Email Questions to:
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Design and Construction

Greenhouse Components-Ground Posts

Adam Montri, Outreach Specialist
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Greenhouse Components-Rafters or Bows

Greenhouse Components-Purlins and Ridge Cap

Intro to Hoophouses and High Tunnels.
Presented by Matt Kleinhenz, OSU
Types of Hoophouses, Considerations before Purchasing, Installation
Presented by Adam Moreti, MSU
Maximizing Production to Meet Market Needs.
Presented by Susan Houghton, Michigan
Using High Tunnels to Meet Market Needs of Institutional Kitchens
Presented by Mike Roney, Indiana

Supported by USDA’s NCR Sustainable Ag Research and Education Program
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

Shading and Spacing

Drainage

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

Moveable vs. Stationary

- West: Warm Season Crops
- Cool Season Crops
- East: Room for tractors or winches
- Overlap at Center
- Water Supply
- Utilities
- 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
14 Steps to a Better Greenhouse

1) Check Elevation and Drainage
2) Square the Foundation
3) A Place to Start

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
- Pipe Wrench
- Post Hole Digger
- Metal File
- Framing Saw
- Battery Drill

\[ a^2 + b^2 = c^2 \]
3) Space and Pound Ground Posts

Leveling Ground Posts

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

Attaching Endwalls

Door Options

Vents

12) Install Wirelock or Lathe for Plastic

13) Cover with Plastic and Install Fan
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?

Matt Kleinhenz
Extension Vegetable Specialist
Horticulture and Crop Science
High Tunnels: Are They for You?

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

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

High Tunnel "Chassis"

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

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

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

SPECIFIC OPPORTUNITIES, REQUIREMENTS
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

High Tunnel Users

CONVENTIONAL ORGANIC SUSTAINABLE

Approach has implications for high tunnel users.

High Tunnel Users

LOW HIGH
• FARM SIZE, INCOME
• HT EXPERIENCE

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

BASIC REQUIREMENTS

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.

Many crops can be grown in a high tunnel. Some tend to be better suited for the system and more profitable.

Images courtesy B. Bergefurd, OSU
Use of Grafted Plants may Enhance High Tunnel Production.

Grafting can:
- overcome breeding barriers
  … time, money, technology
  Goal: improve vigor, stress resistance, yield, quality

HT Production Profitable? Usually.

input costs | gross returns
---|---

scion

combine and secure

rootstock

direct combination of traits
**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

**SUMMARY**
High Tunnels 101

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

High Tunnels 101

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

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THANK-YOU and GOOD LUCK!

QUESTIONS?

Market Planning
One Option

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?
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
MCL Restaurant & Bakery
Farmer Markets
Two locations in the Indianapolis Area
Summer 2007