Canadian Agri-Science Cluster for Horticulture 3

Update to Industry

2020-21 – Semi-Annual

Activity title:
Activity 10 - Development of Regional Management Strategies and Decision Making Tools for Control of Colorado Potato Beetle

Name of Lead Researcher:
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Names of Collaborators and Institutions:
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Activity Objectives (as per approved workplan):
OBJECTIVES: Our overall objective is to reduce economic losses to potato in Canadian growing regions due to herbivory by the Colorado potato beetle (CPB). Specifically, we aim to determine local susceptibility of CPB populations to several classes of insecticides through a national resistance-monitoring network, improve resistance management, better characterize the molecular basis of developing resistance, and develop novel extension tools to improve management practices. To accomplish this, the deliverables are divided into four objectives as follows:

1. Determine susceptibility of Colorado potato beetle populations to multiple classes of insecticides in different potato growing regions in Canada;
2. Develop an interactive online mapping tool for growers to access results of susceptibility surveys to inform local decision making for optimal insecticide selection;
3. Identify molecular signatures of insecticide resistance that can be used to monitor the occurrence and spread of resistance in regional CPB populations and identify new pest control targets;
4. Develop a novel resistance monitoring tool for extension and diagnostic labs as a within-season decision making tool, based on molecular signatures of developing resistance

Research Progress to Date:
The first two years of the project have gone very well and prior to COVID-19 we were meeting or exceeding project milestones. The impacts of COVID-19 and resulting restrictions at AAFC have meant some impacts to our progress in the first half of 2020-2021. However, we are pleased we have been able to make quite good progress in most areas of the project considering the impacts and restrictions.

1. Determine susceptibility of Colorado potato beetle populations to multiple classes of insecticides in different potato growing regions in Canada.
Our goal each year is to obtain a minimum of 25 populations of Colorado potato beetle from various potato growing regions across Canada to complete insecticide resistance screening. We were directed to plan for lab work at 30-40%

capacity in the AAFC Phase 4 lab return in September. In 2020, we were able to receive 15 populations from project partners. We received three populations from Manitoba, three from Ontario, four from Quebec and five from PEI. We updated the grower survey this year, and in most cases as project partners to fill the survey on behalf of growers to ensure consistency. Due to the delay to begin insecticide resistance screening trials, data collection is ongoing and summary results for this year will be available in the year-end report.

2. Develop an interactive online mapping tool for growers to access results of susceptibility surveys to inform local decision making for optimal insecticide selection
Excellent progress has been made in the development of the mapping tool. The GIS platform is complete, and new data can be added annually. At this stage, we are in discussion with the AAFC Agri-Geomatics team to determine how we will roll out the mapping tool to stakeholders. We anticipate a soft roll out sometime in 2021.

Objective 3: Identify molecular signatures of insecticide resistance that can be used to monitor the occurrence and spread of resistance in regional CPB populations and identify new pest control targets
Excellent progress has been made in conducting molecular diagnostics of resistant beetles in the 2018 and 2019 project years. This spring and summer, our teams had the opportunity to work remotely and analyze these data to identify molecular targets of resistance for several insecticide classes. Very good progress has been made towards identifying the molecular basis of resistance to spinosyns (i.e. Entrust, Delegate), which we published recently (Bastarche et al. 2020 https://www.mdpi.com/2075-4450/11/11/820). There will be delays and impacts seen for the remainder of this year as we work in a reduced capacity to process 2020 samples, which are fewer in number and suffered some loss of viability, but are optimistic we will still make some further progress this year.

Extension Activities (presentations to growers, articles, poster presentations, etc.):

Bastarache, P., Wajnberg. G., Dumas, P., Chacko, S., Lacroix, J. Crapoulet, N. **Moffat, C.E.,** and **Morin, P.** 2020. Transcriptomics-Based Approach Identifies Spinosad-Associated Targets in the Colorado Potato Beetle, *Leptinotarsa decemlineata. Insects:* 11(11), 820; https://doi.org/10.3390/insects11110820

Country Guide Magazine, December 2020. Mark Halsall interviewed Project Leads Dr. Moffat and Dr. Scott on our research project. At the time of article submission, the working title was still 'Colorado Potato Beetle Article'.

We have not had the opportunity to engage in any virtual extension activities yet this fiscal year. We would be keen to participate in such events, so if readers of this report have any suggestions we would be happy to be contacted.

COVID-19 Related Challenges:
COVID-19 has impacted our project in a number of ways, but we are fortunate we have still been able to make some progress on most objectives. With the near closure of AAFC facilities in mid-March and suspension of all research activities that could not be conducted reomotely, there was high uncertainty of AAFC researchers being able to complete any field or lab activities for 2020. We engaged early with project partners in Manitoba, Ontario, Quebec and PEI and hosted a number of project planning calls over zoom. Working with our partners, we planned using various scenarios and prioritized research efforts to re-sample populations where insecticide susceptibility was reduced or resistance developed, or other most interesting populations.
Objective 1 (insecticide screening) relies on field collections of CPBs supplied by project partners, followed by laboratory trials conducted at the London and Fredericton AAFC centres. Given the uncertainty over the return to labs, we had to be strategic. Project partners collected roughly 50% of the usual number of collections, as we were directed by AAFC management to plan for a reduced capacity of 30-40% upon return to the lab. Insecticide resistance screening usually is initiated in July, but we the return to the lab was delayed until September. This resulted in the loss of some samples across multiple collections, as insect viability declines with time. However, since the return to the labs, the technicians have made quite good progress considering the circumstances (reduced time in the labs, reduced in-person lab hours, specimens declining with age). The full impacts are not yet realized, but we are optimistic we will achieve successful screening of 30-40% of samples.
Objective 2 (digital mapping) was not impacted adversely by COVID-19 as work could be continued remotely.

Objective 3 (molecular diagnostics) relies on successful insecticide resistance screening in Objective 1. Because we will achieve 30-40% of our target populations, and each population will likely have not quite complete results, progress on Obj. 3 will also be impacted by the impacts to Obj 1. Progress on Obj. 3 this winter and coming spring depends on the results of Obj. 1 but also lab activities continuing at the London research centre and the team there having the in-person hours in the lab to complete the work.

Objective 4 (molecular screening tool) relies on data generated from Objective 3 being validated. Due to cascading impacts (impacts to Obj. 1, cascading to impacts to Obj. 3), we have proposed an amendment to the workplan to delay progress on Obj. 4 from 2021 to 2022. We will endeavor to initiate this objective in 2021, but given ongoing uncertainty with our ability to progress on Obj. 3, it is best to shift the commitment on Obj. 4 to 2022.

Key Message(s):
This project still is in quite good shape. We have made excellent progress in the first two years of the project. Impacts of COVID-19 have definitely impacted the project, but as each year's collections are relatively independent, we will be able to weather the impacts and continue to make strong progress on the project. We are quite confident in our ability to deliver on Objectives 1, 2 and 3, even if there are reduced deliverables for 2020-2021. Due to cascading impacts of COVID-19, we have delayed initiation of Obj. 4 to 2022.

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