

PVY: The Strains and Their Potential Damage

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Potato Virus Y (PVY) is a well-known and for the most part well-studied potato virus. Found everywhere potatoes are grown, this virus often causes little or no clear symptoms in cultivars grown in the Pacific Northwest, and usually results in only small yield loss because of very effective potato seed certification programs. However, if infection levels are high in seed or when growing cultivars Shepody and Russet Norkotah in the Columbia Basin, where only a very mild mosaic symptom occurs, substantial yield losses can result. The virus reduces both yield and class sizes of tubers.

This virus is easily spread by a large number of aphid species, maybe 40 or more. Since this is a "dirty stylet" virus, anytime an aphid probes a potato plant in search of a favorable plant to feed on, the virus can be transmitted. Therefore, if a winged population of aphids moves through a potato circle, even if they do not colonize, they may have significantly spread PVY from the few plants infected by seed. In contrast, Potato Leaf-roll Virus (PLRV) requires a long feeding period to transmit that virus and the number of aphids that are important vectors of this virus are small, only two in the Columbia Basin, the Green Peach Aphid and the Potato Aphid.

Likely the least familiar area of PVY to growers and fieldman are the occurrences of different strains of this virus (Table 1). PVY^o, or known as the common strain, is the strain that the potato industry has dealt with for some time in North America. Not until 1990 was another strain found in the Northeast, PVYⁿ (Table 2). This particular strain, also called the Tobacco Veinal Necrotic Strain, does not seem to impact potatoes (Table 3), but does cause extreme damage to tobacco (Table 4).

Due to the occurrence of PVYⁿ, the PVYⁿ management plan was initiated between the United State and Canada to certify lots of seed free of this virus to allow shipment of potatoes between these two counties. Because this virus was considered an A1 pest, fields were destroyed where this disease was found. PVYⁿ has been found for sometime in Europe and was found for the first time in the Pacific Northwest this past summer (Table 5).

Table 6 identifies specific information related to the occurrence of PVYⁿ this past summer in seed lot trials found in Hermiston OR and Othello Washington. PVYⁿ can be considered another mosaic virus that potato growers need to be aware of, but this virus is not a greater production threat then PVY^o. However, because of the politics of PVYⁿ, this virus posses a serious threat to potato production in North America.

Two other strains of PVY have been identified, PVY^c and PVY^{ntn}. Commonly called Stipple Streak Virus, PVY^c has not been found in North America. The tuber necrotic strain, or PVY^{ntn}, also is commonly found in Europe but has not been confirmed in the North America. PVY^c causes damage like that of PVY^o in potatoes. Whereas, PVY^{ntn} causes both yield loss typical of PVY^o or ⁿ but also, as the name implies, causes necrotic areas in the tubers, not unlike Corky Ringspot. Obviously the occurrence of PVY^{ntn} will be of both political and economic significance to potato growers in the West.

Little is know about the potential to reduce yields in the Columbia Basin due to PVYⁿ, particularly on the cultivars of importance such as Russet Burbank, Russet Norkotah, Ranger Russet, Shepody, or Umatilla. In addition, a careful hunt for the occurrence of PVY^{ntn} needs to be done so that control measures can be instigated if the virus is ever found. Also, a better test is needed to be able to distinguish between PVYⁿ and PVY^{ntn}. A more complete list of research needs related to these viruses is listed in Table 7.

Table 1. PVY strains and their common names

Strain	Common Name(s)
PVY ^o	Common strain
PVY ⁿ	Tobacco Veinal Necrosis Strain
	Tobacco Necrotic Strain
PVY ^{ntn}	Potato Tuber Ringspot Disease
	Tuber Necrotic Strain
	Tuber Necrotic Ringspot Disease
PVY ^c	Stipple Streak Strain

Table 2. Distribution of PVY Strains

Strain	Location
PVY ^o	Worldwide
PVY ⁿ	Europe, USSR, Africa, South America (1950's SA), North America (1990 Canada), Japan, Taiwan {PVY ⁿ management plan established due to the finding in Canada}
PVY ^{ntn}	Europe, Greece, Italy, Portugal, recent: California?
PVY ^c	Australia, India, UK, and some parts of Europe

Table 3. Symptoms of PVY strains in Potato and their potential to reduce yield.

Strain	Symptom	Potential Yield Losses
PVY ^o	Mild to severe mottling, chlorosis, leaf drop death; no tuber symptoms	10 - 80% loss
PVY ⁿ	Mild mottling; (except Ranger and Liberty); no tuber symptoms	up to 30%
PVY ^{ntn}	Mild mottling; tuber necrosis	up to 30 %? + tuber loss
PVY ^c	Stipple-streak, stunting, death; no tuber symptoms	like PVY ^o

Table 4. Symptoms of PVY strains in Tobacco

Strain	Symptom on Tobacco
PVY ^o	Mild vein clearing and mottling
PVY ⁿ	Mottling and bronzing of the midribs, necrosis of leaf ribs, leaf drop, death
PVY ^{ntn}	As above for PVY ⁿ
PVY ^c	?

Table 5. Local distribution of PVY Strains

Strain	Location
PVY ^o	Throughout the West
PVY ⁿ	Reported from Montana and Idaho, 2001
PVY ^{ntn}	California?, 2001
PVY ^c	Not found

Table 6. Where PVYⁿ was found in seed lots planted in Washington and Oregon in 2001

Seed Originated From How Many States	Cultivars	Number of Seed Lots
2	A-84118-3, Shepody Norkotah -112,Norkotah - 3 Ranger, Umatilla Liberty, Gem	7

Table 7. Future Research Needs Associated with PVYⁿ

<ol style="list-style-type: none"> 1. Confirm the identity of strains occurring in North America 2. Confirm symptom expression in the commonly grown potato cultivars 3. Determine incidence and distribution of the PVY viruses in the Pacific North West. 4. Confirm commercial importance, yield and quality information. 5. Develop new serological methods for quick identification of these virus strains 6. Determine if these strains are transmitted at the same rates by the same aphid species.
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