


High Tunnel Cucumber Production



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Outline

- Introduction
- High tunnels for cucumbers
- Cucumber cultivars and types
- Preparing the tunnel for a cucumber crop
- Starting seeds and transplants
- The growing environment
- High tunnel cucumber culture
- Pest management

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Introduction

- Why grow cucumbers in a high tunnel?
 - profitable crop, especially “out of season”
 - higher yields
 - improved fruit quality
 - fewer culls
 - reduction in pesticide applications.

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High Tunnels for Cucumbers

- Customizing the high tunnel for cucumbers
 - Consider structural bracing
 - 4 season vs 3 season
 - Gothic or sidewall vs quonset styles
 - Double layer of plastic
 - Buried insulation around high tunnel
 - Supplemental heat

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Cucumber Types and Cultivars

- Cucumber traits of interest

- **Gynoeious** – all of the flowers produced by a plant are female

- Useful with pruned plants
 - Tend to yield better than monoecious cultivars



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Cucumber Types and Cultivars

- Cucumber traits of interest

- **Parthenocarpic** – the ability to set fruit without pollination

- Useful with gynoeious cultivars
 - Can result in seedlessness



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Cucumber Types and Cultivars

- Cucumber traits of interest

- **Single vs multifruited**

- Single fruited – best for large fruited cultivars
 - Multifruited – desirable for small fruited cultivars



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Cucumber Types and Cultivars

- Cucumber traits of interest

- **Disease resistance**

- Powdery mildew resistant



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Cucumber Types and Cultivars

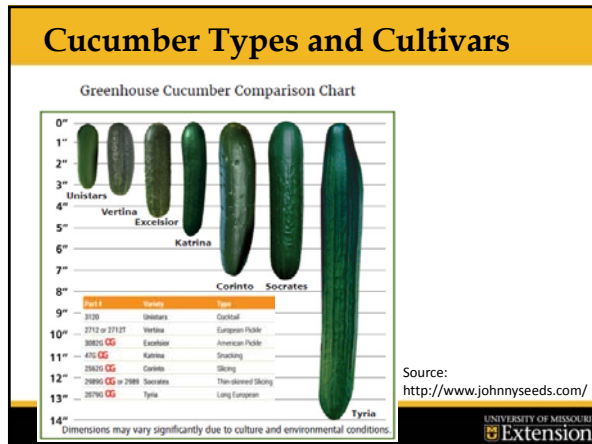
- American slicing
 - Medium to large fruit
 - Medium bumps and spines
 - Thick skin, some bitterness
- Pickling
 - Small to medium fruit
 - Medium bumps and spines
- Cocktail
 - Small fruit
 - Thin skins, lack of spines, crunchy

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Cucumber Types and Cultivars

- Long European
 - Long, thin fruit
 - Thin and smooth skin
 - Few or no seeds
 - Good in greenhouses, caution in high tunnels
- Beit alpha
 - Medium fruit
 - Thin and smooth skins, crisp flesh texture
- Asian
 - Medium to long fruit
 - Skin spiny, thicker skin than other long types

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- ### Cucumber Types and Cultivars
- What type of cucumber to choose
 - Market interest
 - Type of tunnel
 - Production cycle
 - Rotation of the tunnel into another crop
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Cultivar	Type	Gynoecious	Parthenocarpic	Disease Resist.
Corinto	Slicing	yes	yes	PM
Diva	Slicing	yes	yes	PM
Excelsior	Pickling	yes	yes	PM
znik	Cocktail	yes	yes	PM
Katrina	Slicing	no	yes	PM
Isboa	Slicing	no	yes	
Manar	Beit alpha	no	yes	PM
Manny	Beit alpha	no	yes	PM
Picolino	Cocktail	no	yes	PM
Socrates	Beit alpha	no	yes	PM
Sweet Success	Long European	yes	yes	
Taurus	Long European	no	yes	PM
Tyrin	Long European	yes	yes	PM
Unistars	Cocktail	yes	yes	PM
Vertina	Pickling	no	yes	PM

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- ### Crop Timing/Cycles
- High wire
 - Long season cropping schedule
 - Often two crops per year
 - Umbrella
 - 3-4 crops per year
 - Each cycle 3-4 months in length
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- ### Preparing the Tunnel
- New tunnel
 - Submit a soil test and make adjustments as recommended
 - Supplement soil OM with compost
 - If you had a crop previously in the tunnel
 - Clear away all debris
 - Soil test with salts test included
 - Cover crop? Plastic removal to allow for rainfall? Rotation?
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- ### Starting Seeds and Growing Transplants
- Start seedlings in a separate, temperature and light controlled chamber
 - All supplies and media should be sterile and new, or thoroughly sanitized
 - Use 48-50 cell trays or medium soil blocks
 - Germination conditions
 - 80-85°F for optimum germination; 73-76°F day/70°F night for seedling growth
 - 1000-1500 footcandles of light
 - ventilation
 - Transplant when seedlings have 2-4 true leaves
 - 3-4 weeks from seeding to transplanting into the high tunnel
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The Growing Environment

- Supplemental heat
 - use vented heaters only
 - Make sure that vents are tight and draw well
 - Heat distribution is important
- Consider row covers inside the high tunnel for early tomatoes

High Tunnel Cucumber Culture

- Planting design
 - 18-24 inches between plants
 - 4-5 feet between rows
- Raised beds - 8-10" high with 30-36" width at the top
- Drip irrigation - 8 or 10-mil tape is acceptable with drippers spaced 4-12" apart. A drip system operates at 8-15 psi pressure.
- Floor management – cover with mulch, plastic, weed barrier, or leave bare



High Tunnel Cucumber Culture

- Establishing a planting
 - Transplanting
 - 3-4 weeks after seeding
 - Have supplemental heat available for early plantings




High Tunnel Cucumber Culture

- Temperature management
 - First week after transplanting: 73°F to 77°F during the day and night
 - After the first week: 73°F to 77°F during the day, 70°F to 73°F night
 - Harvest: 70°F to 75°F during the day, 63°F to 68°F night


High Tunnel Cucumber Culture

- Umbrella trellising
 - Works well in lower structures
 - Less labor
 - Early in the cycle – only pruning
 - Later in the cycle – only harvesting
 - Shorter production cycles
 - Greater establishment costs for multiple production cycles
- High wire trellising
 - Top wire of at least 9 feet
 - More labor requirements – picking and pruning at the same time
 - Higher overall yield
 - Higher quality fruit





High Tunnel Cucumber Culture

- Choosing a training system
 - Is your structure tall enough to accommodate high wire training?
 - How much labor do you want to put into the crop?
 - Umbrella – 100 hours/acre/week
 - High wire – 140 hours/acre/week
 - What are your personal preferences?
 - Both systems can be profitable!




High Tunnel Cucumber Culture

- Why prune cucumbers?
 - More consistent yield
 - Higher overall yields
- A typical cucumber node
 - One sucker
 - One flower/fruit
 - One tendril
 - One leaf

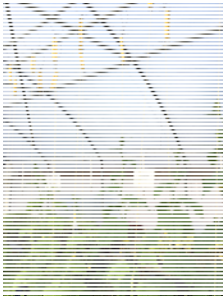

High Tunnel Cucumber Culture

- Fruit pruning
 - Large fruited cultivars
 - Remove fruit from the first 2 feet of the vine
 - Later allow one fruit per node
 - Smaller fruited cultivars
 - Set fruit freely from the beginning



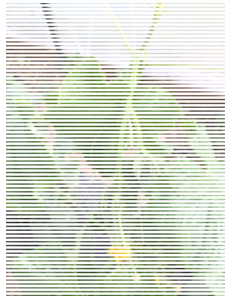

High Tunnel Cucumber Culture

- Pruning for high wire trellising
 - Each plant has a twine attached to a spool that is hung from the top wire
 - Vines are twisted around the twine or clipped to the twine
 - Remove sucker and tendril from each node

High Tunnel Cucumber Culture

- Pruning for high wire trellising
 - Plants are lowered and leaned when the vines reach the wire
 - Remove foliage from the lower stem
 - Maintain a sucker to replace the main stem if needed

High Tunnel Cucumber Culture

- Pruning for umbrella trellising
 - Vines are twisted around the twine or clipped to the twine, which is attached to a top wire
 - Remove sucker and tendril from lower nodes
 - Retain the top 3 suckers as the vine approaches the top wire



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High Tunnel Cucumber Culture

- Pruning for umbrella trellising
 - Cut off the main vine just above the top wire
 - As the laterals (suckers) grow out, guide them over the top wire for support
 - Allow the suckers from the laterals to develop
 - Pinch the tips of the original laterals when 3-4 feet from the ground

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Cucumber Fertility Management

- Before transplanting
 - Collect and submit soil sample
 - Adjust soil pH as recommended using lime, broadcast over the tunnel, and incorporated into the soil
 - Use dolomitic lime if Mg is deficient
 - Add micronutrients, if indicated by soil test and previous foliar analyses

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Cucumber Fertility Management

- Preplant N application, in advance of bedding and laying plastic (based on soil test)
 - Soil test report will have a seasonal nitrogen recommendation, based on crop, soil type and soil organic matter content
 - Apply 50 lbs/acre nitrogen preplant
 - Consider a non-ammoniacal form – calcium nitrate

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Cucumber Fertility Management

- Preplant K and P application, in advance of bedding and laying plastic (based on soil test)
 - Soil test report will have a seasonal potassium recommendation
 - Apply recommended amount preplant
 - Consider potassium nitrate (16-0-44) and superphosphate (0-46-0)

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High Tunnel Cucumber Culture

- Fertigation
 - Apply 5 to 10 pounds of nitrogen per acre per week during fruit production
 - Monitor fertility program with foliar analysis, and adjust as needed
 - Apply micronutrients as indicated by foliar analysis and plant observations

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Pest Management

- Disease problems
 - Powdery mildew
 - Bacterial wilt
 - Other diseases
- Arthropod problems
 - Cucumber beetles
 - Thrips and whiteflies
 - Spider mites

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Pest Management

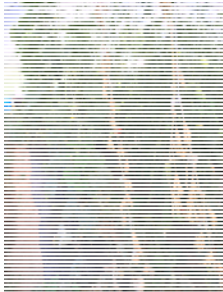
- Powdery mildew



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Pest Management


- Bacterial wilt



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Pest Management

- Cucumber beetles



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Pest Management

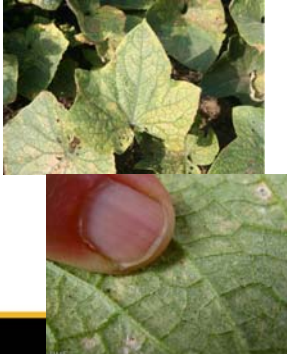
- Thrips and whiteflies



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Pest Management

- Spider mites



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Pest Management

- IPM strategies
 - Plant resistant cultivars
 - Proper plant and row spacing
 - Pruning and leaf removal
 - Manage humidity in the high tunnel – vent as needed
 - Consider using anti condensate thermal plastic film to reduce dripping
 - Screening to exclude insect pests
 - Biological controls
 - Pesticide applications

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High Tunnel Cucumber Culture

- Fruit harvest
 - Harvest when horticulturally mature
 - Harvest before fruit begins to bloat
- Postharvest handling
 - Thin skin fruit – wrap with plastic to prevent dehydration
 - Store at 55°F to 57°F and 95 percent humidity
- Expected yields – maximum 10-12 lbs/plant

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Any Questions?

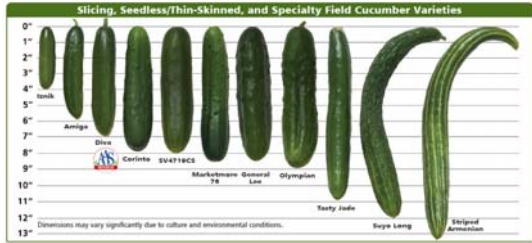


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Cucumber Types and Cultivars

Slicing, Seedless/Thin-Skinned, & Specialty Varieties Comparison Chart



Dimensions may vary significantly due to culture and environmental conditions.

Source: <http://www.johnnyseeds.com/>

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High Tunnel Tomato Culture

- Training indeterminate cultivars
 - Attach clips under a leaf – not under the flower cluster or fruit that can cause damage.
 - Once per week, either add a plant clip or twist string around the stem, always in the same direction; use a clip every 3-4 leaves
 - Drop the plants when the terminal reaches the desired height

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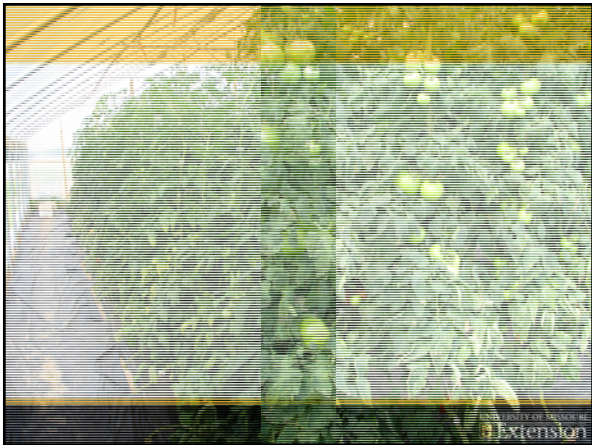


High Tunnel Tomato Culture

- String bobbins
 - Wind with 20-30 feet of plastic twine




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High Tunnel Tomato Culture

- Pruning indeterminate cultivars
 - Wait until the first fruit truss has fruit the size of a nickel
 - Going down, skip one sucker branch and prune out everything below
 - Indeterminate cultivars may be trained to one or two leaders
 - Continue to remove suckers as fruit trusses are harvested – prune every 3-4 days






High Tunnel Tomato Culture

- Pollination
 - Tomatoes are self pollinated, but pollen must be loosened from the stamen and dusted on the stigma
 - Hand pollination
 - Daily if possible
 - Between 10am and 3 pm
 - Bumblebee pollination
 - Place hives at first bloom
 - Hive is active for 6-10 weeks
 - Flowering to harvest = 45 days




High Tunnel Tomato Culture

- Thinning fruit
 - Thin clusters to 3-4 fruit (large fruited cults) or 4-5 fruit (medium fruited cultivars)
 - Thin once per week

High Tunnel Tomato Culture

- Leaf removal
 - Makes plants more manageable
 - Improved air movement
- With indeterminates, remove leaves before leaning and lowering the plants
- Remove 4-6 of the oldest leaves

High Tunnel Tomato Culture

- Preplant N application, in advance of bedding and laying plastic (based on soil test) – **organic production**
 - Composted manure is the best source of nutrients for organic production in tunnels
 - Composted dairy manure: 2700 lbs of compost (fresh weight basis) per 1000 square feet.
 - Composted poultry manure: 900 lbs of compost (fresh weight basis) per 1000 square feet
- Based on supplying about 100 lbs of available N per acre
 - assume 30% total N is available for poultry compost or
 - 14% of the organic N is available for dairy compost.
 - A moisture content of 55%

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High Tunnel Tomato Culture

- Preplant P application, in advance of bedding and laying plastic (based on soil test)
 - Soil test report will have a seasonal phosphorus recommendation
 - Apply all of the recommended amount preplant
 - Consider superphosphate (0-46-0)

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High Tunnel Tomato Culture

- Starter solutions at transplanting
 - Use a fertilizer that has a N:P ratio of 1:3 and no K; example is 10-34-0
 - Typical starter solution: 3 lbs of 10-34-0 in 50 gallons of water
 - Apply ½ pint per plant at transplanting

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High Tunnel Tomato Culture

- Fertiligation
 - Monitor N and K fertility program with foliar analysis, and adjust as needed
 - Apply magnesium (as epsom salts) as indicated by foliar analysis
 - Apply micronutrients as indicated by foliar analysis and plant observations

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High Tunnel Tomato Culture

- Fertility management
 - Foliar testing
 - Tissue analysis is the only way to know if your fertilizer program is optimized.
 - Send in 10 to 12 full-sized leaves taken randomly from the high tunnel.
 - Choose leaves from the same location on each plant so they are all the same physiological age –
 - the eighth fully expanded leaf from the top, or
 - the leaf opposite a golf-ball sized fruit.
 - Consider paired samples if you are investigating a problem
 - Submit to a tissue testing lab: MU Plant Testing Lab <http://soilplantlab.missouri.edu/soil/plantsamples.aspx>

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11-139-7002
1234
May 24, 2011
May 19, 2011

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PLANT ANALYSIS

SAMPLE ID	REPORT OF ANALYSES PERCENT						REPORT OF ANALYSES PARTS PER MILLION					
	N	P	K	Ca	Mg	Other	N	P	K	Ca	Mg	Other
TOMATOES	3.77	0.34	2.08	0.23	1.72	0.99	0.022	102	150	36	9	21
TOMATOES	1.1	0.1	0	0	0	0	0	0	0	0	0	0
ALFALFA	4.4	0.45	3.30	0.88	2.00	0.90	0.080	150	185	52	20	80

The nutrient levels are slightly lower for top production. You should be adding a mixture of nitrogen, potassium, magnesium, and calcium with some zinc. Boron and copper can be added if already part of your program.



Pest Management

- Other issues
 - Blossom end rot

