# BC Plant Health Fund
# Final Report

## Executive Summary

The BC Plant Health Strategy provides the focus for prioritizing and addressing plant health issues that affect productivity, environmental sustainability and competitiveness of agricultural crops in BC.

The BC Plant Health Fund was established in November 2006 as a key mechanism for implementing the Plant Health Strategy. The Plant Health Fund was designed to provide funding to address key objectives outlined in the Strategy, and to support priority projects for the fiscal year 2007/08. A budget of $775,000 sourced from Provincial Agricultural Policy Framework Rollover Funds was allocated to the program.

Implementation of the Plant Health Strategy is a core activity of the Food Safety and Plant Health Branch. It supports Objective 1.2 in the Ministry's Service Plan: *Animal, fish, plant and human health are safeguarded.* A commitment to plant health is also a key strategic outcome in the Ministry's Co-Divisional Strategic Plan*: Agriculture, aquaculture and food sector practices demonstrate a commitment to plant health, and to human and animal health and well-being.* The Co-Divisional Plan promises to deliver several strategies to demonstrate a commitment to plant health, including implementation of the Plant Health and Invasive Plant Strategies. The Plant Health Fund played an important role in delivering these strategies.

The BC Plant Health Fund was divided into two themes:

- Theme I. Provincial Plant Health Emergency Response Strategy
- Theme II. Addressing Emergent Plant Health Priorities

Theme 1 objectives included developing an emergency response framework for BC, simulation exercises to test the framework, identification of gaps in federal, provincial and municipal legislative authority, support for pest risk analyses of invasive alien species, and improved surveillance capacity through strategic surveys, pathway analysis and outreach.

Theme II provided funding to address emergent priority pest management needs in BC. Objectives included finding solutions to key regional pest management gaps that affect or have the potential to affect the competitiveness and sustainability of BC agriculture, and providing information and training resources to enable adoption of improved environmentally sustainable pest management practices.

**Outcomes – Theme I:**

Funding of $219,788 was allocated towards 15 projects, including development of a Plant Health Emergency Response Framework, risk assessment of high priority invasive alien plant diseases, adoption of new technologies for the Plant Diagnostic Laboratory, plant health and invasive plant surveillance, and invasive alien species outreach and awareness for pests such as the apple maggot.

Significant progress was made towards the development of an efficient, rapid and coordinated response to critical plant pest incursions in BC. The vision for the Plant Health Emergency Framework includes a Plant Health Emergency Support Plan and a Critical (non-emergency) Pest Response Plan. Work to finalize these plans will continue to be a priority for the Plant Health Program. Objectives to assess gaps in plant health-related legislative authority and simulation exercises related to the emergency framework have been postponed until after completion of the framework. Additional funding will be necessary to complete these objectives.

**Outcomes – Theme II:**

Funding of $536,230 was allocated towards 30 projects. An additional 25 projects (requested funds $430,000) were declined or withdrawn. Project applications were assessed by a steering committee comprised of Ministry of Agriculture and Lands' plant health and industry specialists using a systematic, science-based process to identify key priorities through consultation with industry and other agencies. It is a reality of funding programs that not all deserving projects can be funded due to limitations of the program. The strong demand for funding to address pest management issues is a good demonstration of the need for ongoing programs to support applied research in BC.

Supported projects were diverse, and touched on all of BC's major crop production sectors. Projects included preparation of extension and educational materials including factsheets, field guides and production guides, applied research into serious pests and diseases of greenhouse, field vegetable, berry, nursery, tree fruit and mushroom crops, weed control in berry crops and rangeland, and management of invasive plants. The amount of funding provided to projects varied from a low of $118 for translation of a factsheet, to $75,000 for support of the Invasive Plant Management Program.

Several projects involved understanding and managing new and destructive invasive pests, including the apple clearwing moth, a wood-boring insect attacking apple trees in the Okanagan and Similkameen Valleys. Many projects focused on adopting new, reduced risk pest management practices to commercial production.

Ultimately, these outcomes will help to protect the capacity of our land resource from colonization by invasive species and support Ministry goals to improve stewardship, maintain market access and enhance competitiveness of agriculture industries.

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# BC PLANT HEALTH FUND
# Project Summaries

## THEME 1 – PROVINCIAL PLANT HEALTH EMERGENCY RESPONSE STRATEGY

### Plant Health Emergency Response Framework

*Staff Lead:* *Madeline Waring, Ministry of Agriculture and Lands*
*Project Lead:* *Jon Bell*

The goal of the project was to facilitate an efficient, rapid and coordinated response to critical plant pest incursions in British Columbia (BC) by developing a Plant Health Emergency Response (PHER) Framework in collaboration with other agencies, and a memorandum of understanding between government agencies on Plant Health Critical Pest Response in BC.

Jon Bell, a former Canadian Food Inspection Agency (CFIA) Biologist, was hired as an auxiliary staff member from September 2007 to March 2008 to lead development of the PHER Framework. A multi-agency advisory team was established to work collaboratively with the Ministry of Agriculture and Lands (MAL) to determine an agreeable path forward and a vision of the framework. A draft PHER Support Plan was prepared and revised, and a potential scenario for a simulation exercise was identified.

Although the timelines for the development of the PHER Framework were ambitious, the project has made major achievements. The vision for the Plant Health Emergency Framework includes a PHER Support Plan and Critical (non-emergency) Pest Response Plan. Staff within MAL will continue to work with stakeholders to complete the PHER Framework. A communication strategy, table top exercises or a simulation, and a more extensive stakeholder review will be carried out after the PHER Support Plan is completed.

### Risk Assessment of High Priority Invasive Alien Plant Diseases

*Staff Lead:* *Gayle Jesperson, Ministry of Agriculture and Lands*
*Project Lead:* *Andrea Buonassisi*

The goal of the project was to conduct risk assessments for high priority invasive plant pathogens with potential to cause deleterious economic and environmental impacts to BC.

Andrea Buonassisi, a plant pathologist, was hired as an auxiliary staff member to work on the risk assessment project from September 2007 to March 2008. Literature reviews were conducted to compile background information on potential invasive alien plant pathogens. Risk assessments were completed for 82 high priority plant pathogens, and key facts were distilled into “info sheets” for 89 pathogens. The literature reviews, risk assessments and summary sheets will provide a valuable source of information on prevention, management and detection of key alien invasive diseases, resulting in an improved surveillance capacity.

### Plant Health Surveillance

*Staff Lead:* *Vippen Joshi, Ministry of Agriculture and Lands*
*Project Lead:* *Lisa Wegener*

The goal of this project was to adopt specific advanced molecular diagnostic technology to identify *Oomycetes* (*Phytophthora* and *Pythium* spp.) to the species level in the Plant Diagnostic Laboratory, and to investigate tools and tests for viral and phytoplasma identification.

Lisa Wegener was hired as an auxiliary staff member to conduct research into new testing methodologies and to transfer appropriate technologies to the Plant Diagnostic Lab. Reverse-dot blot hybridization technology (DNA Array) for detection of Oomycetes was successfully validated for use in the Plant Diagnostic Lab. The DNA array is capable of identifying over 50 species of Phytophthora and over 100 species of *Pythium* in a single assay. Additionally, Real-time PCR assays were introduced to the lab for detection of several specific Phytophthora species, and several other molecular tests were introduced for viral, bacterial, fungal and nematode pathogens. An *Oomycete* culture collection was established.

The Plant Diagnostic Laboratory now has the foundation required to offer routine molecular diagnostics. Additional molecular tests can now easily be incorporated into this system to expand the diagnostic testing offered by the Plant Diagnostic Laboratory.

## PLANT HEALTH SURVEYS

### Weevil Survey in Blueberry Fields in BC

*Staff Lead:* *Tracy Hueppelsheuser, Ministry of Agriculture and Lands*
*Cooperators:* *BC Blueberry Council; E.S. Cropconsult Ltd.*

The goal of the project was to determine the species of weevils present in BC blueberry crops and to link damage to weevil species and abundance. Weevil larvae feed on and girdle the roots, causing plant decline and yield reductions.

A survey was conducted by MAL, in partnership with the BC Blueberry Council and E.S. Cropconsult Ltd. Weevils were detected in 43% of fields surveyed. Species present included the black vine weevil, strawberry root weevil, rough strawberry weevil, and obscure weevil. An additional species, the clay coloured weevil, was detected during damage assessments. Plant decline appears to be a result of various factors working together, including weevils, disease organisms, sub-optimal soil type and pH. Additional research will be necessary to determine economic thresholds for weevil damage in blueberries. Guidelines for monitoring and management of weevils in blueberry crops were prepared.

### Caterpillar Survey in Hazelnut Orchards in BC

*Staff Lead:* *Tracy Hueppelsheuser, Ministry of Agriculture and Lands*
*Cooperator:* *BC Hazelnut Growers*

The goal of the project was to identify pest caterpillar species present in BC hazelnut orchards, and to provide information that could lead to more effective caterpillar management in hazelnuts.

A survey of six hazelnut orchards in the Fraser Valley was undertaken by MAL, in cooperation with the BC Hazelnut Growers in 2007. The Bruce spanworm (*Operophtera bruceata*) was determined to be the most abundant spring-feeding species. Damage was localized, with larval feeding by spanworm reducing the tree canopy by up to 80%. Leafrollers were also present in high numbers, although the level of damage was low. The eyespotted budmoth was the most

common species caught in pheromone traps, followed by European leafroller. Filbertworm was not detected.

Early season caterpillar feeding can impact crop potential; however, summer caterpillar feeding at the levels noted likely will not. Control of spanworms and early leafrollers will be warranted in some cases. This initial survey will give the hazelnut industry a better idea of which species to focus control approaches on, and can be used identify future research projects.

## Cereal Leaf Beetle Parasitoid Survey

*Staff Lead:* *Gayle Jesperson, Ministry of Agriculture and Lands*
*Project Lead:* *Duane Holder, FarmQuest Consulting/Creston Valley Ag. Society*
*Cooperator:* *Creston Valley Ag. Society*

A survey of cereal crops in the Creston Valley conducted in June 2007 assessed the distribution and percent parasitism of cereal leaf beetle (*Oulema melanophus*) by the larval parasitoid *Tetrastichus julis*. The survey was conducted to determine if the parasitoid was providing sufficient biological control of cereal leaf beetle (CLB) to keep populations below treatment thresholds, and if the parasitoid was abundant enough to be a source for redistribution to the Armstrong area. The MAL previously released *T. julis*-parasitized CLB larvae collected from Montana in Creston in 2002 and 2003 to provide biological control of CLB and negate the need for pesticide sprays. A small survey of the release site in 2003 revealed a 40% parasitism; however, a subsequent survey in 2005 failed to find the parasitized larvae although CLB populations were also found to be relatively low.

The 2007 survey, conducted by D. Holder, FarmQuest Consulting, revealed that the parasitoid was present in most sites where CLB was found. Parasitism ranged from 17% to 80% indicating the potential exists for parasitoid collection and redistribution. In addition, CLB populations were found to be below treatment thresholds generally throughout the valley. This is an example of successful biological control against a serious pest of regulatory concern.

## Identification of Midge Species Damaging Fraser Valley Raspberry and Blackberry Plants

*Staff Lead:* *Tracy Hueppelsheuser, Ministry of Agriculture and Lands*
*Cooperator:* *Lower Mainland Horticultural Improvement Association*

The objective of this project was to identify the midge species present on raspberry and blackberry plants in the Fraser Valley, identify any native biocontrol agents, and to start developing monitoring and management approaches.

Midges have been present in blackberries and raspberries at a low level in southwestern BC. Their presence seems to be increasing to a point where growers are noticing their impact. The species present in blackberries and raspberries has not been identified, and no management strategies are in place. Pest damage includes bud distortion and necrosis and incomplete drupelets. This could impact both fruit production and cane growth and fruiting potential for the following year.

Plant material was collected from blackberry and raspberry fields in the Fraser Valley in August and September 2007. Midges obtained from the collection were reared to adults. Adult midges were preserved for taxonomic documentation and species identification. Natural parasitism was not observed in the BC berry midge collection.

The midge species present in BC berry crops was identified as *Dasineura plicatrix* (Loew) (Diptera: Cecidomyiidae) by B. J. Sinclair of the CFIA Laboratory in Ottawa. This insect has not

been recorded in North America previously. It is a common midge pest infesting *Rubus* spp. in Europe. A new pest notification is being drafted for publication.

Further literature review, personal communications, and possibly local research need to occur in order to learn more about this new pest in BC, potential implications of this pest, and monitoring and management approaches.

### Pine Pass Invasive Plant Inventory

*Staff Lead:* *Kerry Clark, Ministry of Agriculture and Lands*
*Project Lead:* *Northeast Invasive Plant Committee*
*Cooperator:* *Peace River Regional District*

The goal of this project was to stop the spread of noxious and other invasive plant species that threaten agriculture from the Prince George/Mackenzie regions to the agriculture lands of the Peace Region. Plant inventories are an important component in stopping the spread. This was a large project with significant funding from many sources, including other government agencies and industry. Field work focused on removing ox-eye daisy from the Pine Pass corridors where it was spreading towards agricultural land in the Peace. Brochures explaining the project and asking for co-operation were produced and distributed to agricultural producers throughout the Peace. The project will continue in 2008, focusing on ox-eye daisy, as well as other invasive species, including orange and meadow hawkweeds.

## OUTREACH

### Weeds Across Borders 2008 Conference

*Staff Lead:* *David Ralph, Ministry of Agriculture and Lands*
*Project Lead:* *Alberta Invasive Plant Council*

The Plant Health Fund provided support to the Weeds Across Borders Conference Committee, to assist in covering costs for the Weeds Across Borders 2008 Conference, May 27-30, 2008 in Banff, Alberta.

The conference was attended by over 160 participants from Canada, the US and Mexico. The conference agenda covered a long list of invasive plant topics such as: federal status reports on activities and projects, presentations on cooperative partnership projects, applied research reports, new issues, early detection and rapid response systems for invasive plants, updates on best management practices and public policy. This diversity of agenda topics was very useful for all invasive plant specialists attending from BC, as presentations offered the most current information being generated on invasive plant management, policy and research available from North American sources.

The conference increased and solidified awareness on the seriousness of imported alien plant species to BC and other North American jurisdictions on their impacts to our economies and ecology.

### BC Invasive Plant Council/BCLNA Joint Meeting

*Staff Lead:* *Leslie MacDonald, Ministry of Agriculture and Lands*
*Project Lead:* *BC Landscape and Nursery Association*

The Plant Health Fund provided support to an Invasive Plant Forum and Workshop, held jointly by the BC Landscape and Nursery Association and the BC Invasive Plant Council in December

2006 in Langley. The purpose of the workshop was to explore the issue of invasive plants that are sometimes grown and distributed as ornamentals, and to determine a course of action to effectively deal with the issue.

The workshop helped to identify several key actions for the next 1-2 years, with the goals of demonstrating leadership, building collaboration and helping to avoid the distribution of invasive plants across BC. Key actions focused on improving education and communication, developing an invasive plant list with alternative plants list, enhancing legislation and enforcement, and developing a certification system. A working group was established to draft action plans for consideration by stakeholders. Follow-up meetings are planned.

## Weeds Cross Borders Tour 2007

*Staff Lead:* *David Ralph, Ministry of Agriculture and Lands*
*Project Lead:* *Boundary Weed Management Committee*

The Plant Health Fund provided support to the "Weeds Cross Borders" Tour held on August 1, 2007. This project is a collaborative, multi-agency effort to coordinate education, invasive plant prioritization and control activities across the US and Canadian border in the Okanagan-Similkameen region. Two local weed committees in BC (Boundary and Okanagan-Similkameen) and 2 Washington counties (Ferry and Okanogan) participate in the project.

The 2007 tour started at the Courthouse in Republic, Washington, and traveled through Curlew, then into BC at Grand Forks and Christina Lake. Tour participants learned how the project successfully controlled leafy spurge sites in the Kettle River system to keep it from spreading between BC and Washington. The hoary alyssum control plots in Malo, established by WSU Ferry County Extension, are an excellent example of how information on effective control options is being shared across the border. Dramatic suppression of diffuse knapweed and Dalmatian toadflax with biological control was visible at locations on both sides of the border.

This coordinated, proactive approach to invasive plant management will benefit and protect species/habitats at risk, critical rangeland habitat and recreational areas. By extending this initiative to our American partners, the project endeavors to prevent the introduction of new invasive species into BC and reduce seed spread from existing infestations in Washington. Ultimately, this will reduce future weed problems and associated treatment costs on both sides of the border.

## Community Weed Pull Pilot

*Staff Lead:* *Leslie MacDonald, Ministry of Agriculture and Lands*
*Project Lead:* *Invasive Plant Council of BC*

The goal of this project was to pilot expansion of the Community Weed Pull Program in the East Kootenays into additional regions of the province. The primary purpose of a community weed pull event is to facilitate effective invasive plant management on high priority sites which have limited management options, such as riparian and pesticide free zones, while increasing awareness of the impacts and ecology of invasive plants.

Four regions participated in the pilot in 2007 and together completed a total of 19 community weed pull events covering over 26 hectares of high priority invasive plant management sites. In total, 338 individuals participated in the program, for a total of 723.5 volunteer hours. Target species varied by region, but included the following: spotted and diffuse knapweed, Dalmatian toadflax, rush skeletonweed, ox-eye daisy, sulphur cinquefoil, field scabious, common tansy, Canada thistle, yellow flag iris, policeman's helmet, purple loosestrife, and Scotch broom. Draft standard operation procedures for a community weed pull event were developed, along with

standard templates for use by participating regions. Recommendations and considerations for 2008 program expansion were drafted.

## Invasive Alien Species Outreach Awareness

*Staff Lead:* *Maria Jeffries, Ministry of Agriculture and Lands*

The goal of this project was to provide information to the public on the most current and relevant invasive alien pest threats to BC and a means for knowing who to contact when suspicious pests are found.

Achievements included: production and distribution of brochures on apple maggot to selected Visitor's Centers and other venues in BC; promotion of the Plant Diagnostic Laboratory by production and distribution of fridge magnets containing contact information for the Plant Lab; design and creation of displays on Invasive Alien Species and information on Diagnosing Plant Disorders for use at various venues such as trade shows and fairs; and development and distribution of factsheets and publications on Invasive Alien Species.

## Home & Garden Pest Management Guide for BC

*Staff Lead:* *Gayle Jesperson, Ministry of Agriculture and Lands*
*Project Lead:* *Seradaye Lean*

The goal of the project was to update and reprint the MAL publication *Home & Garden Pest Management Guide for British Columbia*. This publication raises awareness with the public in identifying invasive pests of concern to BC and in safely managing established pests using the principles of integrated pest management.

Seradaye Lean was hired as an auxiliary staff member to coordinate work on the gardeners guide project from August 2007 to March 2008. Significant progress has been made towards updating and revision of the guide, including preparation of new content on new pests and diseases, Invasive Alien Species, species at risk and organic fertilizers, and collection of higher quality images to better illustrate common garden pests and invasive alien pests of concern. It is anticipated that the guide will be printed and available by fall 2008.

## Apple Maggot

*Staff Lead:* *Tracy Hueppelsheuser, Ministry of Agriculture and Lands*
*Cooperators:* *Ministry of Transportation; Genesis Media*

The main focus of this project was to fund production costs related to signage and media communications to prevent or slow the spread of apple maggot from coastal BC to the fruit production regions of interior BC.

Apple Maggot is a new pest to coastal BC, and not currently present in the interior fruit production areas. In other apple growing regions (outside of BC), presence of apple maggot requires that orchardists spray broad-spectrum insecticides routinely throughout the growing season. Stakeholders in the major interior fruit growing regions of BC have made a concerted effort to implement novel and 'soft' pest management approaches, including sterile insect release, mating disruption, removal of feral hosts, exclusion of new pests, and diligent monitoring. If apple maggot spreads to the interior, it is likely that growers will have to abandon soft pest management practices and will have to employ a routine broad-spectrum pesticide program to protect their fruit.

Outreach activities for 2007 included: newspaper ads, limited highway signage during the fall harvest period, radio public service announcements in the Fraser Valley, outreach activities to

organizations such as the Master Gardeners and municipalities, and placement of brochures in 2 tourist information booths.

## THEME 2 – ADDRESSING EMERGENT PLANT HEALTH PRIORITIES

## PUBLICATIONS AND OUTREACH

### Guide to Best Management Practices for Field Crop Protection in BC

*Project Lead:* *Kevin Murphy, Ministry of Agriculture and Lands*
*Cooperator:* *BC Agriculture Council*

The publication "*Field Crop Protection Guide 2008-2009 – Guide to Best Management Practices in British Columbia for Cereals, canola, field corn, field peas, grasses and legumes for forage and seed production"* was updated and printed as a joint project with the BC Agriculture Council. A total of 1,500 copies were produced and will be distributed free of charge to producers of field crops in BC. The Guide is also posted on MAL's website at: http://www.al.gov.bc.ca/cropprot/fieldcrop/index.htm

### Factsheet: Management Strategies for *Pythium* Diseases of Greenhouse Vegetable Crops in British Columbia

*Staff Lead:* *Jennifer Curtis, Ministry of Agriculture and Lands*
*Project Lead:* *BC Greenhouse Growers Association*
Cooperator: *Andrea Buonassisi*

A factsheet on integrated management of *Pythium* root diseases was researched and prepared, to improve the management of *Pythium* on BC greenhouse vegetable crops. The factsheet is posted on MAL's website at: http://www.al.gov.bc.ca/cropprot/pythium.pdf

### Field Guide Booklet for IPM Scouting for Highbush Blueberry Pests

*Staff Lead:* *Mark Sweeney, Ministry of Agriculture and Lands*
*Cooperator:* *BC Blueberry Council*

Project is underway. It was discovered that a similar project is underway in Washington and Oregon. Preliminary discussions have occurred to investigate pooling resources to produce one guide for the entire Pacific Northwest.

A final document is expected to be produced and released for the 2009 Growers' Short Course in February 2009.

### Development of Information on Pests of Importance in BC Asian Vegetables and Promotion of Good Pest Management Practices

*Staff Lead:* *Susan Smith, Ministry of Agriculture and Lands*
*Cooperator:* *Lower Mainland Horticultural Improvement Association*

This project involved monitoring for insect pests and diseases of Asian vegetable crops, as well as development of extension materials and delivery of a workshop. Pest problems noted included: flea beetles, cabbage root maggots, downy mildew, clubroot, Lepidopteran caterpillars,

aphids and white rust. Pest management practices on the farms surveyed primarily involved application of broad-spectrum insecticides on a calendar or weather-based schedule. There is great potential for education about monitoring and reducing pesticide use.

Through funding from Environment Canada, four new factsheets on pest-related topics produced earlier this year were translated into traditional Chinese text and distributed to all known Asian vegetable farmers.

A half-day grower workshop on Asian vegetables was held in March 2008 at Kwantlen College (Surrey campus). The entire workshop was translated into Cantonese. Presentations and demonstrations included: information on insect and disease life cycles, integrated management of pests and diseases, and pesticide use and safety. Participants came from all the Asian vegetable growing areas, including: Surrey, Delta, Richmond, New Westminster, and Burnaby.

The response was very positive, and most notably, 84% of respondents indicated they would change their pest management practices based on what they learned at this workshop. The workshop can be considered successful in terms of both participation and educational effectiveness.

Project partners would like to acknowledge Tiffany Guan and Madeline Waring (MAL) for their assistance and expertise at the grower workshop, and Evergro Canada Inc. and Terralink Horticulture Inc. for their additional sponsorship.

## Field Guide to Noxious and Other Selected Invasive Plants of British Columbia

*Staff Lead:* *David Ralph, Ministry of Agriculture and Lands*
*Cooperator:* *Southern Interior Weed Management Committee*

The goal of this project was to assist public, private and industrial land managers in BC to accurately identify noxious and other invasive plant species of concern in the province. The *Field Guide to Noxious and Other Selected Invasive Plants of British Columbia* has been a popular publication in BC since 1996.

This funding enabled the printing of 18,000 copies of the newly updated 6$^{th}$ edition of the field guide. To date, over 80,000 copies of this publication have been printed and distributed throughout BC. This popular guide contains information on identification of 80 species of noxious and invasive plant species of concern to BC. Over 232 boxes of field guides were distributed by mid-January 2007, to government resources ministries, invasive plant groups and committees, recreational groups, industry, horticulture and home garden organizations, agriculture producers and organizations and others. It is expected that the reprinting will provide sufficient copies of the publication for a 2-year period.

## BC Vegetable Production Guide Label Information Update

*Staff Lead:* *Susan Smith, Ministry of Agriculture and Lands*
*Cooperator:* *Lower Mainland Horticultural Improvement Association*

The project provided funding to review and update current pesticide label information for production of field vegetables, for the purpose of updating the *Vegetable Production Guide for Commercial Growers in BC*.

The 2008 revision of the *Vegetable Production Guide for Commercial Growers in BC* was completed and ready for distribution by February 2008. The guide provides industry with the most current and relevant pest management information.

## School Spray Document Translation

*Staff Lead:* *Carl Withler, Ministry of Agriculture and Lands*
*Cooperator:* *BC Fruit Growers Association*

This project provided funding to translate a one-page document on best practices for pesticide application in orchards near schools from English to Punjabi, to allow for open, meaningful communication between school staff and the orcharding community.

## Mushroom Industry Pesticide Education Program

*Project Lead:* *Jennifer Curtis, Ministry of Agriculture and Lands*
*Cooperator:* *Mushroom Industry Development Council*

Project is underway. The objectives of this project are to develop and present on-farm training to the mushroom growers on the proper use of pesticides and the management of major pests and diseases.

A final document is expected to be available by December 31, 2008.

## Invasive Plant Council of BC Support

*Staff Lead:* *Linda Wilson, Ministry of Agriculture and Lands*
*Project Lead:* *Invasive Plant Council of BC*

The Plant Health Fund provided $75,000 towards a $150,000 grant from MAL to the Invasive Plant Council of BC (IPC) to support their coordination of province-wide education and awareness of invasive plant issues. The IPC is a non-profit organization whose membership is inclusive and with broad representation across all land, resource and environmental interests in the province. The IPC coordinates and oversees projects funded by external partners, including the Province of British Columbia. The key objective was to strengthen the coordinating activities of the IPC by building partnerships with stakeholders to minimize the negative economic, social and ecological impacts caused by the introduction, establishment, and spread of invasive plants.

Plant health funds, combined with other external sources of funding are being used to support the following activities: increased awareness and outreach initiatives, especially targeting the horticulture and gardening audience; production of brochures, articles, displays, etc. that will be available to all groups across BC; collaboration around shared priority research needs in BC; production of a collaborative list and recommendations for next steps to improve coordinated management across federal, provincial and private lands; establishment of a collaborative approach to identify the top most critical invasive plants for management across diverse land bases resulting in a list of priority “unwanted” invasive plants, including a horticulture list with responsible or non-invasive alternatives; development of recommendations and a range of tools and resources available for local governments to encourage effective management of invasive plants in their jurisdictions.

## State of the Union Report

*Staff Lead:* *David Ralph, Ministry of Agriculture and Lands*
*Project Lead:* *Invasive Plant Council of BC*

The MAL and Invasive Plant Council of BC partnered to conduct a province-wide survey to assess and quantify the breadth and magnitude of invasive plant management in BC. Baseline information collected during this project included: invasive plant management activities and program components, expenditures on invasive plant management, and the current ecological status of 20 selected invasive plant species. This information was collected using a survey

method from individuals with employment responsibilities related to invasive plant management in BC.

Respondents estimated spending approximately $6,979,932 on invasive plant management in 2006. Operational invasive plant management received the largest investment, resulting in more than double the expenditures of any other management category. Outreach and coordination activities appeared to be the next highest priority. Six of the twenty selected invasive plant species which received the largest relative proportion of expenditures in more than one invasive plant management category were: Canada thistle, hawkweed, spotted knapweed, knotweeds, scotch broom and tansy ragwort.

A total of 305 individuals, accounting for 100,010 person hours of time were reported to be involved with invasive plant management in BC in 2006. Members of the public are an important source of assistance with a total of 2,000 volunteer hours reported. Education and awareness activities throughout the province consisted of 111,500 invasive plant publications, 247 presentations, 50 invasive plant related events and 24 invasive plant education media events. Enforcement and compliance activities included but were not limited to a total of 960 weed complaints received, 750 voluntary compliance responses registered and 106 enforced actions required. Research activities reported covered widespread topics such as economics of invasive plants, ecology of invasive plants, regulation, and new, innovative measures of control such as herbivore grazing with budgets totaling $1,998,394.

The majority (85%) of respondents described progress in the past 5 years on the issue of invasive plants in BC as “moderate”, “good” or “very good”. Control, Education/Awareness and Coordination were selected by the majority of respondents to need the most attention in the future. The new information resulting from this project is being used in a broader analysis of the economic and ecological impacts of invasive plants in BC.

# RESEARCH

## Migration Patterns, Biology and Impact of Psyllid on Greenhouse Tomatoes and Peppers

*Staff Lead:* *Jennifer Curtis, Ministry of Agriculture and Lands*
*Project Lead:* *BC Greenhouse Growers Association*
*Cooperator:* *E.S. Cropconsult Ltd.*

The potato psyllid has become a serious pest in BC tomato and pepper greenhouses over the past 10 years with limited management options. This project investigated psyllid occurrence and abundance in greenhouses and whether it is correlated with potato top-kill or any other event. The project involved 16 participating tomato and pepper greenhouses in the Fraser Valley, as well as data from the monitoring of 168 potato fields.

The study found no evidence that psyllid levels in greenhouses are related to top-kill of potato fields. Psyllids were present in greenhouses before potato fields were even planted. Psyllid levels reached very high levels inside greenhouses compared to levels outside greenhouses and in potato fields. At least for 2007, the origin of psyllids in Fraser Valley greenhouses appears to be carryover from the previous year.

A literature search identified several potential new biological and chemical management tools for the potato psyllid. Monitoring, early detection and cultural management strategies, including thorough winter cleanup were recommended.

## Evaluation of an Alarm Pheromone for the Control of Aphids on Greenhouse Vegetable Crops

*Staff Leads:* *Tracy Hueppelsheuser and Jennifer Curtis, Ministry of Agriculture and Lands*
*Project Lead:* *BC Greenhouse Growers Association*
Cooperator: *E.S. Cropconsult Ltd.*

This project investigated the efficacy of "Aphid Chaser", a commercially available alarm pheromone for the control of aphids in greenhouse vegetable crops. The product is currently available in Canada for the control of aphids on roses. The dispenser device is a small rubber donut which is placed by hand on plant stems or branches. Four caged plant experiments were carried out in a research greenhouse to evaluate the effect of Aphid Chaser on 'low' and 'high' populations of aphids. Plants were caged to exclude predators and parasites. Trends in all trials indicated that Aphid Chaser decreased the growth potential of the aphid populations at 6-7 days post-treatment for both green peach aphid and foxglove aphid in peppers by about 40%. Comparisons were not always statistically significant. An additional 4 trials were conducted in commercial pepper greenhouses in the central Fraser Valley during late summer during full production. Aphid Chaser use significantly decreased the growth potential of the aphids over 7 days by about 53%; however, there was substantial variability in the means over the 4 trials.

It appears that Aphid Chaser could become a useful part of an overall aphid management strategy in greenhouse peppers. It decreases aphid population 'spikes', which could optimize biological control and decrease the use of pesticide 'rescue' treatments. The relationships and interactions between pest management tools in this system should be explored further.

## Investigation of Blueberry Root Rot Disease Complex in the Lower Mainland of the Fraser Valley, BC

*Staff Lead:* *Siva Sabaratnam, Ministry of Agriculture and Lands*
*Cooperator:* *BC Blueberry Council*

Evidence of increased incidence of blueberry-decline, mainly due to crown and root rot infections, has been observed in many blueberry fields. A brief field study and survey were conducted in spring/summer of 2007 in the Fraser Valley region of BC. Soil and root samples from ten symptomatic fields were collected and analyzed for the presence of potential soil-borne pathogens associated with root rot incidence. Although *Phytophthora cinnamomi* has been known to cause root rot in blueberry, it was detected only in 20% of the fields; these fields were found to be heavily infested with *P. cinnamomi*. Several other *Phytophthora* and *Pythium* species were also detected, as well as *Cylindrocarpon* and *Fusarium* species. A strong association observed between *Cylindrocarpon destructans* and *Pythium sterilum* with blueberry-decline and their wide distribution among blueberry-decline fields suggest that these pathogens may be contributing to blueberry decline, solely or synergistically with *P. cinnamomi*. Based on the preliminary investigation, blueberry-decline due to root rot incidence can be viewed as a disease complex, involving more than one causal agent, whose pathogenicity, epidemiology and association with blueberry-decline in the field need to be investigated.

## Alternative Management Tactics for Pests of Umbelliferous Crops

*Staff Lead:* *Susan Smith, Ministry of Agriculture and Lands*
*Cooperator:* *Lower Mainland Horticultural Improvement Association*

Alternative control tools for the management of the 2 main pests of carrot and parsnip production in southern BC – carrot rust fly (*Psila rosae*) and northern root knot nematode (*Meloidogyne hapla*) – were examined through a combination of literature review and experiments.

For carrot rust fly, promising alternatives to chemical control include physical barriers, including exclusion fencing and row covers, and under sowing carrot plantings with clover or another crop. Chemical control could be optimized by focusing on field margins. Cultural practices such as the potential of resistant varieties, field location, and management of crop residue and cull piles should not be overlooked as the foundation for rust fly management. A field trial to test the efficacy of insect mesh row covers and diatomaceous earth, found that neither significantly reduced carrot rust fly damage, although the least amount of damage was observed under the mesh. Challenges to using insect mesh are primarily due to weed control. As weeds grow bigger, they can push up the mesh and flies can gain access to carrots.

Cultural practices important for the management of root knot nematode include weed management and crop rotation. Many commonly occurring weeds can support populations of the nematode. Research from Quebec suggests that 2-year crop rotations with barley or oats can be very effective in suppressing nematodes and increasing carrot yields. However, rotations involving just onions were not effective. Corn may be another promising crop rotation and more suitable for Lower Mainland growers. Cover crops are another promising management option. Greenhouse trials indicated that sorghum-Sudan grass and pearl millet were effective at suppressing the number of galls on tomato roots. Spraying the cover crop with Round-up prior to incorporation did not affect the suppressive effects of the cover crops. Finally, soil amendments, especially with materials containing chitin have shown some promising results in studies and may be an option for treating known areas within fields with high levels of nematode activity.

The project partners would like to acknowledge Maria Jeffries (MAL) and Tom Forge (AAFC) for their advice in experimental design and laboratory nematode analysis portions of this project.

## Seasonal Phenology and Management of Apple Clearwing Moth – a New Insect Borer Attacking Apple Trees in BC

*Staff Lead:* *Gayle Jesperson, Ministry of Agriculture and Lands*
*Project Lead:* *Gary Judd, Agriculture and Agri-Food Canada*
*Cooperator:* *Okanagan Similkameen Co-op*

In 2005, an infestation of Apple Clearwing Moth (ACM), *Synanthedon myopaeformis*, was discovered in an organic apple orchard in Cawston, BC. ACM is an invasive, European species which is becoming an increasing problem in high-density apple orchards. Feeding by ACM wood-boring larvae girdles the graft union between the root stock and scion often killing young trees. The ACM infestation in BC is most severe in, but not limited to, the organic apple production area within the Similkameen Valley. Nothing is known about the biology of ACM in Canada, no control products are registered, and few organic options exist. This project worked toward the development of the necessary platform technologies for control of clearwing moths using behavioural tactics that will help sustain organic fruit production in BC. A behaviourally-based management strategy may also serve as a management model for many other clearwing pests.

The sex pheromone of ACM was identified as a single chemical, ZZ 3-13-octadecadienyl acetate (ODDA). Males responded to ODDA in a linear, dose dependent manner with attraction maximal at 10-mg. A self-made lure using ODDA was significantly more attractive than several commercial clearwing lures. Yellow, white and green Delta sticky traps baited with 1-mg of ODDA were significantly more attractive than all other coloured traps. In season-long monitoring comparisons, however, green funnel traps (Unitraps®) were significantly more attractive than white Delta traps. The non-saturating funnel traps are recommended for monitoring when population densities are high. All-yellow funnel traps were the most attractive traps tested and are to be recommended for mass-trapping males with 10-mg sex pheromone lures. Open-sided, 2-litre plastic bottle traps baited with grape juice were highly attractive to both male and female ACM, and at least as attractive as pheromone traps for males. Ethyl butyrate was identified as an active component of grape juice volatiles, but only 40% as attractive as raw juice.

A degree-day model was developed to predict adult emergence and flight that can be used to time tree-trunk pesticide sprays targeting egg laying and hatch. Three years of pheromone-based mating disruption with a registered generic pheromone product Isomate-P resulted in average population reductions of 65% over 2006-2008.

Tools will soon be available to apply a semiochemical-based behavioural strategy combining the tactics of pheromone-based mating disruption against males, and mass-trapping of females with juice volatiles, as a management solution for ACM in organic apple orchards of BC.

## Fungicide Resistance Survey of DMI Fungicides Used on Okanagan Apples, Cherries and Roses

*Staff Lead:* *Gayle Jesperson, Ministry of Agriculture and Lands*
*Project Lead:* *Peter Sholberg, Agriculture and Agri-Food Canada*
*Cooperator:* *Okanagan Similkameen Co-op*

Fungicide resistance is an important concern to growers of horticultural crops in BC. Sterol-inhibiting (DMI) fungicides are commonly used for control of powdery mildew and apple scab. These fungicides have not been surveyed for resistance since the first DMI's (myclobutanil and triforine) were introduced in BC around 1993. In this study, resistance to myclobutanil was evaluated for apple scab (*Venturia inaequalis*), apple powdery mildew (*Podosphaera leucotricha*), cherry powdery mildew (*Podosphaera clandestina*) and rose powdery mildew (*Sphaerotheca pannosa*).

Resistance to myclobutanil was found in all the areas sampled in the Okanagan and Similkameen Valleys, as well as in the Kootenays and Langley. For apple scab, 2 isolates out of 71 were found to be resistant at half the recommended rate of myclobutanil. For apple powdery mildew, 5 out of 10 isolates showed evidence of resistance. For cherry powdery mildew, 13 out of 14 isolates showed some resistance and similarly for rose powdery mildew, 9 out of 10 isolates showed that they were resistant. Resistance was more prevalent in cherry and rose than apple. Further studies with a larger number of isolates for each disease and crop are required to confirm the extent of DMI resistance in BC. Recommendations for resistance management were provided.

## Spring Blossom/Apple Core Rot Trial

*Staff Lead:* *Gayle Jesperson, Ministry of Agriculture and Lands*
*Project Lead:* *Bill McPhee, Okanagan Tree Fruit Company*

The Okanagan Tree Fruit Company has implemented a preventative extension program designed to minimize losses during the production, packing and marketing of fruit. It has been recognized that a major portion of the losses due to post-harvest rots can be traced back to orchard diseases. The program attempts to identify the post-harvest rot problems, trace them back to their source and apply efficient corrective strategies.

This project was designed to look at the potential to utilize blossom monitoring to determine the individual pressures in orchard blocks for blossom infections that can lead to post-harvest diseases such as core rot. Thirty apple blocks in the Okanagan and Similkameen Valleys and 3 apple varieties were included in the 2007-2008 trial.

The blossom study concluded that the blossom monitoring might be feasible for assessing potential post-harvest rot risk, but it was too complex and time consuming to be practical on a large scale. However, a great deal of useful information was obtained that will be used in the preventative extension program. The main post-harvest pathogens encountered by the packing houses were all found to be present at bloom and to persist throughout the summer. *Alternaria* and *Botrytis* spp. were found to be the most common pathogens associated with blossoms, and

latent infections were present in the fruit from the blossoming stages onward. An enclosed cavity at the calyx end in all three varieties can harbour fungi and protect them from summer fungicide sprays. There was clear evidence that latent blossom infections cannot be controlled with post-bloom sprays. Blossom sprays are justified to reduce colonization of the blossom and to reduce fungal spores potentially surviving into storages in the calyx cavity.

## Biological and Reduced-Risk Fungicides for Control of Blackspot of Rose

*Staff Lead:* *Dave Woodske, Ministry of Agriculture and Lands*
*Project Lead:* *Janice Elmhirst, Elmhirst Diagnostics & Research*
*Cooperator:* *BC Landscape and Nursery Association*

Blackspot (*Diplocarpon rosae)* is the most significant disease of roses for which fungicides are used, and no biological or reduced-risk products are currently registered for commercial use in Canada. The goal of this project was to evaluate biological and reduced-risk fungicides for control of black spot of hybrid rose for efficacy and crop tolerance, and to generate data to support Canadian registration. Products evaluated included Pre-Stop (*Gliocladium catenulatum* strain J1446), Plantshield (*Trichoderma harzianum* strain T-22), Rhapsody ASO (*Bacillus subtilis* strain QST 713), Nova 40W (myclobutanil), Milstop Foliar Fungicide (potassium bicarbonate), Pristine WG Fungicide (boscalid + pyraclostrobin), Messenger (harpin protein), and Raingrow Superflow surfactant (*Yucca schidigera* extract).

The trial was conducted in 2 separate experiments on outdoor, container-grown hybrid roses in Langley. Under moderate disease pressure, all products reduced the percent leaf area affected with black spot compared to the untreated check. The best treatments were the conventional fungicides Nova and Pristine, applied every 14 days. Other treatments that performed well included Milstop, Pre-Stop, Rhapsody and Messenger. Under severe disease pressure, the best treatments were Pristine and Nova applied every 14 days, and the low rate of MILSTOP applied at either 7 or 14 days. All of the biologicals and reduced-risk treatments (Plantshield, Rhapsody, Pre-Stop, Superflow and Messenger) reduced the percent leaf area affected by approximately 40-50% for the first month, but disease suppression was overcome after week 4, under high disease pressure. Data will be provided to manufacturers to support registration of effective microbiological and reduced-risk products with the Pest Management Regulatory Agency.

## Minimum Effective Rate and Concentration of Doktor Doom as a Soil Drench Treatment and Avid and Scimitar CS as Foliar Treatments for Control of Rose Midge

*Staff Lead:* *Dave Woodske, Ministry of Agriculture and Lands*
*Project Lead:* *Janice Elmhirst, Elmhirst Diagnostics & Research*
*Cooperator:* *BC Landscape and Nursery Association*

The goal of this project was to evaluate chemical treatments for control of rose midge *(Dasineura rhodophaga)* for efficacy and crop tolerance, and to generate efficacy data to support registration and/or label expansions of effective products for use in landscape beds and commercial nursery container production.

Rose midge is an increasing pest of roses world-wide. Larval feeding occurs within emerging leaf and flower buds causing newly-developing buds to wither, turn black and drop. Infestations of rose midge can cause complete failure of a bloom cycle resulting in unmarketable plants.
Products evaluated included: Avid 1.9% EC (abamectin), Doktor Doom 0.5% (permethrin) + 2X spreader-sticker, Doktor Doom 0.5% (permethrin) + 4X spreader-sticker, and Scimitar CS (cyhalothrin-lambda 100 g/L).
All rates of permethrin applied as a soil-treatment reduced midge infestation and damage significantly (60-70%) compared to the untreated check. Aphid and thrips infestations were

significantly reduced also. There was no statistically significant difference between product rates or spreader-sticker concentrations. Foliar sprays of Scimitar also significantly decreased the number of midge-damaged buds and aphid-infested shoots; however, it only moderately decreased the number of thrips-infested buds. Abamectin significantly decreased injury caused by aphids and thrips, but only suppressed the number of midge-infested or damaged buds by 45%.

## Investigation of the Causal Agent of Cranberry Dieback Disorder

*Staff Lead:* *Siva Sabaratnam, Ministry of Agriculture and Lands*
*Cooperator:* *Anna DiCarlo*

This project was the first comprehensive investigation of "Cranberry Dieback Disorder" (CDD), which is the common name given to symptoms of cranberry vine decline recently observed by cranberry growers in BC.

Cranberry fields with characteristic symptoms were identified by a systematic survey carried out in May-June 2007, consisting primarily of field inspections and grower comments. Based on the survey, 40 cranberry beds with the "dieback" symptoms were chosen from 24 cranberry farms in Burnaby, Delta, Pitt Meadows and Richmond. Samples of plant tissues and soils were collected from the symptomatic areas from May to August 2007. Root, runner and upright samples were analyzed for the presence of potential pathogenic bacteria, fungi or viruses and soil samples were analyzed for the presence of Oomycetes using the appropriate diagnostic techniques. Nematode analyses were conducted on samples from each of the 40 beds, including several non-symptomatic beds.

Observation, sampling and analysis revealed several plant pathogens and plant-parasitic nematodes previously unrecorded from BC cranberry farms, and ruled out cranberry girdler as a contributing factor in CDD. No pathogen, nematode, or complex of pathogens or nematodes was consistently associated with symptoms of CDD.

*Phytophthora cinnamomi (P. cinnamomi)* was detected in soil samples from several cranberry beds. These results are significant as *P. cinnamomi* is recognized as the primary cause of root and runner rot in other cranberry-growing areas, and it has not previously been reported in BC. However, *P. cinnamomi* was not cultured from symptomatic roots, runners, or surrounding soil; therefore, it is premature to make a conclusive statement about whether or not it is a causal agent of CDD in BC.

Several species of potentially damaging plant-parasitic nematodes were found in BC cranberry beds. *Paratrichodorus* spp. and *Hemicycliophora* spp. appear to be the nematodes most likely to be causing damage. However, no plant-parasitic nematodes were found in a few beds with extreme dieback symptoms, indicating that nematodes are not likely a primary cause of the dieback disorder.

## Seedling Weed Control in Newly Planted Strawberries

*Staff Lead:* *Mark Sweeney, Ministry of Agriculture and Lands*
*Project Lead:* *Victoria Brookes, AAFC, Agassiz; Grant McMillan, ICMS, Abbotsford*
*Cooperator:* *Fraser Valley Strawberry Growers*

The goal of the project was to screen new herbicides for weed control in newly planted strawberries, with particular focus on reduced-rate tank-mixes. The lack of broadleaf herbicides for the establishment year of strawberry production is a limiting factor for proper crop establishment. Combinations of herbicides can be more effective and control a wider range of weeds than when applied alone.

In 2007, trials in Abbotsford and Agassiz were carried out on newly planted strawberry cultivars "Puget Reliance" and "Totem" to identify possible new herbicides and tank mix combinations. A total of 15 herbicide treatments either alone or in combination were applied. Plots were evaluated for weed control at both locations and plant height and runner counts were recorded at Agassiz.

There are varietal differences in strawberry plant tolerance to herbicides. Crop tolerance was higher at the Abbotsford site than the Agassiz site.

At Abbotsford, the tank mixes of sulfentrazone + oxyfluorfen, flumioxazin + sulfentrazone, flumioxazin + terbacil, oxyfluorfen + s-metolachlor, sulfentrazone + terbacil and sulfentrazone + pendimethalin resulted in the best weed control.

At Agassiz, flumioxazin alone and the tank mixes of sulfentrazone + napropamide, flumioxazin + napropamide, flumioxazin + sulfentrazone, flumioxazin + terbacil, oxyfluorfen + s-metolachlor, pendimethalin + sulfentrazone, pendimethalin + flumioxazin, sulfentrazone + oxyfluorfen resulted in the best weed control.

Further trial work is needed to confirm weeds controlled and to modify rates used to reduce total herbicide usage and still result in acceptable weed control.

### Investigation of Novel Insect Management Approaches for the Key Pests, Currant Fruit Fly (*Eurphranta canadensis*) and Currant Clearwing Borer (*Synanthedon tupuliformis*) in Currants

*Staff Lead:* *Tracy Hueppelsheuser, Ministry of Agriculture and Lands*
*Cooperator:* *Lower Mainland Horticultural Improvement Association*

The goal of this project was to generate field efficacy data to support registration of reduced-risk products for management of currant fruit fly and currant clearwing borer.

Field trials were conducted to investigate efficacy of GF-120 (spinosad bait) for control of currant fruit fly, and for a sex pheromone-based mating disruption product used in Europe and New Zealand for control of currant clearwing borer.

This study provides evidence that GF-120 prevents fruit fly larvae in currant fruit; however, there remain some questions that could be elucidated with more replicates and more years of treatment at the same locations. Information was collected on flight times for this pest.

Mating disruption appeared to have a significant impact on borer populations. There were 60% fewer live larvae recovered in canes in treated plots compared to untreated plots. Damage assessments will be continued into 2009.

## DEMONSTRATION TRIALS

### Plant Health in First Nations Rangelands

*Staff Lead:* *Brian Harper, Ministry of Agriculture and Lands*
*Cooperator:* *Grasslands Conservation Council*

Project is underway. The goal of this project is to inform community members of 5 First Nations about how to restore rangeland productivity through employing noxious weed management strategies and re-seeding.

A final document is expected to be available September 30, 2009.

## A Demonstration Trial for the Control of Powdery Mildew in Cherries

*Staff Lead:* *Gayle Jesperson, Ministry of Agriculture and Lands*
*Project Lead:* *Duane Holder, FarmQuest Consulting*
*Cooperator:* *Okanagan Kootenay Cherry Growers*

Powdery mildew, caused by *Podosphaera clandestine,* is a serious disease of sweet cherries in BC. The disease attacks foliage and fruit impacting fruit quality and has occasionally resulted in the loss of entire crops. Fungicide programs are necessary for control of powdery mildew; however, there are few products registered in Canada, and fungicide resistance is becoming an issue. Cherry producers in BC have expressed interest in pursuing the registration of reduced-risk summer oil products for powdery mildew control and fungicide resistance management programs.

Trials were conducted to evaluate the effectiveness and tolerance of petroleum and vegetable-based oils during the 2007 growing season in small scale plots on commercial cherry orchards in the Creston Valley. The oil products used were Bionatrol-M (a vegetable-based oil from NTS Research) and Purespray Green (a petroleum-based oil from Petro-Canada). Both products provided significant mildew control compared to the untreated control. There was no synergistic effect from the addition of either oil product to the standard fungicides. There were no signs of phytotoxicity from any of the treatments in any of the trials at harvest.

Observations and experimental data support experience in Washington State that summer oils have the potential to contribute to an integrated approach to powdery mildew control as part of a fungicide resistance management program. Additional research of rates and timing is required under local conditions with commercial varieties to assess the efficacy of summer oils used alone and in combination with standard materials.

## A Demonstration Trial for the Control of Obliquebanded Leafroller in Cherries

*Staff Lead:* *Gayle Jesperson, Ministry of Agriculture and Lands*
*Project Lead:* *Duane Holder, FarmQuest Consulting*
*Cooperator:* *Okanagan Kootenay Cherry Growers*

Obliquebanded leafroller (OBLR) *Choristoneura roseceana* is an important insect pest of sweet cherries in BC and can cause significant damage to fruit if left uncontrolled. Recent changes to insecticide use patterns for cherry fruit fly with “softer” chemistry have reduced control of OBLR, which is emerging as a more serious secondary pest. To realize the potential of reduced-risk options for the control of both pests, a demonstration trial was conducted to compare the effectiveness of these materials against a standard organophosphate treatment.

A demonstration trial was conducted in 3 separate blocks within a commercial cherry orchard in Creston. The treatments for OBLR control consisted of Bt (Foray – Valent Biosciences), Success (Dow Agro-Sciences) and Azinphos methyl (Sniper – UAP). The Bt treatment received GF-120 for cherry fruit fly control. Spray timing was determined using trap monitoring data and a degree day model.

Spray timing and population pressure are critical factors in regard to achieving effective control. Leafroller activity was accurately predicted from the degree day model and trap capture data. The reduced-risk materials that were applied for the control of OBLR and cherry fruit fly provided equivalent control to the broad spectrum standard organophosphate azinphos methyl. The control achieved with Bt for OBLR and GF-120 for cherry fruit fly and the control achieved with Success for both pests were equivalent to the control achieved with azinphos methyl for both pests.

## Demonstration of Various Fly Control Tools and Approaches for Use in BC Mushrooms

*Staff Lead:* *Tracy Hueppelsheuser, Ministry of Agriculture and Lands*
*Cooperator:* *Mushroom Industry Development Council*

The MAL, in partnership with the Mushroom Industry Development Council, initiated a project in 2007 to investigate the utility of alternative mushroom fly control products for BC growers, through demonstration and evaluation on commercial mushroom farms. Presently, the BC mushroom industry relies on very few products for fly control. Risks of this approach include potential for pest resistance development to the main pesticides.

Products included in the trials were: Red Lake Earth (diatomaceous earth + clay), nematodes: Nemasys (*Steinernema feltiae*), predator mites (*Hypoaspis miles*), and Citation (cyromazine) applied at casing.

The untreated plots had significantly more flies than the treated plots. The alternative products worked as well as the standard treatment, Citation. It appears that alternative approaches to fly management are effective and could be adopted by industry. Ideally, trials should be repeated on other farms to ensure the results are consistent.

## Peace Region Weed Warrior Demonstration

*Staff Lead:* *Kerry Clark, Ministry of Agriculture and Lands*
*Project Lead:* *Peace River Regional District*

This is the first year the Peace River Regional District has participated in a community-based "Weed Warrior Program". Two successful weed control events were carried out in riparian areas, targeting spotted knapweed at the Clayhurst Gravel Pit on the banks of the Peace River, and ox-eye daisy along the Pine River. As the year progressed, several possible changes were noted that would make this a more successful ongoing program in northeast BC. Sites suitable for future Weed Warrior events were identified.

The Weed Warrior Program is an excellent program to educate the public about the concern of invasive alien plants, how to identify them, and the need to control them. With planning and area-wide coordination, this could be an important, ongoing and successful program in the Peace River Regional District.