

Diagnostic optimization of viral detection and characterization of Potato virus Y for the Michigan seed potato certification program, 2024

Mio Satoh-Cruz¹, Stefanie Rhodes², Damen Kurzer³, Elizabeth Dorman² and Jaime Willbur¹;
¹Michigan State University, Dept. Plant, Soil and Microbial Science, Potato and Sugar Beet Pathology; ²Michigan Department of Agriculture and Rural Development, Pesticide and Plant Pest Management Division, Plant Pathology; ³Michigan Seed Potato Association

The MSU Potato and Sugar Beet Pathology (PSBP) program continues to work with the Michigan Department of Agriculture and Michigan Seed Potato Association to: 1) investigate improved detection options to identify accurate, timely, and cost-effective methods for use in Michigan seed potato certification, 2) monitor PVY strain and other tuber necrotic virus prevalence in Michigan seed potatoes, and 3) investigate PVY strain by chipping potato variety responses.

Materials & Methods:

We were evaluating immunocapture-reverse transcription-polymerase chain reaction (IC-RT-PCR) (Chikh-Ali and Karasev, 2015) methods used by Montana, Idaho and Wisconsin certification programs. In 2024, we shifted to using IC-RT-PCR methods for faster and cost-effective methods to screen for PVY in seed tubers. These methods will be further compared for accuracy, efficiency, and cost for adoption in Michigan. In 2024-25 postharvest testing, at least five commercial seed operations voluntarily submitted samples for direct tuber testing, either coring on-farm or sending tubers to MDARD. This option will not be used for certification but will be available to provide growers early virus information.

We are further collecting comparison data from field plot samples collected by Dr. Zsofia Szendrei from MSU Vegetable Entomology program. We tested total 32 plots (8 treatments, 4 replicates) with Silverton Russet or Mackinaw varieties. Samples of 100 tubers were collected from each plot. Direct tuber testing with IC-RT-PCR was conducted in 10-tuber subsamples at least two weeks postharvest. Cored samples were then suberized and sent to Hawaii for planting and winter grow-out. Results from direct tuber and leaflet ELISA methods will be compared. Subsets of positive samples will be subject to PVY strain confirmation by RT-PCR (Chikh-Ali et al. 2013; Lorenzen et al. 2006, 2010; Mackenzie et al. 2015).

We also are repeating assays to assess PVY strain by variety responses (Gundersen et al. 2019). Based on Michigan survey observations, three chipping lines and varieties of interest were selected for repeat greenhouse experiments (Lamoka, NY163, and Manistee) and screened using three prevalent PVY strains (N-Wi, NTN, N:O) in a greenhouse assay. These experiments are currently in progress for 2024-2025.

Results & Conclusions:

Prevalence of PVY strain types in Michigan seed growing regions

PVY strain prevalence survey will be performed in leaf material received from Hawaii, currently in progress for the 2024 field season. Survey of seed lots for two other tuber necrotic viruses, Potato mop-top virus (PMTV) and Tobacco rattle virus (TRV), in Michigan is also ongoing.

Screening of PVY strain x variety responses

In repeated bioassay experiments, potato variety responses of daughter plants were measured after mechanical infection of mother plants with four PVY strains for growth chamber and three strains for greenhouse assays. We observed mild to severe foliar symptoms depending on strain and variety. From growth chamber assays, aboveground biomass was reduced by seedborne N-Wi and O infection on both resistant and susceptible varieties (Figure 1). Reduced relative tuber yield for all strains was observed in susceptible compared to resistant varieties, however NTN and O resulted in greater impact (Figure 1). In these experiments, yield of PVY-resistant varieties, Mackinaw and Lady Liberty, appear less impacted by mother plant infections while others appear more sensitive to certain strains (e.g., Snowden and Lamoka to N-Wi and NTN, Petoskey and Snowden to strain O, and NY163 to strain N-Wi and NTN). Confirmation of these observations is in progress, and will identify PVY resistance to multiple strains, further informing variety selection and breeding efforts.

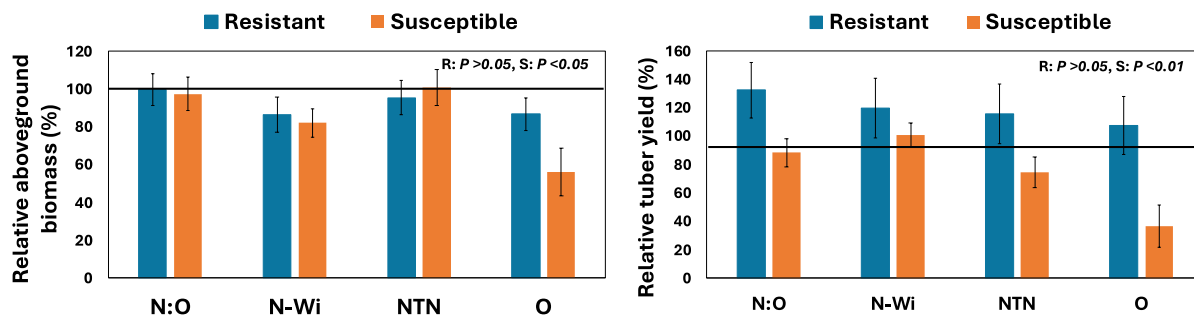


Figure 1. Relative aboveground biomass and tuber yield of resistant vs. susceptible entries growth chamber bioassay. Results are from second-generation plants and represent 5 to 8 replications across two timepoints.

Overall Summary:

- Direct tuber methods using IC-RT-PCR will be complement observations made in summer and winter field inspections and to offer a rapid option for use in seed certification testing, particularly in latent varieties, and early decision making.
- Observations from the past five years of PVY strain prevalence observations was published in peer-reviewed APS journal: Satoh-Cruz et al. 2025. Prevalence of the *Potato Virus Y* Strain Composition Impacting Michigan Seed Potato Production. Plant Health Prog. <https://doi.org/10.1094/PHP-06-24-0063-S>.
- Bioassay results of variety by strain screening efforts suggest tuber yield impacts and foliar symptoms may be observed from seed infected with common Michigan strains.

Acknowledgements:

We would like to thank the Michigan potato growers, the Michigan Potato Industry Commission, the Michigan Seed Potato Association, the Michigan Department of Agriculture and Rural Development, as well as the USDA-NIFA-SCRI Grant No. 2020-51181-32136 and national Potato Virus Initiative: Developing Solutions for the continued support and productive collaborations necessary to continue this research.