Organic Tree Fruit Production

Thursday afternoon 1:00 pm

Where: Grand Gallery (lower level) Room C

CCA Credits: PM(1.5) CM(0.5)

Moderator: Mark Whalon, Entomology Dept., MSU

1:00 p.m. USDA/ National Organic Program: New England Tree Fruit Orchard Research and Demonstration Plot Update

- Renae Moran, Tree Fruit Specialist, Univ. of Maine Cooperative Extension

1:45 p.m. Performance Characteristics of Organic Pest Control Materials

- Matt Grieshop, MSU Organic Pest Management Specialist
- John Wise, MSU Trevor Nichols Research Station

2:15 p.m. Biopesticides in Upper Midwest Organic Tree Fruit Production

- Renee Pereault, Entomology Dept, MSU
- Mark Whalon, Entomology Dept., MSU

2:45 p.m. Flash-grazing of Hogs in Apple for Reduced Input Organic Insect and Disease Management

- David Epstein, Tree Fruit IPM Integrator, MSU
- Jim Koan, Al-Mar Orchards, Flushing, MI

3:15 p.m. Discussion and Wrap-Up

USDA/ NATIONAL ORGANIC PROGRAM: NEW ENGLAND TREE FRUIT ORCHARD RESEARCH AND DEMONSTRATION PLOT UPDATE

Lorraine Berkett, Heather Darby, Robert Parsons, John Hayden, Terry Bradshaw, Sarah Kingsley-Richards, and Morgan Cromwell, University of Vermont
Elena Garcia, University of Arkansas
Renae Moran, University of Maine

Organic apple production in New England has historically been limited to a few, small farms because of two major obstacles. Market demand for certain cultivars, most of which are highly susceptible to apple scab, made disease control expensive and not always successful. Lack of good methods for preventing insect problems, such as plum curculio, severely limited yield. These two obstacles have been partially overcome by the adoption of new cultivars with greater scab resistance and by development of materials that increase the ability to control plum curculio and other insect pests.

In 2006, the OrganicA Project established two organic orchards at the University of Vermon research center in Burlington, one with new nursery trees and the other by topworking an existing orchard. The purpose of this research project, which is funded by a grant from the USDA Integrated Organic Program, was to compare topworking and replanting using organic methods and five different cultivars, Honeycrisp, Zestar!, Ginger Gold, Macoun and Liberty. Disease and insect damage, yield and costs are being closely monitored in this six-year study which is currently at the end of the third year.

Orchard 1 was prepared with the intent of being organic. The land was fallowed in 2003, and planted to buckwheat, oats and red clover in sequence in 2004. In 2005, fescue, dwarf perennial ryegrass, blue grass and white clover were planted. Prior to planting apple trees, soil in the tree row was amended with a large quantity of compost. New trees were planted in April 2006. Trees are supported by a trellis and trained as a vertical axe. The rootstock is B.9 for all cultivars except Honeycrisp which is on M.26.

To manage weeds, the replanted orchard was mulched with wood chips after planting. The mulch soon became invaded by grass. In 2007, flaming was used in addition to the remaining mulch. The risk of fire from flaming was too great for the short-term weed control it provided. Consequently in 2008, the tree row was tilled three times using a Weed Badger. Trees are still in the establishment phase when they need superior weed control. Shallow tillage provided reasonable control of weeds, but occasionally trees were damaged, and the potential for soil erosion still exists.

Orchard 2 was cleft grafted in April 2006 to the same varieties as in Orchard 1. These trees were 18-year-old McIntosh and Liberty on M.26, planted 10’ X 15’. They are trained as a central leader. The herbicide strip became a cover of grass mix and other native plants. It was thought that topworking already established trees would allow us to bypass the need for the high level of weed control normally needed for newly planted trees. Weed management in the topworked orchard was less intensive than in Orchard 1. The row has been maintained as mowed sod. These trees have established root systems, and tree growth has been good despite the lack of an herbicide strip.

Disease control in the first year was aimed at controlling scab and other foliar diseases such as fire blight. Since trees were in the nonbearing stage, fruit diseases were not a concern. The fungicides sulfur and liquid lime sulfur were used alone or in combination three times during the season. In the first year, this did not control scab because the first spray was put on late and because of unsprayed neighboring crab apple trees. In the first year, scab was most severe on Ginger Gold and Zestar!, intermediate on Macoun, and low on Honeycrsip. Liberty did not have scab. In the second year, lime sulfur or sulfur were applied 12 times. In 2007, when fungicides were applied earlier and more frequently, all cultivars had little or no foliar scab. In 2008, scab was more severe on Ginger Gold than other varieties. Trees had their first crop in 2008, but yield was insufficient for a good scab assessment.

Cedar apple rust was severe on foliage in all three years because of Junipers located near the orchard. This would not be expected to occur in commercial orchards, so the level of cedar apple rust is not representative. Symptoms were most severe on Ginger Gold and Honeycrisp.

In the nonbearing years, foliar feeding insects were the concern. Measures taken to control insect pests involved application of repellent and insecticides. Surround was applied twice in July in the first year. In the second year, dormant oil was applied once, Surround twice and spinosad once. In the third year when trees had fruit, several sprays were applied to target the many arthropod pests. Compounds used in the first bearing year included dormant oil, neem, Bt, Surround, spinosad and pyrethrum.

Aphids, European red mites and leafhoppers were insignificant on all cultivars in the first year. Leafminer mines also were not a problem. Japanese beetles also occurred and showed a preference for Honeycrisp over the other cultivars, except for Liberty. This occurred in the second year as well. European red mites were more numerous in the second and third years with some bronzing occurring in the third year. They did not show a preference for one cultivar over another. Aphids and leafminers were not problematic in the second year or third years. Some foliar damage by potato leafhoppers occurred in the third year.

Trees were allowed to bear in the third year, but fruit were thinned to a light crop load because trees were still small. Tree survival in Orchard 1 has been good. In Orchard 2, several trees died or are very weak from what appears to be phytophthora root or crown rot.

This research is on-going and will document disease challenges along with the overall economic costs, returns, and risks associated with these five cultivars being grown under organic production practices within the two orchard systems.

For more information, please visit the Organic Apple Project website:
www.uvm.edu/organica

Major funding for this project is from the USDA Integrated Organic Program and from the Universities involved in the project. We thank them for their support.

OrganicA

a resource for organic apple production

Biopesticides in Upper Midwest Organic Tree Fruit Production

Great Lakes Fruit, Vegetable and Farm Market EXPO

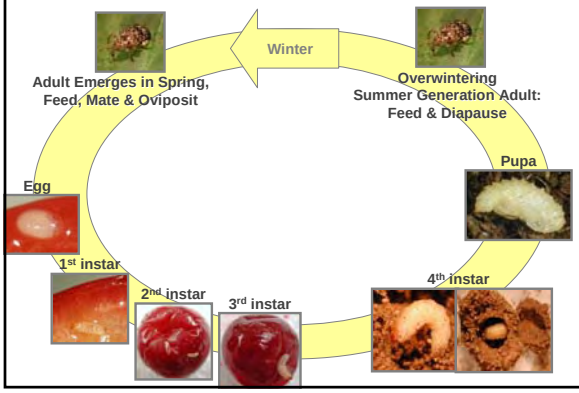
Renee Pereault
Mark Whalon

Michigan State University Department of Entomology

Organic Tree Fruit Production Biopesticide Targets

- **Plum Curculio**
- **Borers**
- **Codling Moth**

Plum Curculio Life History



Plum Curculio Background

- **Damage:**
  - **Feeding & oviposition scars**
  - **Zero tolerance for larvae in processed fruit**

- **Few Organic Management Tactics:**
  - **Repeated kaolin clay coverage**
  - **Pyganic**
  - **Livestock**

Pathogen Experiment Design

-Larvae placed on surface of enclosed pots installed in 5 orchards

-Soil surface of each pot treated with a pathogen on day 0

-Response variable = Number of adults emerging from pots

Pathogen Experiment Design

Pathogens: / Rates:

-B. bassiana **GHA** (Mycotrol-O®)	**(1) 5x10^{13} conidia/ha**
-H. bacteriophora (Utah, unformulated)	**(2) 1x10^{9} or 4x10^{9} IJ/ha**
-S. riobrave (355 strain, Biovector®)	**(2) 1x10^{9} or 4x10^{9} IJ/ha**
-Control (water)	

Timings:

-Introduce larvae to soil -10, -5, 0, 5, 10, 15, or 20 d from pathogen application

-Hb was not tested for -10, 10, or 20 d

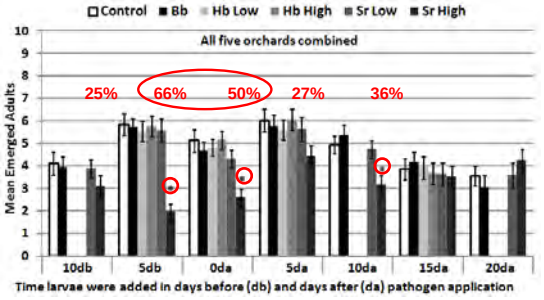
Design:

-36 treatments total

-LSMeans comparisons made within each timing (α=0.5)

-8 reps per orchard, under two tree rows

Pathogen Experiment Results



Average number of adult plum curculios emerging from pathogen-treated soil. Soils were treated with the fungus *Beauveria bassiana* (Bb) or the nematodes *Heterorhabditis bacteriophora* or *Steinernema riobrave* at a low or high rate (Hb Low, Hb High, Sr Low, Sr High). Larvae were placed on soil either -10, -5, 0, 5,10, 15, or 20 days from pathogen application. Bars with an asterisk (*) denote significantly lower means within a day-timing. Note: Hb Low and High were not included for the -10, 10, or 20 day treatments.

Pathogen Experiment Results: Orchards

	Percent Reduction from Control Treatment for *S. riobrave* high rate treatments						
	-10 d	-5 d	0 d	5 d	10 d	15 d	20 d
All Orchards	25	66	50	27	36	8	-18
Loamy Sand	48	89	56	-22	25	-26	12
Sandy Loam	45	69	70	70	41	55	43
Loam	14	65	82	44	36	15	-24
Clay Loam	33	50	4	16	56	4	-79
Loam, High Org.	34	17	21	-10	50	-18	10

Pathogen Experiment Discussion

- ***S.riobrave*** **significantly suppressed adult emergence when larvae were added -5, 0, and 10 d after pathogen**
- **Mortality highest in sandy orchards at -5 and 0 d**
- ***S. riobrave*** **NOT yet formulated for certified organic**

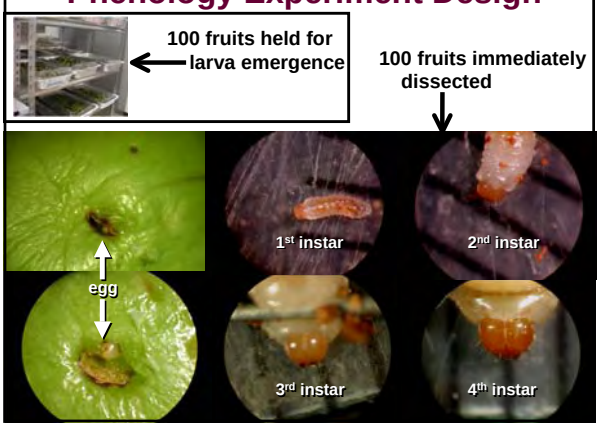
Phenology Experiment Design

-Orchards in NW, Central, and SW Michigan
-Early (320-500 DD10°C) and Late (660-730 DD10°C)

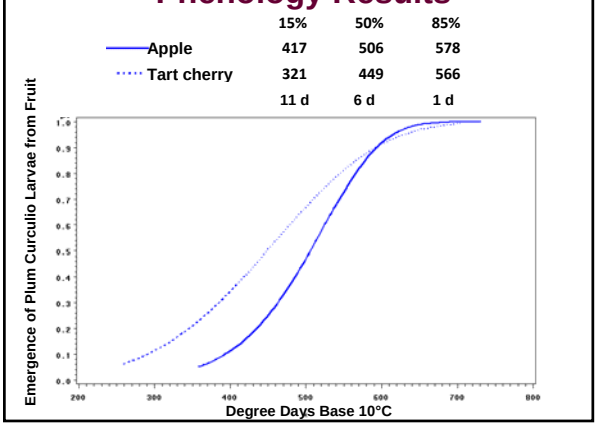
-Samples picked from ground and tree
Excluded apples on tree from analysis
Excluded samples with <10 larvae

Crops:
Apple
Tart cherry
Sweet cherry

Phenology Experiment Design



Phenology Results



Phenology Discussion

- 18 d from 15%-85% emergence in apple
- 27 d from 15%-85% emergence in tart cherry
  - Sample size
  - Reader beware: more data coming before the organic session on December 11th. Please come to the meeting if you want the latest information. Results coming soon to www.enviroweather.msu.edu

www.enviroweather.msu.edu

Borers

Greater Peachtree Borer
Lesser Peachtree Borer
American Plum Borer
Dogwood Borer



Borers: Sites

Site	Crop	Location	# Trees Treated	# Trees Control	Evaluation Destructive	Evaluation Non-Destructive
1	Peach	SW	32	32	2-Oct	
2	Tart cherry	SW	28	28	4-Nov	
3	Tart cherry	NW	32	32		summer 2009
4	Tart cherry	NW	32	32	16-Oct	
5	Sweet cherry	NW	32	32	16-Oct	summer 2009
6	Apple	CENTRAL	32	32		summer 2009
7	Apple	CENTRAL	32	32	15-Oct	

Borers: Applications

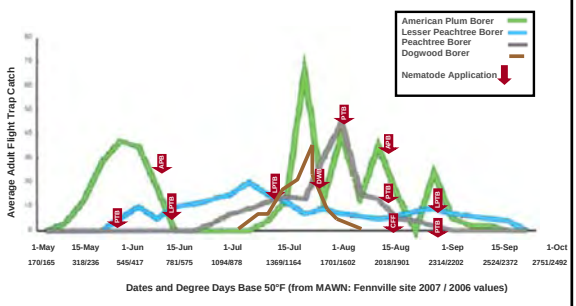
Wet 1 hr (30 gallons/acre/hr) with microjet sprinklers before nematode application

-Wet 1 hr/day three days post-treatment

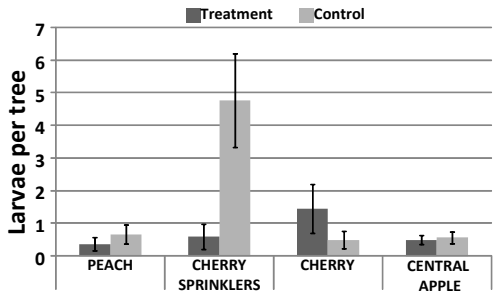
Backpack sprayer application of nematode *S. carpocapsae* (BionemC, organic formulation)

Rate: 300,000 Infective Juveniles (IJ's) in 2 cups water applied to tree trunks and 300,000 IJ's in 2 cups water applied to the soil under the tree to a radius of 0.5 m from the trunk

Borers: Timing



Borers: Early Results

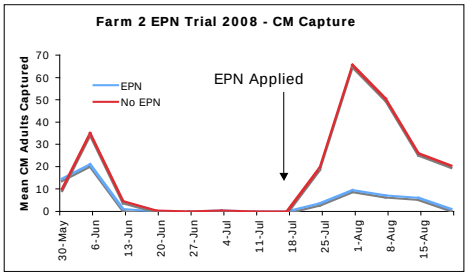


Modifying Environment Key to Performance
Solid State Delivery System

Codling Moth

Larry Gut & Dave Epstein

Same organic formulation of *S. carpocapsae* (BionemC)

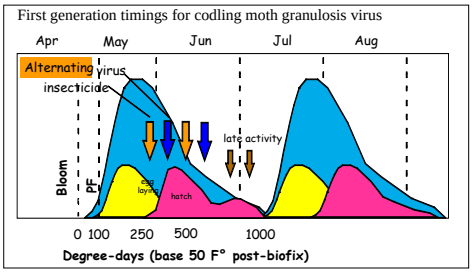


Adult CM captures in pheromone-baited traps for organic farm two showed significant declines following the mid-season EPN application.

Codling Moth

Larry Gut & Dave Epstein

Granulosis Virus



Two CpGv deployment strategies: a) alternating insecticide and virus treatments for control of first-generation CM activity, and b) targeting late 1st generation activity, only.

Acknowledgements

Project GREEEN
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Weather-based pest, natural resource, and production management tools

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