High Tunnel Raspberry Production 7th Annual VA Berry **Production & Marketing** Conference March 13, 2014

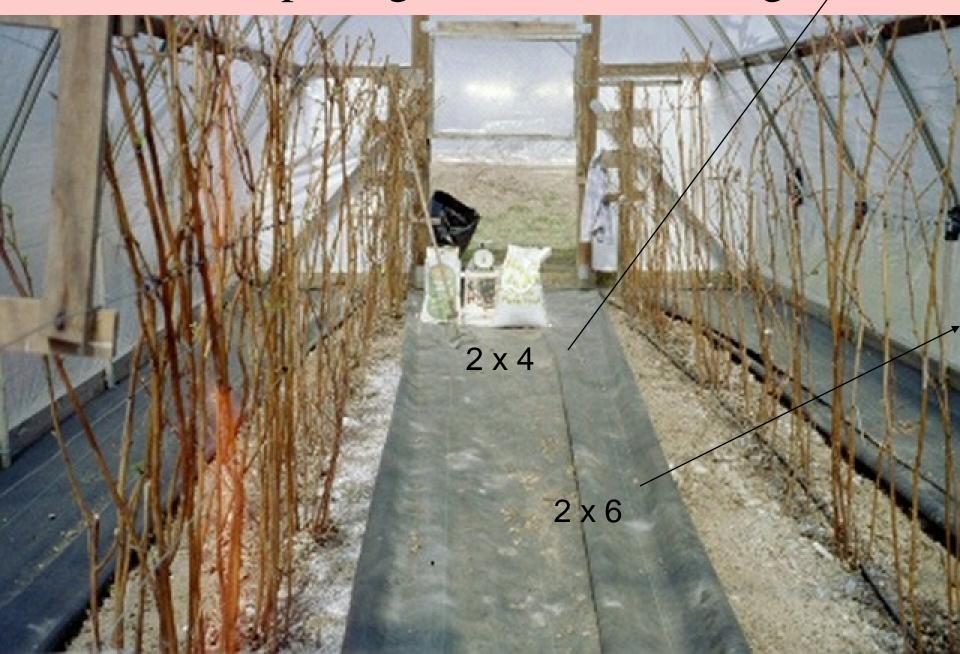


High Tunnels

High tunnel – greenhouse like structures

- No heat source
- Passive ventilation by raising sides and opening ends of tunnel
- Essential: minimum of 5 ft. opening for raising plastic on sides
- Single layer 4 year, six mil plastic covering
- Word to the wise: If you want to produce berries organically, don't use pressure treated lumber for baseboards.

Side Opening & Structural Design,



High Tunnels

- Size single bay tunnels
 - Wider tunnels = more stable environments
 - Doesn't cool as quickly when clouds appear
 - Doesn't heat as quickly with sun
 - Longer tunnels may want to have break in row to get from one side of row to the other without having to walk all the way around.
 - We have one tunnel 148 ft long, two tunnels 160 ft long and one tunnel 180 ft long. We made a walk through half way down the tunnel so we could go from one side of the row to the other.



Wind Control for Sides

- Storm or cold weather approaching
- Lower sides
- For control of plastic, create a "X" system with baler twine or clothes line to hold plastic in place. Line must have a UV inhibitor.
- Useful before closing sides for winter.



High Tunnels Environmental Adjustments

- Shade Cloth

• 50% shade cloth to minimize heat buildup in summer

Light Diffusing Plastics

• New plastics available that diffuse the light reducing temperature within the tunnel without the use of shade cloth: Klerk's Kool Lite 380 is an example.

High Tunnels Season Extension

- Season extension

- Spring We have raspberries in late May early June when outdoor berries in our area aren't available until the end of June
- Late fall berries until the end of Nov; some years into Dec.

Row Cover

• To warm earlier in spring or save crop in fall

Emergency Heat Source

• To keep crop from freezing when an overnight cold front presents a problem for a day or two

How high tunnels capture heat for season extension

Clear polyethylene film

- Good light transmission
- IR treated blocks and traps heat

Dark mulch soil covering

 Absorbs heat during day, warms soil = keeps roots warm

Row covers

Reduce heat loss around plant

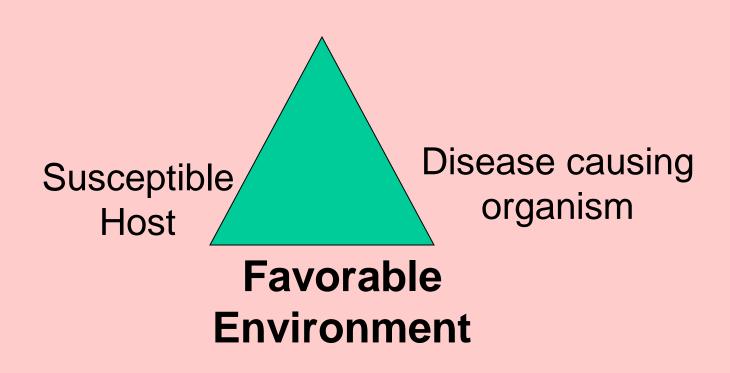
Size of tunnels on our farm for raspberry production

- (one) 30 ft x 148 ft 5 rows
- (one) 30 ft x 96 ft 4 rows
- (three) 14' by 96' 2 rows
- (one) 20' by 96' 3 rows
- (one) 14' by 160' 2 rows

Why I like high tunnels?

- Higher quality fruit
 - Longer shelf life
- Longer harvest period
 - May through November for high tunnels
 Outdoors: late June through October in Southern NJ
- Less problem with spotted wing drosophila (SWD)
- Less disease
 - No rain or dew strikes the berry

Factors required for disease development



Most disease causing organisms, ie. fungi and bacteria require free water to germinate and penetrate the cell wall of your crop plant.

High tunnels alter disease development by creating an environment that is less than favorable for the disease causing organism. High tunnel
Raspberries
Second week
November



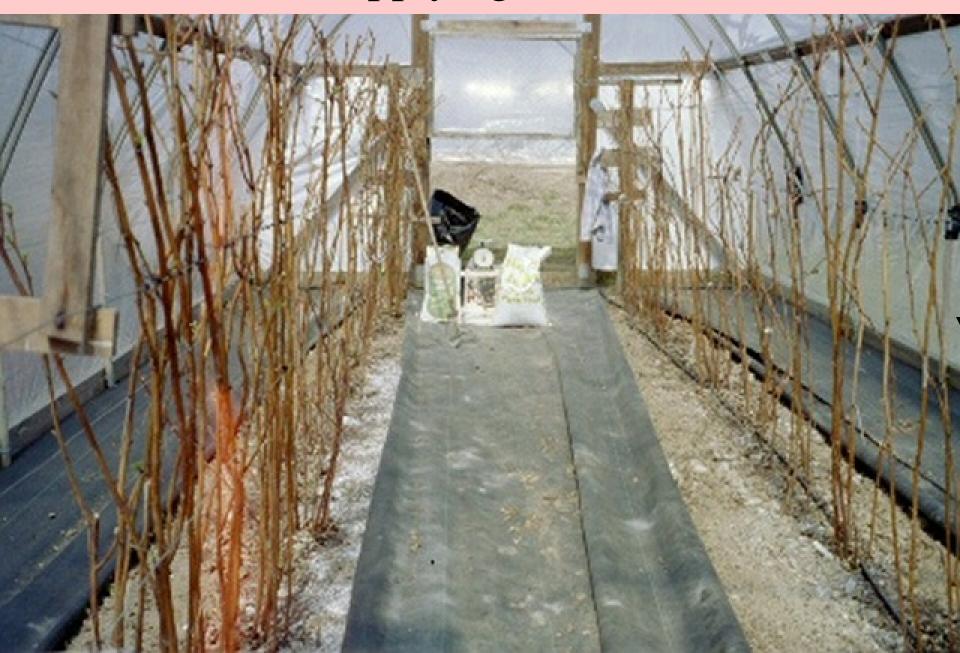
Outdoor raspberries Second week in Nov.



Lime and Fertilizer

- Test soil and apply lime as recommended
 - pH 6.5 6.8 recommended. Incorporate lime,
 phosphorus and potassium prior to planting.
- Spring fertilizer recommendations (general)
 - 50 lbs. N/A may be applied as a split application
 - mushroom compost in early spring to add organic matter to our sandy soil
- Fertigation through the growing season
 - 100 ppm N through the drip
- Check nutrient levels with tissue analysis at flowering

Applying Lime



Planting in Soil in High Tunnels

- Planted virus free bare root stock plants as early in the spring as possible (March or before)
- 5 ft. minimum between rows.
- 18 to 24 inches between plants

Raspberry Biology

- Perennial
 - Roots live for years
- Biennial
 - Canes die after second year of life

Primocane vs. Floricane

(Fall Bearing vs. Summer Bearing)

Primocane (fall bearing, everbearing)

- Canes begin emerging in spring
 - Primocane bear fruit at end of cane first year of growth
 - Can produce second crop after a chilling period
 - Chilling occurs at temperatures below 45°F and is most efficient at temperatures between 40 45°F. Primocane varieties usually do not require as many hours of chilling as Floricane varieties.
 - Canes die after producing second crop of berries

Primocane vs. Floricane (Fall Bearing vs. Summer Bearing)

- Floricane (summer bearing)
 - Grow vegetatively first year
 - Require a chilling period (vernalization)
 - 800 1000 hours of temperatures below 45°F
 - Accumulated chilling can be reversed by temperatures over 45°F during the time of vernalization
 - Produce berries after vernalization
 - Canes die after berry production

Raspberries

- Red most popular
- Yellow small market
- Black short harvest season for floricane varieties. Fruits before blackberries in NJ.
 - New primocane variety Niowot
- Purple cross between red and black

Varieties

High Tunnel Production

- Joan J early, good flavor, excellent productivity, thornless
- Autumn Britten early, but very spiny and tendency toward double berries
- Himbo Top beautiful conical shape berry that holds color well, but lacking in flavor. Maturity falls between Autumn Britten and Caroline.
- Caroline mid season, good flavor, spiny
- Heritage late, the standard bearer for years, excellent flavor but small berry size
- Josephine late. Did not do well for us
- Nantahala late. Release from NC breeding program. Good flavor, color: pinkish – red

Varieties

- Choose early, mid-season and late varieties to spread out harvests.
- Think about work load when choosing which varieties to plant.
- Use pruning/pinching techniques to spread out harvests.

Pruning for Manipulating Harvest Date

- Check a few plants of the variety you want to alter harvest date on. Use a stick or bamboo cane to check height every week beginning in mid-May. When rapid growth ceases, prune 1 inch from canes that you want to delay harvest one week.
- Prune 2 inches from canes that you want to delay harvest three weeks.

Culture

- Pinch growing point of new canes when they reach 18 to 24" to encourage branching. This promotes more fruiting area.
- Remove small, unthrifty canes emerging late, but wait til canes have 18 inches of growth. This prevents the regrowth of the cane.
- If you want to control height once the period of rapid growth ceases ($\sim 5.5-6$ ft), pinch just the growing point. This may delay harvest some.

Tall canes in tunnels due to increased heat buildup under plastic in summer.



Caution

Remember when delaying harvest, (especially the late varieties) that you may have cold temperatures to deal with before all the berries mature.

Irrigation

- Drip irrigation
 - We've gone to two drip lines on each side of the row – sandy soils.
 - Raspberries need at least an inch of water per week
 - Short daily or every other day irrigations
 preferable to long once or twice a week
 irrigations. Morning irrigation best helps
 reduce incidence of sunburn.



Trellising

- Use treated wood posts at the ends of the run.
- Can use metal posts in the middle of runs
- Place a post every 20 to 25 ft.
- We use wire to support canes. We found baling twine did not keep canes within the row area.
- 24, 42 and 60 inches from ground level

Trellis Supports



Dormant Pruning

- After canes have gone through the winter, prune canes back to soil surface if you don't want the summer crop
- If you plan to harvest the summer crop, prune dead wood out and limit height of canes to ~5 feet.

Before pruning



After pruning

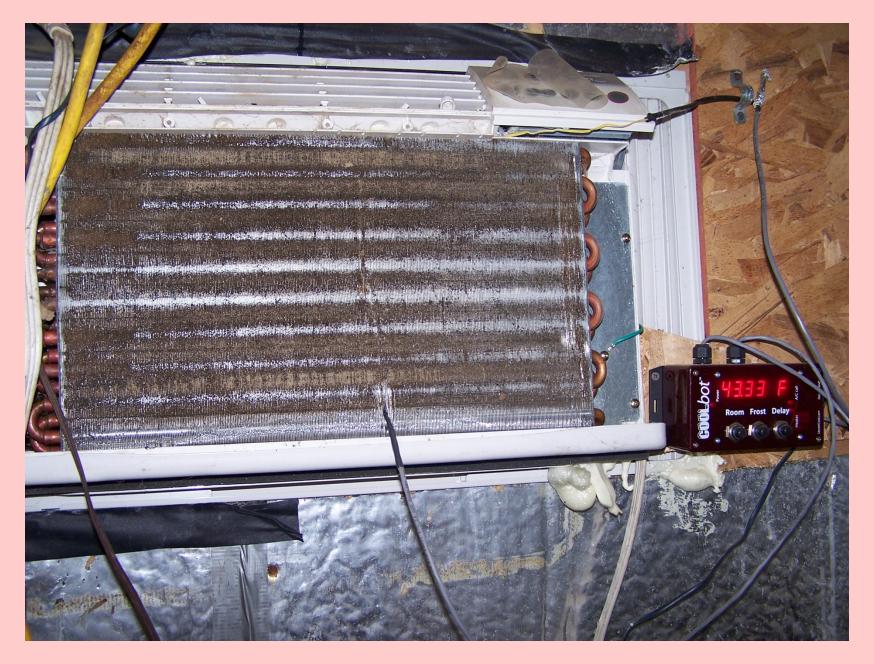


Harvest

- Harvest daily into one half pint containers
- Mechanically damaged, sunburned, deformed berries may be placed in a "cull" container at picking.
- Refrigerate berries promptly to 40°F. This also seems to prevent problems with SWD.
- We grade berries once they are cold. "Good" culls are frozen and sold for raspberry wine, jam, etc.

Low Cost Refrigeration

- Cool Bot + Standard room size air conditioner
 - CoolBot over rides the temperature controls of your air conditioner while controlling the defrost so that the refrigeration coils do not freeze up.
 - Size of AC unit depends on size of room



Cool Bot Unit

Dimensions of Cooler	Size of AC Unit
6' x 8'	10,000 BTU
8' x 8'	12,000 BTU
8' x 10'	15,000 BTU
8' x 12'	18,000 BTU
10' x 12'	21,000 BTU
10' x 14'	25,000 BTU

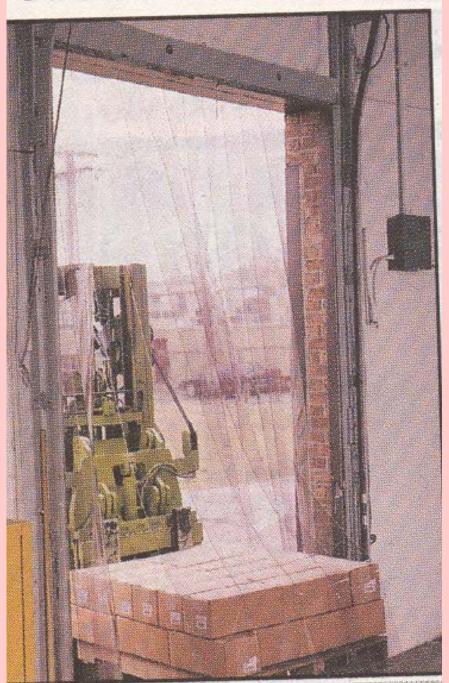
Cost

- Estimated cost of refrigeration for walk-in cooler for our 12' x 12' room = \$3500
- Cost of Cool Bot plus air conditioner = \$750
 - \$850
 - Installation was easy.
 - Cool Bot uses a standard 110 outlet as did the 10,000 BTU air conditioner we had on hand, but the 25,000 BTU air conditioner requires a 220 line.
 - Temperature setting 36°F − 50°F

Cost

- Cost to run last year = \$150/month with temperature set to cool to 40°F
- Lower energy costs by
 - Insulating walls 4"
 - Insulating floors bare floors are a great sink for cooled air
 - Seal holes use "Great Stuff" foam to seal any leaks
 - Use energy curtains at entrance

VINYL STRIP DOO!





Marketing

- CSA (Community Supported Agriculture)
- Farmers Market
- Wholesale to farm markets, coops, etc.

Marketing



Pesticide Free



Happy Valley Berry Farm

Voles

- Production in high tunnels = more problems with voles than outdoors
- Feed on roots of raspberries may see holes in the soil
- Create tunnels through the soil = a super highway for vole movement
- T type bait trap; bait Rozol (anticoagulant)
- Glue trap difficult voles covered mine with soil and made them ineffective.

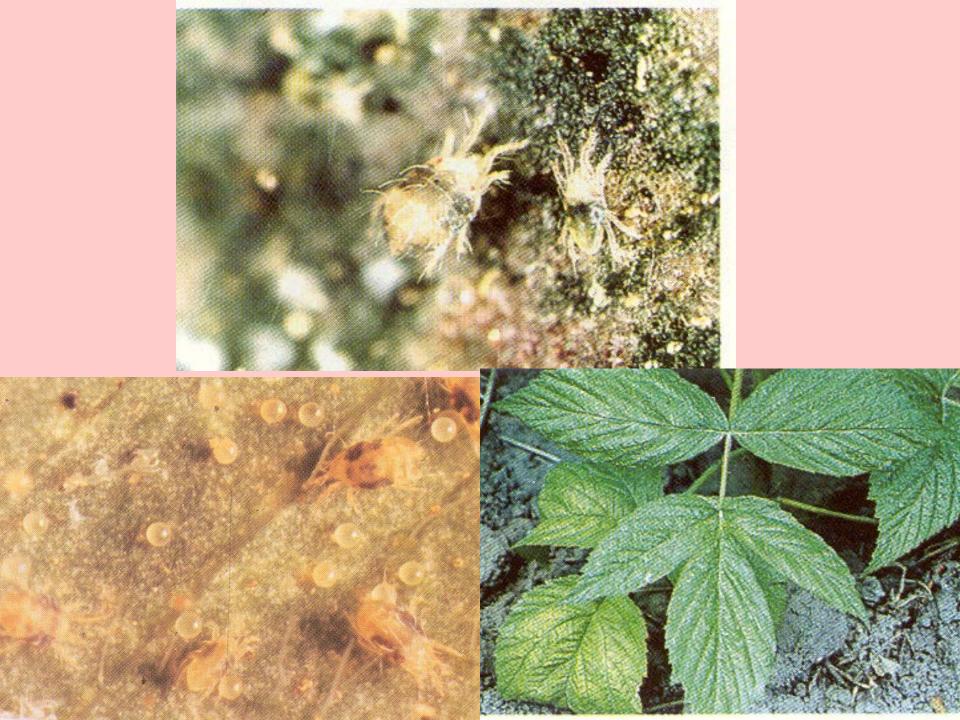
Pests

- Spotted Wing Drosophila (SWD)
 - Invasive vinegar or fruit fly
 - Different from other vinegar/fruit flies in that the female lays eggs in immature fruit
 - Most problematic on fall raspberries and blackberries
 - Excellent information available from website at extension.psu.edu
 - Less of a problem in high tunnels than outdoors, but sanitation and daily picking are very important.



Pests

- Two spotted spider mites
 - Overwinter on bud scales
 - Use dormant oil to reduce overwintering population
 - Use predatory mites
 - Originally started with *Phytoseiulus persimilis* with poor control
 - Two years ago, changed to *Neoseiulus fallacis* released in May works great for me



Pests

- Thrips
 - Feed on flowers
 - Can be found on fruit if populations are high
- Oriental beetles used pheromone traps with good result
- Japanese beetles
 - Not a problem in tunnels do not seem to want to enter.

Diseases

- Botrytis cane blight occasional problem if rainy season and many, many canes crowded together.
- Late rust
 - Nova fungicide controls very well; no organic control that I know
 - Start application in mid July



