Differential Current Season Infection by Potato Virus Y (PVY) in Potato Varieties

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Introduction

Potato viruses are important production issues regardless of where potatoes are grown in North America. Two specific viruses, PVY (Potato Virus Y) and PLRV (Potato Leaf Roll Virus) have been shown to be of major importance either because of reduced yield or reduced yield and quality, respectively. Probably the single most important and differing aspect of PVY from PLRV is its ability to move quickly through a potato field regardless of management or insecticide use. This is possible because the virus acts as a contaminant on the stylet of vectoring aphids and is transferred to the potato plant as the aphid probes before they are killed by any insecticide. Infection that occurs during the growing season is called "current season infection" while seed that is produced by this plant will have tubers that produce "seedborne" infections the next year. PVY infection is a problem in both seed and commercial production areas. Seed growers are limited to how much infection is allowed in their seed. Commercial growers want little or no infection in the seed due to yield and quality reductions. The situation is further complicated by certain cultivars that harbor the virus but poorly express symptoms.

Two such cultivars that are widely grown are Shepody and Russet Norkotah. Seed growers producing these cultivars have a very difficult time recognizing infected plants and rouging them. And since they are not easily recognized as infected, they become reservoirs both in seed and commercial fields from which aphids can spread the disease to healthy plants. While there are cultivars that tend to be more likely infected with PVY, other cultivars are relatively free of infection. Differing levels of infection was thought to be related to the ability of the virus to replicate in the plant but recent observations may suggest another possibility.

Over the last four years an interesting pattern of virus infection has been observed in potato cultivars planted on the Experiment Station in Hermiston. Side by side rows of potato, planted at the same time differing only by cultivar, appear to come down with current season PVY infection at differing levels. These plants were not planted in any kind of replicated situation, nor were there any virus testing done prior to symptom development, but the indication was that PVY was spreading differentially with respect to cultivar. With current season infection, it would be expected that all susceptible varieties growing in the same area would become infected at a similar frequency. If differential infection occurs, then knowing the response of a cultivar to PVY acquisition would greatly aid both seed and commercial potato growers. Seed and commercial growers could concentrate their control efforts on cultivars more likely to be infected by PVY, possibly reducing costs related to the use of insecticides.

Methods
A randomized complete block design with four replications was used to compare current season infection by PVY in 8 different cultivars (Alturas, Russet Burbank, Russet Norkotah, Shepody, Gemstar, Gem Russet, Umatilla, and Ranger Russet) of potato. Two hundred plants of each variety were planted in four replications at two locations, Othello WA and Hermiston OR. All plants were tested by ELISA for the presence of PVY at emergence, at in-row plant closure, and at plant row closure (27 June and 2 August at Othello and three (20 June, and 18 July) at Hermiston in 2005 and at 28 June and 2 August at Hermiston in 2004). An additional testing time (16 August) was done at Hermiston in 2005. Testing identified seed-borne infection levels, rate of current season infection and cumulative infection levels for each variety. These procedures were designed to ascertain the existence of differing rates of current season PVY infection of the 8 cultivars. Normal agronomic procedures (fertilizer, herbicides, fungicides, etc) common to the region were used. This trial was also done at the Hermiston Agricultural Research and Extension Station in 2004.

RESULTS
Higher than expected levels of PVY were found in several seed lots (seedborne infection), specifically Gem Russet (both years) and in Gemstar, in 2005. Results are reported in Figures 1-3.

Highest current season infection was found in Shepody and Gemstar in both 2004 and 2005. High seedborne infection in Gem Russet made data difficult to interpret though final infection levels were the highest for this cultivar. Alturas and Ranger Russet had the least amount of current season PVY in both 2004 and 2005. Overall, Russet Norkotah was the only cultivar that showed differing results between 2004 and 2005. Early senescence in 2005 resulted in one less evaluation than for the other cultivars and may have underestimated the final infection level. Figure 4 is the summary of all plot data showing the average percent of current season infection when seedborne levels are removed from consideration.

Overall, infection level was higher at Hermiston than Othello in 2005 (Fig 4). Infection levels were also lower in 2005 than in 2004 at Hermiston.

Discussion
Why cultivars are differentially infected is not known at this time. Aphids may be more attracted to one cultivar over another. If this is true then it would indicate that aphids are much more discerning on what they land/feed on than what might have been thought in the past. Work proposed in 2006 will look to determine if larger aphid numbers are more commonly found on one cultivar over another. Another alternative may be that the virus is not as able to replicate as quickly in one cultivar as another. If this is true then all cultivars are being fed on by aphids uniformly, and therefore are being infected by PVY. That would mean some cultivars, however, do not produce symptoms and/or are ELISA negative, even when infected. Clearly, more work is needed to determine what appears to be differential infection in some cultivars.

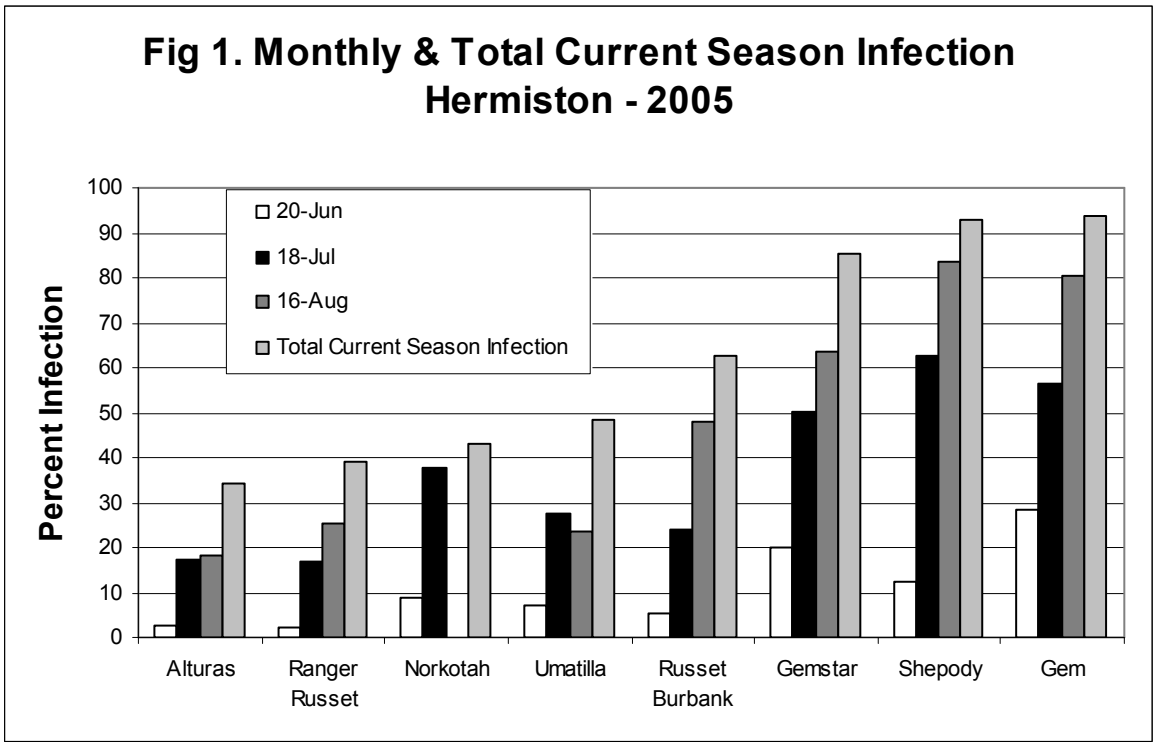
Fig 1. Monthly & Total Current Season Infection
Hermiston - 2005
Percent Infection
100
90
80
70
60
50
40
30
20
10
0
20-Jun
18-Jul
16-Aug
Total Current Season Infection
Alturas
Ranger Russet
Norkotah
Umatilla
Russet Burbank
Gemstar
Shepody
Gem

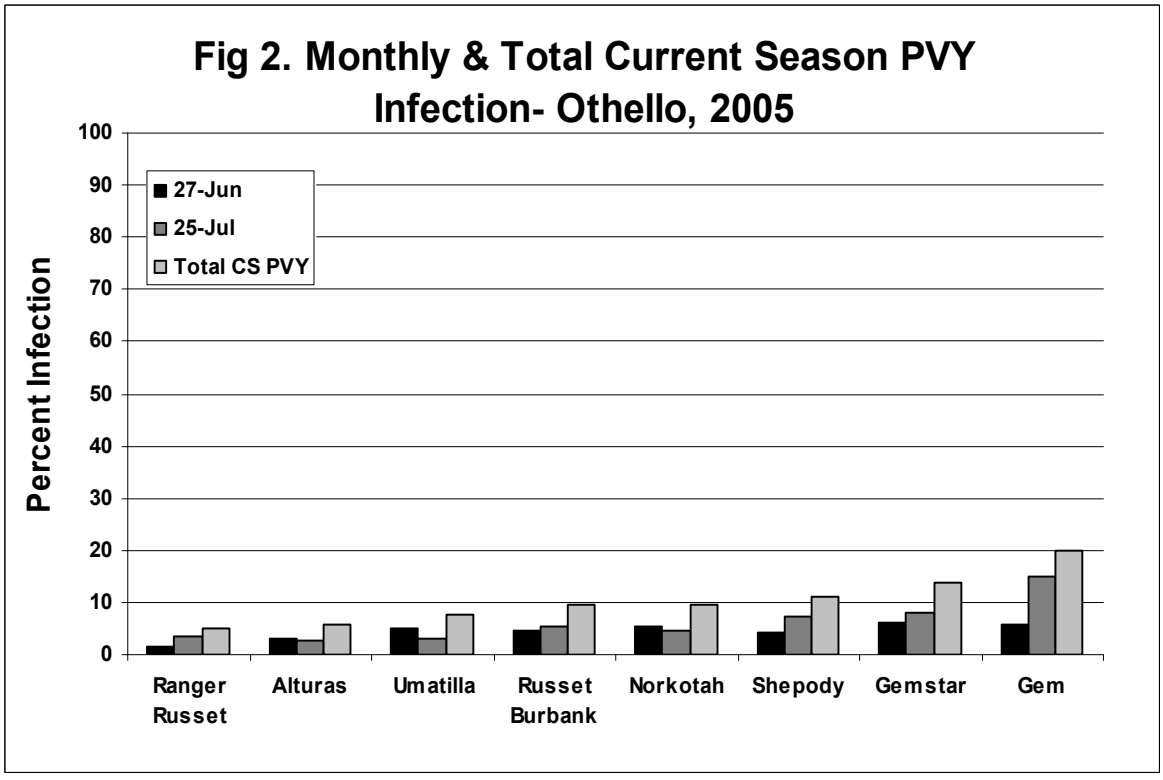
Fig 2. Monthly & Total Current Season PVY Infection- Othello, 2005
Percent Infection
100
90
80
70
60
50
40
30
20
10
0
27-Jun
25-Jul
Total CS PVY
Ranger Russet
Alturas
Umatilla
Russet Burbank
Norkotah
Shepody
Gemstar
Gem

Fig 3. Current Season PVY Infection Hermiston OR-2004

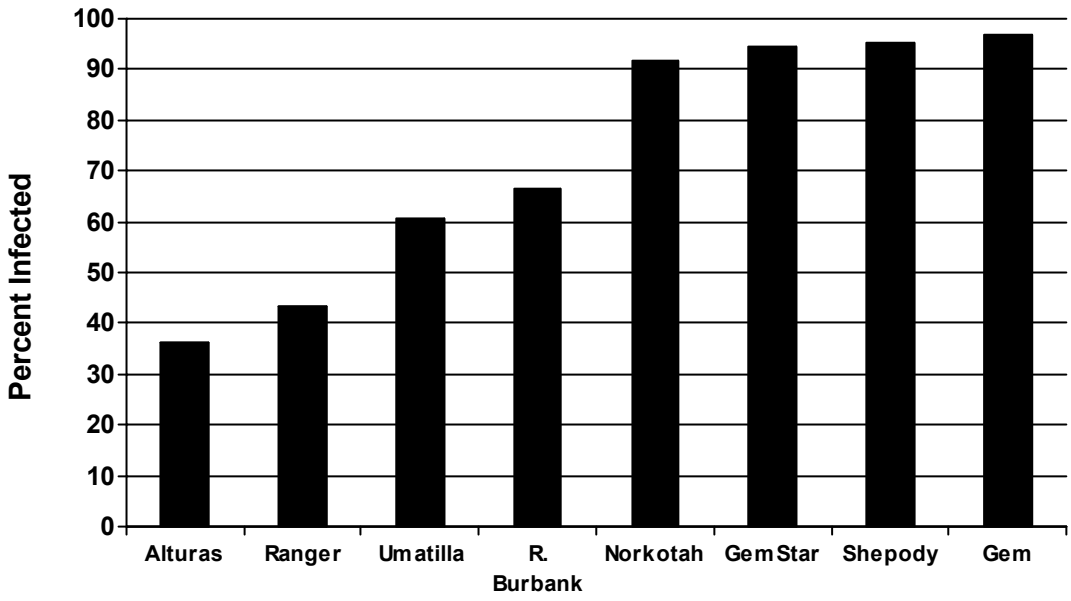

Fig 4. Average Current Season PVY infection at Othello WA and Hermiston OR - 2005