



POTATO VIRUS Y AND ORGANIC POTATOES IN WESTERN WASHINGTON

Two companion resources to this fact sheet are:

[TB49E Alternative Sources of *Potato virus Y* in Western Washington](#)

FS313E Proactive Approaches for Controlling Recombinant Strains of *Potato virus Y* in Western Washington

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POTATO VIRUS Y AND ORGANIC POTATOES IN WESTERN WASHINGTON

By

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Introduction

Specialty potatoes at the rural/urban interface in western Washington frequently are grown organically on small farms and in home gardens that sometimes adjoin commercial potato fields. Even though most organic potato fields and home gardens are relatively small in size, they can be viewed as a threat to conventionally managed potato fields because of the perception that they may host uncontrolled diseases and insects, especially those that can be tuber borne in seed potatoes. However, often organic potato producers and home gardeners simply do not have access to adequate educational resources or virus-free seed potatoes. In 2017, there were only about 50 acres of organic seed potatoes grown in Washington that were blue tag certified (Figure 1). Blue tag certification means that a seed lot has passed state standards for having low levels of disease.

One of the most serious diseases facing Washington's potato industry is caused by *Potato virus Y* (PVY) which is transmitted by seed potatoes as well as by aphids. PVY can seriously diminish potato yield and tuber quality. This project was carried out to:

1. Establish whether PVY is more widespread in organically-managed than conventionally-managed potato fields,
2. Investigate the incidence of PVY in organic seed potato lots sold at garden store outlets,
3. Provide recommendations and PVY management resources for organic potato production.



Figure 1. A hundred-weight bag of Washington blue tag certified seed potatoes; the blue tag means that the seed potato lot meets Washington State Department of Agriculture standards for low disease.

PVY survey in organic and conventional potato fields

In 2016, leaflet samples were collected from eight (four conventional and four organic) commercial potato fields in western Washington. Of these, seven were in Skagit County—five were planted to Chieftain (four conventional and one organic) and the other two (both organic) were planted with a mix of fresh market cultivars. The eighth field was an organic field in San Juan County and planted to a mix of fresh market cultivars. Each field was

sampled once between early and full bloom (June 9 to July 15), and then again preceding vine kill (July 20 to August 7). The sampling procedure involved selecting 25 or 50 symptomatic plants, depending on field size, in a zig-zag pattern across each field. Strong mosaic and mild mottling on foliage were among the selected symptoms; plants that did not have obvious symptoms (asymptomatic) were not sampled in this study. For photographs of PVY symptoms on specialty potatoes and information on asymptomatic reactions, see WSU [TB49E Alternative Sources of *Potato virus Y* in Western Washington](#).

The third trifoliate leaflet and petiole from the top of each plant was removed by hand using new gloves each time to prevent contamination between samples. Collected leaves were transported in paper bags for immediate testing with Agdia ImmunoStrips (Elkhart, IN) or held under refrigeration for up to 12 hours before testing. Altogether, 400 conventional- and 350 organic-field leaflets were collected over the season, and 1% and 11.7% (4 of 400 and 41 of 350), respectively, showed positive reactions with the test strips.

Following initial testing, all of the positive conventional samples (4) and a portion (27) of the positive organic samples were shipped overnight to the Plant Virology Laboratory at the University of Idaho for PVY strain identification by serotype-specific ELISA and RT-PCR. Various strains of PVY are known to exist (Kerlan et al. 2011), and PVY^O, PVY^{NTN}, and PVY^{N-Wi} have been identified as among those commonly present in the Pacific Northwest.

The organic field samples had a higher incidence of PVY confirmed by the laboratory tests: 26 of the original 350, or 7.4%, as compared to 4 of 400, or 1%, for the conventional field samples. The distribution of PVY strains also varied by production system. The proportion of to PVY^{N-Wi} was 50:50 among the conventional field samples, and approximately 50:25 among the organic field samples (Table 1).

Displacement of PVY^O by PVY^{N-Wi} is reported to be occurring throughout potato growing areas of the Pacific Northwest, including western Washington

Table 1. Proportion of *Potato virus Y* strains recovered from conventional and organic potato field samples collected in western Washington in the 2016 field survey.

PVY strain(s) identified ^a	Distribution of PVY strains (% recovery by no. plants sampled) ^b	
	Conventional fields	Organic fields
Mix: NTN/N:O or NTN/N-Wi	0	11.1 (3 of 27)
Mix: O/N:O or O/N-Wi	0	3.7 (1 of 27)
N:O	0	7.4 (2 of 27)
O	50 (2 of 4)	48.1 (13 of 27)
N-Wi	50 (2 of 4)	25.9 (7 of 27)
NEG ^c	0	3.7 (1 of 27)

^a Laboratory test results provided by Karasev laboratory at the University of Idaho.

^b A total of 400 and 350 plants were sampled in the conventional and organic fields, respectively.

^c NEG = Sampled positive by Agdia ImmunoStrips in the field, but later negative by ELISA.

(Benedict et al. 2015; Crosslin et al. 2006; Funke et al. 2017). The displacement is likely occurring under both conventional and organic potato management systems. This trend is important to watch because recombinant strains of PVY, like PVY^{N-Wi}, sometimes cause only mild or asymptomatic reactions on potato foliage and can confound efforts towards producing virus-free seed potato tubers (Karasev and Gray 2013). For more information about symptoms caused by three PVY strains on ten commonly-grown specialty potato cultivars, see WSU [TB49E Alternative Sources of *Potato virus Y* in Western Washington](#).

PVY survey of seed potatoes at local garden stores

In 2016, an unexpected incidence of PVY was noted in a survey of organically produced seed potato tubers collected from western Washington garden store outlets (Beissinger 2016), even though some lots had blue tags. Thus, the survey was continued in

2017, but expanded to include a wider range of potato cultivars. A total of 31 seed potato tuber samples from seven outlets were obtained during the spring. Whenever possible, seed tuber sample selection was based on the presence of shallow, suberized canoe-shaped cracks (Figure 2) or evidence of tuber necrosis (dying tissue), symptoms which have been associated with PVY (Benedict et al. 2015; Inglis 2016). The seed tubers were grown-out in three replicates in a greenhouse test at WSU Mount Vernon NWREC (Figure 3), and all foliage, whether symptomatic or asymptomatic, was tested for PVY by ELISA. All positive PVY samples were then typed to strain at the Plant Virology Laboratory at the University of Idaho as mentioned above.



Figure 2. Cracked seed potato, showing typical shallow, canoe-shaped crack sometimes indicative of PVY infection, obtained during garden store outlet survey.



Figure 3. Greenhouse grow-out potato plant with mild mosaic symptoms of *Potato virus Y*, shown later to be infected with PVY^{N-Wi}.

Eighteen cultivars acquired in the survey included ‘Adirondack Blue’, ‘All Blue’, ‘Bintje’, ‘Cal White’, ‘French Fingerling’, ‘Huckleberry Gold’, ‘Kennebec’, ‘Modoc’, ‘Norkotah’, ‘Red Pontiac’, ‘Red LaSoda’, ‘Red Norland’, ‘Rose Finn Apple’, ‘Russet Burbank’, ‘Russet Goldrush’, ‘Russian Banana’, ‘Viking Purple’, and ‘Yukon Gold’. Nine of the cultivars were sold as Washington blue tag certified seed potatoes, while five were Idaho blue tag certified, and three were Montana blue tag certified. The remaining five cultivars were either not blue tag certified or certification was not listed. Seven lots qualified for organic production, eight for conventional production, but the remainder were not labeled.

Altogether, 20 of 93 (21.5%) of replicated tuber samples (Table 2) proved positive for PVY by both foliar symptoms and ELISA laboratory testing of the greenhouse grow-out plants. The affected cultivars in 2017 were ‘Bintje’, ‘French Fingerling’, ‘Kennebec’, ‘Red Pontiac’, ‘Rose Finn Apple’, ‘Russet Burbank’, and ‘Russian Banana’. PVY strains O and N-Wi predominated, each representing 45% of the positive samples. No new or unusual PVY strain types were found in western Washington in 2017. However, 65% of the positive samples in the survey were acquired from organic seed tuber sources compared to 5% from conventional seed tuber production sources; 30% were from unknown cropping system sources. Higher detection of PVY in organic seed potato sources, and an equivalent ratio of PVY^O to PVY^{N-Wi}, are findings similar to those reported in the related study by Beissinger (2016). Of particular interest, 37 of 93 (39.8%) of the seed tubers that were planted were cracked. Plants grown-out from these cracked seed potato tubers included 10 of 37 (27%) that were PVY positive: three plants for PVY^O, one for PVY^{NTN}, and six for PVY^{N-Wi}. These rates of seed tuber transmission from cracked tubers are relatively high, and there is a known association between canoe-shaped cracks and PVY-infected tubers (Benedict et al. 2015; Inglis 2016). However, in considering these transmission rates, it is important to remember that cracked and symptomatic seed tubers were selected for the survey whenever possible. Also of interest in the greenhouse grow-out, foliage that was only mildly

Table 2. Positive *Potato virus Y* samples^a obtained during 2017 survey of seed potatoes sold in various western Washington garden store outlets.

By PVY strain	No. grow-out plants, positive	By state certification	No. grow-out plants, positive	By production system	No. grow-out plants positive
O	9/20 (45%)	WA	13/20 (65%)	Conventional	1/20 (5%)
NTN	1/20 (5%)	ID	1/20 (5%)	Organic	13/20 (65%)
N-Wi	9/20 (45%)	Unknown	6/20 (30%)	Unknown	6/20 (30%)
O + N-Wi	1/20 (5%)				

^a Of 93 total grow-out plants (three reps of 31 different seed potato lots), 20 were positive for PVY (5 plants in Rep A, 8 in Rep B, and 7 in Rep C).

symptomatic or asymptomatic occurred for both PVY^O (6 of 9) and PVY^{N-Wi} (7 of 9) plants.

Recommendations and PVY management resources for organic potato production

To help protect the state’s potato industry and prevent the introduction and spread of new strains of PVY, either by tuber borne seed or current seasonal infections spread by aphids, all potato growers (conventional, organic, and home gardeners) need to strive to manage PVY. Many of the same practices that are useful for managing PVY in conventional potato production systems are applicable to organic potato production systems and home gardens. Commonly recommended control practices have included: (i) planting virus-free seed potatoes, (ii) eliminating volunteer potatoes and potato cull piles, and (iii) managing aphid vectors (Crosslin et al. 2008; Nolte et al. 2009; Beissinger et al. 2018; Inglis et al. 2018).

- Seed potatoes that are certified for organic potato production by Washington State Department of Agriculture (WSDA) and also meet blue tag standards for acceptable levels of virus (or mosaic, see Washington seed potato certification rules [WAC 16-324-361 through 16-324-446](#)), are limited in availability (WSDA 2015). However, organic growers can plant untreated non-organic seed potatoes, if organic potato varieties are not commercially available, but in this case, blue tag seed should be used. In Washington, a seed potato lot must have <0.10% mosaic symptoms for generation one (G1) seed lots in order to meet the blue tag standard. Potatoes grown organically need

to be produced from seed potato stocks grown according to [National Organic Program \(NOP\) guidelines](#). Thus, organic growers should check on both types of requirements, be careful that their suppliers are meeting the established standards, and purchase early generation seed potato tubers whenever possible. Visiting seed potato fields, whenever practical, while the fields are in production during the growing season is highly recommended and can help insure that adequate inspection and roguing for PVY is taking place by the seed potato producer. Doing so, is especially important if only small quantities of a particular cultivar are available, because in Washington, seed potato lots grown on <0.25 acre are exempt from post-harvest greenhouse grow-out testing for seed potato certification by WSDA. When choosing a seed lot, organic growers should pay attention to winter grow-out test results— with laboratory tests, like ELISA, along with visual inspections offering the most effective means of assessment. Home gardeners should purchase blue tag certified seed whenever possible, the earlier the seed potato generation, the better e.g., G1 or G2 lots as opposed to G5 or G6 lots. Seed tubers with cracks, especially if the cracks are shallow and canoe-shaped, should be discarded, because there is a likelihood that the tubers are infected with PVY and could initiate seed tuber borne PVY.

- Eliminating volunteer potatoes and cull piles are essential parts of any sanitation program, no matter the crop production system. Saving potato tubers and planting out the subsequent generations as seed (as is often done in home gardens) is a practice that should be avoided as the number of tubers infected with PVY (and other viruses) increases from seed potato tuber generation to seed potato tuber generation.

- Since aphids can spread PVY during the growing season, managing aphids is more challenging because there are fewer insecticides registered for organic than conventional potato production, and their use is not always practical for home garden settings. The virus is transmitted in a non-persistent manner which means that aphids acquire and transmit PVY in only a few seconds, and, therefore, have the potential to spread disease before they can be killed by a spray. However, there are some crop oils which are registered for organic potatoes that interrupt transmission of PVY on aphid stylets (see the [WSU PICOL](#) website, and the [PNW Pest Management Handbook](#)). Bordering a potato field with a barrier crop, like spring oats or a sorghum and Sudangrass mix, also can help minimize aphid movement into field interiors (Inglis et al. 2018; Schramm et al. 2011). It is important to plant as early as possible and vine-kill potato vines as early as possible because aphids become increasingly active and present as temperatures warm throughout the season. Planting early and vine-killing early can further decrease aphid virus vector efficiency through avoidance (Schramm et al. 2011).

Other important PVY management practices that organic potato growers can adopt include:

- Learning to [recognize PVY](#) symptoms on foliage (WSU [TB49E Alternative Sources of Potato virus Y in Western Washington](#)), so infected plants can be removed (rogued) from the field and destroyed (not composted) (Kreitinger 2018),
- Eliminating weeds near plantings as many weedy plants can be hosts of PVY (Beissinger et al. 2018),
- Sanitizing knives regularly throughout any seed potato cutting operation; hot soapy water and/or bleach can be used. Consult the [National Organic Program](#) (NOP) for disinfectant maximums,
- Being very careful not to mechanically transmit the virus from infected to healthy plants via hands, tools, and/or equipment whenever diseased plants are handled in the field, greenhouse, or garden, and,
- Using test kits in the field like [Agdia ImmunoStrips](#). These kits are easy to use for

screening plants for PVY, especially if symptoms are difficult to discern, but should always be used before plants start to senesce (Beissinger and Inglis 2018).

ADDITIONAL RESOURCES

Agdia ImmunoStrips and other products to test for PVY. <https://orders.agdia.com/agdia-immunostrip-for-pvy-20001>.

[PICOL](#) (Pesticide Information Center Online). Washington State University.

[PNW Pest Management Handbook](#)

ACKNOWLEDGEMENTS

Special thanks to Charlie Gundersen and Babette Gundersen for assisting with the field and garden store surveys, respectively, and Dr. Alexander Karasev and members of his laboratory for PVY strain typing. This research was made possible by the Northwest Potato Research Consortium, WSDA Specialty Crop Block Grant Program Project K1509, and USDA AFRI Specialty Crops Research Initiative CAPS Project 2014-07878.

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