

Potato Virus Y

Potato Virus Y or more commonly called PVY is a serious disease of potatoes worldwide. The disease is caused by a virus which is transmitted by aphids and mechanical means. PVY has grown in importance in recent years due to the formation of new more aggressive strains of the virus. The disease can cause yield and quality loss in potato crops in the form of decreased yields, misshapen tubers or internal discoloration, resulting in thousands of dollars loss. **PVY has a significant impact on all sectors of potato production including seed, fresh processing.** However, the production and use of certified seed potatoes inspected to meet tolerances for PVY, provide the main line of defence for the management of this disease.

What is PVY of potatoes?

PVY is a viral disease of potatoes, tomatoes, tobacco and some weeds related to the family of the Solanaceous group of plants. The virus that causes PVY of potatoes belongs to the Potyvirus genus. Crop losses of 80-90% have been reported due to PVY, while additional losses in potato quality are observed (Figure 1). PVY can cause a range of symptoms including mottling and chlorosis (yellowing) of foliage; on tubers a necrotic ring can be observed and/or severe growth cracking making tubers unfit for sale/use.



Figure 1 Quality losses associated with PVY Top Left: Cultivar Atlantic with necrotic rings on tuber; Top Right Cultivar Denali with severe growth cracks Bottom Left: Symptoms of PVY on Atlantic foliage note patches of yellowing (chlorosis) on leaves and "rough" leaves. Note some potato cultivars do not show foliage symptoms when infected with PVY and yet may have tuber symptoms eg Denali, Wilwash.



PVY infection is an issue for both seed and commercial growers. Seed growers must produce seed with low infection levels to meet standards for seed certification. Commercial growers can be affected through lower yields and reductions in tuber quality.

Causal agent

PVY is caused by several different virus strains. PVY causes mosaic in potatoes. The symptoms of PVY vary depending upon the strain of the virus and the variety of potato. A number of potato varieties when infected with PVY show mild or no foliage symptoms of PVY and can act as “carriers” of PVY. Other strains of PVY, produce mild foliage symptoms but also produce severe tuber symptoms of necrotic lesions and/or tuber malformations.

Strain	Description
PVY ^o	The “ordinary” strain of PVY
PVY ^N	The necrotic strain of PVY. (necrotic meaning “dead”)
PVY ^{NTN}	The tuber necrotic strain of PVY
PVY ^{N:O}	Strains of PVY that have properties of N and/or O strains

PVY strains can interact with other potato viruses such as Potato virus X (PVX) and Potato virus A (PVA) to result in heavier losses.

How is PVY spread?

The main source of PVY across seasons is through infected seed tubers. Once a potato is infected with PVY it cannot be cured (without a laboratory process) and infected stocks act as virus reservoirs.

PVY is not able to spread without assistance. The two major mechanisms of spread, other than through infected seed, are by aphids and via mechanical transmission.

Aphids

Potato virus Y can be spread by many species of non-colonizing aphids. Within minutes of starting to feed on a PVY-infected plant, the PVY virus contaminates the aphid’s stylet (its piercing-sucking mouthpart). If the aphid then moves to a healthy plant and starts to feed, the virus is transmitted to the healthy plant. This mode of virus transmission is technically known as non-persistent transmission.

Mechanical spread (sap transmission)

Seed and seed cutting

PVY can be spread to clean seed through seed cutting increasing the degree of infection within a seed stock – the spread in this case may be multiplied greater than tenfold depending on the initial severity of the infected tubers.

In crop

PVY can be spread through sap transmission in field especially when the foliage is wet. Operations such as inter-row cultivation, irrigation and spraying can contribute to the spread of PVY in crop. Traffic, both vehicular and pedestrian, should be minimized in the field.

How can PVY be managed?

Once a potato is infected with PVY it cannot be cured. Therefore, PVY management relies on prevention and disease minimisation strategies.

PVY management does not rely on a single factor. The following is a list of options for consideration in your PVY management plan.

- ✓ **Plant only certified seed.** Certified seed is harvested from potato fields that have been inspected for several plant diseases, including PVY. The tolerance for PVY in the ViCSPA seed scheme is a maximum of 1%. All G2 crops require a laboratory leaf test to assess PVY loads in crops.

DON'T PLANT A PROBLEM - know the status of you seed and use certified seed.

Certification is the first line of defence in managing PVY. The continual supply of pathogen tested material through the seed scheme ensures a supply of healthy seed stocks and 'flushes through' any problematic seed stocks. However, a certification scheme is only as effective as the support the commercial growers provide it. Growers who use tubers graded from commercial stocks as seed are at risk of PVY loss BUT importantly these crops also act as a source for PVY for an entire district. It is a risk that is simply not worth taking.

- ✓ **Hygiene.** All cutting and planting equipment should be disinfested before coming in contact with seed, as well as between seed lots. Several commercial disinfectants are available.
- ✓ **Whole round or cut seed.** Using whole round seed can reduce the spread of PVY within seed stocks by preventing the need to cut seed. However, sprouting of all seed stocks should be avoided to prevent sap transmission and virus transmission.
- ✓ **Manage sources of PVY.** Self sown potatoes can be a reservoir for PVY allowing it to carry over between seasons. Management of volunteer plants after potato crops will reduce such carryover of the disease across seasons.

Waste **piles** of potatoes can harbour PVY should be managed so as to prevent PVY carry over. Cull piles of sprouting potatoes are an absolute no for PVY management (and other potato diseases) - dispose (bury) or feed-off culled potatoes. **DON'T ADD TO THE PROBLEM**

- ✓ **Field selection/planting time.** Avoid planting seed potatoes in close proximity to commercial potato crops, especially early generation seed crops. *Consider the time of planting* - late planted seed crops are potentially at greater risk due to the build up of PVY inoculum in surrounding "dirty" potato crops and the movement of aphids from crops other than potatoes. Early generation material should be, where practically possible, planted ahead of other crops to minimise PVY risk.
- ✓ **Rogue early and rogue often.** Early detection of infected plants and their removal from the crop can reduce the impact of PVY in the crop and reduce the in crop spread of the disease. Regular inspections of seed crops at various growth stages enable early detection of PVY in the field.
- ✓ **Don't prolong the risk** prevent late-season virus infection by top-killing seed potato fields early. It is important that crops are burned down quickly reducing the potential exposure to a late aphid flight resulting in PVY infection. ***Early top removal will reduce the crops exposure to aphid attack and will reduce the potential for virus in the seed crop.*** Consider spilt applications of desiccant to maximise efficiency and burn down quickly. Forward and reversed nozzles on spray rigs can enhance penetration of desiccant into the crop canopy, thereby improving efficiency of crop burn down.
- ✓ **Know your aphids and their activity levels in crops.** Actively walk and inspect crops for aphids. This can be done by using a clean white sheet of paper which is quietly placed near ground level in the furrow under a plant. The plant is then shaken vigorously to dislodge aphids from leaves which fall onto the paper. Quickly take the paper from under the plant and inspect the array of insects which should show up any aphids if they are present - repeat 10 time around the paddock. Consider the remaining management options in relation to understanding aphid activity in your seed crops
- ✓ **Consider the good guys.** With careful use of selective insecticides, natural enemies can be allowed to survive and exert their control of aphid populations. Many of these natural controls are not fully appreciated by growers. Growers should learn how to identify natural enemies and encourage their presence in potato fields.

- ✓ **The border issue.** In overseas studies, the use of border crops was effective in reducing PVY spread to small plots of seed potato, with winged aphids being captured in greater abundance in crop borders than in the crop. The border crop, which is not a host to PVY (such as wheat, oats, sorghum), is planted around the edge of the potato crop. The border crops need to be only a few metres wide to be effective. Border crops should have a fallowed border to the outside with no gap between the border crop and the potatoes to take advantage of the tendency of winged aphids to enter a field at the interface of fallow ground and green crop. Therefore, aphids enter the potato crop through the border crop and by feeding on the border crop aphids lose the virus from the mouth parts and are “clean” of the virus before moving into the potato crop.
- ✓ **Chemicals.** Insecticides are very effective at managing colonising aphids within the crop and can be used to prevent populations of potato-colonizing aphid species from increasing within a field and thereby limiting the plant-to-plant spread of virus. However, PVY is transmitted by many species of non-potato-colonizing aphids in a “non-persistent” manner and, because of this, insecticides are often considered an ineffective means of control. Insecticides that deter or prevent aphid feeding have a role in managing aphids and assisting in reducing the spread of PVY. In overseas studies, insecticides such as imidacloprid (*Confidor*), spirotetramat (*Movento*), pymetrozine (*Chess*) have been used to reduce PVY.

It is important to note that most organophosphate, carbamate and pyrethroid insecticides registered for use on potato tend to flare outbreaks of potato-colonizing aphids, especially *Myzus persicae* (green peach aphid) and, therefore, growers should be urged to continue monitoring crops even after application of an insecticide to ensure aphids remain in check.

Rotating use of insecticides with different modes of action is recommended from the standpoint of insecticide resistance management.

Nontoxic mineral oils applied to plants have been shown to substantially reduced PVY transmission. **From overseas experience, mineral oils have provided reductions of PVY spread as high as 90%.** However, the use of oils for PVY management has some limitations including the negative interactions with fungicides, application cost, the need for repeated applications and because control is not complete. Oils persist on sprayed leaves for 10-14 days, but weekly applications are required to protect new foliage. Mineral oils can be phytotoxic, especially when mixed with fungicides or if applied when temperatures are high. Despite the problems with mineral oils they have been shown to be very effective in managing PVY.

All options for PVY management should be considered remembering that management of PVY relies on prevention and disease minimisation. Because aphid management can never be entirely 100% effective, the primary line of defence must be to minimize the amount of PVY in seed potatoes used for planting. Prevention of PVY by reducing inoculum is a primary objective of the ViCSPA seed certification program. The level of infection of PVY originating in seed will have an impact on the success of any management program.

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