Canadian Agri-Science Cluster for Horticulture 3

Update to Industry

Semi-Annual – Spring 2022

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

Name of Lead Researcher: Xianzhou Nie, AAFC

Names of Collaborators and Institutions:
Mathuresh Singh, potato virology/pathology/diagnostics, ACS, Fredericton, New Brunswick;
Jacques Lavoie, , potato specialist NBDAAF, Grand Falls, New Brunswick;
Vikram Bisht, potato pathologist, Manitoba Agriculture, Carman, Manitoba;
Laixin Wang, principal scientist-global science, potato processing quality, McCain Foods, Florenceville, New Brunswick;
Gary Hawkins, potato varieties, McCain Foods, Florenceville, New Brunswick;
Huimin Xu, virologist, CFIA-Charlottetown Laboratory, Charlottetown, Prince Edward Island;
Sean (Xiang) Li, soil pathologist, CFIA-Charlottetown Laboratory, Charlottetown, Prince Edward Island

Activity Objectives (as per approved workplan):

- Unveiling the incidences/occurrences of necrotic viruses (mainly PMTV and PVYNTN) in potatoes in the participating provinces (mainly Manitoba and New Brunswick) in 2021;
- 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 PVYNTN-induced potato tuber necrotic diseases;
- Unveiling the sensitivity to PMTV-induced necrosis in (a) 12 potato cultivars – second year trial of group one cultivars; and (b) up to 13 potato cultivars – first year trial of group two cultivars.

Research Progress to Date (use plain language, not to exceed 500 words):
Objective 1: In the previous semi-annual report filed in November 2021, we reported the completion of the laboratory testing of a total of 523 tuber samples from the year 2000 crop from the participating provinces (i.e., MB and NB) for the targeted viruses, namely PMTV, PVY tuber necrotic strain (PVYntn), alfalfa mosaic virus (AMV) and tobacco rattle virus (TRV). In this reporting period (Dec 2021 – May 2022), we are still in the process to complete the testing for the target viruses in tubers of the 2021 crop. It is anticipated the testing will be completed in summer 2022.
Objective 2: We completed the second repeat of study on the sensitivity of 9 cultivars (Shepody, Dark Red Norland, Goldrush, Atlantic, Kenebec, Snowden, Lamoka, Russet Burbank and Russet Norkotah) to **AMV-induced internal necrosis** under secondary infection (i.e., tuber-borne) and the sensitivity of 11 advanced clones (F14002, F14021, VF14016, VF14017, VF14018, CV011010-2, F15062, 1-4, 12-4, 9-7, 12-7) along with the control cv Yukon Gold to **PVYntn-induced necrotic ringspot disease (PTNRD)**, and similar results were obtained as those of the first repeat. In addition, we selected 10 commercial cultivars (i.e., AC Chaleur, Ranger Russet, AAC Canada Gold-Dorée, Green mountain, AAC Valley Crisp, Exploits, CalWhite, Cherokee, Eramosa, Katahdin), along with the susceptible control cv. Shepody as the third group of cultivars to study their sensitivity to AMV-induced tuber necrosis. The plants of each

cultivar have been inoculated with AMV, the infection has been confirmed by ELISA test. Tubers from the AMV-infected plants will be analyzed for necrotic symptoms in next reporting period.
Previously, we reported that one of the advanced clones, F15062, was prone to PTNRD. Pedigree record of F15062 indicates that the clone is an offspring of the PTNRD-susceptible cultivar AC Chaleur, suggesting the trait is likely inheritable. To test this theory, two populations derived from AC Chaleur, specifically AC Chaleur x F02010 and AC Chaleur x Sunrise, were analyzed for the inheritance of PTNRD susceptibility after PVYntn infection. Among 81 progeny of AC Chaleur x F02010, 20 produced tubers with PTNRD; and among 140 progeny of AC Chaleur x Sunrise, 42 produced tubers with PVYntn-induced PTNRD. These results clearly support the hypothesis that this trait is inheritable. Further testing is on-going. Due to the inheritable nature of PTNRD susceptibility, screening for PVYntn- and PTNRD-susceptible potato breeding germplasm is probably more effective for breeding for PTNTD-insensitive potato cultivars. Bearing this in mind, we tested 88 germplasm/breeding clones for their response to PVYntn infection in the greenhouse. Among them, 12 (i.e., 13438-34, 12583-72, 13399-04, 12060-14, 12032-06, 12032-20, 12673-01, F03069, 14935-01, 14930-06, A522, 14127-83) were readily infected with the virus strain. No tubers from any of the 12 clones developed visible PTNRD, suggesting their insensitivity to PVYntn-caused tuber necrosis. Further testing is under way.

Objective 3: In previous semi-annual update, we reported the resuming of the PMTV field trial in NB. In this period ending in May 2022, we have analyzed tubers stored for 0 and 3 months for the 21 cultivars (**9** for the second-year trial: Atlantic, Chieftain, Dark Red Norland, Goldrush, Kennebec, Russet Burbank, Shepody, Snowden, Yukon Gold; and **12** were for the first-year trial: AAC Canada Gold, AAC Valley Crisp, Caribou Russet, Hodag, Innovator, Ivory Russet, Manistee, Maritime Russet, Monica Russet, Mountain Gem Russet, Non Pareil Russet, and Reveille Russet). At each time point, 5 tubers from each treatment were selected randomly for ELISA and RT-PCR testing for PMTV. Meanwhile, 20 tubers each of every treatment were dissected and examined for spraing-like symptoms. Tubers exhibiting the suspected symptoms were tested for PMTV with ELISA and RT-PCR. The laboratory results from the non-dissected tubers are considered to be cultivar sensitivity to PMTV infection whereas the results from the dissected tubers are indicators for cultivar sensitivity to PMTV-induced tuber necrosis. The preliminary results from 0 and 3-month storage indicate a clear difference in cultivar sensitivity to PMTV infection, with Dark Red Norland being the most susceptible to PMTV infection at 62.5% and Ivory Russet the least to PMTV infection at 2.5%. Similarly, the cultivars showed a clear difference in their sensitivity to PMTV-induced tuber necrosis, with the red cultivar Dark Red Norland being the most susceptible (35.8%), followed by Chieftain (21.7%) and several smooth-skinned cultivars including Hodag (16%), Kennebec (15.8%), Atlantic (15%) and Snowden (13.3%). Russet cultivars generally exhibited lower sensitivity to the virus-induced tuber necrosis. This trend is in agreement with those obtained from the trial 2019. Tubers stored for 6 and 9 months are yet to be analyzed.

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

One (1) oral presentation in a scientific technology forum: Nie X, Singh M, Lavoie J, Bisht V, Shukla M, Creelman A, Mackenzie T, and Lai M. 2022. Assessment of cultivar sensitivity to potato mop-top virus induced tuber necrosis. Northeast Potato Technological Forum 2022 (Virtual). 16-17 March 2021.

COVID-19 Related Challenges:

1. Some lab/greenhouse based activities have been delayed due to COVID-19 caused space restrictions.

Key Message(s):

All progresses well.

This project under the Canadian Agri-Science Cluster for Horticulture 3 is funded in part by the Government of Canada through the Canadian Agricultural Partnership's AgriScience Program, a federal, provincial, territorial initiative, with support from the Fruit and Vegetable Growers of Canada (formerly the Canadian Horticultural Council) and industry contributors.

CANADIAN AGRICULTURAL PARTNERSHIP
Innovate. Grow. Prosper.

FRUIT & VEGETABLE GROWERS OF CANADA | PRODUCTEURS DE FRUITS ET LÉGUMES DU CANADA

Canada