Reduced-Risk Management Strategy for Foliar Insect Pests of Prairie Field Crops

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Preface

Pesticide risk reduction strategies are developed under the Pesticide Risk Reduction Program (PRRP), a joint initiative of Agriculture and Agri-Food Canada (AAFC) and the Pest Management Regulatory Agency (PMRA) of Health Canada. The Program’s objective is to reduce risks to the environment and to human health from pesticide use in agriculture. To achieve this, the Program works with grower groups, provincial experts and researchers to identify gaps in pest management and opportunities for pesticide risk reduction, and to develop and implement strategies to address these.

A pesticide risk reduction strategy is a detailed plan that aims to address grower needs for reduced-risk management tools and practices for specific pest issues. The strategies are developed through extensive consultation with stakeholders. The strategy document presented here summarizes the framework and activities supported by the Programme. It is intended to provide an update on the progress in developing and implementing the strategy and new tools and practices made available through this process.

For more information, please visit the Pest Management Centre website: www.agr.gc.ca/pmc.

Acknowledgement

The Pesticide Risk Reduction Program acknowledges the contribution of participating organizations and stakeholders, including the current and former members of the Foliar Insect Pests of Prairie Field Crops Working Group: John Gavloski (Manitoba Agriculture, Food and Rural Development); Jim Broatch and Scott Meers (Alberta Agriculture, Food and Forestry); Jim Bessel, Troy Prosofsky, and Greg Sekulic (Canola Council of Canada); Dan Johnson (University of Lethbridge); Bill Ross (Manitoba Canola Growers); Patricia Flaten and Errin Tollefson (SaskCanola); Scott Hartley, Sean Miller and Danielle Stephens (Saskatchewan Ministry of Agriculture); Kenton Possberg (Western Canadian Wheat Growers); Owen Olfert, Hector Carcamo, Bob Elliott, Jennifer Otani, Julie Soroka, Chrystel Olivier, Erl Svendsen, Tyler Wist and Haley Catton (Agriculture and Agri-Food Canada).
Executive Summary

Many insect species causing above-ground feeding damage to plants can be serious pests that affect yield and quality of economically important field crops across Canada. Following systematic assessments, priority pests with the greatest potential for pesticide risk reduction were identified by stakeholders. Control of these pests relies mainly on the application of older, broad-spectrum insecticides, some of which are undergoing regulatory review by Health Canada's Pest Management Regulatory Agency (PMRA). Thus, safer solutions are needed to control these pests.

This report summarizes the support from the Pesticide Risk Reduction Program towards developing reduced-risk alternatives to manage foliar insect pests of field crops, with a focus on the prairie region. Some of the outcomes resulting from this work may be applicable to other regions of Canada where similar crops are grown.

A strategy to address these pests has been developed in collaboration with provincial crop specialists, research scientists, and industry stakeholders. The most pressing crop/pest issues were selected, solutions were discussed and prioritized, and an action plan was put into place. Selection of solutions was driven by the goal to achieve viable pest management while reducing risks associated with the use of insecticides, including pest resistance to these products.

To date, the Program has funded 13 projects addressing cereals, canola and alfalfa to implement this strategy. The pest species targeted for the above crops are aphids, cereal leaf beetle, Lygus bugs, cabbage seedpod weevil, and alfalfa weevil. Tools generated for growers so far include:

- A monitoring network to estimate risk for seven insect pests in three prairie provinces
- A new guide “Field Crop and Forage Pests and their Natural Enemies in Western Canada”
- A validated alfalfa weevil prediction model, adapted for the Canadian prairie region
- The relocation of a parasitoid wasp for biological control of the cereal leaf beetle
- The prototype of a dynamic action threshold for the control of aphids in cereal crops
- An updated economic threshold for Lygus bug in canola

Grasshoppers, an important pest of field crops, were not included here as these have been addressed previously through the Reduced-Risk Strategy for Grasshopper Management.

More details about the projects and solutions resulting from this strategy are provided in Table 1. Adoption of the new tools will enable growers to enhance their integrated pest management practices and reinforce judicious use of chemical insecticides.

Pest management and pesticide risk reduction issues

Foliar pests include numerous insect species which affect field crops in Canada. This strategy work focuses on the three Prairie Provinces because of the predominantly large acreage of field crops grown in this region. Out of a total of over 21 million hectares of field crops grown in Canada annually, 93% of cereals and 98% of canola are grown in the Prairie Provinces.
Significant amounts of pesticides are sprayed over large crop areas to protect crop quality and yields from foliar pests, especially during outbreaks. Most insecticides available are older chemistries that belong to two main groups, organophosphates and pyrethroids. Several of the products are being re-evaluated in light of new science and some of the registered uses may be eventually phased out. Moreover, repetitive use of a few insecticides with similar modes of action is a risk factor in the development of insect resistance to these products.

Therefore, a need was identified to diversify the tool box with alternative control options suitable for integrated pest management systems. This strategy is working to develop reduced risk solutions and decision support tools to facilitate sustainable management of priority pests.

**Strategy development**

Some gaps were previously identified for this group of pests through preliminary stakeholder consultations in 2003 and 2005. In response, the Program supported several projects addressing these gaps, while emphasizing the need for broader stakeholder engagement and a more concerted approach across the prairie region.

**Working group consultations**

In fall 2011, a working group was established to help the Program develop a plan of action to address these pest issues. The group brought together subject matter experts and stakeholders, including grower organizations, university researchers, and scientists, as well as provincial extension and pest management specialists.

**Priority issues and gaps**

Through multiple rounds of consultations over five years, the working group has progressively identified several gaps in pest management and associated reduced risk solutions for high priority foliar pests. These pests had been treated regularly with older insecticides and the need for alternative control options in the toolbox was critical. Top crop/pest needs identified to-date:

1. **Cereals**
   
   1a **Cereal aphids**: There was a need to develop and validate a dynamic action threshold tool that takes into account natural enemies of aphids present in cereal crops. A similar model previously developed for soybean aphid management in Ontario gave rise to the idea of adopting such approach in cereals;

   1b **Cereal leaf beetle**: Economic and dynamic (which takes into account the role of natural enemies associated with the pest present in a crop) action thresholds were needed for the Prairie regions. In addition, a highly effective biocontrol agent of cereal leaf beetle that had previously been introduced needed to be relocated into new areas where the pest was becoming endemic;
1c **Wheat midge:** Growers needed a simple way to apply the new science and technologies available in their decision making process for the management for this pest.

2 **Canola**

2a **Lygus bugs:** The 20-year-old economic thresholds needed to be updated for current canola cultivars, economics and climatic conditions;

2b **Cabbage seedpod weevil:** Control options with reduced risk to bees were needed for use during blooming of canola to protect foraging bees and other beneficial insects;

2c **Diamondback moth:** An economic threshold needed to be developed and validated for the prairie region.

3 **Forages**

3a **Alfalfa weevil:** Improved monitoring and prediction techniques for informed management decisions and knowledge on the status of key biocontrol agents were needed for this pest in the prairies.

4 **Other (overarching areas)**

4a Given that the only comprehensive pest management tool available to field crop growers was the *Insect Pests of the Prairies* published in 1989, a new field guide with up-to-date information was needed to help growers with proper identification of key pests and beneficial insects of field crops, as well as with integrated pest management approaches

4b Establish a coordinated prairie-wide insect pest monitoring network.

**Action Plan**

An action plan targeting the following goals was put in place to address the various issues listed above in a deliberate, sequential approach:

1. Develop biological pest control options as alternatives to insecticides;
2. Improve pest management decision making to minimize unnecessary insecticide sprays;
3. Develop IPM technologies and educate growers about the new knowledge and techniques developed through this strategy.

Table 1 below outlines the goals of the strategy along with the solutions recommended by the working group members and the actions taken by the Program to implement them.
Table 1. Progress to implement a reduced-risk strategy for foliar insect pest management in prairie field crops (August 2016)

*Status: Activity addressing a milestone is underway (In-progress); Activity is complete (Completed); Areas recommended for further work or promotion (Future).

<table>
<thead>
<tr>
<th>Goal</th>
<th>Milestone</th>
<th>Status</th>
<th>Results from projects undertaken by the Program</th>
<th>Completi on Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Develop biological pest control options</td>
<td>Evaluate the potential for cabbage seedpod weevil biocontrol in canola (2b)</td>
<td>Completed</td>
<td>PRR03-370 <strong>Assessing potential non-target risks of biological control agents used in IPM against cabbage seedpod weevil.</strong> Due to concerns with the breadth of host range revealed by host plant-weevil-parasitoid associations, no steps were taken to release any of the tested biocontrol agents. New non-target host test lists were developed for the Canadian Food Inspection Agency (CFIA).</td>
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<td></td>
<td></td>
<td>Support regulatory submission for XenTari for diamondback moth control in canola</td>
<td>Completed</td>
<td>BPR12-030 <strong>Evaluation of XenTari for the management of diamondback moth in canola.</strong> Efficacy data generated was used by registrant (Valent Biosciences) to complete the registration package for XenTari WG Biological Insecticide (<em>Bacillus thuringiensis</em> ssp. aizawai) submitted to PMRA. XenTari was registered for use for diamondback moth control in canola in November 2014.</td>
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<tr>
<td></td>
<td></td>
<td>Relocate cereal leaf beetle parasitoid <em>Tetrastichus julis</em> into new areas of cereal crops (1b)</td>
<td>Completed</td>
<td>PRR13-020 <strong>Expanding distribution of existing parasitoid to new areas for biocontrol of cereal leaf beetle in small grain cereals in the Canadian prairies.</strong> From 2013 to 2015, about 14,000 <em>Tetrastichus julis</em> wasps were relocated and released in various wheat fields of Alberta, Saskatchewan and Manitoba where the pest had become prevalent, but the parasitoid was not recorded or parasitism was at insufficient levels. Also, a landscape ecology study indicated that abundance of cereal leaf beetle decreased in cereal fields surrounded by landscapes that had a high proportion of non-cropped habitat.</td>
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<tr>
<td>Action</td>
<td>Description</td>
<td>Project Code</td>
<td>Details</td>
<td>Status</td>
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<tr>
<td>Improve pest management decision making</td>
<td>Establish a coordinated prairie-wide insect pest monitoring network to inform growers on pest risks (4b)</td>
<td>PRR07-060</td>
<td>Development of reduced-risk strategies through coordinated monitoring, forecasting and risk warning systems for insect pests of field crops in Canada. A monitoring network was established for seven pest species across three prairie provinces and data were translated into interpretive risk maps indicating near real time distribution and density of each target pest. Collection of data and delivery of this service to growers continues through the Prairie Pest Monitoring Network.</td>
<td>Completed</td>
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<tr>
<td></td>
<td>Update economic threshold for Lygus bug in canola (2a)</td>
<td>PRR12-030</td>
<td>Refine and validate economic threshold for Lygus bugs in canola production in Alberta. Project provided preliminary recommendations against spraying irrigated canola fields for Lygus control at pod stage. Work to further refine these recommendations continues under other sources of funding.</td>
<td>Completed</td>
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<td></td>
<td>Develop a dynamic action threshold for cereal aphids that takes into account natural enemies of aphids present in the crop (1a)</td>
<td>PRR12-040</td>
<td>Develop and validate a dynamic action threshold (DAT) tool for aphid management in cereal crops in the Prairies. A new DAT prototype was developed to predict growth of cereal aphid populations accounting for changing numbers of aphids and their natural enemies. The model needs further refinements and field validation before recommending to growers as a tool for making informed spray decisions.</td>
<td>Completed</td>
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<tr>
<td></td>
<td>Refining and making accessible to growers a validated dynamic action threshold (DAT) for cereal aphid control in cereal crops</td>
<td>PRR15-040</td>
<td>Refining and making accessible to growers a validated dynamic action threshold (DAT) for cereal aphid control in cereal crops. Project aims to develop an online application for growers to access an operational and field validated DAT developed earlier in project PRR12-040. The DAT is expected to recommend a pesticide spray when the populations of predators and parasitoids of cereal aphids are insufficient to prevent the pest from reaching the economic threshold.</td>
<td>In-progress</td>
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<td></td>
<td>Make available prediction tool for alfalfa weevil in prairie regions (3a)</td>
<td>PRR13-010</td>
<td>Improve decision-making for monitoring and management of alfalfa weevil in alfalfa crops on the prairies. The project validated degree-day models which best determined the stage of alfalfa weevil development. The prediction tool has been made available to growers since 2015 through the Prairie Pest Monitoring Network. The project also revealed that the parasitoid wasp Bathyplectes curculionis, a natural enemy of alfalfa weevil, is well established across Saskatchewan and is present in Manitoba.</td>
<td>Completed</td>
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</table>
| | Develop field guide to identify harmful & beneficial insects of field crops in the Prairie (4a) | PRR13-040 | Production of a field guide on pest and beneficial insects and mites of field crops in western Canada. Project developed an illustrated 150 page publication titled Field crop and forage pests and their natural enemies in Western Canada available in English and French. Both print and electronic (USB card and
<table>
<thead>
<tr>
<th>IPM technology development and transfer</th>
<th>In-progress</th>
<th>Completed</th>
<th>Future</th>
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<tr>
<td>Develop economic thresholds for cereal leaf beetle (1b)</td>
<td></td>
<td>PRR16-020 Development and validation of a dynamic action threshold for cereal leaf beetle in the Canadian prairie. This project aims to develop and field validate an action threshold that incorporates elements of the density and voracity of important natural enemies of the cereal leaf beetle present in wheat crops. The goal is for growers to use this tool to make informed spray decisions in the field.</td>
<td>2016-2019</td>
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<tr>
<td>Develop economic thresholds for diamondback moth in canola (2c)</td>
<td>In-progress</td>
<td></td>
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<td>Promote IPM adoption and pesticide risk reduction strategies in cereals</td>
<td>Future</td>
<td>PRR06-870 Accelerating the adoption of Integrated Pest Management and risk management strategies in wheat and other cereals. Project determined existing adoption levels of selected IPM systems in cereals and encouraged further uptake of best management practices through on-farm demonstrations and educational activities.</td>
<td>2006-2009</td>
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<tr>
<td>Develop integrated control approaches for cabbage seedpod weevil (2b)</td>
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<td></td>
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<tr>
<td>Develop IPM educational tool for wheat midge (1c)</td>
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* Crop/pest code corresponds to the issue number listed under ‘Priority issues and gaps’ on page 5.
Strategy outcomes

Major outcomes from the implementation of this strategy to date include:

- Field crop growers now have easy access to new science and decision support tools to inform integrated management actions for some priority insect pests;

- Field crop growers have access to scientifically based recommendations on the incorporation of biological control agents and natural enemies in integrated pest management systems for some priority insect pests;

- Large cohorts of field crop growers, crop advisors, and pest management specialists have been informed about the use of new tools and approaches made available through this strategy work.

It is anticipated that by making these new tools and approaches available and educating growers in their use, more sustainable crop protection practices will be adopted, whereby growers reduce their reliance on chemical insecticides and practice better resistance management.

This report will be updated periodically as new projects are completed and new information becomes available.