Growing Vegetables in the Winter

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Opportunity

- Season extension and out of season growth
 - Maximum yield and increased quality
 - Less insect and disease pressure
- Organic
- Locally grown
- Tunnels and row covers are a low cost method for season extension











What to Grow

- Important to select plant types based on marketability and economic viability
- Select varieties that are suitable to your area
 - Seed packs, hardiness zone maps, other growers
- Consider diversity in your product offering
- Production, harvest and postharvest considerations
- Educate yourself







What to Grow

- Cole Crops
 - Kale, collards, cabbage, kohlrabi
- Spinach
- Onions
- Swiss Chard
- Boc Choi
- Radish
- Beets
- Carrots
 - http://organics.tennessee.edu/pdf/Cool%20Season%20Specialty%20Crops%20in%20High%20Tunnels.pdf
- Herbs
 - https://www.uky.edu/ccd/sites/www.uky.edu.ccd/files/hightunnelgreens.pdf
- Lettuce
 - <u>https://vegcropshotline.org/article/facts-about-lettuce/</u>









What to Grow

- Seed sources
- Making transplants
- Media
- Plastic
- Soil blocking
- Greenhouse or growroom











How to grow

- High tunnel or hoop house
- Greenhouse
- Row covers













Row Covers

- Floating or hooped
- Can provide protection from weather and insects
- Various construction
 materials











Frost Protection Fabric

Needs way to cool

Polyethylene (plastic) Polypropylene fiber

"Reemay", "Agribon"





Weights per Sq yard	Protection Provided	Light Transmission		
Lightweight 0.6 oz	Down to 27 ⁰	Transmits 85%	Lowers moisture loss Promotes better growing conditions in early spring	
Medium 1.0 oz	Down to 24 ⁰	Transmits 70%	Reduces winter kill form desiccation Porous to air and water, transmits 70% light Moderate freeze protection	
Medium 1.2 oz	Down to 22 ⁰	Transmits 60%	Intermediate weight Porous to air and water, transmits 60% light. Added freeze protection	
Heavy 1.5 oz	Down to 20 ⁰	Transmits 50%	Porous to air and water, transmits 50% light. Strong and durable for repeated use Heavier freeze protection	
Heavy 1.8 oz	Down to 18 ⁰	Transmits 40%	Porous to air and water, transmits 40% light. Maximum strength and durability Maximum freeze protection	



Considerations with Row Covers

- Can be reused
- Use sharp scissors
- Make sure to secure properly
- Vent as necessary
- Trapped pest populations can grow quickly
- Remove when flowering
- Heavier fabric = more shading
- Still get weeds in spring not as much in fall under cover
- Rips happen especially with lighter cover
- Store carefully









High Tunnel

- Resembles a conventional greenhouse
- Crops are grown in the soil
- Season extension
 - Spring earliness
 - Fall extension
- Protects crops from adverse environmental conditions

















USDA-NRCS High Tunnel System - Environmental Quality Incentive Program

- Financial assistance is provided on SF basis up to \$10,000 per year
- Planting must be in soil or raised beds
- Structure peak height must be at least 6'
- 6 mil UV resistant cover
- Electricity and irrigation are allowed
- Located on land that is growing or has grown a typical high tunnel crop
- Contact your local NRCS office or go to:
- www.va.nrcs.usda.gov











Locating the High Tunnel

- Orientation
 - Generally based on wind
 - NS ridge for Virginia
- Shade
- Drainage
 - Well drained soil
 - Higher location
 - Swells, drain pipe
- Windbreaks (heat loss)

Google search - high tunnel heating alternatives Missouri

Construction

- Materials
 - Bows
 - Purlins
 - Ground Stakes
 - Hardware
 - Endwall braces
 - Trusses
- Self constructed or contractor
 - Construction knowledge
 - Ladder work
 - Tools

Polyethylene Covering

- 6 mil
- 1 or 2 layers
- 4 year UV protected
- Greenhouse grade not construction grade
- Replaced every <u>4-5 years</u>
- Different types of plastic
 - IR
 - Anti-condensate
 - Diffused (good for taller crops)
 - SolaWrap (bubbles), Luminance

https://ag.umass.edu/greenhouse-floriculture/fact-sheets/plastic-greenhouse-film-update

Managing the High Tunnel

- Temperature
 - Ventilation
 - Passive heating
- Irrigation/Fertilization
- Light
 - Plastic layers
 - Shade cloth
- Humidity
 - Ventilation

Temperature

- Most critical
- COLD and HOT
- Range optimums
- Can effect:
 - Yield
 - Crops growth
 - Nutrient/water uptake
 - Pollination
 - Fruit formation

Crop	Growth stage	Optimum temperature (°F)	Maximum temperature (°F)	Threshold temperature for venting (°F)
Tomato	Transplant- flowering	70-75°F	85°F	75°F
	Flowering- harvest	70-75°F	85°F	65°F
Pepper	Transplant- flowering	70-80°F	85°F	75°F
	Flowering- harvest	70-80°F	90°F	75°F
Eggplant	Transplant- flowering	70-85°F	95°F	80°F
	Flowering- harvest	70-85°F	95°F	80°F
Cucurbits	Transplant- flowering	70-85°F	90°F	80°F
	Flowering- harvest	75-85°F	90°F	80°F
Leafy Greens	Seeding-harvest	60-65°F	75°F	55°F
				Adapted from Jett, WVU
vtong	ion			

Temperature

- Prevent dramatic temperature fluctuations
- Venting ahead of the thresholds
- Venting to reduce humidity
- Closing curtains early
- Tall sidewall
- Ridge type vent
- Higher volume structure
- Know your crops

Irrigation

- Growing in a covered environment requires irrigation
- Usually through drip irrigation systems
- Sometimes overhead
- Rainwater catchment
- Sensors or tensiometers
- Automated or manual

Fertilization

- Organic or synthetic
- Think about soil testing and/or tissue analysis
- Fertigation
- BMPs
 - Leafy greens

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High Soluble Salts in High Tunnels

- Can happen with organic or conventional methods
- Because of covering, leaching out does not occur
- Some crops might be more sensitive to high salt levels - young plants more sensitive
- Make sure to site in well drained area to promote leaching
- Try to select fertilizers with low soluble salt index. ex. ammonium nitrate vs. calcium nitrate

- Animal manures tend to be high in salt
- One scenario might be a movable tunnel

- Leaching with overhead irrigation or drip tape (depend on soil type – see commercial veg recommendation guide)
 - 6 inches of water reduces salt levels by 50%
 - Tape could take 6-7 hours to supply 1" water

Soil Solarization in High Tunnels

- Uses solar radiation to heat soils to a temperature that would kill many annual weed seeds and fungus
- Might be more practical in HT with higher temperatures
- Prepare the soil like you would for planting
- Irrigate
- Cover with transparent poly
- Button up structure
- Trying to achieve >110 F for 2-4 weeks
- Be careful with people and equipment

https://www.uky.edu/hort/sites/www.uky.edu.hort/files/documents/solarization.pdf

Marketing

- Higher production cost requires grower to identify consistent markets willing to pay premium price
- Local grocers
- Food service
- CSA
- Farmer's Market
- Schools
- Wholesale
- Remember lots of variety

Final High Tunnel Tips

- Be ready for the intensity
- Spend time finding the right site
- Peaked roof for snowy areas
- Generally, higher side walls
- Pick high value crops with market potential

- Think about frost protection strategies
- Think about biocontrols
- IPM (scout, know lifecycles, etc.)
- Keep all areas clean
- Drip irrigation with fertigation
- Transplants

Resources

- Puckett Greenhouses
- Farmtek
- Atlas Greenhouses
- Berry Hill Irrigation
- Johnny's Seeds
- Rimol
- Noble Foundation
- SARE
- ATTRA

Other 'Tools' for Season Extension

- Greenhouse
- Low tunnels
- Row cover
- Cold frame

Contact

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