

Canadian Agri-Science Cluster for Horticulture 3



Update to Industry

Semi-Annual – Spring 2021

Activity title: Investigating the occurrence and distribution of potato tuber necrosis-inducing viruses in Canada and studies on varietal responses to the viruses for minimizing economic losses caused by the pathogens

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Activity Objectives (as per approved revised-workplan):

FY 2020-2021

- Unveiling the incidences/occurrences of necrotic viruses (mainly PMTV and PVY^{NTN}) in potatoes in the participating provinces (mainly Manitoba and New Brunswick) in 2020;
- Understanding the sensitivity of up to 6 potato cultivars to Alfalfa mosaic virus-induced internal necrosis and the sensitivity of up to 5 newly released potato clones/cultivars to PVY^{NTN}-induced potato tuber necrotic diseases
- Unveiling the sensitivity to PMTV-induced necrosis in up to 12 potato cultivars – second year trial of group one cultivars (i.e., cultivars that were tested in the previous cropping year).

Research Progress to Date (use plain language, not to exceed 500 words):

Objective 1: In the first semi-annual update (Apr-October 2020), we reported the completion of the analysis on tubers of 2019's crop for the target viruses [i.e., potato mop-top virus (PMTV), tobacco rattle virus (TRV), alfalfa mosaic virus (AMV) and potato virus Y strain NTN (PVY_{ntn})] from the two participating provinces (i.e., Manitoba and New Brunswick). In this semi-annual period (i.e., November 2020 – March 2021), we received a total of ca. 600 tubers from Manitoba in December 2020, but yet to complete the detection of the target viruses.

Objective 2: Previously, we reported the completion of the analysis of varietal sensitivities to AMV (9 cultivars) or PVY_{ntn} (11 advanced clones) induced tuber necrosis under primary infection (i.e., plants get infected during the growth). In this semi-annual period, we analyzed the cultivar sensitivities to AMV or PVY_{ntn} under secondary infection (i.e., tuber-borne). **For AMV**, in addition to Shepody, Dark Red Norland and Goldrush exhibited a high level of sensitivity to AMV-induced internal tuber necrosis as all tubers developed internal necrosis. In Atlantic, Kenebec and Snowden, approximately 15% - 50% tubers developed internal necrosis in AMV-infected plants, suggesting an intermediate level of sensitivity to AMV-induced tuber disease. Conversely, less than 10% tubers from AMV-infected plants of Lamoka, Russet Burbank and Russet Norkotah developed internal necrosis, indicating a low level of sensitivity to the virus-caused tuber disease. A repeat of the trial is underway in the 2021-2022 fiscal year. **For PVY_{ntn}**, distinct PTNRD was found in ~50%

tubers of Yukon Gold as anticipated. In F15062, one tuber exhibited “potato tuber necrotic ringspot disease (PTNRD)-like” symptoms. No tubers from the clones developed PTNRD symptoms, demonstrating insensitivities of the clones to PVYntn-induced tuber necrosis. A repeat of the trial is underway.

Objective 3: As reported in the previous update, the field trial 2020 in a PMTV-infested field in NB was cancelled due to COVID-19. In this reporting period, we completed the laboratory test for PMTV in the tubers obtained from the field trial 2019 and stored for 0, 3, 6 and 9 months. Our results demonstrated that the number of tubers with PMTV-related internal necrosis increased as the time of storage increased. At 0 month postharvest, 15 out of 1200 tubers exhibited PMTV-associated spraing disease; at 3-month, the number increased to 30; at 6-month, it increased to 35; and at 9-month, the number increased further to 44. Of the 15 cultivars/clones tested, Dark Red Norland showed the most susceptibility to PMTV-induced necrosis with an occurrence of ca. 7.8%, followed by Chieftain (6.5%), Kennebec (5.3%), Snowden (3.4%), Yukon Gold (2.5%), Atlantic (1.6%), Shepody (1.3%), Russet Norkotah (1.3%), Goldrush (0.9%), Lamoka (0.9%), and Russet Burbank (0%). Among the four advanced clones, F13014 showed the most susceptibilities with an occurrence of 2.2%, followed by F13007 (1.3%), F13015 (0.9%) and F13049 (0.6%). Although these results are largely consistent with those obtained from similar trials at the USA, cautions should be taken as these are yet to be repeated. A trail in the same field is planned for the 2021 cropping year.

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

One (1) oral presentation in a potato technology forum for this reporting period (Nov 2020 – Mar 2021): Nie X, Singh M, Chen D, Gilchrist C, Soqrat Y, Shukla M, Creelman A, Dickison V, Nie B, Lavoie J, Bisht V. 2021. Development of high-resolution DNA melting analysis for simultaneous detection of potato mop-top virus and its vector, *Spongospora subterranea*, in soil. Northeast Potato Technological Forum 2021 (Virtual: <https://northeastpotato.com/>), 23-24 March 2021.

COVID-19 Related Challenges:

Restrictions on number of persons allowed in a given inside space such as laboratory and greenhouse.

Key Message(s):

Despite significant challenges, we have made good progress on the project. It is particularly worth of note that the PCR-based method termed high-resolution DNA melting (HRM) analysis for simultaneous detection of potato mop-top virus (PMTV) and its fungal vector *Spongospora subterranean* (Sss, the powdery scab-causing pathogen) from soil samples directly has an excellent potential to be used for large scale survey of fields for PMTV and Sss infestation.

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