Update on Worm (Lepidoptera) Management in California Tomatoes

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Main worm pests in California tomatoes

- Beet armyworm
- Tomato fruitworm
- Western yellowstripe armyworm
- Tomato pinworm
- Loopers
- Hornworms & cutworms
Beet Armyworm

Spodoptera exigua
Eggs laid in clusters.
Pupate in soil.
3 - 5 generations per year.
Control

- Biological control: parasitic wasps (esp. Hyposoter), minute pirate bugs, nuclear polyhedrosis (virus).
- Insecticides based on monitoring
  - Processing
  - Fresh Market
Control

- Processing tomatoes:
  - Leaf sampling: factor in parasitized eggs.
  - Sample at least 100 fruit at random, green, not too small, 6 weeks before harvest.
  - 3.25% damage threshold before treating (5 - 10 larvae per plant).
  - Treat based on total worm damage (other species contribute).
Control

- Fresh market tomatoes
  - No fruit sampling thresholds established.
  - Leaf sample instead, after flowering.
  - 5 minute timed search: treat if > 1 larvae or egg masses.
Beet armyworm

- Avaunt (indoxacarb)
- Intrepid (methoxyfenozide)
- Success/Entrust (spinosad)
- Bt (Dipel, Xentari)
- Lannate (methomyl)
- Asana (esfenvalerate)
- Danitol (fenpropathrin)
- Coragen (chlorantraniliprole)
- Synapse (Flubendiamide)
- Radiant (spinetoram)

Proclaim, Rimon
Tomato Fruitworm

*Helicoverpa (Heliothis) zea*
Eggs laid singly.
Pupate in soil.
About 3 - 4 generations per year.
Damage
Control

- Biological: parasitic wastes (esp. Trichogramma), minute pirate bugs, nuclear polyhedrosis virus.
- Processing tomatoes vs fresh market
Control

- Processing tomatoes:
  - Leaf sampling begins at 1” fruit.
  - 30 random plants in field, select leaf below highest open flower.
  - treat when > 5 white eggs per 30 leaf samples
  - Factor in parasitized eggs. A black/white egg chart has been developed.
  - Treat based on total worm damage.
# LEAF SAMPLING

<table>
<thead>
<tr>
<th># black eggs</th>
<th>Number of white eggs</th>
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<tr>
<td></td>
<td>4 to 8</td>
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<tr>
<td>0</td>
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<tr>
<td>1</td>
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Fresh Market Tomatoes

- Traps may help to determine first flight in July.
- 968 degree days
- Treat when 5 minute leaf sample has > 1 egg.
Scouting for tomato fruitworm

- This is a major pest. Mark the location with flag & mark your calendars!
- Use **pheromone traps** for monitoring flight
- ET = scout intensely for eggs/larvae if 7 adults per trap
- Scout for larvae during fruit set.
- ET = one larva per plant or one fresh injury per plant
- Improve scouting technique with experience
UC IPM Guidelines

- Bt (40% - 60% control)
- Success (spinosad)
- Intrepid
- Asana
- Avaunt
- Dannitol
- Lannate
- Monitor (methamidophos)
- Sevin (carbaryl)
- Pyrethrins (PyGanic)
- Trichogramma pretiosum

many of the newly registered materials listed later in this presentation are not yet on the website.
Western Yellowstripe Armyworm

*Spodopera praefica*
WYSA

- Many years can become very damaging in certain fields and certain times (late summer).
- Migrate out of alfalfa, beans, other crops.
- Strip treatments can be effective.
- Bt, Success not that effective. Lannate may cause leafminers to flare.
- Intrepid, Proclaim, Avaunt, Confirm all effective.
Tomato Pinworm

Keiferia lycopersicella
Pinworms

- Small, burrow into fruit from under the calyx.
- Late summer and fall problem. 7 - 8 generations per year.
- More likely to impact fresh market growers.
Control

- Biological control: parasitic wasps.
- Cultural: discing after harvest.
- Monitoring and pheromone traps. 1 - 2 larvae per 6-ft section of row showing mines or folded leaf shelters.
Alfalfa Looper, Cabbage Looper

*Trichoplusia ni*
Cabbage Looper

- More of a foliage pest.
- In processing tomatoes, levels of 10 per plant without needing to treat.
- Serve as a host for parasites that attack fruit worms and armyworms (wasps and virus).
Hornworms
Manduca spp.
Research Trials
Worm trial in fresh market tomatoes 2003

1. Entrust 1.5 oz/A
2. Success 4.5 fl oz/A
3. Intrepid 4 fl oz/A
4. Intrepid 8 fl oz/A
5. Intrepid 12 fl oz/A
6. Pro Axis 3.8 fl oz/A
7. Warrior 3.8 fl oz/A
8. Avaunt 3.2 oz/A
9. Proclaim 2.4 oz/A
10. Dipel 1 lb/A
11. UTC
Fruit Damage
Gun Club North

2006
Tomato Worm Trial 2007

![Graph showing adjusted worm counts for different treatments.](image-url)
2009

fruit damage at harvest, %

UTC
Rimon 12 1/2 oz/A + Proclaim 4.8 oz sequential
Rimon 12 1/2 oz/A + Coral 4.8 oz sequential
Intrepid 4 oz/A
Coragen 5 oz/A
Proclaim 4.8 oz/A
Voliam Xpress 9 oz/A
FM Tomato Worm Trial 2010 Graph

LSD 0.05 = 4.4

Fruit Damage at Harvest, %

Rimon, Rimon + Proclaim, Rimon + Temprano, Rimon + Warrior II, Rimon + Brigade, Voliam Express, Coragen, Rimon + Provado, Intrepid, Radiant, Voliam Flexi, Hero, Synapse, UTC
2015 - 16 Trial Results

**Worm Damaged Fruit**

- UTC
- Intrepid Edge 12 fl oz/A
- Radiant SC 6 fl oz/A
- Intrepid SC 2 fl oz/A
- Coragen SC 1.67 fl oz/A
- Leverade 360 4.3 fl oz/A
- Sympro 3.2 oz/A
- Proclaim 4.0 oz/A
- Entust 4.0 oz/A

**Fresh Market Tomato Worm Trial**

Merced County 2016

- UTC
- Minecor Pro 10 oz/A
- Besige 9 oz/A
- Intrepid Edge 12 oz/A
- Radiant 15SC 6 oz/A
- Coragen 1.67SC 5 oz/A

**Fruit Damage, %**

- UTC
- Minecor Pro 10 oz/A
- Besige 9 oz/A
- Intrepid Edge 12 oz/A
- Radiant 15SC 6 oz/A
- Coragen 1.67SC 5 oz/A
Conclusions

• New, reduced risk worm control insecticides give excellent control of tomato worm pests typical of central CA.
  • This translates into significantly reduced fruit damage as compared to untreated controls.

• Bt’s, Success can also provide very good control, but can be weak on WYSA.

• Warrior, Assail, & similar chemistries did not provide better control than the untreated check plots.
  • knock-down beneficials?
How to Manage Pests

Tomato

Year-Round IPM Program—tells you what you should be doing throughout the year in an overall IPM program. Includes Year-Round IPM Program Annual Checklist.

Year-Round IPM Program for Tomato (1/07) New

- Preplanting activities
- Planting activities
- Bloom to early fruit set
- Late fruit set
- First red fruit
- Harvest and postharvest activities

UC IPM Pest Management Guidelines—University of California's official guidelines for pest monitoring techniques, pesticides, and nonpesticide alternatives for managing pests in agriculture, floriculture, and commercial turf. More

General Information

Insects and Mites