# Canadian Agri-Science Cluster for Horticulture 2

## Progress Report December 2014

Activity 13, Potato 12

**Understanding of Potato Virus Y (PVY) Complex in Canada and Development of a Comprehensive On-Farm Management Strategy**

**Lead Researcher**

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**Collaborators**

Provincial potato grower organizations and extension specialists

**Activity Objectives**

- Survey the occurrence of PVY strains across Canada and characterize the genetic affiliation and pathological properties of novel strains;
- Characterize the responses of common potato varieties to the major PVY strains;
- Investigate the efficacy of mineral oil, insecticide and combination mineral oil/insecticide foliar sprays to reduce on-farm PVY spread.

**Research Progress to Date**

In 2014, samples were received from five provinces across Canada to screen for PVY infection and strain determination. A rapid screening protocol utilizing ELISA to identify PVY-positive samples in leaves, followed up with RT-PCR for determining strain affiliation was used. A routine supply and processing chain for receiving samples has been developed. Dedicated greenhouse space is used to grow-out tubers with peculiar symptomology or strain affiliation, and maintain an array of tobacco plants which can be inoculated with sample viruses of interest to further examine strain pathogenicity and to grow viral strains for experimental inoculation in potato.

Thus far, six potato varieties have been inoculated with $PVY^{O}$ strain and the tuber-necrotic strains $PVY^{N:O}$ and $PVY^{NTN}$: Norland, Norchip, Eva, Shepody, Innovator and Envol. Tubers from this first panel of varieties are currently being held dormant, for later planting to observe symptom presentation in secondary (tuber) infection. A second set of varieties for testing: Atlantic, Bintje, Chieftan, Sangre and Snowden will be planted in early December 2014, for inoculation in January 2015 and subsequent symptom observation.

A field trial to compare the effectiveness of mineral oil alone, insecticide alone and mineral oil-

insecticide combination took place in the 2014 growing season in a field of Goldrush variety centrally located in the potato producing region of New Brunswick. Viral inoculum rows were interlaced with the test plant rows. A leaf test determined the extent of mid-season PVY spread, then after top-kill, three random tubers were dug from each plant. The geographic position and strain identification of all positive individuals has been calculated to allow analysis of spatial patterns of viral spread, which can be matched to strain affiliation and prevalent weather data collected on site through the season.

**Early Outcomes or Challenges**

The overall objective of these linked activities is to understand the current population structure of *Potato Virus Y* (PVY) strains in Canada, their individual phenotypic expression with respect to many of the common commercially important potato varieties in Canada, and determine specific control measures to reduce the capacity for spread of these viruses.

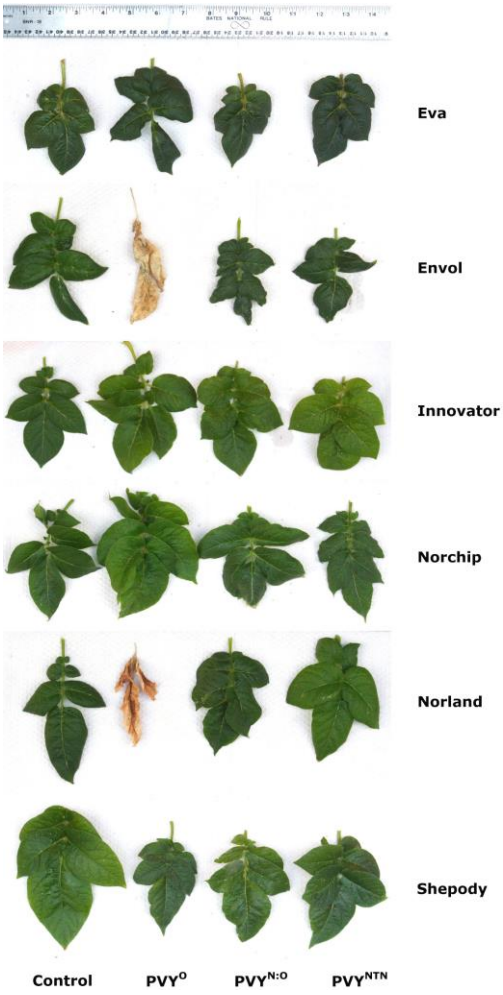
Our results to date suggest that the major PVY strain groups, $PVY^{O}$ and the tuber-necrotic strains, $PVY^{N:O}$ and $PVY^{NTN}$, are well distributed across the country. The necrotic strains, in particular the more worrisome $PVY^{NTN}$, has been increasing in proportion of the virus population in recent years. This strain has been shown to exhibit significant yield reduction and visible symptoms on tubers that may have a substantial effect on the marketability of a potato crop.

The predominant virus strains exhibit widely varying effects depending on strain and potato variety infected. $PVY^{O}$ generally causes more dramatic foliar symptoms and early plant senescence, and may be more easily recognized in the field, while $PVY^{N:O}$ and $PVY^{NTN}$ show relatively mild symptoms in the plant. Some cultivars, such as Norland and Envol, are particularly susceptible to $PVY^{O}$ and even the other strains, while others like Innovator and Eva show nearly no symptoms with any strain.

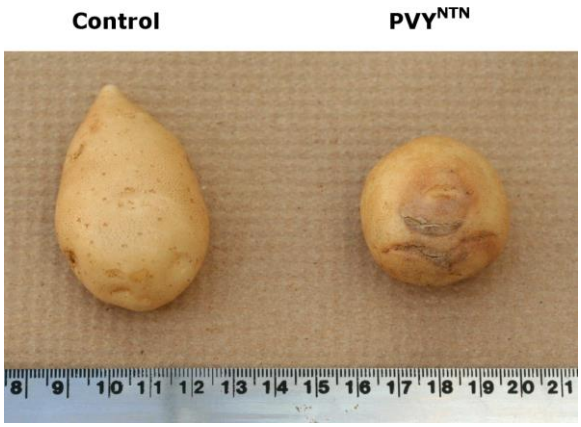
In terms of PVY control, a range of mineral oil and insecticide practices has been observed in the industry, with which some anecdotally appear to be relatively effective at reducing on-farm spread of the virus. In the 2014 growing season, a controlled, replicated trial of various combinations of mineral oil, insecticide and combined mineral oil-insecticide spraying was undertaken to quantify the efficacy of these different practices. Early results from mid-season testing suggest that these management practices likely lower spread of PVY compared to control, but statistical distinction between the treatments is still waiting on results of post-harvest tuber testing.

**Key Message(s)**

- In a survey of PVY strains across Canada in 2014, several provinces now show the $PVY^{NTN}$ tuber-necrotic strain to be dominant in the viral population, followed by $PVY^{N:O}$ and $PVY^{O}$, though samples from some provinces still show $PVY^{O}$ as the dominant strain. However, it is clear that the proportions of $PVY^{NTN}$ and $PVY^{N:O}$ strains are steadily climbing over time.
- Six potato varieties were tested against three common PVY strains. Generally, symptom severity ranked greatest in Envol and Norland, more mild in Norchip, Shepody and Innovator, and absent in Eva. $PVY^{O}$ caused most severe foliar symptoms. Substantial tuber yield reduction occurred with $PVY^{O}$ infected Norland and Envol, while severe necrotic lesions developed on $PVY^{NTN}$ infected Envol tubers.
- In a field trial to experimentally determine the efficacy of mineral oil, insecticide, and combined mineral oil and insecticide sprays to control on-farm spread of PVY, early results show that our trial design allowed for substantial PVY spread during the season, and that the various spray treatments are trending toward lower PVY spread.




*Leaf Symptoms for Six Potato Varieties Infected With Three PVY Strains*




*Symptoms of the Necrotic Strain $PVY^{NTN}$ Infection on Tuber of "Envol" Variety*