New Developments in Tomato and Lettuce Pest Management in California

Tom Turini
University of California
Agriculture and Natural Resources
Vegetable Crops Advisor
Fresno and Kings Counties
Overview – Recent challenges in Central CA

• Tomato
  • Fusarium diseases
  • Beet curly top virus/Beet leafhopper
  • Stink bug

• Lettuce
  • Fusarium wilt
  • Thrips-transmitted viruses
Overview – Recent challenges in Central CA

• Tomato
  • Fusarium diseases
Fusarium Diseases of Tomato Common in Central California

Fusarium Foot Rot

*Fusarium solani* f. sp. *eumartii*

Fusarium Crown and Root Rot

*Fusarium oxysporum* f. sp. *radicis-lycopersici*

Fusarium Wilt

*Fusarium oxysporum* f. sp. *lycopersici*

Race 1
Race 2
Race 3
Fusarium Foot Rot

*Fusarium solani* f. sp. *eumartii*

Hosts: Tomato, potato, eggplant
Fusarium Crown and Root Rot

*Fusarium oxysporum* f. sp. *radicis-lycopersici*

Hosts: some legumes, cucurbits, other solanaceous plants, ect.

Optimum temperature: 18 C (64 F)
Fusarium Wilt

*Fusarium oxysporum* f. sp. *lycopersici*

Hosts: some legumes, cucurbits, other solanaceous plants, ect.

Optimum temperature: 27 C (80 F)
Control Options for Fusarium Pathogens of Tomato

• Containment - Sanitation, limit movement of infested soil and plant material.
• Resistant varieties – Resistance to 1 and 2 are common in commercial varieties; 3 is present in very few & Crown and Root Rot is also available in very few.
• Crop rotation away from susceptible crops will reduce levels of the pathogen in the soil, but will not eliminate risk if susceptible crop is planted.
• Avoid root knot nematode-infested soils.
Root Knot Nematode in Tomato

*Meloidogyne hapla, M. incognita, M. javanica, and M. arenaria*

- Resistant varieties are widely available.
- Resistance is not effective against all species.
- Resistance-breaking nematodes are present in tomato production areas in Central California.
Overview – Recent challenges in Central CA

• Tomato
  • Fusarium diseases
  • Beet curly top virus/Beet leafhopper
Beet curly top virus
Beet leafhopper
_Circulifer tenellus_

- The only vector of the curly top viruses.
- Four to 5 generations in California
- Strong flier
- Favored by warm dry conditions
- Introduced from the Middle East ~100 years ago.
- Tomatoes and melons are not preferred hosts

Photo by Lori Dunning
Host Range: > 300 species

- Crops: beets, beans, tomatoes, peppers, cucumbers, squash, muskmelon, watermelon, spinach.

- Weeds: filaree, perennial pepperweed, Buckhorn plantain, Russian thistle and mustard species.
Curly Top Disease Cycle

Fall: adult leafhoppers migrate for overwintering in the foothills

Spring: adult leafhoppers migration

Multiple generations on the valley floor

From Gilbertson Presentation 9 May 2013.
Cultural Control

• Increase planting density
• Sanitation: weed control on roadsides, ditch banks, young orchards and vineyard
• Where possible and needed, treat weeds with insecticide before mowing or disking: If it is during production of susceptible crops.
Insecticide Treatment of Crop

• Use with other management tactics
• Under conditions of very high pressure, may not provide commercially acceptable levels of control
• The objective is to reduce the number of times that a leafhopper transmits the virus
Insecticide Program Comparison, 2015

• University of California West Side Research and Extension Center – Five Points
• Sun 6366 processing tomato plants were transplanted on 22 May
• 6 treatments were compared in 4 rep RCB design – 200 ft long plots
• Total plants per plot recorded on 17 Jun, BCTV symptomatic plants were recorded 22 Jun and at 14 day intervals; Harvested on 10 Sep
Overview – Recent challenges in Central CA

- Tomato
  - Fusarium diseases
  - Beet curly top virus/Beet leafhopper
  - Stink bug
Extremely High Population Densities in San Joaquin Valley Processing Tomatoes, 2013-14
Stink Bugs Associated with Damaged Tomatoes from 2013-2014 were Consperse

Consperse stink bug: *Euschistus conspersus*
Biology

• Overwinter as adults on the ground under cover, or on weeds.
• In March or April, they move from the overwintering site mate and lay eggs.
• There are multiple generations per year dependent upon temperatures.
Management

• Trapping, degree day model to target nymph stage, which is more sensitive to insecticides.

• Pyrethroid and neonicotinoid insecticides are effective if coverage is good.

• In fall, destroy overwintering habitats near sites where tomatoes will be planted in spring.
Overview – Recent challenges in Central CA

• Tomato
  • Fusarium diseases
  • Beet curly top virus/Beet leafhopper
  • Stink bug

• Lettuce
  • Fusarium wilt
Fusarium Wilt in Lettuce

*Fusarium oxysporum f. sp. lactucum*
Biology

• Temperature: 46\(^\circ\) - 90\(^\circ\)F (optimum: 82\(^\circ\)F)

• Lettuce is only affected by *F. oxysporum* f. sp. *lactucum* and this pathogen does not cause disease in other plants.

• Survives on surfaces of roots of other plants and in resting structures.

• Soil inoculum levels decline substantially over 5 years
Management

• Avoid planting lettuce in fields with a history of this disease.

• Sanitation: Avoid moving soil from an infested field to a clean field.

• Susceptibility of lettuce varieties to *F. oxysporum* f. sp. *lactucum* differs
Response of lettuce varieties to *F. o. f. sp. lactucum*, Coalinga, 2012
Overview – Recent challenges in Central CA

• Tomato
  • Fusarium diseases
  • Beet curly top virus/Beet leafhopper
  • Stink bug

• Lettuce
  • Fusarium wilt
  • Thrips-transmitted viruses
Tospoviruses: Thrips transmitted viruses

Impatience necrotic spot and Tomato spotted wilt virus
Biology

- *Tomato spotted wilt virus* has over 800 plant hosts: including tomatoes, peppers, radicchio, as well as many weeds.

- *Impatiens necrotic spot virus* has a smaller host range, though this virus still infects a large number of ornamental plants and a few vegetable crops.
Tospovirus Management

Before planting
• evaluate planting location and time
• implement weed management
• use virus- and thrips-free transplants

During the season
• monitor fields for thrips
• manage thrips
• rotate insecticides
• monitor fields for tospovirus and remove infected plants
• implement weed management

After harvest
• promptly remove and destroy plants after harvest
• control weeds/volunteers

From: Gilbertson/Batuman Mar 2014
Thank you

Tom Turini
UCCE, Fresno/Kings
Vegetable Crops
taturini@ucanr.edu
559-375-3147
Stink Bug Species Reported in CA

Say's stink bug complex: *Chlorochroa sayi* and *Chlorochroa uhleri*

Conspersed stink bug: *Euschistus conspersus*

Redshouldered stink bug: *Thyanta pallidovirens*

Southern green stink bug: *Nezara viridula*
Stink Bugs Recently Reported in California

*Euschistus servus*
Brown stink bug

*Halyomorpha halys*
Brown marmorated

Slide adapted from Goodell 2014
Brown marmorated stink bug (BMSB), *Halyomorpha halys*
Brown vs. Conspersse
### Influence of Insecticide Applications on BCTV incidence, Five Points, 2015

<table>
<thead>
<tr>
<th>Treatment Description</th>
<th>BCTV (%)</th>
<th>22 Jun</th>
<th>1 Jul</th>
<th>14 Jul</th>
</tr>
</thead>
<tbody>
<tr>
<td>Untreated Control</td>
<td></td>
<td>9.9</td>
<td>12.1</td>
<td>13.9</td>
</tr>
<tr>
<td>Verimark 13.5 oz/A tray drench (5/21/15)</td>
<td></td>
<td>2.8</td>
<td>3.7</td>
<td>5.7</td>
</tr>
<tr>
<td>Admire Pro 4 oz/A transplant water (5/22/15)</td>
<td></td>
<td>7.8</td>
<td>8.1</td>
<td>10.3</td>
</tr>
<tr>
<td>Silvanto 2 fl oz directed foliar (5/22/15)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Admire Pro 6.5 Drip (6/22/15)</td>
<td></td>
<td>5.3</td>
<td>6.8</td>
<td>8.0</td>
</tr>
<tr>
<td>Admire Pro 10.5 oz/A transplant water (5/22/15)</td>
<td></td>
<td>11.7</td>
<td>12.8</td>
<td>11.5</td>
</tr>
<tr>
<td>Silvanto 2 fl oz directed foliar</td>
<td></td>
<td>10.4</td>
<td>11.8</td>
<td>9.7</td>
</tr>
<tr>
<td>Admire Pro 6.5 Drip (6/22/15)</td>
<td></td>
<td>4.29</td>
<td>3.18</td>
<td>3.87</td>
</tr>
<tr>
<td>LSD&lt;sub&gt;0.05&lt;/sub&gt;</td>
<td></td>
<td>35.95</td>
<td>22.88</td>
<td>26.06</td>
</tr>
<tr>
<td>CV (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Acknowledgements Stink bug

• California Tomato Research Institute
• Peter Goodell: UC IPM Kearney Ag Center
• Frank Zalom : UC Davis Entomology
• Les Ehler : Retired UC Davis
• Managers and PCA’s of large scale ag operations in Fresno-area
• West Side Research and Extension Center
Acknowledgements: Beet Curly Top

- Robert Gilbertson
- Ozgur Batuman
- Neil McRoberts
- Daniel Delgado
- UC WSREC staff
- California Department of Food and Agriculture
- Growers and Ag consultants in Fresno and Kings Counties