

WINTER 2008 Michigan Apple NEWS



Michigan Apple Committee
www.MichiganApples.com

Research subcommittee names Tubbs new chairman



Tubbs is the new chairman of the Michigan Apple Research Subcommittee.

Tim Tubbs of Hart has been elected the new chairman of the Michigan Apple Research Subcommittee.

A lifelong farmer, Tubbs owns and manages **Tubbs Orchard in Hart** with his father, **Fred**, founder of the orchard. They grow apples, cherries, peaches and asparagus on 800 acres.

“I look forward to serving as chair of this fine group of growers,” said Tubbs, who has served on the subcommittee since 2002. “They

are really expanding their thinking and focusing on the future of the industry and what our apple growers need to succeed and thrive here in Michigan.”

Over the past several years, research projects have had a heavy emphasis on pest control. Tubbs said the subcommittee is looking to explore new types of research possibilities including packaging and marketing.

“Being on the research subcommittee, you get to see and hear a lot of really informative knowledge that is beneficial to everything we do,” said Tubbs. “Some of these researchers have become absolutely invaluable to the industry as a whole.”

Tubbs is married to Susie and the father of five children, ages 4 to 21. He is also a member of the Michigan Agricultural Cooperative Marketing Association (MACMA), which represents the apple processing industry, and the Michigan Asparagus Research Committee.

Tubbs takes over the helm of the research group from **Dr. Paul Rood** of Covert.

SPECIAL RESEARCH SECTION INSIDE

Production Cost Scenario*

Fresh Market Apples	Conventional	Organic
Income/Acre		
Yield	20,000 pounds	16,000 pounds
FOB Price Per Pound	\$0.25	\$0.40
Revenue/acre	\$5,000	\$6,400
Variable costs		
(Crop protection, labor)	\$2,000	\$2,800
Fixed costs		
(Marketing, storage, land, equipment)	\$700	\$700
Net Revenue/Acre	\$2,300	\$2,900

Study examines feasibility of organic production

Growing organic apples in Michigan may bring a higher price for the fruit, but production costs and crop loss will also rise, according to a recent study completed by The Perishables Group on behalf of the Michigan Apple Committee.

The ultimate goal was to determine if price received for organically grown apples outweighed higher production costs. The study revealed that growers can earn an extra \$600 per acre by changing over to organic apples, increasing wholesale prices from 25 to 40 cents a pound.

However organic growers can expect to spend much more on production — anywhere from 10 to 40 percent higher than conventional practices. The study assumes that the organic grower will also endure a greater loss at pack out and some loss due to biennial bearing.

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Conklin teen earns title of Michigan Apple Queen

Laura Dietrich of Conklin is the 2008 Michigan Apple Queen and will serve as an ambassador for the state's apple industry for the next year.

The Sparta High School senior is the daughter of apple growers **Alvin and Helen Dietrich**. She looks forward to representing the industry and educating the public about Michigan apples. Laura has worked at a local farm market the past three years, fielding questions about apple varieties and helping to raise consumer awareness.

"The public needs to know how important Michigan apples are to the economy and to their health," she said. "I am honored to have this opportunity to bring this message to them."

Emily Koenigshof of Coloma was named First Runner-Up. The daughter of **Fred and Linda Koenigshof**, Emily attends Coloma High School.



The 2008 Michigan Apple Queen Court from left: Emily Koenigshof of Coloma is First Runner-Up, Laura Dietrich (center) of Conklin is Queen, and Angie Dietrich of Conklin is Second Runner-Up.

Angie Dietrich of Conklin was named Second Runner-Up. The daughter of **James and Carmen Dietrich**, Angie attends Coopersville

High School. (Laura and Angie are cousins.)

The Queen's Court represents the Michigan apple industry at parades, fairs, festivals and media events throughout the year. Contestants, between the ages of 17 and 23, are judged on several factors including poise, professionalism and apple industry knowledge. They take part in one-on-one interviews with judges, an evening gown competition and a live onstage interview question.

Laura enjoys working with children, playing piano, cooking and swimming. After high school graduation, she plans to participate in World Youth Day in Sydney, Australia, and attend Michigan State University in the fall to pursue a career as a physician.

FEASIBILITY continued from page 1

Research included the process of converting from conventional to organic, trends in organic acreage productions and price trends for organically grown apples.

Organic food, in the study, was defined as that which is:

- produced by farmers who emphasize the use of renewable resources and the conservation of soil and water to enhance environmental quality for future generations
- produced without using most conventional pesticides; fertilizers made with synthetic ingredients or sewage sludge; bioengineering; or ionizing radiation.
- grown at a farm which has been approved by a governmental inspector to be in compliance with rules to meet USDA organic standards.

- grown on a farm or processed at a company that has been certified as organic as well.

One example cited in the study showed organic apple production to cost \$2,857 per acre compared to \$2,047 per acre for conventional.

Approved compounds for use on organic include: copper, lime sulfur and fish oil; but these must be applied more frequently (two to three times) to achieve efficacy.

Higher organic production costs are derived from lack of chemical thinning agents which require more labor and do not prevent alternate bearing. The study cites one Michigan orchard where the organic spray bill was twice that of a conventional orchard. Despite organic apple production leveling off somewhat, industry leaders expect to realize a strong jump over the next few years due to increased market demand.

Prices for organic continue to be higher with the average retail price of \$1.61 per pound in 2006 being 32 cents higher than the conventional counterpart. The study cites that organic apples make up 1.5 percent of total apple category sales and capture a 20-percent premium.

The top-selling organic item in the U.S. is a three-pound bag of Gala apples priced at \$1.46 per pound.

For a copy of the study, please call the Michigan Apple Committee offices at 1-800-456-2753.

*Production costs based on the following assumptions: yield 20 percent lower due to lower pack-out and alternate bearing; FOB price 40 percent higher last three years Washington State average; crop protection and labor costs 40 percent higher due to more frequent applications; and no change to fixed costs.

It's that time of year again for our special research edition of the *Michigan Apple News*!

Every year, MAC funds a significant amount of research which is part of our charge under Public Act 232. In 2007, we funded \$299,181 in research projects and this year plan to spend about \$268,696, owing to a smaller crop.

My congratulations go out to **Tim Tubbs** on being named chairman of the research subcommittee. I am very pleased to have him directing this group of fine growers. Not only does he bring to the table a great deal of fruit industry experience, Tubbs has valuable insight having served on this research subcommittee for the past six years.



Members of this group have recently made a commitment to look "outside the box" in terms of future research. They are examining proposals that I consider to be "forward-thinking" such as packaging, consumer-oriented projects and storage protocols for Honeycrisp. This is all very exciting for our industry's future.

Equally exciting is the news that national apple consumption is up! Demand is strong for fresh, as well as the processed sector, with the fresh slice business growing rapidly.

Success like this doesn't happen overnight. This is the result of much hard work, investment and talent from so many people involved in the Michigan apple industry.

But even in the good times, challenges continue to exist — particularly on the labor front. Food safety is also an issue the entire industry is confronting. Keep in mind that changing governmental regulations (for example, chemical, water usage and tax policy) can also have a dramatic impact on how successful our industry remains.

So as you read the research summaries in this issue, please keep in mind the many valuable services provided through MAC. If you have any questions about the research projects or MAC, feel free to call 1-800-456-2753.

Sincerely,

Mark Doherty
Chair, Michigan Apple Committee

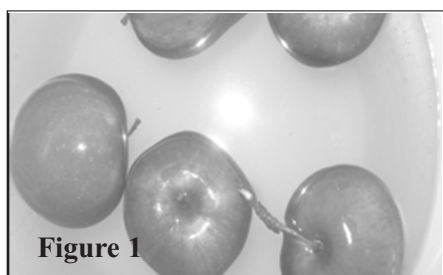


Figure 1



Figure 2



Figure 3

Improving apple appearance

Lead Researcher: Maria Rubino
Project: Continuation - Year 2/2
Cost: \$14,499

The goal of this project is to improve the appearance and value of fresh Red Delicious Michigan apples by enhancing the gloss of the fruit when shellac is the commercial wax.

The objective of this study was to evaluate and improve the packing line. The work in this study has been divided into four stages:

- surface preparation
- gloss meter development
- waxing
- scale-up

A pilot packaging line had been built in the School of Packaging (Figure 1) in order to carry out this study. It was found that surface preparation was improved using alkaline surfactants rather than neutral surfactants.

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Pilot packaging line in chronological order: dump tank (figure 1), washing (figure 2) and waxing (figure 3).

Reducing Smartfresh® (1-MCP) use and cost-evaluating impact of absorption of 1-MCP by wooden bin material

Lead Researcher: R.M. Beaudry
Project: New - 1 Year
Cost: \$5,000

Examining ways to reduce the cost of 1-Methylcyclopropene (1-MCP or SmartFresh®) is the focus of this study.

The apple industry has extensively adopted the use of Smartfresh® with significant increases reported in the past few years.

In 2002, SmartFresh® was used in four controlled-atmosphere storage operations in Michigan. In 2003, that number rose to more than 40. For the past three years, the use of Smartfresh® is between 25 to 50 percent of the CA-stored fruit.

A drawback to the use of SmartFresh® is the cost. Treatment is extremely expensive. Growers pay from \$6 to \$7 per bin (approximately \$0.35/bushel) to treat apples. This is equivalent to approximately \$200 per acre. Costs would be lower if treatment doses could be reduced.

In this study, researchers have so far been able to determine that the presence of wood does reduce the effectiveness of 1-MCP. A room where wooden bins are used requires 0.6 to 1 parts per million (ppm) 1-MCP.

However, in a room where plastic bins are used, approximately 0.1 to 0.3 ppm 1-MCP will give the full effect. Thus, initial findings suggest that the use of plastic bins might allow a reduced rate of 1-MCP to be applied. To some extent, it appears the cultivar has an effect on the degree to which the 1-MCP treatment rate can be reduced. Researchers are further examining this relationship.

Last year, research evaluated the impact of wooden bins on Jonagold and Red Delicious fruit. This year, researchers are investigating McIntosh and repeating results with Red Delicious.

Effect of initial ripeness, delay between harvest and application effectiveness of Smartfresh®

Lead Researcher: R.M. Beaudry
Project: New - Year 1/2
Cost: \$8,500

It has been documented that 1-MCP or Smartfresh® is effective at improving the storage and retail quality of apples. However, the effectiveness is dependent on initial responsiveness of the fruit, which is directly related to fruit ripeness at time of application.

Fruit ripeness at harvest is not always easily controlled. Frequently poor fruit color development, lack of adequate labor or environmental conditions result in a harvest delay.

Once harvested, there can often be a significant amount of time between harvest and the time of application. This can translate into a shift in the ripeness of the fruit at the time of treatment with SmartFresh® and a possible reduction in fruit responsiveness.

As part of this study, researchers are evaluating the effect of the delay between harvest and the application of 1-MCP for six varieties (Empire, Jonagold, Golden Delicious, Red Delicious, Rome and Fuji) over two years.

On each harvest date, researchers transfer fruit to a 32° F storage and treat after one, three, seven, 10 and 14 days. This year, researchers are evaluating Jonagold, Empire and Red Delicious. The fruit is being held in air- and controlled-atmosphere storage for testing this winter.

This study should reveal to what extent the system is forgiving in terms of applications of 1-MCP to fruit that are more physiologically advanced than optimally recommended. Recommendations will allow storage operators to decide if a 1-MCP application will be effective before incurring the expense of treatment.

IMPROVING APPEARANCE from page 3

Using a dump tank at 40° C with apple residence of at least 60 seconds and a 40° C rinse at 60 psi were significantly effective in acquiring a cleaner surface.

In the second step, a customized glossmeter (Figure 2), had been developed which assesses curved surfaces and it has been correlated to human perception of gloss by using sensory evaluation.

The third wax application stage is currently being assessed and designed. Once complete, a pilot and scale-up will operate and recommendations outlined from that. The final phase of this study (scale-up) is expected to be completed by August 2008.

Apple rootstock evaluation trials

Lead Researcher: Gregory Lang
Project: New - 2 Years
Cost: \$5,000

This project currently involves the evaluation of:

- 66 apple rootstock genotypes and clones, including standards (M.9, M.26, M.7, MM.106, M.111).
- more than 35 selections of genetically improved Cornell rootstocks with varying levels of disease and insect resistance.
- a selection of standard and new rootstocks from Russia, Poland, Czech Republic, Germany, and Japan, most of which are part of the NC-140 regional fruit tree rootstock research trials that are coordinated throughout North America (including Canada and Mexico).

These are being tested in nine plots (scion cultivars include Gala, Golden Delicious, Honeycrisp and McIntosh), planted at the MSU Clarksville Horticultural Experiment Station (CHES), the MSU Northwest Horticulture Research Station (NWHR) and at a commercial orchard near Belding.

Objectives of the study are:

- To establish and maintain replicated apple rootstock trials with common scion varieties to assess long-term adaptation potential in Michigan.
- To collect routine yield, vigor and survival data to assist in making assessments.
- To inform the apple industry and extension educators regarding progress in improved rootstock performance.

The Apple Rootstock Evaluation Trials project has been ongoing for many years under the guidance of Dr. Ron Perry (MSU Horticulture Tree Fruit Extension Specialist), supported for many of those years by the Michigan Agricultural Experiment Station's federal regional research project funds.

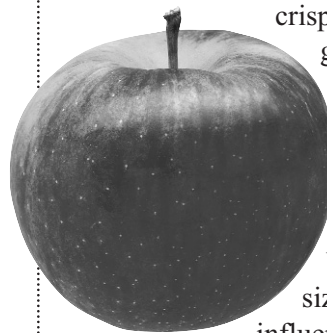
In recent years, as those funds have diminished, project support has increasingly shifted to the Michigan Apple Committee with some additional support from Project GREEN. In 2007, oversight of the project also shifted to Dr. Gregory Lang (MSU Horticulture Tree Fruit Physiologist).

These trials are long-term (generally 10 years). It is too early to draw major conclusions from most of these trails at this time. Researchers do note that McIntosh on G.30T has performed well in the sandy infertile soil at the NWHR, suggesting potential commercial promise for this region.

Management of crop load, vegetative growth on Honeycrisp to optimize fruit size, fruit quality, return bloom, fruit set

Lead Researchers: Jim Flore, Paolo Sabbatini and Phil Schwallier
Project: Continuation - Year 2/2
Cost: \$16,000

Honeycrisp, the most profitable variety in the apple industry today, is known for its outstanding flavor, crispness and market demand. Michigan growers are widely planting this variety.



However, Honeycrisp does present some challenges, such as being strongly biennial.

Uniformity and regulation of fruit size and return bloom can be greatly influenced by crop load and tree vigor.

This study set out to conduct detailed studies on:

- the effect of crop load on return bloom in relation to tree and seasonal variability.
- the crop quality (size, color and bitterpit).

In 2006 and 2007, there was a direct effect of crop load on current season's crop quality. Crop loads that had at least two fruit per spur were considered high, and one fruit per two spurs or less was considered low.

Some of the findings were:

- Leaf yellowing was greater in low-crop trees, but did not significantly affect current season's yield or fruit size.
- Crop load was inversely related to fruit size.
- There was a strong inverse relationship between crop load and next year's bloom.
- At optimum crop levels (four to seven fruit per cm² of trunk cross-sectional area), there was a high degree of variation in return bloom, indicating that factors other than crop load alone are regulating the initiation of flower buds for the next year.

Future research will focus on factors which may influence variation in return bloom. The results will help develop management strategies related to crop load adjustment that will assure optimum fruit size (200-225 grams per fruit) and quality.

More detailed information can be obtained at <http://www.hrt.msu.edu/faculty/flore.htm>.

Curative activity of insecticides to control apple maggot post-infestation

Lead Researcher: John C. Wise
Project: Continuation - Year 2/2
Cost: \$16,399

Examining the ability of several different types of insecticides to control apple maggot post-infestation was the focus of this project.

Larval systemic activity bioassays on apple maggot larvae were conducted one and two weeks post-infestation. Pre-infested apples were treated in the lab with insecticide treatments and larval emergence measured.

The chemicals studied were:

Thiacloprid (Calypso®)
 Acetamaprid (Assail™)
 Thiamethoxam (Actara™)
 Clothianidin (Clutch™)
 Azinphos Methyl (Guthion®)
 Phosmet (Imidan®)
 Spinetorum (Delegate™)
 Rynapypyr (Altacor™)

The research revealed that:

- Delegate™ and Altacor™ did not have lethal “curative” effects on AM larvae post-infestation.
- Imidan®, Actara™, Assail™, Clutch™, and Calypso® all showed significant curative activity when applied seven days post-AM egg laying.
- Only Imidan® showed significant curative activity when applied 21 days post-AM egg laying.

In conclusion, researchers note that capturing these unique systemic characteristics of the insecticides is critically important if growers are to optimize performance in apple pest management programs.

Furthermore, the concept of moving from a purely preventative approach to one that incorporates curative insecticidal activity will provide growers with greater timing flexibility and the opportunity to reduce the overall number of sprays.



A rainfall simulation chamber was used to measure the ability of eight insecticides to uphold under various precipitation patterns.

Impact of precipitation on performance of insecticides

Lead Researcher: John C. Wise
Project: New - 2 Years
Cost: \$17,899

In this study, eight different insecticides were tested for their ability to uphold under various amounts of simulated precipitation patterns.

A new rainfall simulation chamber at Trevor Nichols Research Center (TNRC) was used to create the research database.

Insecticides tested this summer were:

Novaluron (Rimon®)	Thiacloprid (Calypso®)
Acetamaprid (Assail™)	Indoxacarb (Avaunt™)
Emamectin Benzoate (Proclaim®)	Azinphos Methyl (Guthion®)
Phosmet (Imidan®)	Esfenvalerate (Asana®)

The study involved spraying the treatment compounds in the field. After 24 hours of drying time, .1 to .5 inches of rainfall was simulated. The fruit clusters were then exposed to mated female codling moth in the laboratory, comparing fruit protection to untreated (no simulated rainfall) samples.

Parallel fruit samples were frozen to attain the related chemical residue wash-off by the various rainfall treatments.

The research concluded that:

- With 24 hours of insecticide drying, all treatments provided excellent control of codling moth larvae, even with 0.1 and 0.5 inches of rainfall.
- For Calypso®, Rimon®, Avaunt™, Imidan® and Guthion® there was no reduction in insecticidal activity after 0.5 inch rain simulation.
- Performance was reduced for Asana®, Proclaim® and Assail™.
- After 7 days of field-aging, all treatments provided excellent control of codling moth larvae without rain, but only Calypso®, Assail™, Avaunt™, Imidan® and Guthion® provided equally good control after 0.5 inch of simulated rainfall.

Antibiotic resistance management and alternative strategies for fireblight control

Lead Researcher: George W. Sundin
Project: Continuation - Year 2/2
Cost: \$22,314

Fireblight, caused by the bacterium *Erwinia amylovora* (Ea), seriously limits apple production in Michigan.

The main objective of this project was to integrate the various chemical and biological control options available with streptomycin (or substituting for streptomycin) to optimize disease control and to reduce the number of streptomycin sprays required.

Researchers continue to work with biological control agents to optimize their potential for fireblight management.

A second objective was to continue the long-term survey of Michigan apple orchards for the occurrence of streptomycin-resistant Ea in an effort to determine if resistant strains are spreading throughout the state.

Field research on alternative antibiotics provided the data that enabled researchers to submit a successful application for the use of gentamicin (Agry-Gent) in 2007.

Research performed in 2006 and 2007 indicated that a second antibiotic, kasugamycin or kasumin, also controlled blossom blight at levels similar to gentamicin and streptomycin. There is no cross-resistance between streptomycin and kasumin. In addition, kasumin is not used in human medicine which is an important attribute of this antibiotic for fireblight management.

Researchers continue to work with biological control agents to optimize their potential for fireblight management. Serenade MAX is effective under low to moderate disease pressure and provides about 50 percent control under high disease pressure. Bacterial biocontrols such as BlightBan C9-1 and Bloomtime Biological E325 are now registered in Michigan, but have not been consistently effective in these experiments.

In 2007 surveys, streptomycin-resistant isolates of the fireblight pathogen continue to be found in Southwest Michigan and the Fruit Ridge area. The spreading was slower, indicating orchard-to-orchard spreading.

Research did not isolate any streptomycin-resistant isolates in Oceana County in 2007, after finding small numbers in 2006. These results suggest that the streptomycin-resistant strains of the fireblight pathogen have not effectively established yet in Oceana County.

Evaluation of Pentra-Bark and Agri-Fos for apple scab control

Lead Researcher: George W. Sundin
Project: New - 1 Year
Cost: \$8,193

Apple scab, caused by the fungus *Venturia inaequalis*, is an important constraint on apple production in Michigan. This study examined the combination Pentra-Bark and Agri-Fos has to control this disease.

Apple scab develops in the spring in infected leaves from the previous season. If the primary scab infection is not controlled, significant infection to leaves and fruit is expected. Apple scab infection periods occur annually in Michigan orchards requiring extensive use of fungicides for effective disease management.

Researchers in this study evaluated a novel method of scab control using a bark-penetrating surfactant (Pentra-Bark) to deliver a fungicide that would act systematically in the tree. The proposed fungicide, Agri-Fos, is composed of mono- and di-potassium salts of phosphorous acid; and does not represent use of a fungicide at-risk of resistance development.

In addition, based on results seen in Ohio in 2006, use of the Pentra-Bark treatment early in the season controlled apple scab for an extended period without the need for additional sprays. If such a treatment was successful in Michigan, this could provide significant savings for growers.

Unfortunately, the Pentra-Bark and Agri-Fos treatment combination in 2007 did not provide effective control of apple scab. Results from this study were confirmed by researchers in other regions of the United States.

Since the combination treatment was effective in 2006 and showed no effective control a year later, researchers say there are factors relating to tree physiology, weather conditions, etc. that have had a direct impact on treatment. Researchers say these factors must be examined and further understood before any further field-testing of this treatment is done.

Gala fruit size enhancement

Lead Researcher: Phil Schwallier

Project: Continuation - Year 3/3

Cost: \$8,200

Aggressive pruning shows the most promise in improving the fruit size of Gala, according to research conducted over the last three years on this project.

In addition to pruning, this study examined aggressive thinning, nitrogen and irrigation treatments to determine their impact on fruit size.

It was concluded that:

- Heading reduced fruit set in year 1, but heading increased fruit set in year 2 and 3 and resulted in the highest 3-year accumulated fruit size and yield.
- Blossom thinning will enhance fruit size and reduce fruit set.
- Nitrogen fertilizer application was quite variable, but generally increased fruit size by about 2 percent and increased fruit set.
- Irrigation generally increased fruit size but results were not consistent. (A 2 percent increase can be achieved by adding irrigation or increasing irrigation.)
- Heading pruning (removing 33 to 50 percent of the flower clusters) significantly increased fruit size and reduced fruit set.
- Spur pruning (removing every other bud, about 50 percent of clusters) did not significantly increase fruit size.
- Multiple year heading pruning increased average fruit weight and fruit set.
- Spur pruning in year 1 followed by heading significantly reduced fruit numbers and yield, however average fruit weight was not improved.

According to the research, doubling and even tripling the standard nitrogen rate had very little effect on fruit size in the first year. However, over time there appears to be some impact on size.

Schwallier notes that Galas should be aggressively thinned because appropriate nitrogen levels will increase fruit set as well.

Irrigation tended to increase fruit size when twice the amount of water was applied, especially in hot years.

Aggressive thinning was also shown to increase fruit size over lesser thinning approaches.

When heading pruning was done, about one-third of the trees had immediate fruit size improvement (about 1/8-inch in diameter), however yield decreased about 25 percent. The offset in yield may not compensate for the higher price received for the larger fruit, notes the research.

In conclusion, the studies have found that growers should strive to get 2.5-inch (minimum) diameter fruit in order to make the greatest profit per acre.

Evaluation of behavioral effects of a new product on plum curculio

Lead Researcher: Mark E. Whalon

Project: New - 1 Year

Cost: \$7,000

This study examined the effectiveness of a new neem product called Enhance!! (Gantec Inc.) to control plum curculio, a primary apple pest.

Neem oils are potential repellants for plum curculio in organic management systems. Enhance!! was tested against a common neem product (Neemix). To evaluate the new formulation, field and several lab experiments were conducted against plum curculio.

Each product was sprayed for six weeks, through the plum curculio oviposition window in replicated blocks at the Clarksville Horticulture Experiment Station. Mid-season damage assessment evaluated the prevention of plum curculio oviposition and foliar damage.

Results indicate:

- A significant decrease in oviposition with Enhance!! when compared with the control.
- Foliar damage was assessed as well, essentially determining effective on soft-bodied insects. Harvest data indicates a similar trend in reduced damage.
- Lab experiments showed no significant effect on plum curculio. This indicates that the repellent effect of Enhance!! is variable depending on resource availability.
- Enhance!! seems to hold some promise for use against plum curculio and soft bodied insects, such as leafrollers and aphids.
- Tree health seemed to be significantly improved through the use of this product.

Honeycrisp and growth regulators

Lead Researcher: Phil Schwallier
Project: Continuation - Year 4/4
Cost: \$7,000

The purpose of this research project was to: regulate the annual bloom and crop load of Honeycrisp by reducing the biennial tendencies with plant growth regulators (PGRs); to test other plan PGRs for effectiveness on Honeycrisp; and to increase accumulated total fruit production at the end of the trial.

It was concluded that:

- Summer Ethrel and NAA significantly increase return bloom.
- Thinning with BA significantly increases return bloom better than thinning with NAA.
- Provide reduces return bloom and in some years significantly (reduction can be slight).
- Apogee had no negative impact on combination applications with thinners.
- Return bloom from 2006 treatments were directly correlated with the degree of thinning that occurred. Apogee had no impact on return bloom.

With attempts to manipulate bloom less than successful, a trial was started this year to help sort out crop load and

time of thinning. Replicated Honeycrisp trees were hand-thinned at six early through normal timings: pink, petal fall, 10 mm, 20 mm, 30 mm, and 40 mm stage. It is expected that early thinning should improve return bloom. These trees will be evaluated at bloom time in 2008 to determine the effect.

Biennial bearing is a difficult characteristic to control in Honeycrisp, which has the propensity to set heavy crop loads even at a young age. These heavy-set trees will not come back with return bloom the next year. Moderately set trees tend to produce a light return bloom which can set a fair crop.

Honeycrisp is a difficult variety to correct. Treatments of 5 parts per million NAA applied five, seven and nine weeks after full bloom significantly increases return bloom on most varieties by 20 to 30 percent. A 5 to 15 percent increase in return bloom on Honeycrisp is the best one can expect, according to the research.

Research has also shown that Honeycrisp is resistant to summer NAA treatments. Researchers suspect that perhaps additional treatments, as well as a combination of treatments may give better results.

Evaluation and incorporation of reduced risk biopesticides into plum curculio management

Lead Researcher: Mark E. Whalon
Project: Continuation - Year 2/2
Cost: \$11,000

Plum curculio is a key primary pest in Michigan apple production, especially organic growers who are faced with an extreme lack of control tactics.

During the past several years, Michigan apple growers have funded cutting-edge research into the use of various biopesticides against the larval stage of this key pest.

Two fungal pathogens, *Beauveria bassiana* and *Metarhizium anisopliae*, were tested against plum curculio in the field. Additionally, researchers tested the efficacy of two

entomopathogenic nematodes against plum curculio, *Steinernema riobrave* and *Steinernema carpocapsae*.

With continued funding, research will investigate alternative methods of delivery and work to perfect timing.

The research compared the following four biopesticides in a replicated experiment:

- Liquid *Beauveria bassiana*
- Granular *Metarhizium anisopliae*
- *Steinernema carpocapsae*
- *Steinernema riobrave*

Data collected indicates very good performance from the nematode species, especially *S. riobrave*. The fungus *M. anisopliae* shows some impact on plum curculio.

With continued funding, research will investigate alternative methods of delivery and work to perfect timing.

The development of these new strategies of plum curculio control is huge boost to the organic apple community in Michigan. Researchers believe that these biopesticides are the best chance organic growers have of gaining significant control of this problematic pest.

New approaches to achieve high levels of codling moth mating disruption

Lead Researchers: Larry J. Gut, Peter McGhee, Mike Haas and David Epstein

Project: Continuation - Year 2/2
Cost: \$11,200

Developing mating disruption formulations and approaches that can provide a much higher level of codling moth (CM) control than currently achieved is the overall goal of this project.

A major effort to test a new hand-applied dispenser, Trécé Cidetrack CM, was conducted on-farm at five locations. Results suggest that this new technology should not only provide enhanced CM disruption but hopefully accomplish this at a lower cost.

A second study looked at the effectiveness of pheromone applied

at different heights in the tree canopy. It found that:

- High and evenly distributed applications of dispensers provided better control than dispensers placed at mid-canopy.
- A greater amount of mating occurred low in the canopy when all dispensers were placed high compared to when some were placed high and some lower in the canopy.
- Researchers note that the results are promising but preliminary. They do not suggest modifying the standard practice of placing all dispensers high in the canopy.

The use of mating disruption technologies is on the rise in Michigan, helping growers achieve substantially better control of

codling moth. Major impediments to greater reliance on mating disruption are the need for highly efficacious formulations that are less costly than current commercial products.

The combination of improved efficacy and application ease make the CideTrack dispenser an appealing choice for Michigan apple growers. The data gathered in this study provided support for the registration of this promising dispenser technology. A limited amount of product should be available for the 2008 season.

New insecticides, management programs for key apple pests

Lead Researchers: Larry J. Gut, Peter McGhee, Mike Haas and John Wise

Project: New - 2 Years
Cost: \$32,560

The aim of this project is to gather the information needed for growers and consultants to incorporate newly registered pesticides into their Integrated Pest Management (IPM) programs.

Management programs and new insecticides were evaluated in plantings at the MSU Trevor Nichols Research Complex (TNRC) and in commercial orchards throughout Michigan.

A suite of trials at the TNRC evaluating control programs for codling moth (CM), Oriental fruit moth, apple maggot and plum curculio included over 30 treatments.

Among the best early season CM control programs was:

- a petal-fall Rimon® followed by a delayed application of Rynaxypyr® or
- two applications of the newly registered insecticide, Delegate®

On farm trials provided valuable information on different timings, rates and programs for CM and obliquebanded leafroller, including a first-time look at Rynaxypyr® under a non crop-destruct EUP granted by the US Environmental Protection Agency.

This research provides a foundation for MSU's winter educational programs and helps set published guidelines (Michigan Fruit Management Guide).

Apogee evaluation on Apple 2007

Lead Researcher: Phil Schwallier

Project: Continuation - Year 6/7
Cost: \$8,000

While ongoing research continues to support the benefits of Apogee for Michigan apple growers, the latest findings indicate it may be most effective in stress years and less helpful in non-stress years.

One of the greatest effects of Apogee is the suppression of Fireblight.

Other important benefits include the reduction in vegetative growth and thus reduced costs of pruning trees. On average, Apogee reduces pruning costs by 33 percent and in some cases, as much as 50 percent.

Now that streptomycin resistance is spreading across the state, research shows that growers need to use Apogee on highly susceptible varieties and rootstocks.

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New lures for effective monitoring of codling moth

Lead Researchers: Larry J. Gut, Peter McGhee and Mike Haas
Project: New -Year 1/2
Cost: \$8,500

Developing highly effective codling moth (CM) trapping lures, in an effort to provide growers with more reliable monitoring systems than currently available, is the goal of this study.

Direct comparisons between commercially available and experimental lures for monitoring CM were conducted in commercial orchards and at the MSU Trevor Nichols Research Station.

A substantial focus this year was to evaluate two commercial lures

produced by Trece — a pear ester only and a pear ester and a low load of CM pheromone — and a USDA lure that was developed to enhance attraction of the pear ester.

**Monitoring CM
in pheromone-treated
orchards has been
especially problematic
for growers . . .**

Monitoring CM in pheromone-treated orchards has been especially problematic for growers, since lures currently available can provide misleading information.

Overall, researchers say the results of the study are very promising.

- A lure that combines both an attractive fruit volatile (pear ester) and pheromone was found to be a good option for monitoring CM in mating disruption orchards.
- A couple of the lures under development by an Australian company compared favorably to the pear ester, and will be further evaluated in 2008.
- An MSU-produced season-long CM lure performed as well as the industry standard, but that needs to be replaced prior to the start of each CM generation.

Obliquebanded leafroller and codling moth resistance

Lead Researchers: Larry J. Gut, John Wise, Mike Haas and Peter McGhee
Project: Continuation - Year 2/2
Cost: \$22,720

Identifying areas where codling moth (CM) and obliquebanded leafroller (OBLR) control failures can be attributed to resistance was the focus of this study.

Larval bioassays (leaf disk assays) were used to assess the susceptibility of OBLR to compounds used to control this pest.

Obtaining populations to survey proved difficult, as excellent control is being achieved with the newer insecticides now available.

Resistance bioassays were conducted on a couple of populations for two of the primary materials being used for OBLR control: SpinTor® and Rimon®. No reduction in susceptibility was detected.

Topical pheromone trap bioassays were used to assess the susceptibility of CM populations to Guthion® in apple orchards where control of this pest appears to be failing. Overall findings from the past three years indicate that the majority of CM populations tested are resistant.

This project has alerted growers of the problem of resistance that has developed throughout the state and consequently, rejected loads of apples due to the detection of worms in the fruit are down in Michigan.

APOGEE continued from page 10

Apogee has also been shown in some years to increase many nutrients in leaves and fruit. Of particular importance is the increase of calcium in apple flesh directly under the skin.

According to the research, Apogee has also been found to:

- improve post harvest fruit quality and reduce bitterpit development.
- increase bloom and fruit set each year after application.
- improve storage life of treated apples.
- does not appear to have any negative interaction with thinners when mixed together in the same tank.

It should be noted that the effects of Apogee vary from one apple variety to the next. (This study examined Cortland, McIntosh and Gala planted in super spindle system at Clarksville Horticultural Experiment Station in 2002.)

Evaluation of new apple germplasm for Michigan fresh, processing industries

Lead Researcher: William Shane

Project: New - 1 Year

Cost: \$10,000

New apple varieties, which are crucial to the success of the Michigan apple industry, are the focus of an ongoing project at Michigan State University under the direction of MSU researchers and extension educators Bill Shane, Phil Schwallier and Nikki Rothwell.

The project goal is to provide growers, nursery operators, packers, and producers with performance data on new apple varieties. The team gathers an array of new varieties including unnamed experimental selections from breeding programs, sports and newly released selections, usually from regions with growing conditions, insects and diseases different than Michigan.

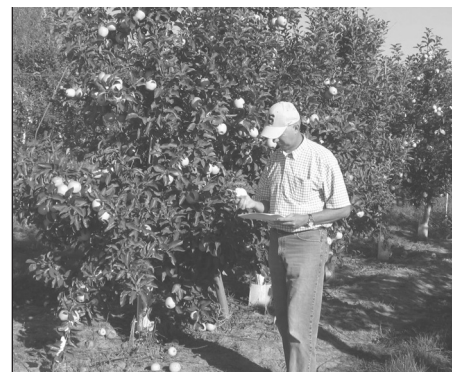
The apple selections are tested at three experiment stations displaying

the wide range of environmental conditions from the Michigan/Indiana border (SW Research and Extension Center), the Grand Rapids region (Clarksville Horticultural Station) to the Traverse City region (Northwest Horticultural Research Station).

Entries added to the MSU test sites include Rubymac, MO1040 and Aztec Fuji, keeping the plantings updated with the latest available selections. A total of 106 varieties and experimental are under trial in the MSU plantings.

A series of new McIntosh and Cortland-like apples (Eden, Supermac and Belmac), some scab-resistant, will be added to the three variety trials in 2008 through a signed agreement with Quebec.

Novel cider (hard) apples, many European types, are being grown at the NW station to gain experience with their cultural, yielding and fruit



MSU researcher Phil Schwallier examines new apple varieties under test at the Clarksville Horticultural Research Station, one of three MSU test sites.

characteristics. These apples were processed in fall 2007 to learn and acquaint Michigan cider makers with the challenges and opportunities of use of these in Michigan's growing hard cider industry.

Summaries of findings and recommendations are presented in the annual fruit variety showcase at the Great Lakes Fruit and Vegetable Expo in Grand Rapids. Growers are also invited to visit any of the three test sites during the growing season for a self-guided tour.

Incorporation of reduced-risk insect growth regulator novaluron into Michigan apple production

Lead Researcher: Mark E. Whalon

Project: New - 1 Year

Cost: \$7,000

Conventional apple growers have had fewer control tactics for plum curculio ever since the passage of the Food Quality Protection Act of 1996.

Consequently, it is important to develop new control strategies and test new chemistries, such as the insect growth regulators.

The potential for the use of novaluron to manage plum curculio was first suggested by laboratory bioassays, in which adult weevils were reared on novaluron-sprayed apples. Though novaluron did not show acute toxicity, it exhibited the

unique trans-ovarial sub-lethal activity of reducing subsequent larval emergence.

Field trials were conducted at Michigan State University's Trevor Nichols Research Station in apple plots. Tree terminals were collected on the day of spray, as well as seven and 14 days after the spray and adult plum curculios were exposed to these terminals.

Results showed that:

- When plum curculio adults were exposed to apple leaf and fruit terminals, as well as leaf terminals collected at day 0, all exhibit

trans-ovarial activity in reducing subsequent larval emergence.

- After day 0, only fruit terminals were effective. It is important to note that sub-lethal activity does not prevent plum curculio oviposition stings to fruit, but acts to suppress the population over time.

Novaluron is already registered for use in apple orchards for codling moth control and spray timing is early summer. Therefore, it is a good possibility of having dual control with one spray.

Though novaluron did not show acute toxicity, it exhibited the unique trans-ovarial sub-lethal activity of reducing subsequent larval emergence.

Sparta man takes blue ribbon in pie contest



Fred Burns of Sparta holds his homemade apple pie that won first place in the 3rd Annual Michigan's Best Apple Pie Contest.

A double-crust apple pie recipe handed down from his father earned **Fred Burns** first-place honors in the 3rd Annual Michigan's Best Apple Pie Contest, which took place Jan. 23 in Frankenmuth.

The Sparta resident prefers Northern Spy apples to make his delectable dessert.

Other winners were:

2nd place – **Amy Jo Bates** of Saginaw

3rd place – **Carol Socier** of Bay City

4th place – **Linda Tower** of Portland

Burns, whose old-fashioned apple pie was chosen tops from a field of 60 finalists, will travel to Florida in April to compete at the National Pie Championship. Below is the first-place recipe. For other winning recipes, visit www.MichiganApples.com.

MY FATHER'S APPLE PIE

From the kitchen of Fred Burns

History

My father grew up as the youngest of six males in a family of 10 on a farm in Ionia County in the early part of the 20th century. Instead of working in the fields, he stayed home and helped his mother with the cooking. As a young adult, he served as a cook at a Northern Michigan summer camp for kids. While I was growing up in the 1950s, he baked this deep-dish apple pie on many weekends from later summer until around Christmas using Northern Spy apples and his homemade crust. When he went into a nursing home in the late '90s, I took over the making of his pie that has always been a staple at our frequent family gatherings. I still use the original 9-inch Pyrex deep pie dish my father used for many years.

Crust

2 C flour
 1/2 T PIONEER SUGAR
 1 tsp. salt
 1 C shortening
 1/4 C cold water
 1/2 tsp. vinegar
 1 large egg

Filling

5 avg. size MICHIGAN NORTHERN SPY APPLES, peeled, sliced about 1/4" thick
 1 C PIONEER SUGAR
 1/3 C PIONEER GOLDEN LIGHT BROWN SUGAR
 dash of salt
 1/4 tsp. cinnamon
 1/4 tsp. nutmeg
 2 T tapioca
 5 T butter

Instructions

Crust – Combine flour, PIONEER SUGAR and salt in mixing bowl. Cut in shortening with pastry blender until coarse. In a separate bowl, combine cold water, vinegar, and egg and whip lightly, then add to flour mixture, stirring lightly with fork until it becomes a sticky dough. Refrigerate finished dough in a small covered container or plastic wrap overnight.

Filling – Combine all ingredients except butter and apples in a bowl. Peel and slice MICHIGAN NORTHERN SPY APPLES. Now stir the apples thoroughly into the dry ingredients to coat all the apple slices. Let mixture set for 15 to 30 minutes to develop a "juice" while you roll out the crust.

Roll 2/3 of refrigerated dough to about 13-inch in diameter. Adjust to fit the deep dish and trim edges. Combine remaining dough and roll to about 11-inch in diameter. Add filling to dish and place 8 slices butter on top of the filling. Add upper crust, roll the edges and cut a few "steam" slits in a design of your choice. You can also add colored sugar sprinkles to the top crust. Create your own art piece. Bake at 400 degrees for 15 minutes and then reduce to 350 degrees for 40 to 50 minutes. I use an aluminum ring over the crust edge to avoid burnt edges. Cool on a wire rack for about 2 hours.

Dates to Remember

March 4
Michigan Apple Research Subcommittee meeting

March 4-7
Michigan Delegation to Mexico

March 5-8
Capitol Hill Visits, USApple Conference

March 10-21
Michigan Apple Referendum

March 19
Ag Day, Michigan Capitol

April 18-20
National Pie Championships, Celebration, FL

May 4-7
FMI & UFFV Show, Las Vegas, NV

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Cider winners demonstrate success

Engelsma's Apple Barn of Walker is gaining quite the reputation for its fine-tasting cider. Cider mill owners **Becky** and **Jim Engelsma II** received top honors in Michigan's 11th Annual Apple Cider Contest, which took place during the Great Lakes Fruit, Vegetable and Farm Market Expo in December.

Their cider was chosen from 34 entries, which were rated on appearance and color, aroma and bouquet, acidity and sweetness, sugar/acid balance, body, flavor, finish and overall quality. Engelsma's Apple Barn has fared quite well in this competition over the years — placing first in 2005 and second in 2006.

Second-place honors went to **Hill Brothers Orchards of Grand Rapids**, who finished first in 2006, and third place went to **Erwin Orchards and Cider Mill of South Lyon**, first-place winners from 1999-2002.

MAC, USApple trained for crisis

The Michigan Apple Committee and USApple Association offer valuable services in the event a problematic situation from a food-borne illness to a labor issue arises. MAC has staff and board members who have been specially trained in crisis communications.

"If a grower is facing a serious problem, that's what we're here for," said Denise Yockey, MAC executive director. "We have the capabilities to helping you out from the grassroots on up."

Following the Alar incident of 1989, a key function of organizations like MAC and USApple has been to help growers with handling crisis situations, in particular the media.

A crisis communications manual is readily available that can help walk growers step-by-step through the appropriate channels, and give tips on what to say and how to say it. If a grower ever becomes aware of a substantial problem on their orchard, please contact MAC at 1-800-456-2753.



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