

A Little About You

- Who Has High Tunnels/Hoophouses?
 > 1?
- # Months Are You Farming?
- # Months You Want To Farm?
- Markets
- Farmers Markets
- CSA – Restaurants
- Chocom Sto
- Schools or Childcare Facilities
- Other Institutions (Hospitals, etc.)

A Little About Me

- Michigan State University
 - Hoophouses for Health
 - + Farmer access to \$
 - + Access for vulnerable youth and families
 - Have the \$ work 2x
 - Online High Tunnel Course

• Ten Hens Farm





















Existing Site

Little additional prep of production site if

 Weeds have been managed well
 Soil organic matter is high

Prepping a New Site

- Begin early (1+ year before if possible)
 Make site several feet larger than the hoophouse footprint in all directions
- Cover crop if possible
- Goal is a weed free site with high organic matter and good soil structure

Initial Sod Plowed and Tilled





Rye with Frost Seeded Clover



Mowing Rye

Tilled Footprint





Compost Additions



Pre-Build Soil Goals

- Perennial weed management
- Increase organic matter
- Improve soil structure
- Manage drainage and excess water

Post Build Soil Management



The High Tunnel Situation

- (Mostly) Closed System
- Limited Rotations
- Not much Leaching (Impact?)

Great Lakes Watershed Water

- 300 ppm Bicarbonate
- 100 ppm Calcium
- 25 ppm Mg
- Translation: No Leaching = Liming (+pH) Ca:Mg (Mg +), Gypsum additions

Compost

- Plant-based compost
- Application Rates and frequencies
- Application Options

Compost Application Rates

- 3 yds³ per 30 X 96 foot house per crop
- 3X per year
- \$20/yd³ delivered @ 9/yr = \$180/tunnel/ yr
- ~0.5 in/year



Moving Compost



Soil Prep - Broadfork



Soil Prep – Walk Behind





Compost by plant



Additional Soil Amendments

- Blood Meal 25 lbs
- Bone Meal 50 lbs
- Potassium Sulfate 25 lbs
- Gypsum (if needed): 4-5 pints/100 ft2 (1/yr)
- Per 30 X 96ft tunnel (5 beds at 4 X 88ft)
- Yields and crop visuals as guidelines (with experience)

Soil Health: Crop Rotation

- The Brassica Challenge
- Time vs. # of crops considerations
- Incorporation vs. residue removal
- Niche or other crops for rotation

	Beds	%	Space	Bed	s 9	Space	
	Fall Early-long resid	dency		Spring Early -			
	Scallions		3.0%	BLSM		12.1%	
	Carrots		3,0%	Lettuce		11.4%	
August	Kale			chard		3.8%	
Planting	Chard		5.3%	kale		3.8%	February
	Collards		3.0%	collard		2.3%	Planting
	Parsley		3.0%	spinach		3.8%	
				Carrot		3.8%	
	Fall Late-Long Resi	dency		radish		2.3%	
	BLSM			beet		2.3%	
	Fall Late-Short Res	idency		umip		2.3%	
	Lettuce		13.6%	scallions		3.0%	
September	Spinach		13.6%				
Planting	Radish		5.3%	Spring Late-Summer Residency			
	Tumip		3.0%	Tomato		15.2%	
	Cilantro		3.0%	Pepper		7.6%	April
	Choi		3.0%	Eggplant		7.6%	Plantin
	Tatsoi		3.0%	Cukes		7.6%	
	Komatsuna		3.0%	SumSquash		7.6%	
	Napa Cabbage		3.0%	Beans		3.8%	

Pest and Disease Management Principals

- Identify the concerns
- Manage the environment
- Scout for early identification
- Take action early

Approaches to Pest (and Disease) Management

- Cultural Cultivar selection; moisture and fertility
- Physical/Mechanical Barriers and cultivation
- Biological Attracting, releasing or applying biological agents; organic matter management
- Chemical Sprays or other chemical applications
- Economic thresholds for action

Cultural

- Select cultivars/varieties for disease resistance
- Crop Rotation
- Moisture Management (especially on foliage)
- Sanitation
- Fertility management



Aphids



Cultural – Ant control Clean transplants

Physical/Mechanical – Clean transplants Water sprays

Biological – Lady Beetles, Parasitic Wasp

Chemical – Insecticidal Soaps

Releasing Predators and Parasites



Tomato Hornworm



Cultural – Rotation (Pupae Overwinter) Tillage

Physical/Mechanical – Row covers or tunnels Hand removal (at scale)



Biological– Bacillus thuringiensis (bT)

hemical – Spinosad

Parasitized Hornworm



DO NOT THROW OUT!

Striped and Spotted Cuc Beetle



Cultural – Bac. Wilt Resistant Cultivars Long distance rotation

Physical/Mechanical – *Insect netting* Row covers or tunnels Trap crops (then tilling)



Biological – Parasitic nematode for larvae

Chemical – Kaolin Clay

Insect Netting for Cucumber Beetles



Colorado Potato Beetle



Cultural – Rotation Weed control

Physical/Mechanical – Straw mulch Hand picking (on scale)

Biological– Parasitic fly (2) Parasitic Wasp

Chemical – Spinosad bT





Cultural – Weed control Till in debris

> Physical/Mechanical – Row covers or tunnels

Biological– bT

Chemical – Spinosad

Squash Bugs



Cultural – Rotation Plow debris

> Physical/Mechanical – Row covers or tunnels Trap crop

Biological– Tachinid fly

Chemical – Kaolin Clay



Flea Beetles



Cultural – Straw Physical/Mechanical – Row covers or tunnels

Biological– Braconid wasp



Chemical – Spinosad





Groundhogs or Woodchucks



Potential High Tunnel DiseasesBacterial (Few)Fungal (Most Common,
esp. Winter)- Wiltesp. Winter)- Canker- Powdery Mildew- Speck- Downy Mildew- Spot- Anthraenose- Spot- Early and Late Blight
- Gray Mold (Botrytis)Viruses (Few)- Selerotinia- TSWV- Phytophthora
- Phytophthora- TMV- Septoria
- Cercospora







White Mold (*Sclerotinia*) - Lettuce and other salad



Cultural:
Rotation
Soil moisture mgmt.
Foliar moisture/
humidity Plant density
Removal

Chemical: - Oxidate

Symptoms: Lesions with rotting stems leave tissue, white growth



- Copper - Potassium Bicarbonate

Symptoms: White, powdery leaf surface or Sporangiophores

Anthracnose -Tomato, Cucumber

Cultural:



Moisture management Trellising and pruning Airflow

Chemical: Prevent spore formation - Sulfur - Copper

Symptoms: Small, sunken lesions followed by black fungus



Symptoms: Small spots on leaves followed by lesions on stem

Cultural: - Moisture management - Sanitation - NO potato cull piles - Rotation - Pruning (tomato) - Resistant Varieties - Tunnels Charming Chemical
Copper hydroxide
Oxidate
Serenade (B. subtilis)

Gray Mold (Botrytis) Tomato, Lettuce, Raspberries



- Moisture management

• Cultural:

• Chemical: - Copper hydroxide

Symptoms: Lesions on leaves and stems turning to fuzzy gray mold



Phytophthora, Fusarium, Phythium, Rhizoctonia -Pepper, cucurbits, melons, potato · Cultural: - Moisture management -Rotation · Chemical: - Oridate

Chemical:
 Oxidate
 Rootshield

Symptoms: Damping-off, wilt (because of root damage/death)



Cercospora Spinach, beets, chard



Cultural: - Moisture management - Mulch (to limit splashing)

Chemical: - Copper

Symptoms: Small, circular, dark lesions with yellow halo

Tomato Leaf Mold



Review for Pest and Diseases

- Scout and identify
- Set economic thresholds...
- ...and take action EARLY
- Manage soil and air moisture levels
- Remove or deep plow/till diseased tissue
- Rotate crops

