4th International Organic Tree Fruit Research Symposium

Proceedings

March 3-6, 2007
Kellogg Center, East Lansing, Michigan

Hosted By:
Michigan State University

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Thanks to Gerber Foods for their generous financial support that made this event possible.

Symposium Planning Committee:
Mark Whalon, Michigan State University
George Bird, Michigan State University
Deirdre Birmingham, Upper Midwest Organic Tree Fruit Growers Network
Kathleen Delate, Iowa State University
Greg Lang, Michigan State University
Jim Koan, Al-Mar Orchards

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Proceedings produced by Abbra Puvalowski and Jeanette Wilson, Michigan State University, East Lansing, MI

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Soil Management

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Value-Added Issues: A Discussion

Marketing and Networking

4th International Organic Tree Fruit Research Symposium
March 3-6, 2007, East Lansing, MI

PROGRAM

Saturday, March 3, 2007
6:00-8:00 PM Registration – Kellogg Center Conference Registration Desk

Sunday, March 4, 2007

8:00-9:00	Registration – Kellogg Center Conference Registration Desk
9:00-10:00	Bus Travel to Clarksville Horticultural Research Station
10:00-10:30	Symposium Overview – George Bird Welcome to Clarksville Horticultural Research and Education Station and Organic Apple Project Overview – Phil Schwallier, Jim Flore
10:30-11:30	Clarksville Organic Apple Orchard Tour and Discussion Hosts: Phil Schwallier, Mark Whalon, Dario Stefanelli, Jim Flore, Denise Ruwersma, and George Bird
11:30-12:30	Lunch
12:30-2:30	Bus Travel to Al-Mar Organic Apple Orchard Directions: Exit 123 off of I-69. Turn on Calkins Rd and travel east for 1 mile to Duffield Rd. Then, go north to the store houses.
2:30-4:00	Al-Mar Organic Orchard Tour and Discussion Host: Jim Koan
4:00-5:00	Bus Travel to MSU Kellogg Center
5:00-6:00	Poster Set-up: Kellogg Center River Room
6:00-8:00	Wine and Cheese Poster Session Kellogg Center River and Spartan Rooms

Monday, March 5, 2007

7:30-8:30 Coffee - Kellogg Center Auditorium Break Area

8:00-8:30 Registration - Kellogg Center Conference Registration Desk

8:30-9:30 Symposium Kickoff - Session No. 1
Kellogg Center Auditorium
Moderator: Mark Whalon, Michigan State U. (MSU)
Speakers:
- *Welcome* – Ron Perry, MSU
- *Symposium Overview* - George Bird, MSU
- *Comparison of Organic Apple Systems in New Zealand and the Midwestern U.S.*- Kathleen Delate, Iowa State U.
- *Organic Materials Update* - Dave DeCou, OMRI

9:30-10:00 Transitioning or Establishing Organic Orchards - Session No. 2
Kellogg Center Auditorium
Moderator: Mark Whalon, MSU
Speakers:
- *Key Considerations in Transitioning or Establishing Organic Orchards,* Harry Hoch, Hoch Family Orchard & Gardens, MN

10:00-10:30 Break - Kellogg Center Auditorium Break Area

10:30- 11:00 Transitioning or Establishing Organic Orchards con't
Kellogg Center Auditorium
Speakers:
- "*The Organic Apple Project: Introductory Top-Grafting Results in a Transitional Organic Apple Orchard*- Lorraine Berkett, U of Vermont
- *Sweet Cherries: High Tunnels Change Just About Everything* - Gregory Lang, MSU

11:00 – 12:15 Horticultural Practices - Session No. 3
Moderator: Kathleen Delate, Iowa State U.
Speakers:
- *Preliminary Observations of Serviceberry (Amelanchier ssp. Rosacea) as a Dwarfing Rootstock for Pear in an Organic Orchard*- David Sliwa, Sliwa Meadow Farm, IA
- *Organic and Integrated Fruit Production Systems in New York: Three Years of Research in a Liberty Apple Orchard*- Gregory Peck, Cornell University
- *From the Soil to the Apple*: Dario Stefanelli, Michigan State U.

12:15-1:15 Lunch - Kellogg Center Lincoln Room

1:15-2:30 Pest Management - Session No. 4
Kellogg Center Auditorium
Moderator: Greg Lang, Michigan State U.
Speakers:
- *Developing an Ecologically Based Organic Tree Fruit Production System* - Mark Brown, USDA-ARS, WV
- *Analysis of Insect Collection Data from MN* Orchards - Emily Hoover, U of Minnesota
- *Plum Curculio Management in Organic Systems* - Mark Whalon, MSU

Panel Members: Mark Brown, Emily Hoover, Mark Whalon, and Jim Laubach

2:30 - 3:00 Soil Management - Session No. 5
Moderator: Deirdre Birmingham, Regan Creek Farm, WI
Speakers:
- *The Soil Biology of Organic Orchards* - George Bird, Michigan State U.
- *Evaluation of a New Soil Health Indicatior*: Jennifer Moore Kucera, Oregon State U.
- *Evening Discussion "Soil Management"* - Joe Scrimger, Biosystems Consultant, MI

3:00 - 3:30 Break - Kellogg Center Auditorium Break Area

3:30 – 4:00 Soil Management con't

4:00 – 4:45 Value-Added Issues: A Discussion - Session No. 6, Kellogg Center Auditorium
Moderator: Dennis Mackey, Northern Natural Organics, MI
Panel Members:
- Todd DeKryger, Gerber Foods
- Steve Ela, Ela Family Farms, CO
- Dan Kelly, Missouri Organic Apple Grower, MO

5:00 - 5:30 Keynote Talk – *Marketing & "O" Research*
Jim Koan, Al-Mar Orchard, MI
Kellogg Center Room 61

5:30 - 7:30 Cash Bar - Kellogg Center Lincoln Room

6:30 – 7:30 Dinner – Kellogg Center Lincoln Room

7:30 – 8:30 Keynote Address - Kellogg Center Lincoln Room
Organics in the Upper Midwest
Jim Bingen, President, Michigan Organic Food and Farm Alliance

Tuesday, March 6

7:30-8:30 Coffee - Kellogg Center Auditorium Break Area

8:30-10:00 Marketing and Networking - Session No. 8
Kellogg Center Michigamme Room
Moderator: Jim Lindemann, Gardens of Goodness, WI
Speakers:

- *Farm Market Strategies* - Zach Koan, Grand Blanc, Farmers' Market, MI
- *Networks and Networking* - Deirdre Birmingham, Upper Midwest Organic Tree Fruit Growers Network
- *Joint Development and Marketing of Juice, Apples, and Fermented Products* - Dennis Mackey, Northern Natural Organics, MI

10:00-10:30 Break - Kellogg Center Auditorium Break Area

Concurrent Research Priority Discussion Sessions
Morning Moderators will compile a list of suggestions to be presented in the afternoon Report - Back Session.

10:30-noon Transitioning and Establishing Organic Orchards -
Kellogg Center Vista Room
Moderator: Deirdre Birmingham

10:30-noon Horticultural Practices and Soil Management
Kellogg Center Room 106
Moderator: Steve Ela

10:30-noon Pest Management
Kellogg Center Michigamme Room
Moderator: Jim Laubach

10:30-noon Value-Added and Marketing
Kellogg Center Room 61
Moderator: Harry Hoch

12:15-1:15 Lunch - Kellogg Center Red Cedar A-B

1:30-2:30 Research Priority Report - Back Session
Kellogg Center Michigamme Room
Moderator: Mark Whalon

2:30-3:00 5th International Organic Tree Fruit Symposium Discussion
Kellogg Center Michigamme Room
Moderator: Steve Ela

3:00 Adjourn

Symposium Kickoff

Session #1

Comparison of Organic Apple Systems in New Zealand and the Midwestern U.S.

Kathleen Delate, Associate Professor, Depts. of Agronomy/Horticulture

The global market for organic product sales was $20 billion in 2005, with a growth rate of 20 to 35% per annum. In the U.S., there were 937,000 ha of certified organic land in 2003 with 5626 ha of organic apples [*Malus sylvestris* (L.) Mill var. *domestica* (Borkh.) Mansf.]. Increases in organic fruit production have been associated with improved pest management methods, the use of disease–resistant cultivars, and organic–focused marketing schemes. Four case studies are presented focusing on these themes. In Midwestern U.S. organic markets, the scab–resistant cultivars, Enterprise, Liberty, Redfree, and Gold Rush, have gained increased acceptance, with the use of kaolin clay–and spinosad–based insecticides resulting in codling moth damage levels below 5% in these cultivars. Similar pest management systems have been developed by apple–exporting countries like New Zealand in order to comply with export standards and quarantines. Codling moth granulosis virus and a spinosad–based insecticide have led to an increase in organic exports with a 41% premium price over conventional apples, but non–target effects from spinosad have been suggested through experimental evidence in the case of beneficial insects and secondary pests, such as woolly apple aphid, *Eriosoma lanigerum* (Hausmann). An alternative to spinosad applications is insect disinfestations through controlled atmosphere treatment. In order to control quarantined pests and extend storage potential of scab–resistant cultivars, a controlled atmosphere treatment of 9 wk of 2% O_2 and 2% CO_2 at 0.5 °C was evaluated on a scab-resistant cultivar, Pinkie, and determined to decrease internal ethylene concentration by 84% in CA–stored apples compared to apples stored in air. In addition, new scab–resistant cultivars with ‘Pinkie’ background show promise for organic production. Future pest management strategies in organic apple production will focus on development of scab–resistant cultivars with enhanced storage capability and reduction in inputs associated with negative environmental and health effects.

Organic Materials Update

Dave DeCou, OMRI

The /Organic Materials Review Institute/ (OMRI) provides organic certifiers, growers, manufacturers, and suppliers an independent review of products intended for use in certified organic production, handling, and processing. OMRI reviews applying products against the National Organic Standards <http://www.ams.usda.gov/nop/NOP/NOPhome.html>. Acceptable products are OMRI Listed® and appear on the OMRI Products List <http://www.omri.org/OMRI_about_list.html>.
OMRI also provides subscribers guidance on the acceptability of various material inputs in general under the National Organic Program. Recently OMRI has established a real time on-line searchable database of suppliers of organic seeds. Our goal is to provide information for those in the organic industry to more easily choose appropriate inputs for their certified operations.

Transitioning or Establishing Organic Orchards

Session #2

Establishing a balanced ecosystem and implementing advanced IPM to enhance organic controls in a Minnesota Apple Orchard

Harry Hoch MS
Hoch Orchard and Gardens
La Crescent Mn

Abstract

We have been monitoring pests and working to reduce our reliance on pesticides for two decades at Hoch Orchards. We use state-of-the-art IPM practices to create a sustainable low input system. We have been experimenting with organic systems on a small scale since 1990 when we planted a ¼-acre block of disease resistant varieties. In 2005, we started the transition process on two acres of disease resistant cultivars and in 2006, we added some conventional blocks to total about eight acres in transition.

At Hoch Orchard and Gardens, we create a positive environment for beneficials in the orchard. Timed alternate row mowing allows a wide variety of plants to become established on the orchard floor. Alternate row mowing keeps a continual assortment of flowering plants throughout the growing season providing a pollen and nectar source for beneficial insects. Side discharge of the grass cuttings provides a light mulch under the tree canopy and encourages the activity of earthworms. Birdhouses throughout the orchard increase the numbers of wrens, tree swallows, and bluebirds. Resident nesting pairs of birds help reduce insect pest pressure. Allowing a mix if poultry to graze in the orchard also reduces pest pressure.

The primary pests in Southeastern Minnesota are plum curculio, apple maggot, codling moth, and apple scab. The use of insect traps, weather data recorders, and computer modeling increases the efficacy of the soft organic insecticides and repellants. Squash mount spore monitoring and computer disease modeling allowed us to control scab in 2006 with lime sulfur in a post-infection control system. The combination of these IPM systems and organic products produced 50% to 80% US No 1 fruit on disease susceptible apple varieties in a high pest pressure environment.

The OrganicA Project: Preliminary "Top-Grafting" Results in a Transitional Organic Apple Orchard

M. Elena Garcia[1], Renae E. Moran[2], Terence L. Bradshaw[3], Lorraine P. Berkett[3], Heather M. Darby[3], Robert L. Parsons[3], John P. Hayden[3], Sarah L. Kingsley-Richards[3], and Morgan L. Cromwell[3]
[1]University of Arkansas, [2]University of Maine, [3]University of Vermont
Contact address: megarcia@uark.edu

Keywords: Organic, apple, top-grafting, 'Ginger Gold', 'Zestar!', 'Honeycrisp', 'Liberty', 'Macoun'

Abstract: Organic apple production in the eastern United States is significantly influenced by cultivar susceptibility to apple diseases because of the weather conditions during the growing season. In New England, there has been a recent shift away from 'McIntosh', the historically predominant cultivar which is very susceptible to apple scab, to 'newer' cultivars because of consumer preference for unique cultivars and a shift in market focus from wholesale to more profitable retail, niche markets. These cultivars may offer new opportunities for enhancing organic apple production in the region. As part of the OrganicA Project, an 18 year-old orchard at the University of Vermont Horticulture Research Center in South Burlington was top-grafted in April 2006, with five cultivars that growers identified as having high consumer appeal and which would strengthen local and regional niche-markets: 'Zestar!', 'Ginger Gold', 'Honeycrisp', 'Liberty', and 'Macoun'. A goal of this long-term research project is to determine sustainability and profitability of this organic production system. Initial assessment of scion survival and incidence of flowering on scions in June revealed that of the five cultivars grafted in the orchard, 'Zestar!' had significantly less scion survival and greater incidence of flowering.

Sweet Cherries: High Tunnels Change Just About Everything

Gregory Lang*, Bill Shane, Phil Schwallier, and Rufus Isaacs
*Horticulture Dept., Plant & Soil Sciences Building, Michigan State University
East Lansing, MI 48824

Keywords: environmental modification, high density orchard systems, tree growth, fresh market production, fruit size and quality, yield, frost protection, rain-cracking, integrated pest management, brown rot (Monolinia fructicola), powdery mildew (Podosphaeria clandestina), bacterial canker (Pseudomonas syringae), Japanese beetle (Popillia japonica), plum curculio (Conotrachelus nenuphar), cherry fruit fly (Rhagoletis cingulata)

High quality fresh market sweet cherry production is a risky endeavor in the Great Lakes region; organic production adds additional challenges. Research projects to develop high tunnel production systems for sweet cherries were established in 2005 at MSU's experiment stations at Clarksville/CHES (established trees) and Benton Harbor/SWMREC (newly-planted trees). The objectives include modification of production environments to: 1) optimize vegetative and reproductive growth of sweet cherry trees on dwarfing rootstocks; 2) hasten or delay cherry ripening and thus extend marketing seasons; and 3) reduce chemical inputs for protection of cherries from diseases, insect pests, and/or physiological disorders. In 2006, no synthetic pesticides were used; likewise, woven geotextile polypropylene barriers and mowing were used for orchard floor management. Tunnel covers were installed pre-bloom and removed ~1 month before autumn leaf drop at both sites; tunnel ends were open. Results with tunnels thus far include: reduced pollinator (honeybee) activity, fruit set, and yields, but improved fruit quality and crop value; increased leaf size and terminal shoot growth; decreased radial trunk growth; decreased cherry leaf spot and bacterial canker; increased powdery mildew; no control of brown rot; no infestation by plum curculio or cherry fruit fly; dramatically reduced Japanese beetle damage; increased aphids and mites.

Horticultural Practices

Session #3

Preliminary Observations of Serviceberry (Amelanchier spp. Rosacea) as a Dwarfing Rootstock for Pear in an Organic Orchard

David Sliwa

Sliwa Meadow Farm
2682 Lannon Hill Rd.
Decorah IA 52101
USDA Growing Zone 4b

Key words: Dwarfing rootstock, pear, Amelanchier, serviceberry

The purpose of this study is to evaluate serviceberry (Amelanchier spp. Rosacea) as a dwarfing rootstock for pear in an organic orchard. Three pear varieties, Worden Seckel, Patten and Summercrisp, grafted on four rootstocks, A. canadensis, A laevis, A grandiflora and Pyrodwarf were tested. Over the course of one growing season 'Worden Seckel' on all rootstocks had vigorous growth throughout the season, had the greatest height growth and percent graft take (95%) compared to all other pear/rootstock combinations. 'Summercrisp' had stagnated growth after the initial two months, about half the height growth of 'Worden Seckel' and 65% graft take. 'Patten' was generally intermediate between the two other pear varieties. These trees will be transplanted into the orchard to observe their dwarfing and fruiting characteristics.

Organic and Integrated Fruit Production Systems in New York: Three Years of Research in a 'Liberty' Apple Orchard

Gregory M. Peck and Ian A. Merwin

Dept. of Horticulture, Cornell University, Ithaca, NY 14853

Keywords: Integrated Fruit Production (IFP), organic, systems study.

While individual components of organic (OFP) and integrated fruit production (IFP) have been evaluated in Northeastern apple orchards, to date there have been no comprehensive studies to validate the feasibility or profitability of the entire OFP or IFP system. We are conducting a long-term experiment comparing OFP and IFP systems in an established commercial orchard block of disease resistant 'Liberty' on M.9 rootstock to systematically evaluate OFP and IFP systems for pest control efficacy, fruit quality, soil quality, environmental impacts, and profitability. The OFP system follows USDA-NOP standards and the IFP system follows newly developed NY IFP standards. The first three seasons have illustrated that the IFP system has the potential of becoming widely adapted in NY, but without consumer recognition price premiums will be difficult to obtain. Growing apples organically in NY is also feasible, but consumers must be educated about small fruit size and poor fruit finish. We expect this project to provide vital information for fruit growers in the Northeast and elsewhere who are considering adopting either of these two apple production systems in order to maintain profitability and improve sustainability on their farms.

Evaluation of Orchard Floor Management Systems for Apple under Organic Protocol: Effect on Rootstock Performance.

Dario Steffanelli, Michigan State University

In organic apple production, orchard floor management is of greatest importance since it determines weed management and fertility. In this experiment we evaluated the response of the cultivar “Pacific Gala” on three rootstocks of different vigor: M.9 NAKB 337, M.9 RN 29, and Supporter 4 (in respective order of vigor from dwarfing to semi-vigorous). The three rootstocks were also evaluated for the response to three orchard floor management systems: mulching (alfalfa hay), flaming, and strip tillage on each side of the row with natural vegetation allowed to grow on the tree row (Swiss Sandwich System). The experiment was conducted in an orchard planted in 2001 and certified organic since 2003.

The three treatments did change the soil conditions with mulch showing higher concentrations of SOM and N creating different growing conditions for the rootstocks. The OFMS treatments did not have an effect on the tree growth parameters measured except for foliar nitrogen concentration that was higher with alfalfa mulch. Trees on Supporter 4 were most vigorous, as anticipated. There was an interaction between treatments and rootstocks with M.9 RN 29 showing the highest yield and “yield efficiency” per tree in flame and sandwich while no differences were noticed between the rootstocks in mulch despite its better growing conditions. This suggests that M.9 RN 29 is a rootstock that adapts well to more stressful conditions (lower SOM and N, and in case of the Sandwich vegetated area, water content) posed by sandwich and flame treatments. Cumulative yield/ha was highest in mulch and sandwich and lowest in the flame treatment.

The flame treatment appeared less desirable related to management regarding low SOM, N, fire risk, risk of injures to branches, and irrigation plastic system. On a positive side the flame was economical at an annual expense of $278 in our experimental orchard. Drawbacks to the alfalfa hay mulch system included; expensive ($788), high maintenance (to keep it thick), high risk of rodents damage, and risk of leaching. The sandwich system provided a less suitable growing conditions (lower SOM, N concentration and water content in the vegetated area), it was however, easy to deploy and manage, it did not damage the tree, it was low cost at $98, and it requires only an easily modified notch disk tiller.

Overall, considering the sandwich system coupled with the M.9 RN 29 rootstock seems to be a suitable choice for growers that want to grow Pacific Gala under organic protocol in Michigan and similar climates. More research is still necessary especially to confirm these results in a longer term study.

Pest Management

Session #4

Effective biological control of rosy apple aphids by interplanting peach trees into apple orchards

Mark W. Brown[1] and Clarissa R. Mathews[2]

[1]USDA, ARS, Appalachian Fruit Res. Sta., Kearneysville, WV
[2]Institute for Environmental Studies, Shepherd Univ., Shepherdstown, WV

Field studies were done from 1997 to 2006 to investigate the interactions between biological control of rosy apple aphids and the interplanting of peach trees into apple orchards. Studies were done in research orchards that were not treated with insecticides. Orchards were either a monoculture of apple, interplanted with 9% of the trees as peach, or interplanted with 50% of the trees being peach. All the peach trees produced extrafloral nectar from glands at the base of the leaf blades. There was a significant decrease in rosy apple aphid populations in the interplanted orchards due to dilution of host plant concentration as compared to the apple monoculture. There was also an increase in biological control of rosy apple aphids in the early spring in orchards interplanted with 9% peach trees; monoculture apple and 50% interplanted orchards had lower rates biological control. Within a week after bloom, before migration to alternate hosts could begin, all rosy aphid colonies were destroyed in the 9% interplanted orchards whereas in the other orchards colonies persisted more than a month after bloom, allowing time for migration and continuation of the population into the next year. In other studies we demonstrated that the dominant predator, the multicolored Asian lady beetle, concentrates its feeding around individual peach trees that are producing extrafloral nectar. It is recommended that interplanting an apple orchard with 9% fruit trees bearing extrafloral nectar glands (e.g., peach, cherry, or apricot) would provide adequate control of rosy apple aphids in an organic apple orchard.

What we know about insects in Minnesota orchards

Emily Hoover[1], Harpatap Mann[1], Jean Cibrowski[2]
[1]Department of Horticultural Science, University of Minnesota, St. Paul, MN 55108, [2] Minnesota Department of Agriculture, St. Paul, MN 55155

Keywords: apple, apple maggot, codling moth, degree day modeling

Insects are cold-blooded organisms with the growth of adults, larvae, and eggs driven by temperature. Since temperatures may vary widely from year to year, pest management strategies may not be effective if control measures are based on calendar dates rather than on insect development. A widely used tool for predicting insect growth is the degree day (DD) model. These models establish a relationship between insect flight and accumulated DD above the minimum (base) temperature threshold. From 1998 to 2005 data was collected weekly during the growing season on six insects (apple maggot, codling moth, lesser apple worm, obliquebanded leafroller, redbanded leafroller and spotted tentiform leafminer) trapped in 25 orchards in Minnesota (MN). We analyzed the data with the objective of developing a DD model for incidence of each insect in MN and comparing the model to published models from other Eastern states. We graphically summarized the insect trap data and then used the data to model peak insect flight activity. Models generated from this data were compared to published peak flight activity models. We conclude that using models developed in Michigan would closely approximate what we have found in MN orchards. This study provides an easy reference for initiating insect scouting operations by orchardists.

Plum curculio management in organic systems

Mark E. Whalon, Dan Nortman, Renee Pereault
Michigan State University

Abstract
Plum curculio (PC) is a primary internal feeding pest of tree fruit in the US west of the Rocky Mountains. With the increase in organic tree fruit in the Upper Midwest, growers are desperate for highly effective control strategies for use against this pest. The pesticide alternatives lab at Michigan State University has been involved in developing a comprehensive control strategy, involving the development of monitoring tools, phenology modeling and novel management strategies. We have developed pyramid and screen traps modified from weevil traps that are now the standard for monitoring plum curculio. These traps utilize two PC attractants, plum essence and benzaldehyde in conjunction with these traps. Phenology models have also been developed by monitoring degree-day based emergence and performing dissections in correlation with degree day accumulation to determine reproductive and physiological state of the insect. These models have been incorporated into management programs to refine spray timing and increase the efficacy of management. We have also developed two major control strategies for PC. The first is an attract and kill strategy that essentially uses attractants on the edges of the orchard and repellents, such as Surround, on the orchard interior to concentrate adult on the outer edges of the orchard, where they are killed with Pyganic. This strategy has also proven moderately effective integrated into a trap out approach. We have also begun development of a biopesticide based management strategy that uses rice grains infected with insect pathogenic fungus, which is seeded into soils prior to larval drop from fruit. The fungus then kills the larvae. This talk will provide information on developed tactic methodology and give insight into PC biology. Tactics in development and on the horizon will also be covered.

Organic Apple Project Spray Program 2004-2006

Denise Ruwersma – Organic Technician
Phil Schwallier – District Extension Agent
Clarksville Horticulture Experiment Station

The first spray was copper on 4-16 to prevent apple scab and fireblight. After that we started a weekly spray schedule of sulfur, serenade and surround. There were 17 applications of Sulfur, 15 applications of Serenade, and 15 applications of Surround. Sulfur was applied for control of apple scab and powdery mildew at 12#/acre. Serenade was appllied for control of fireblight at 3#/acre and Surround was applied for insect control at 40#/acre. There were 6 sprays of PyGanic to control Plum Cucullio, Rosie Apple Aphids and OBLR at 12oz/acre. CYD-X virus was sprayed 7 times to minimize the effects of Codling Moth at 2oz/acre. Fish oil was applied twice at 2g/acre to aid soil nutrients and foliar fertilization.

Organic Control of Broadleaf Weed Seed Germination and Establishment

Suzanne Lang, Muralee Nair, and Tara Valentino
Department of Horticulture

Ron Calhoun, John Rogers, and Thomas Nikolai
Department of Crop and Soil Science

The use of broadleaf herbicides has become scrutinized due to negative environmental impact. Research has focused on finding sustainable approaches for the successful management of undesired weed species. Work at Michigan State University suggests that maple leaf mulch can be an effective organic herbicide to suppress broadleaf weeds. Recent work compared broadleaf weed control from leaf litter mulches with different maple species (*Acre*) in established Kentucky bluegrass (*Poa pratensis* L.) (Kowalewski, 2006). Fall applications of maple leaf mulch (1.5-kg m^{-2}) provided more than 80% control of dandelion (*Taraxacum officinale* W.). Previous research has focused on control within established stands, thus the effect of maple leaf mulch on germination (pre-emergence) and seedling growth (post-emergence) grass and weed species is unknown. The present research tests whether the herbicidal action derived from maple (*Acer*) leaf mulch can be an effective organic herbicide to control the germination and/or the growth of broadleaf weeds, without deleterious impact on grass species. Objectives include: 1) determine the influence of water soluble maple leaf extracts on the germination performance (germination percentage and rate) of dandelion; 2) determine the effect of water soluble maple leaf extracts on seedling growth of dandelion; and 3) evaluate the influence of water soluble maple leaf extracts on the germination performance and seedling growth of grasses.

Significant progress has been made to test the hypothesis that herbicidal action derived from maple (*Acer)* leaf mulch can be an effective organic herbicide to control the germination and/or the growth of broadleaf weeds (dandelion, *Taraxacum* spp. Germination studies using the water-soluble fraction from naturally senesced leaves has been completed. There were no significant differences in mean time to germination (MTG) between control and grass or dandelion seeds treated with the control leaf treatment (oak) or either of the maple water-soluble extracts; MTG was ca. 7 days for controls and all treatments. However, there was a significant 20% decrease in germination percentage for dandelion seed germinated in 2mg, 4mg, and 6mg/L sugar maple leaf extract. Additionally, germination percentages for the high sugar maple leaf extract decreased by 26% and 45% for the 4mg and 6mg/L treatments, respectively. There were no significant effects on germination percentage for the grass species under any leaf extract treatment.

Plum Curculio Suppression in Organic Orchards with Insect Pathogenic Fungus

Renee Pereault[1], Mark Whalon

[1]pereault@msu.edu, B10 Center for Integrated Plant Systems, Michigan State University, East Lansing, MI 48824

Abstract:
Few methods to manage plum curculio in tree fruit orchards are available for organic growers. Insect pathogenic fungi, including Beauveria bassiana and Metarhizium anisopliae, offer the potential to suppress plum curculio populations during soil contact periods. These periods occur when larvae emerge from fruit to pupate in soil and also during overwintering. The plum curculio life cycle is outlined as well as a degree-day model proposing treatment times. Field experiment results evaluating Beauveria bassiana commercial spray formulation and a granule formulation are presented. No significant differences were found between pitfall trap catches of several selected non-target arthropod groups within experimentally treated plots.

Mites as Ecological Indicators in Michigan Tree Fruit

Andrea Biasi Coombs[1], Mark E. Whalon[1], Brian A. Croft[2], Danielle McEachin[1], and Daniel Nortman[1]
(1) Michigan State University, Center for Integrated Plant Systems, East Lansing, Mi (2) Oregon State University, Department of Entomology, Corvallis, OR

In the early 1980s research was conducted to determine the effect of a range of orchard management strategies on mite species composition. The data exhibited trends in the relationship between mite species presence and pest management practices. We are reexamining this data to show a statistical relationship between mite populations and environmental sustainability.

Analysis of Southern Strain Plum Curculio (Conotrachelus nenuphar) Female Reproductive Development

Eric J. Hoffmann, Curtis Howard, Mark E. Whalon

Reproductive development of lab-reared female plum curculio was assessed under different temperature regimes in same- and mixed-sex cohorts. Individuals were fed ad libitum and three individuals were dissected daily for each temperature and cohort type until full maturity was reached. Reproductive structures were dissected and assessed for number of visible oocytes, size of proximal and distal oocytes, and spermatheca development. Oocyte development appears to be temperature-dependent and unaffected by mating status. Developmental thresholds are estimated for the observed parameters.

Plum curculio control strategies for organic apple and tart cherry

Mark E. Whalon, Dan Nortman, Eric Hoffman

Plum curculio (PC) is a primary internal feeding pest of tree fruit in the US west of the Rocky Mountains. With the increase in organic tree fruit in the Upper Midwest, growers are desperate for highly effective control strategies for use against this pest. The pesticides alternatives lab at Michigan State University has been involved in developing various PC management tools for organic growers. This poster will present several of these as well as appropriate spray timing models.

Soil Management

Session #5

A Nematode Community Structure Standard for Assessment of Soil Quality.

G. W. Bird, D. Stefanelli, J. Smith, M. Berney, L. Webster, R. Perry, R. Gore and J. Davenport. Department of Entomology. Michigan State University. East Lansing, MI 48824

Nematode community structure can be used as a tool for ecosystem analysis. An assessment standard using five feeding groups (bacterivores, fungivores, herbivores, omniviores and carnivores), absolute population density, relative population density and vertical distribution (O horizon, 0-15 cm soil depth and 15-30 cm soil depth) was developed for two managed and two non-managed Michigan ecosystems (woodlot, old field secondary succession, certified organic vegetable production and conventional corn-soybean production). The tool was validated with data from four organic and four conventional MI tart cherry orchards and the Clarksville Horticultural Research Station Organic Apple Orchard. In the organic vegetable and both cherry systems, the majority of the bacterivores were recovered from the O horizon. A similar pattern was observed for other bacterivores such as amoebae, flagellates and ciliates. The relative density of fungivores associated with the organic standard was significantly ($P = 0.001$) greater than that of the woodlot and conventional corn-soybean systems. The absolute density of herbivores in the organic standard system was significantly ($P = 0.002$) less than those recovered from the woodlot or conventional corn-soybean system. Of ten physical parameters studied; soil pH, cation exchange capacity and soil organic matter explained the greatest amount of variance among nematode population densities. The organic cherry orchards had significantly ($P= 0.005$) more bacterial feeding nematodes, flagellates, ciliates and amoebae in the O-horizon than the population densities of these organisms recovered from conventional cherry orchards. Absolute nematode population densities (mainly bacterial feeding nematodes) increased in the Clarksville Horticultural Research Station Organic Orchard soil during the three years following the end of the formal transition process. The population densities of bacterivores were significantly ($P = 0.05$) greater under a mulch system, compared to flaming, weeds or the Swiss Sandwich System. Endomycorrhizal spores recovered from soil were highly correlated with those observed in apple root tissue.

Evaluation of a New Soil Health Indicator in Cherry Orchards: Particulate Organic Matter

Jennifer Moore-Kucera, Anita Azarenko, Lisa Brutcher, and Annie Chozinski
Department of Horticulture, Oregon State University, Corvallis, OR 97331

Orchard floor management (OFM) is relying more heavily on organic amendments to increase SOM, which enhances multiple soil functions critical to orchard health. Traditionally, changes in whole soil organic matter (SOM) concentrations have been monitored to determine success but these changes often occur too slowly. Therefore, researchers are investigating a biologically active fraction of SOM, particulate organic matter (POM), which is more responsive to management and has been successfully used as a fertility index in annual cropping systems. However, no studies have assessed its use in perennial orchard systems. We are evaluating POM-C and POM-N in ten orchards (two research farms and eight commercial farms) with different OFM strategies, soil types, and climates to determine their potential as soil fertility indicators for sweet cherry orchards in Oregon. In October 2006, soil samples were collected from 0-15 and 15-30 cm depths. They were analyzed for POM-C, POM-N, N mineralization potential (Nmin), soil nitrate and ammonium concentrations, and five enzyme potentials involved in C, N, P, and S cycling. Soil Nmin and enzyme activities served as proxies for soil nutrient status and overall biological activity, respectively. In general, POM-C and POM-N concentrations were higher in organically managed systems that added organic amendments relative to orchards that relied more on rapid-release fertilizers. In the organic orchards, POM was significantly correlated with four out of the five soil enzymatic activities ($r > 0.60$; $N = 56$; $p < 0.0001$). Moreover, in all orchards, these concentrations were positively correlated with N mineralization potential ($r > 0.47$; $N = 98$; $p < 0.0001$) and the sum of nitrate-N and ammonium-N ($r > 0.65$; $N = 98$; $p < 0.0001$) indicating that POM holds potential as a soil fertility index in cherry orchards.

Evening Discussion "Soil Management"

Joe Scrimger

The Evening discussion will be started with a quote from the *Albrecht Papers 1*, chapter 5, Let Rocks Their Silence Break, page 104:

"Perhaps when we give ear more attentively to the voice of the soil reporting the ecological array of the different life forms (microbes, plants, animals, and man) over the earth, we shall recognize the soil fertility-according to the rocks and resulting soil in their climatic setting-playing the major roles through food quality rather that quantity, surpluses, prices, etc., in determining those respective arrays. Man still refuses to see himself under control by the soil."

In the European news this week it was announced that 24 states in the US were losing their honeybee populations. As fruit or food producers we have to consider what the environment is trying to tell us here in the year 2006 that Dr. Albrecht was relating to over 70 years ago. Because he didn't go with the standard soluble fertilizer and pesticide use of the time, he eventually was let to retire from his position as Soils Department Chair at the University of Missouri. We find today that pesticides have become a major part of the crop and soils system, even though currently we do have the actual measurements of how these products negatively effect the biology of the soil, while we see the long term effect on the biology of the community.

The late Dr. John Clark, an Organic Farmer from Michigan, had often made the statement that "pesticides cause pest". When we look at how pesticides have disrupted beneficial insects and soil organisms we can see why John was so passionate in that statement. If we also look at how the soil organisms relate to the soil nutrient cycles, which in turn were to fulfill the plants nutritional needs, we can possibly start to relate to how the pest pressure and pesticide use has compounded over the years. If we are to change this cycle it is important to know the history and to be able to get back to the point where pest were not the problem that they are today. Versus trying to go ahead with a system of soil and ecology, following a conventional orchard management system that could lead to more organic pesticide use.

In fruit crops such as cherries and apples in Michigan we appear to have the classic case over the last 70-80 years of production of losing the biological life in the orchard, which has caused a situation of more pesticide use. In the start of this process, in Michigan, the farms not only had fruit but animals and for the most part when researched back far enough it is found that the pest pressure was not what it is today with more pesticide use. It appears that for an Organic Orchard system to work properly it could gain from adding the animals or part of the animal system, through manure composting, back to the farm. This has been shown to yield a broader base of life forms to the soil and the culture of the

orchard system. Because the lack of beneficial life forms and proper culture on the orchard floor or leaf surface currently can be the larger cause of more pest and disease pressure, growing the “life” and the “culture” is becoming more of the opportunity or the secret of the working Organic Farm.

Farmers have recently tied some fowl (chickens, guineas, etc.) in the orchard for starter with limited and mixed results. Sheep, in New Zeeland and other areas, have also been tried and they appear to have their place and time to be in the orchard to get a complimentary biological effect, to the soil and above ground beneficial organisms. With proper timing pigs and calves could also become part of the orchard setting. Because of the increased demand for the meat from organic foraging animals and the experience that is being gained from these trials, it appears that a diverse animal/fruit farm or community could or possibly should become the norm again, especially in the Organic Farming Community.

Because most pest or disease pressure comes from a lack of beneficial organisms not from too much of the pest, bringing more life into the organic orchard can be a factor in soil and pest management.

This should be a good basis to get the evening discussion started on “Soil Management” in the orchard

Acoustical Properties of Soil Aggregates Associated with Alternative Management and Natural Ecosystems: With Special Reference to Compost.

Quintanilla, M. [1], Smucker, A.[2], Gage, S.[3] and Bird, G. [1]. [1] G. W. Bird Nematology Laboratory, Entomology Department, Michigan State University, [2]Department of Crop and Soil Sciences, Michigan State University, [3]Department of Entomology, Michigan State University.

Acoustical analysis procedures are under development for ecosystem assessment. One current research project at Michigan State University is to determine if acoustics can be used to evaluate soil aggregate stability and porosity. Soil aggregates were placed on the surface of water in a 250 ml corrugated glass container in a sound chamber. This was repeated four times for each treatment. The resulting acoustics were recorded with a hydrophone and analyzed using the Gage EAS and modified Matlab computer programs designed to produce sonograms and graphic representations of acoustical frequencies and intensities. Soils used in a first experiment where from a KBS native ecosystem, Wooster forest site, and Hoytville continuously tilled agricultural site. The first experiment was modified and repeated, with more repetitions and treatments added in a second experiment. In the second experiment, Wooster soil came from a continuously tilled site, a no-till agricultural site, and a native forest site. Hoytville soil was from two agricultural sites: continuously tilled and no-till. KBS soil from the native ecosystem was also used. Soils with disruptive management practices involving tillage had greater sound intensity and variability; whereas soils from natural ecosystems where silent and had less within sample variability. The results from both experiments were similar. We conclude that tilled soils are heterogeneous, with a mix of unstable and stable soil aggregates. Overall, conventionally tilled soils have less soil aggregate stability and greater sound intensity. Soils from natural ecosystems are homogeneous and the soil has high soil aggregate stability and less sound intensity. In an experiment with compost, acoustical signatures were not obtained when the compost was sterilized, with or without using water as a pulsing agent. An acoustical signature was obtained from non-sterilized compost after it had been pulsed with water. A weak acoustical signature was obtained from the nematodes recovered from the compost. the results indicated that acoustics can be a useful and rapid way to determine soil aggregate stability. It is anticipated that the procedure will have utility as a methodology for overall soil quality assessment.

Value-Added Issues

Session #6

Fields to Kitchens: Opportunities and Sustainability for Processing Organic Fruits

by Dan Kelly

Anticipation of the first harvest should begin before the first hole is dug and the tree planted. Major issues of 'location' in all of its aspects will of course predominate any considerations of success. Markets are people and the consciousness of those people will make or break the person attempting to produce their first "organic" crop.

A door to open for an operation would be to enhance the harvest with value-added products. A state inspected processing kitchen is a good beginning to help cope with much of the fruit that does not make grade and is nearly essential for a beginning grower.

Time is a commodity that is more than equal to any crop of apples (pomes happen to be this focus) and how to sequester time is what growers need. A storage facility is our best attempt to hold both.

An organic grower, in its most traditional sense, reflects ones stewardship and an aspect that needs to be confronted is our impact on the ecosystem. The materials that one chooses to utilize, reflects our own concerns and commitment.

Straw bales are a viable and local on farm material that can be used to make a refrigerated storage facility to 'capture' time and allow the grower opportunities to extend harvest and sales. Construction techniques are simple and the structure is very effective in controlling temperatures and conserving energy.

Marketing and Networking

Session #8

THE EVOLUTION OF A MICHIGAN ORGANIC APPLE GROWER: CAUTIONS AND CONSIDERATIONS FOR THE FUTURE OF EASTERN ORGANIC APPLE GROWING

by Jim Koan, Al-Mar Orchard, Flushing, MI
almarorchard@aol.com

This paper gives my perspective as a former conventional who became an organic fruit grower. I sell product year-round via my on-farm store, as well as local farmers' markets. I sell fruit via wholesale accounts with co-ops, CSA's and large food retailers. At least 10% of my apples are processed into fresh sweet cider, hard cider, and wines.

I started as a conventional fruit grower in 1975 with 15 acres of apples that I expanded to 100 acres by 1995. A shift in apple economics as well as my own philosophy and experience caused me to change my focus from conventional to organic practices. After ten years of the transitioning process, I stand on a new plateau: 100% *organic production*.

Decent profit margins in retail, wholesale, and processed market sales, in conjunction with an ever-increasing demand for locally grown and organically grown food, painted a rosy picture of the future for this moderately-sized organic fruit grower. However, I now question the future profitability of organic apple growing in the eastern USA. In my estimation, lower profit margins, transitioning costs, higher risks due to unpredictable and potentially devastating weather extremes, as well as, ever-changing political policies do not forecast a profitable, stable, or secure future. I will discuss my cautionary tale with those considering and those advising large-scale organic tree fruit production.

Networks and Networking

Deirdre Birmingham
Upper Midwest Organic Tree Fruit Growers Network

Three different networks are explored for their purposes and strategies in tree fruit production. The first is the Upper Midwest Organic Tree Fruit Growers Network, the next is the Berkshire Meeting and its related list-serv called Applenet in the northeastern US, and the Eco-Apple Network in Wisconsin. While the Midwest network was started by growers, the other two were started with university and grant assistance. The Berkshire group's grant assistance, however, was almost 20 years ago. Yet the group continues on without financial or technical assistance. The Midwest group is focused on organic tree fruit production and marketing, while the Berkshire-Applenet group is not focused on any particular type of production method or label, but is for "open-minded growers" using sustainable methods including organic. The Eco-Fruit Networks are IPM-focused and are using EPA and EQIP funds to help growers reduce synthetic pesticide use. They bring together growers of geographic proximity to learn IPM principles and practices from private or university-based experts. All networks share information among their participants and encourage growers to advance at their own pace toward individually set goals to produce high-quality fruit with fewer environmentally negative impacts.

Joint Development and Marketing of Juice, Apples, and Fermented Products

Dennis Mackey, Northern Natural Organics, MI

Northern Organics LLC was formed in 1995 and involved the efforts of 6 farms to market together organic apples and tart cherries.
We also had manufactured organic shelf stable apple juice, sauce and butter. We really had no head person and left selling of these products to the individual farms. This did not work out all that well. In 2002 we purchased a fresh juice processing line, including an APV pasteurizer and concentrated on sales in the Midwest. I also took over the job of managing this company on a full time basis. This worked better but we were limited to just selling organic juice.
In 2006 the company was reorganized. 3 farms departed and 2 new ones came on board and we renamed the company, Northern Natural Organics LLC. Our plan now, in addition to fresh juice, is to expand into several organic value added products. It is our hope to provide a home for raw product not only for our grower owners but also for other organic growers in this state and region. This past season we purchased and utilized 20,000 Bu. of organic apples. We also purchased 35 ton of certified organic tart cherries and had tart cherry concentrate and IQF tart cherries in 40 lb boxes produced. We recently started selling the concentrate in 12 oz glass bottles, the first of several organic products we plan to produce and market.