

HIGH TUNNEL PRODUCTION AND MANAGEMENT

Gena Moore



CFSA's MISSION

We help people in the Carolinas grow and eat local, organic food by **advocating** for fair farm and food policies, **building** the systems that organic family farms need to thrive, and **educating** communities about local, organic farming.



CFSA PROGRAMS

FARM SERVICES: Technical assistance on organic production/ certification, food safety, seasonal high tunnel production, post-harvest handling, and selling into wholesale markets.

Elma C. Lomax Incubator Farm: Certified organic incubator farm in Concord, NC. That provides beginning farmers with access to land and equipment to start their own farm business. Onsite organic research program.



CFSA PROGRAMS

FOOD SYSTEMS: Provide business development assistance to farmers and businesses looking to supply the local food system.

EDUCATION: Host SAC, OCLC, and the Piedmont Farm Tour

ADVOCACY: We work to change agriculture laws and regulations to benefit local and organic small and mid-sized farms.



What is a high tunnel?



Benefits to high tunnel production

- Season Extension
 - Early spring, late fall, and winter production
- Lower input cost as compared to greenhouses
- Clean fruit/plants
- Protected from elements
- Reduced disease pressure
- Controlled growing environment

Drawbacks to high tunnel production

- Pollinator Exclusion
- Temperature Extremes
- Summer Heat
- Humidity
- Soil Health
- Maintenance Inputs

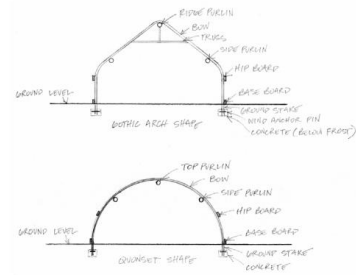


Timothy Coolong, University of Kentucky

CONSTRUCTION & ORIENTATION

Functionality

- Treated wood, un-treated wood, metal bottom bracing
- How deep are the side posts buried?
- Side wall height: 5ft or greater side wall height is best
- V vs W bracing
- Solid end walls vs soft end walls
- Doors
- Vents
- Shade cloth



8 ft. Arch Spacing

5 ft. Arch Spacing

Standard High tunnel (8' sidewall height)			
30'x48'	\$3,107	30'x50'	\$3,554
30'x60'	\$3,685	30'x60'	\$4,070
30'x72'	\$4,188	30'x90'	\$4,637
30'x90'	\$5,341	30'x90'	\$5,961
30'x120'	\$6,406	30'x120'	\$7,218

Y-Truss High tunnel (8' sidewall height)			
30'x48'	\$3,340	30'x50'	\$3,828
30'x60'	\$3,997	30'x60'	\$4,384
30'x72'	\$4,575	30'x90'	\$5,051
30'x90'	\$5,828	30'x90'	\$6,406
30'x120'	\$7,071	30'x120'	\$8,000

W-Truss High tunnel (8' sidewall height)			
30'x48'	\$3,500	30'x50'	\$4,027
30'x60'	\$4,195	30'x60'	\$4,700
30'x72'	\$4,852	30'x90'	\$5,352
30'x90'	\$6,255	30'x90'	\$6,988
30'x120'	\$7,577	30'x120'	\$8,487

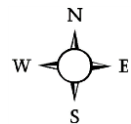
2.5" diameter side poles (13 gauge steel) are set in ground 22 inches

Zimmermans High Tunnels

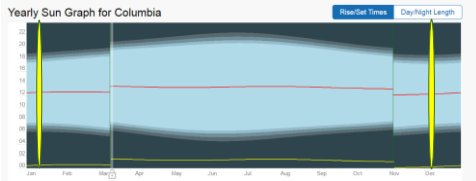
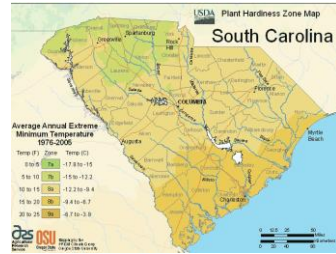
http://www.zimmermanshightunnels.com/main/page_pricing_high_tunnel_pricing.html

Orientation and Geography

- We are south of 40° Latitude so orient the ridgeline of your tunnel North to South
- Shading
- Wind
- High vs Low Land
- Access to water



MICROCLIMATE



Get To Know Your Tunnel

- Every high tunnel is going to be a little bit different
 - How big is your tunnel?
 - How many layers of plastic?
 - Are you using row covers?
 - How do you irrigate?
- Every area/farm has a unique climate
 - What is your USDA Hardiness Zone?
 - Is wind an issue?
 - How much sun/shade does your tunnel receive and when?
- These factors (+ your management practices) create your high tunnel microclimate!



High/Low thermometers range from \$10 to hundreds of dollars. This digital one cost \$25. It provides relative humidity as well!



Soil temperature probes are helpful since many plants root systems are sensitive to cold soils. This is a very basic one, great and only \$9.

HIGH TUNNEL MANAGEMENT

Key management practices

- Variety Selection
- Early/Late Season Production
- Row Covers
- Shade Cloth
- Pruning
- Crop Rotation
- Cover Crops
- Irrigation
- Trellising
- Temperature Management



Variety selection

Cool Season

- Spring
 - Bolt resistant varieties
- Summer
 - Heat loving varieties
- Fall
 - Cold loving varieties
- Winter
 - Day neutral OR extend the harvest with cold loving varieties

Warm Season

- Spring
 - Indeterminate tomatoes
 - Early producers
- Summer
 - Usually carrying through spring plantings
- Fall
 - Determinate tomatoes
 - High disease resistance varieties

What about transplants?

- This is a particular challenge for high tunnel production
 - Not readily available for season extension plantings
 - Specific varieties are not available
- Grow you own
 - Need a growing environment like a green house or grow room
 - Time and materials
- Buy
 - Order from transplant suppliers
 - Banner Greenhouses in Nebo NC
 - Sprout in Barnwell, SC

<https://www.carolinafarmstewards.org/successful-transplant-production/>

Medium Weight Row Cover

- Thick fabric
- High light penetration (70%)
- Good frost protection
- Overwintering
- Avoid soggy row covers by mulching aisle ways



NC A&T University

Shade Cloth

- Used on:
 - Green houses
 - High tunnels
 - Low tunnels
- Inhibits light penetration
- Lessens greenhouse effect in tunnels
- Different weights available



<http://www.johnnyseeds.com/p-8450-knitted-shade-cloth-50-shade-10-x-100.aspx>

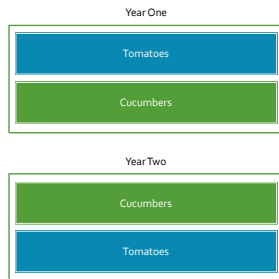
Pruning and culling

- Increases ventilation
- Reduces disease
 - Reduces spread of disease
- Reduces pest pressure
- Easier harvesting
- Healthier plants!



Crop Rotation

- Why?
 - Soil health
 - Disease
- Monoculture
 - Whole tunnel rotation
 - Tomato and lettuce
- Section or row crop rotation
 - Integrate as possible
- Example: Rotating Nightshades and Cucurbits



Cover Crops

- Why?
 - Soil health
 - Beneficial's
 - Crop rotation
- Entire tunnel cover cropping
 - Done during fallow production time (summer)
- Section or row cover cropping
 - Permanent beds



Irrigation

- Basics
 - Drip is best
 - Plants can be placed at each emitter
 - Needs: pressure reducer, filter, fittings, injection system
- Over head is necessary for cover crops. Install above the maximum height of the cover crop and irrigate as needed.
- Higher pressure is needed to run these



<https://www.carolinafarmstewards.org/high-tunnel-micro-irrigation-guide/>

Trellising

- Proper trellising makes management easy
- Less Inputs
- Choices
 - Roller hook/line trellising
 - Florida weave
 - Cages
 - Single stakes
 - Mesh wire/fence



Ventilation tips

- Opening and close sides at appropriate times can be critical to plant health and quality of produce
- Ventilation practices will depend on the crop. Warm season vs Cool season
 - Warm season: base temperature of 50°F
 - Cool season: base temperature of 40°F
- Cold damage
 - Warm season: anything at or below freezing
 - Cool season: typically at or below 25°F but it varies
- Humidity! Vent the tunnel to decrease humidity and leaf wetness

Ventilation Continued

- Optimizing solar radiation and heat accumulation
- Close the sides in the evening soon enough to trap in some heat for that long cold night
- Heat accumulates fast during sunny conditions so get those sides up early
- Avoid high leaf wetness and humidity while maintaining heat can be difficult
- Vent the tunnel during high moisture conditions even if it's a little chilly, you need the air movement

Management Effects on Planting Dates

- How much work are you willing to put in?
- Row covers can be labor intensive
- Will be around to close the tunnel if the afternoon turns chilly?
- Think about how much time you want to put into this. Intensively managing high tunnels means work twice a day EVERY DAY; no excuses, vacations, or sick leave.
 - If you want a less intensive approach, choose "safer" planting dates.

CFSA's Consulting Services: Organic Certification



Organic Transition: guidance choosing a certifying agent and record keeping system, Q&A on NOP regulations, and records and application review.

- **Conservation Activity Planning (CAP-138):** a farm resource inventory, identification of resource concerns and options to address them, a soil and water quality impact analysis for each option.



CFSA's Consulting Services: Production

High Tunnel Production: Help farmers identify best management practices including planting dates, varieties selection, and irrigation, soil fertility and pest management.



Good Agricultural Practices (GAP): Conduct risk assessments, identify ways to mitigate pathogen risks, review Food Safety Plans, and provide assistance preparing for an audit.

CFSA's Consulting Services: Wholesale Readiness

Building Wholesale Capacity: Help farmers assess wholesale readiness and understand post-harvest handling infrastructure, packaging, labeling, traceability, transportation and basic food safety norms to meet wholesale requirements



DISCUSSION

Thank You!