Cucurbit bacterial wilt

- Melons, cucumber, honeydew
  - Up to 80% losses

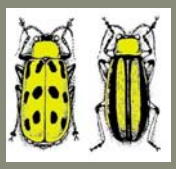
- Squash, pumpkin

Cucumber beetles

- Adult beetles overwinter near fields
- Become active in May
- Find young melon plants
- Feed, reproduce, lay eggs
- Next generation emerges in fields

Bacterial wilt of cucurbits

- Caused by *Erwinia tracheiphila*
- Transmitted by cucumber beetles
- Plants wilt and die
- Highest risk early in season



Bacterial wilt management

- Insecticides
  - Seeds, in-furrow, sprays
  - Imidacloprid, other systemics
  - Organic: Pyganic?
  - Use cuke beetle scouting threshold?
- Barriers: row covers?
- Late planting

How muskmelons become infected with *Erwinia tracheiphila*

Why row covers?

- Protect from frost and severe weather
- Increase earliness and yield
- Protect against bacterial wilt!
- Prevent insect damage

How do they work?

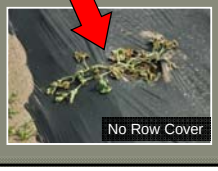
What about pollination?

- Open row cover ends for pollinators
- Add bumblebees under covers
- Remove row covers 10 days after flowering

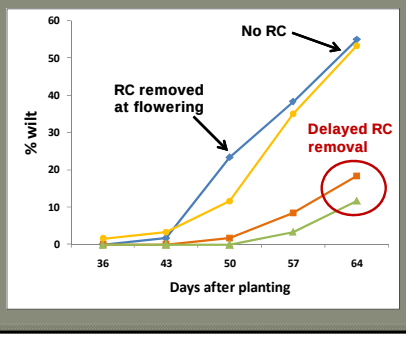
ISU field trials (2007-2009)

- Compared 4 row cover strategies:
  - Opened the ends
  - Removed row covers at bloom
  - Added bumblebees

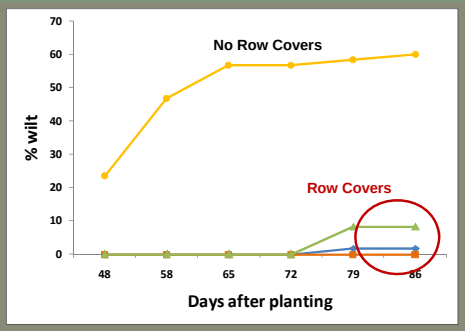
At flowering:



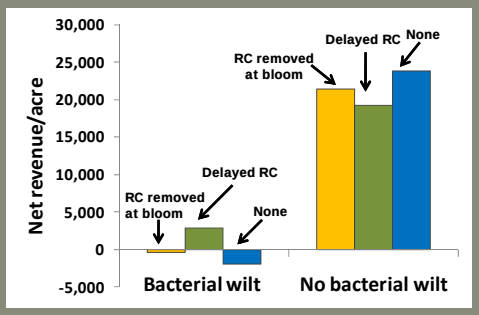
Bacterial wilt *vs.* row covers



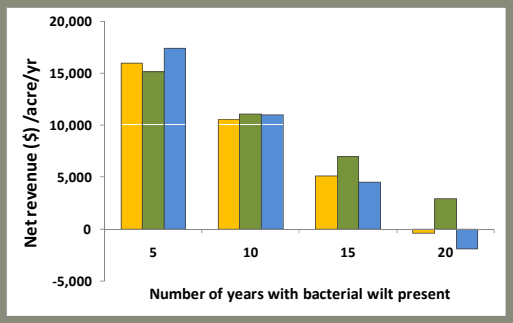
Delayed planting



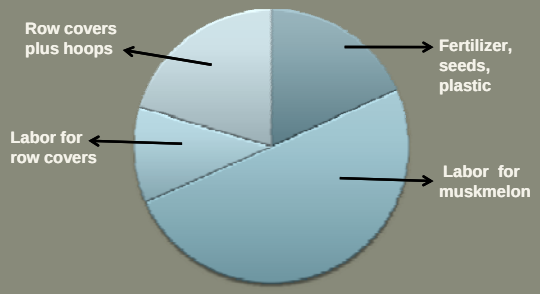
Does it pay?



Do you feel lucky?



Breaking down the cost



Do row covers make sense for you?

Ongoing research (ISU, UKY, Penn State, Ohio State)

http://www.youtube.com/watch?v=W9RagcNrO5g

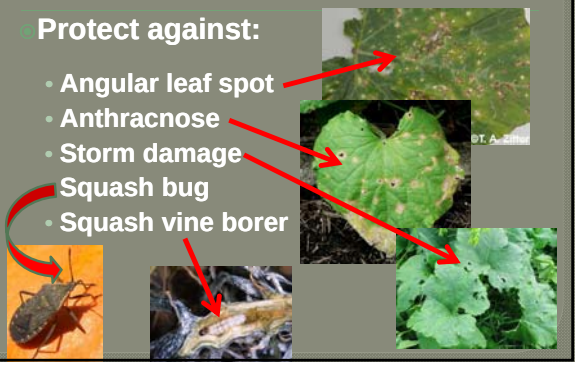
Other options

Will delaying row cover removal also delay harvest?

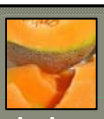
- Iowa data: Delayed harvest by 1-7 days

Added benefits from row covers

- Protect against:
  - Angular leaf spot
  - Anthracnose
  - Storm damage
  - Squash bug
  - Squash vine borer



No protection against this!



Take-home messages

- Delaying removal of row covers for 10 days protected against bacterial wilt all season long.
- Profitable where bacterial wilt appears in at least half of years.
- Labor is the main limiting factor.
  - Good fit for organic growers
- New: Row cover/hoop layer from Mechanical Transplanter Company
  - Contact: Dr. Mark Williams, UKY (mawillia@uky.edu)

Fighting diseases on greenhouse tomatoes

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Greenhouse Tomato Disease IPM

Greenhouse Disease IPM

- Start with clean stock
- Resistant varieties
- Optimize soil, water, N
- Control humidity & drainage
- Sanitation- soil, foliage, fruit

Greenhouse Disease IPM

- Monitor/control insect vectors
- Scout for disease outbreaks
- Keep good records
- Fungicides/insecticides

Greenhouse tomato diseases

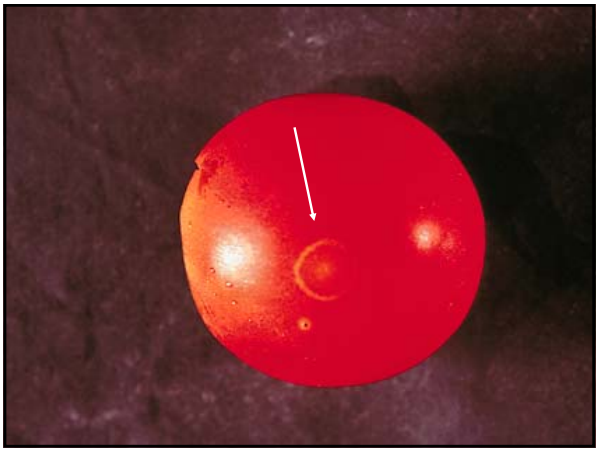
- Gray mold & ghost spot
- Leaf mold
- Powdery mildew
- Bacterial canker
- White mold
- Pepino mosaic virus

Gray Mold & Ghost Spot

- Fungus: *Botrytis cinerea*
- The most common disease of greenhouse crops
- Infects hundreds of plants
- Grows in live and dead tissue

Symptoms and signs

- Seedling damping off
- Stem cankers
- Leaf spots
- Ghost spots on fruit
- Grayish-brown, felt-like mat of spores



Cultural Management

- Sanitation – remove dead leaves and flowers each day
- Don't crowd plants
- Keep humidity below 90%
- Fans placed at crop height
- Keep foliage as dry as possible

Fungicides

- Coppers
- Cabrio
- Scala
- Endura
- Switch

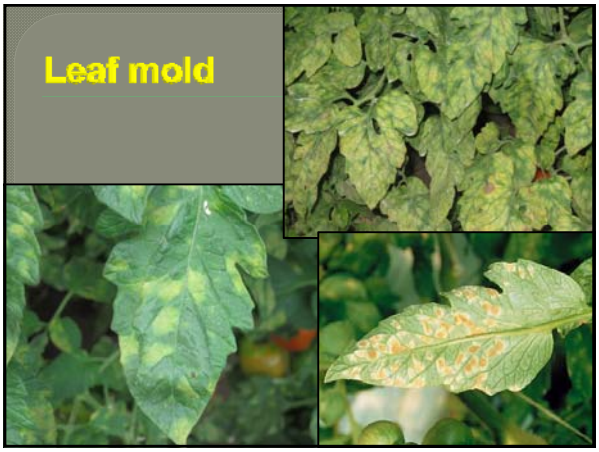
Leaf Mold

- Fungus: *Mycovellosiella fulva*
- Only on tomatoes
- Primarily in greenhouses
  - Field outbreaks start in greenhouse.
- Likes high humidity
- Infects lower leaves and moves up

Symptoms and signs

- Greenish-gray felt on undersides of leaves ONLY.
- Older spots turn yellow-brown.
- Distinct from gray mold
  - Spores only on underside of leaf.

Leaf mold



2010: "Perfect storm" for leaf mold

- Organic (no fungicides)
- Grew own transplants
- Susceptible cultivar
- Crowded
- Very humid year

Leaf mold management

- Use resistant varieties
- Keep temperature above 60º.
- Keep GHSE warmer than outside at night.
- Ventilate when humidity above 85%.
- Sanitation between crops
- Fungicides
  - Coppers, Inspire, Revus, Tanos, mancozeb

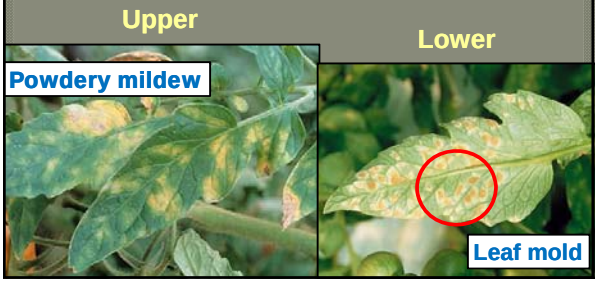
Powdery mildew

- Fungus: *Oidiopsis taurica*
- Common in greenhouses
- Leaves shrivel, yield drops
- Lower leaves affected first

Symptoms and signs

- Light green or yellow blotches
- Later: White, powdery growth on upper or lower leaf surface.

Powdery mildew *vs.* leaf mold



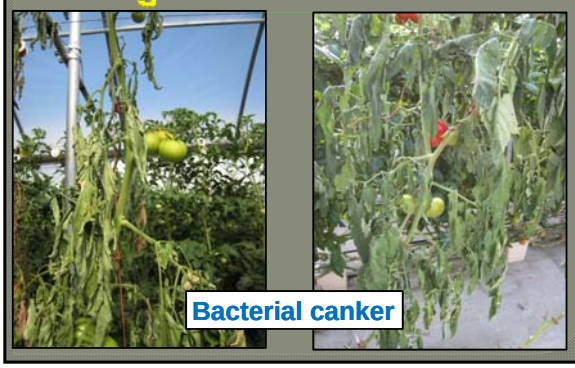
Powdery mildew management

- Good air movement
- Avoid excess nitrogen.
- No resistant cultivars
- Fungicides
  - Amistar, Quadris, Cabrio, Inspire, Revus, Rally, Switch

Bacterial canker

- Bacterium: *Clavibacter michiganensis* subpecies *michiganensis*
- Carried on seed and transplants
- Spreads in greenhouse
- Causes wilting in greenhouse when weather turns warm in spring
- One of the toughest diseases to manage!

Iowa greenhouse – June 2009



Field symptoms of bacterial canker

Management of bacterial canker

- Seed treatments
- Use disease-free seed.
- Minimize overhead watering.
- Clean up between crops.
- Remove wilting and nearby plants.
  - Bacteria can be spread by handling.
- Bactericides:
  - Coppers, Agri-Mycin, Actigard (?)
  - Use preventively.

White mold (timber rot)

- Fungus: *Sclerotinia sclerotiorum*
- Occurs indoors and outdoors
- Hundreds of crop hosts:
  - Tomatoes, beans, soybeans, etc.
- Ascospores infect in the spring.
- Source can be near (300 ft.) or inside a greenhouse or high tunnel.
- Sclerotia survive in crop debris and soil.

White mold symptoms and signs

Sclerotia are survival structures

They are black and look like rat turds.

White mold risk factors

- Wet soil
- Crop debris left in or near house
- High humidity
- Poor air circulation
- No crop rotation to non-hosts

White mold management

- Reduce humidity
- Strict sanitation
  - No crop waste within 300 feet
  - Clean house thoroughly between crops
- Contans® in and near greenhouse
- *Coniothyrium minitans*
  - Biological control
  - Spray on, water in.
  - Areas with white mold hosts within 300 feet of greenhouse or tunnel.

Pepino mosaic virus

- Recent arrival in U.S. (2003)
- Previously known only from Andes region of Peru.
- Probably came from infected seeds.
- Primary threat is to greenhouse tomatoes.
- Colorado in 2003, Nebraska in 2004.

Nebraska situation

- 10-acre house
- Tomatoes on 30-ft pulleys
- Continuous tomatoes since 2002
- Losses went from 0 to 40% in 2 years.
- June 2004: All tomatoes pulled out, debris removed, greenhouse disinfected

Lessons from this disaster

- Buy virus-free seed (not so easy…..)
- Get problems diagnosed quickly.
- Pepino mosaic virus is mechanically transmitted – handling spread it.
  - Trellised tomatoes require lots of handling.
- Remove tomatoes from house and clean up before losses become huge.
- Many viruses can survive weeks/months in plant debris.

Contacts

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