Michigan Cherry Committee's PESP Strategy

Describe your Organization's Five-Year Goals Related to Pesticide Risk Reduction

The Michigan Cherry Committee represents 75% of the tart cherry production nationally and is the funding arm for growers in addressing research, new technology and education. Annually the industry will spend $150,000 - $165,000 of their own money to fund work on reduced risk pesticides and to encourage IPM adoption, sustainability and environmental stewardship. We are so committed to advancing IPM in the state and region that we, in addition to funding IPM research, also fund two positions that are instrumental in advancing IPM programs on the farm.

One of our primary concerns today is a viable replacement for organophosphates (OP) in our production system. Organopohsphates such as azinphos methyl have been key insecticides used to control two key pests that include cherry fruit fly and plum curcullio. Plum curculio is the most difficult pest of the two to control and the biggest challenge for cherry growers. Over the years we have invested heavily in fund research on alternatives.

Our second major concern is a plant disease called cherry leaf spot. Left unchecked this cherry disease leads to tree defoliation and death. In summary, our 5 year goals are to implement stronger IPM programming at the farm level, develop new biopesticide alternatives to OPs and carbonates for control of cherry fruit fly and plum curculio and to focus on new fungicides that will effectively control cherry leaf spot. We will continue to address these challenges through our breeding for long term solutions to disease problems in the field.

Finally, while not covered in this document but remains to be very important to the cherry industry and is one of our research priorities is the strategy to develop a sustainable industry that will reduce its carbon imprint. We are very excited about this possibility and are actively engaged in a research model.

What do you envision doing (broadly) to try to resolve your major issues?

Covered in the Goals & Tactics listed below.

Goal 1 and Tactics

Development of Novaluron for use against Cherry fruit fly in Michigan orchards.

The cherry fruit fly (CFF), Rhagoletis cingulata (Diptera: Tephritidae), is a serious direct pest of cherries fruits in North America. CFF females are attracted to ripening fruit and

generally lay a single egg per fruit. Eggs hatch in 3-7 days, after which larvae burrow into the fruit, causing rotten fruit and larvae in harvested fruit. Management of CFF populations has been achieved through careful use of organophosphate insecticides. As growers are forced to transition away from the organophosphates due to federal legislation, they will begin to rely on EPA mandated reduced risk compounds, including soft topical insecticides and insect growth regulators (IGRs).

Insect growth regulators are a group of insecticides that have a lower overall environmental impact compared to conventional insecticides. For this reason, they are a potential replacement for the organophosphates. Novaluron acts by inhibiting chitin formation in eggs via vertical transmission, causing changes in the cuticle composition. This activity has been observed in plum curculio (Wise et al. 2007) and codling moth (Kim et al. 2007). With observed sublethal effects seen in both of arthropod pests, there is a high likelihood that a similar effect will be observed in CFF.

Objectives, hypotheses, and methods to be employed (by Objective):

1. Determine lethal activity of novaluron on adult cherry fruit fly.
2. Determine sublethal activity of novaluron on adult cherry fruit fly and evaluate different methods of exposure.

Novaluron is generally considered to be non-toxic to humans, so is unlikely to fall under the scrutiny that the organophosphate and carbamate pesticides have. Demonstrations of the effectiveness of novaluron against cherry fruit fly will provide growers an opportunity to better prepare themselves for organophosphate phase-out. Preliminary laboratory testing of novaluron against apple maggot, a species closely related to cherry fruit fly, has shown promising sublethal activity. Success of novaluron on cherry fruit fly can provide growers with another outlet for control of this fly species. Even if female flies oviposit on ripening cherries, no larvae will develop, and there will be no issues of larvae in fruit at harvest.

Once novaluron begins to become integrated into tart cherry production, there is potential for cross target spraying for major pests such as plum curculio as well as emergent pests, such as oblique banded leafrollers and the borer complex insects.

Goal 2 and Tactics

Plum curculio is an internal feeding primary pest of cherry in Michigan. Gone unchecked, growers can experience 75-95% damage, leading to potential load rejection due to larvae in fruit at harvest and reduced yield, particularly in organic production. Organic growers face a virtual lack of efficacious controls. Previous funding from the Michigan Cherry Committee has lead to the development of some promising fungal based biopesticides and nematode biological control agents.

The development of biopesticide-based controls is necessary to deliver a multi-tactic approach to optimize PC control. Previous research has focused on providing an economic delivery system for the entomopathogenic fungus *Beauveria bassiana* (Bb) by growing it on grain, then seeding the infected grain into the orchard. Although, we have shown this method to be highly effective, the regulation issues facing this delivery method were such that the legality of using it was in question. Therefore, we have turned to testing *Metarhizium anispoliae*, instead, because there is a granular formulation already commercially available. This granular formulation is economically similar to the infected grain strategy, costing approximately $100/acre, according to registrant. Additionally, soil screening for natural occurring entomopathogenic fungi lead to the discovery of strains that had a higher level of activity than Bb. Additionally, with funds from the American Farmland Trust, we have found good efficacy with two species of entompathogenic nematodes: *Steinernema carpocapsae* and *S. riobrave*.

Objectives, hypothesis, and methods to be employed (by Objective):

We believe that the entomopathogenic nematodes and fungi hold the most promise for control of plum curculio for Michigan's organic producers. To test this hypothesis, we will:

1. Test the fungal and nematode pathogens against plum curculio
2. Determine the length of time that these entomopathogens will persist in the soil.

Objective 1:

Potential sites and blocks within cooperating orchards for study will be evaluated by sight-sampling fruit for characteristic plum curculio oviposition scars during peak oviposition indicated by the accumulated degree days in spring. Entomopathogen (*S. riobrave*, *S. carpocapsae*, *M. anisopliae* and *B. bassiana*) will persistence will be evaluated by caging 10 field-collected larvae per pot with weevil trap-tops over nematode or fungus-treated soil under the drip-line of orchard trees, in treatment plots on-farm, where replicated soil plots have been treated at time intervals ranging across 6 days, 12 days and 18 days. The mean number of adults emerging from the pots will be compared between treatments.

On the farms with micro-sprayers, nematodes will be delivered three times at 5-day intervals at the maximum field rate to 8 0.5 replicated plots at infested blocks during the predicted period of larval emergence from fruit into soil. Nematode performance will be evaluated by placing pyramid traps and screen traps within plots and comparing means of collected captured adult PC per treatment.

You have heard of "chemigation", why not "nemagation"? We will also work with a grower who is installing micro-sprinkler irrigation in order to explore entomopathogens applications through irrigation devices. We believe that there may be merit in "nemagation" of orchard understory areas with micro-sprinklers where the pore size of the sprinklers will not damage the nematodes. If we can demonstrate that this technique

can work; we may be able to enhance efficacy in the whole-orchard context, as the citrus industry has done with the citrus root weevil in Florida.

Objective 2:

Soil samples will be collected from test sites at weekly intervals throughout the season. Plum curculio larvae will be placed in these soils as to screen for continued survival of entomopathogens.

Justification and impacts on the Michigan Industry:

The successful delivery of entomopathogens for control against plum curculio will give organic tart cherry growers a huge advantage. Currently, organic growers have virtually no reliable control methods, and the activity that we have been seeing with some of these products is very promising. Additionally, the successful development of these strategies will give conventional growers a potential control alternative as they face further federal legislation and the end of organophosphates.

Goal 3 and Tactics

Develop a strategic cherry-pest chemical screening program for potential new pesticide candidates and seek their registration.

Screening promising new pesticide chemistries for use in cherry will essentially be a three step process. Potential candidates will initially be identified in existing technical literature or in on-going efficacy trials in other crops (or other pests within a crop) at the Trevor Nichols Research Center (TNRC). Products that appear to have potential for meeting a specific pest management need in cherry will be evaluated in efficacy trials or in field-based bioassays. The general methodology for field testing will be to compare new materials with the industry standard and an untreated control. Tests will be conducted in research blocks at the TNRC (or other MAES station) that have at least moderate pest pressure. Pesticides will be applied with a commercial orchard sprayer and at rates appropriate for commercial use. The efficacy of various treatments will be evaluated by measuring pest densities and crop injury.

These performance data will be the basis for determining if the chemical should be submitted as a clearance request to IR-4, and then as supporting data for arguing the case for receiving the highest possible priority setting at the annual IR-4 Food-Use Workshop. Residue tests for chemicals that receive an A-priority in the IR-4 process will be conduced at the TNRC (or NWHRS) following the protocols required for Federal (EPA) registration of pesticides.

Potential IR-4 Candidates for Cherries:

1. Spinetorum (Delegate) is an early pipeline insecticide developed by Dow AgroScience and has been targeted for Lepidoptera, fruit fly and beetle pests. Preliminary research conducted in apples at the TNRC indicates that there is potential for use in cherries for Plum Curculio, Conotrachelus nenuphar (Herbst), and Cherry Fruit Fly, Rhagoletis cingulata (Loew). This compound stands-out as potential tools for cherries because of its broad pest spectrum and expectation of short PHI. Field screening trials will be conducted in 2008 to determine its performance on these key cherry pests.
2. Metaflumizone (Alverde) is an early pipeline insecticide developed by BASF and has been targeted for Lepidoptera, fruit fly and beetle pests. This indicates that there is potential for use in cherries for plum curculio, *Conotrachelus nenuphar* (Herbst), and cherry fruit fly, *Rhagoletis cingulata* (Loew). Field screening trials will be conducted in 2008 to determine its performance on these key cherry pests.
3. Flubendiamide (Belt) is a new insecticide developed by Bayer Cropscience and has been targeted for fruit feeding Lepidoptera and fruit fly pests. Field performance work done at the TNRC last year shows that is has potential for use in cherries for the cherry fruit fly, *Rhagoletis cingulata* (Loew). Field screening trials will be conducted in 2008 to determine its performance on this key cherry pest.

New screening trials will be initiated in 2008 for control of the plum curculio, *Conotrachelus nenuphar* (Herbst), and cherry fruit fly, *Rhagoletis cingulata* (Loew) in cherries. We are presently scheduled to conduct 7 IR-4 residue trials (the fungicide V-10118 and post-harvest dip Propiconazole) in cherries in 2008, and will plan to continue as full and effective participants in the IR-4/EPA pesticide registration process.

Goal 4 and Tactics

New tart cherry varieties that are resistant to diseases and insects could be a major step forward for the cherry industry nationally.

Key Goals: Include developing new varieties that are resistant to cherry leaf spot and fruit that can withstand wind damage and mechanical harvesting. The MSU Breeding program has made substantial progress toward meeting the core program goals for successful breeding selections that are resistant to cherry leaf spot. Finding a solution to this major cherry disease would go a long way to achieving a reduced risk strategy.

Research in this area is one of our top priorities. Trees that show promise are being planted in different grower locations across the state for testing. Successful strides in this area will make our industry more sustainable and reduce the industry carbon foot print, over the long run.