil does well
- Labor
- Cost/Break even point

### Equipment
- Hand tools vs mechanical
- Hoes, shovels, harvester, water, sinks,
  - Seeders, rototiller, broadfork
- Packaging

### Options
- Restaurants
- CSA
- Co-ops
- Farmer’s Markets
- Wholesale

### CSA
- Advantage
  - Prepay
  - Planning/cost
  - No backing out
  - Product doesn’t have to be “perfect”
  - Minimal packaging
- Disadvantage
  - Keeping happy
  - Working with
  - exclusivity/other markets
  - Education “volunteers”
Restaurants

- Advantage
  - Price
  - Dependability
- Disadvantage
  - Timing
  - Delivery
  - Quality must be perfect
  - Invoicing

Co-op

- Advantage
  - Ready market
  - Little time spent to market/just deliver
  - Half wholesale – planning easier
- Disadvantage
  - Packaging
  - Wholesale pricing
  - Dependability

Farmer’s Market

- Advantage
  - As crop is available
  - Retail price
  - Consumer recognition/education
- Disadvantage
  - Display cost
  - Labor cost
  - No guaranteed sales/whim of weather

Restaurants

- Advantage:
  - High end – or local food
  - Relationship with owner/chef
  - Market/Advertise together
- Disadvantage
  - “perfect”
  - Dependability/Flexibility
  - Risk of not paying

What to grow

- What is market? Will the market take more?
- What can I do better than current distribution?
- How much does it cost? What is return?
- Do the crops I am passionate about.
  - Easier for me to market
  - Easier for me to grow

High Tunnel

- Season extension
- Crops to maximize income
  - Depends on market
  - Tomato, cucumber, onion, summer squash, melons, strawberries, raspberries, carrots
  - Head Lettuce, Mixed greens, spinach...
Crops

- Routine –
  - Spinach, lettuce, mixed greens
    - Local is “in”
- Specialty
  - Carrots, beets, potatoes
  - Lettuce
  - Herbs
  - Edible flowers

Pricing

- What is cost?
- What is break even point? Can I produce/sell that much?
- What will market pay? Why?
  - Quality
  - Local
  - Organic
- Promote your advantage

Hoophouse Tomato Production

Mike Roney
Tuttle Orchards

Purdue Extension

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