

Canadian Agri-Science Cluster for Horticulture 3



Update to Industry

2018-2019

Activity title: Common Scab: Increasing profitability of Canadian potato producers by controlling common scab

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Activity Objectives (as per approved workplan):

The overall objective of the project is to evaluate several methods to control common scab of potato under a range of environmental conditions and soil types across Canada.

The specific objectives of this project are to:

- Sub-activity 1.1 Characterize the genetic diversity of *Streptomyces* spp. causing common scab and develop tools to measure specific genotype,
- Sub-activity 1.2. Evaluate methods to control common scab using small plot and field-scale trials in commercial potato fields,
- Sub-activity 1.3. Determine the effect of common scab control methods on soil health and quality parameters,
- Sub-Activity 1.4. Determining the concentrations of soil isothiocyanates,
- Sub-Activity 1.5. Evaluate the effect of common scab control methods on microbial communities.

Research Progress to Date (use plain language):

Common scab results in significant economic losses every year in Canada. Common scab symptoms are characterized by brownish lesions on potato tubers that can result in declassification of tubers in the seed production, rejection for the table market and difficulty in peeling the tubers leading to significant losses in the processing industry. There are currently no chemical registered specifically to control common scab in Canada. The overall objective of the project is to evaluate several methods to control common scab of potato under the different environmental and soil properties of Prince Edward Island (PEI), and Manitoba (MB).

Sub-activity 1.1 Characterize the genetic diversity of *Streptomyces* spp. causing common scab and develop tools to measure specific genotype. The genetic diversity of the pathogen responsible for common scab in NB, PEI, and MB will be determined. Tubers were collected from forty-nine infested fields in NB, PEI, and MB and 349 isolates were obtained from the common scab lesions. The isolates are currently being characterized.

Sub-activity 1.2. Evaluate methods to control common scab using small plot and field-scale trials in commercial potato fields.

Sub-activity 1.2.1 Due to the delay in approval of the project, field trials to control common scab planned under this sub-activity were postponed to summer 2019 with the exception of the field evaluation of somaclonal variants. Common scab resistance of known potato varieties can be increased using a technique named somaclonal variation. Common scab resistance of variants obtained using somaclonal variation were evaluated in fields infested with common scab in PEI. This approach was used for two varieties including Riverdale Russet and Prospect. Around 100 variants of each variety were obtained and screened for common scab resistance in the field since 2017, with the top 25 being selected for each variety. In Summer 2018, the 25 most resistant variants of Riverdale Russet and Prospect were planted in field trials with 2 replications in three sites across PEI. After harvest, disease severity was assessed on the top 10 tubers for lesion coverage and amount of pitted lesions. Based on the results, four variants of Riverdale Russet, three variants of Prospect, in addition to four variants of Shepody, will be screened in three sites in PEI in summer 2019.

Sub-activity 1.2.2. Crop rotation in potato crop system can reduce the severity of common scab in the potato year. The effect of the preceding rotational crop on common scab severity and soil physiological properties were evaluated. Six potato fields were identified that were split in the previous year with a variety of rotational crops including brown mustard, sorghum-sudan grass, red clover, buckwheat, ryegrass, pearl millet or a variety mixture. Soil samples were taken from six replicated strips in each treatment area at tuber initiation and analyzed for soil properties. At harvest, six replicated ten-foot strips were harvested from each treatment area and soil samples were also taken from the harvested zones. Soils were analyzed for various properties and harvested tubers were assessed for incidence and severity of common scab. Data is currently being analyzed for treatment effects and correlations of common scab incidence and severity with soil chemical properties.

Sub-activity 1.3. Determine the effect of common scab control methods on soil health and quality parameters

A method to quantify the abundance of common scab pathogen from commercial potato fields and the effect of rotation crops on this measurements is being developed. Growers and industry are interested in having a tool to quantify common scab pathogen from commercial fields. This approach will use a molecular tool, named quantitative PCR, to quantify the common scab pathogen by targeting a gene essential for its pathogenicity. There are already methods using quantitative PCR to quantify the common scab pathogen described in the scientific literature however it is still unclear what the best approach to quantify common scab pathogen from commercial potato fields is. For example, the relationships between the abundance of the pathogen in the fall preceding the potato crop and the severity of the disease in the potato in the following was not demonstrated. This study will be developing an approach to sample fields to evaluate the abundance of the common scab pathogen at the field level. It will evaluate the effect of the preceding crop rotation on the quantification of the pathogen in PEI. Four fields with different crop rotation were sampled including triple mix, rye grass, sudan grass and alfalfa. Ten soil cores were sampled in a W pattern at a 0-15 cm depth. Field locations were noted using GPS coordinates in order to return to the same area in 2019 for disease severity assessment. The fields in PEI had a range between 1,300 to nearly 15,000 common scab cells per gram of soils. Disease

severity will be evaluated in fall 2019. Relationships between common scab severity and the abundance of the common scab will be evaluated.

It would be simpler for soil samples to be stored at 4°C than shipped with ice packs to Fredericton. However, the effect of the storage at 4°C on the abundance of the common scab pathogen was unknown. To test this, a field infested with common scab was divided in four blocks and six cores were taken randomly from each blocks then mixed. Sub-samples were taken from the same samples and either immediately frozen upon return to the laboratory or stored at 4°C for 72h. The results showed that the abundance of the common scab pathogen increased significantly by 9-fold when soils were stored at 4°C compared to samples frozen immediately. This means that the samples will need to be frozen as soon as possible after sampling in PEI and MB and the samples shipped to Fredericton on dry ice.

Sub-Activity 1.4. Determining the concentrations of soil isothiocyanates.

Isothiocyanates (ITCs) are volatile compounds produced via the degradation of mustard meal and mustard residues in soils. ITCs are known to reduce the populations of soil-borne-disease. To better observe the effect of mustard on the common scab pathogen population mustard meals and mustard crop under A method to quantify ITCs was identified.

Sub-Activity 1.5. Evaluate the effect of common scab control methods on microbial communities.

This activity is planned for year 2-5 of the project.

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

1. Goyer, C. 2019. Update on common scab research. NB Seed Potato Day, Grand Falls, NB. 2019/02/28.
2. Al-Mughrabi, K. Potato pathology research update. NB Potato Conference and Trade Show, 2019/02/07
3. Goyer, C. 2019. Title: Creative solutions for common scab. Potatoes Canada magazine. Interview with Julienne Isaac. 2018/11/26

Early Outcomes (if any) or Challenges:

- About 349 isolates were obtained from common scab lesions of tubers originating from PEI, NB and MB.
- Four variants of Riverdale Russet and three variants of Prospect obtained using somaclonal variation, a technique that can increase resistance to common scab, showed reduction in the severity of the disease compared to the parental line.
- An approach to quantify the common scab pathogen abundance from commercial potato field in the fall preceding potato crop that predicts reliably the common scab severity is being developed.
- A method to quantify isothiocyanates, the volatile compounds produced via the degradation of mustard meal and mustard residues, was identified.

Key Message(s):

This project will allow to better understand the diversity of the common scab pathogen in NB, PEI and MB in order to improve detection of specific species or strains of the common scab pathogen. The tools to evaluate the effect of the agricultural practices on disease severity including the molecular tool to quantify common scab pathogen and the measurement of isothiocyanates are ready to be used.

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