Progress Report to the Maine Potato Board Research Subcommittee

Project Title: Evaluating the Risk of Late-Season Potato Virus Y Transmission and Symptomless Carriers in the Imported Seed Plots

Executive Summary: Potato virus Y (PVY) is transmitted by many different aphid species, most of which do not stay on potato plants. As a result, PVY vectors maybe missed by field scouts. We used yellow sticky cards placed on a mast to correlate the spread of PVY with aphid flight among potato plants. Aphid flights started early in the season, although peak captures happened at the end of the summer. There was also considerable early virus transmission. Our results support the importance of early oil sprays on seed plots. In addition, we evaluated the imported seed plots which are grown on Aroostook Farm as part of the Maine Department of Agriculture Conservation and Forestry Potato Seed Certification. Results of visual observations were fairly consistent with ELISA testing of the foliage.

This work was accomplished in cooperation with the Seed Certification Program, U Maine Cooperative Extension, Maine Potato Board Seed Certification Laboratory, and Aroostook Farm Entomology Program.

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Background: Potato virus Y (PVY) causes a very damaging disease of potatoes. It is carried by numerous aphid species, most of which do not settle on potato plants. Still, they probe plants to test their suitability as hosts, and, by doing so, transmit virus from infected to healthy plants. Virus transmission often takes only a few seconds, and insecticides do not kill aphids quickly enough to prevent virus spread. Because of their fleeting nature, non-colonizing PVY vectors are usually not detected by field scouts.

Using yellow sticky cards within the field to investigate effects of weather on aphid flight and to correlate both parameters with PVY spread among potato plants. Our ultimate goal is developing ability to predict when most PVY transmission takes place. This will allow a more precise timing of oil sprays and traditional insecticides for crop protection. It will also allow optimizing the timing of vine kill in the fall for achieving the best yield and virus protection.

Having a reliable and practical trap for quantifying the number of dispersing aphids is important for improving our general understanding of PVY epidemiology. Once developed, such a trap will also help specific decision-making by commercial growers.

Accomplishments (Research plot): Beginning June 1, 2015 yellow sticky cards were placed on the tower for a seven day period. After the seven days were up, the sticky cards were taken down and replaced with a new set of cards. There was a total of 14 weeks of aphid collection. The last day data were collected was September 4th. Captured aphids were collected and identified to a species (Table 1). PVY transmission was evaluated by sampling the foliage on adjacent potato plots in July and August. Samples we also taken from sprouted tubers during late December. The initial results proved the PVY to be quite high (Table 2), supporting the theory that early oil sprays may reduce transmission by aphids. The second set of results was

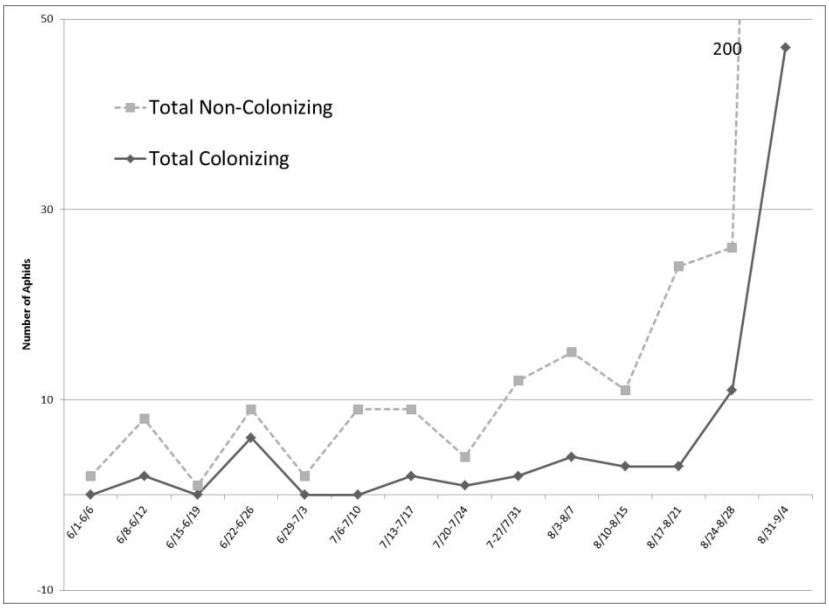
much lower than the first, possibly because PVY late in the season moves from foliage to the roots and subsequently to the tubers. Finally, the tested tubers displayed further reduction of PVY. Again, this may reflect uneven distribution of PVY throughout potato plants (Table 2).

(Table 1) Aphid species captured over the entire 2015 season

Bird Cherry Oat - *Rhopalosiphum padi*	Melon - *Aphis gossypii*
Black Bean - *Aphis fabae*	Pea – *Acyrthosiphon pisum*
Buckthorn - *Aphis nasturtii*	Potato - *Macrosiphum euphorbiae*
Cabbage - *Brevicoryne brassicae*	Rose - *Macrosiphum rosae*
Clover – *Therioaphis trifolii*	Soybean – *Aphis glycines*
Corn Leaf- *Rhopalosiphum Maidis*	Turnip - *Lipaphis erysimi*
Green Peach - *Myzus persicae*	Willow Carrot - *Cavariella aegopodii*
Leaf Curling Plum – *Brachycaudus helichrysi*	Yellow clover – *Therioaphis triyolii*

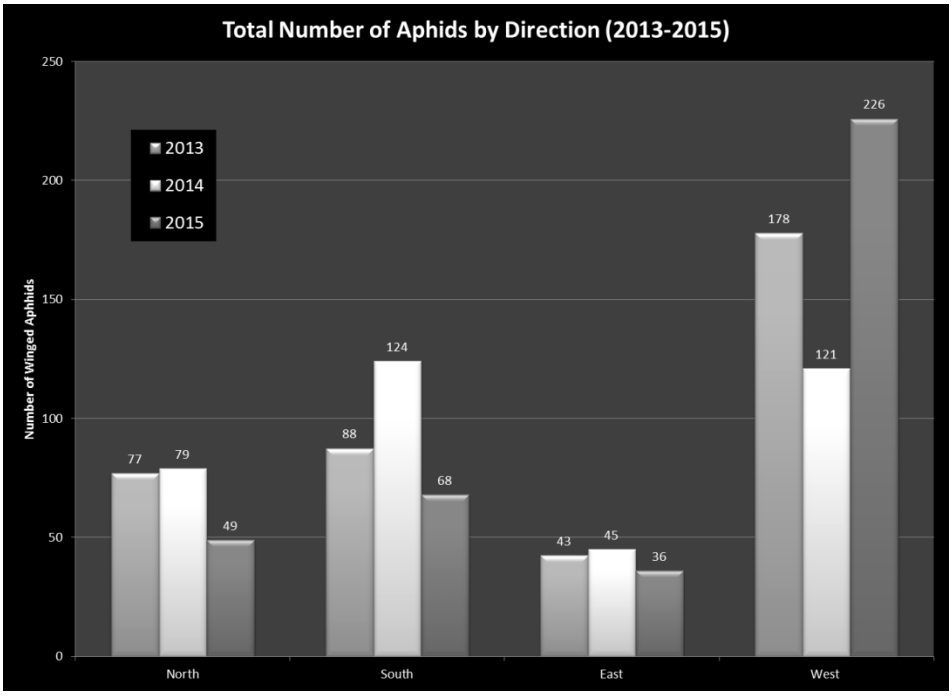
The majority of aphids belonged to non-colonizing species that do not live on potato plants, but can still transmit PVY. Flight dynamics were similar for colonizing and non-colonizing species (Figure 1), with the first significant captures observed in late June - early July. Peak flight, however, happened late in the season.

(Figure 1) Number of aphids collected over time



The majority of aphids were caught on westward-facing traps, corresponding to predominant wind direction in the area of study (Figure 2). Our results highlight the importance of early applications of protective oils. There is considerable flight activity at the time of potato emergence from the soil, and most flying aphids belong to non-colonizing species that are unlikely to be controlled by insecticides.

(Figure 2) Total number of aphids by direction (2013-2015)



(Table 2) Results from ELISA testing

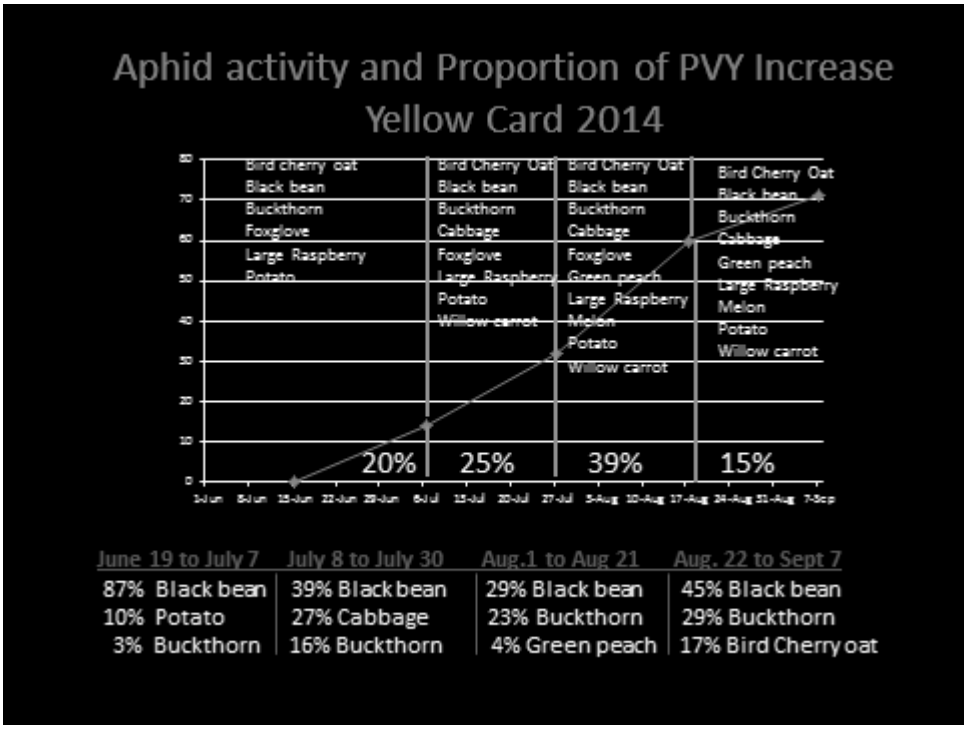
				% PVY (ELISA)		
			Application	Foliar	Foliar	Sprouts
	Treatment	Rate/Acre	Date	16-Jul	12-Aug	7-Jan
1	Reglone (standard)	1.25 pt	26 Aug	14.49a	9.42a	4.89a
2	Movento	5 fl oz	19 Aug	10.87a	5.04a	4.83a
	Reglone	1.25 pt	26 Aug			
3	Movento	5 fl oz	19 Aug	17.39a	8.58a	4.27a
	JMS Stylet Oil	3% v/v	19 Aug, 2 Sept			
	Reglone	1.25 pt	26 Aug			
4	JMS Stylet oil	3% v/v	25 Aug, 2 Sept	23.91a	8.07a	3.47a
	Reglone	1.25 pt	26 Aug			
5	Untreated	----	----	13.04a	10.97a	3.53a

Means followed by same letter do not significantly differ (P=.05, LSD)

Accomplishments (Commercial plot): In 2014, a plot was established on the MSAD#1 School Farm to attempt to look at when virus expanded into a potato field and which aphid species

appeared to be the drivers of the virus spread. Nuclear seed with a winter virus evaluation of zero was planted with no systemic insecticide. Aphid populations were monitored via field scouting and yellow sticky card traps. Within field aphid populations were very low; however, significant aphid activity was recorded via the sticky card traps. Virus levels rose from zero to 71%.

(Figure 3) Aphid Activity and proportion of PVY Increase

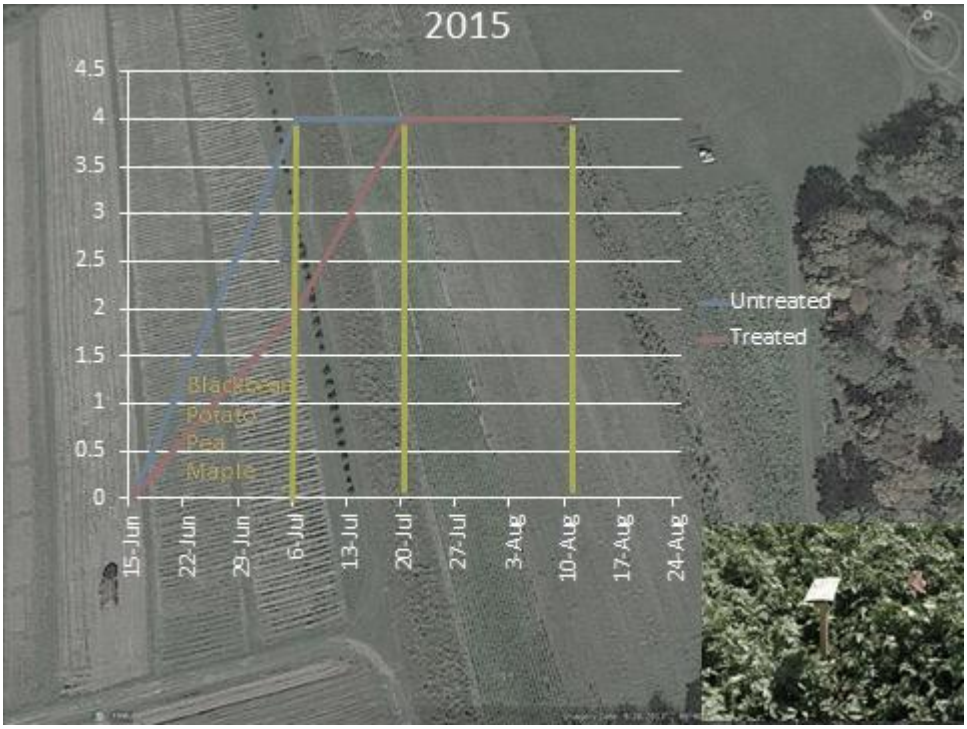


In 2014, we were unable to determine which aphid species were the major drivers for the spread of the virus because there was some minor in field aphid activity and rather significant aphid activity noted on the sticky cards (Figure 3).

In 2015, a similar plot was established. However, in 2015, there were two treatments, no systemic insecticide and systemic insecticide, with four randomized replicates planted. This was done in order to try to determine if, the virus spread was being driven by colonizing, or non-colonizing aphids. Aphid populations were monitored via field scouting and yellow sticky card traps.

Aphid populations in 2015 at this site were extremely low and the virus expansion within the plot was much less than in 2014. The virus expanded from zero to 4%.

(Figure 4) PVY Spread over time



With the small number of aphids collected and rather low virus level, we are not comfortable with making assumptions of which aphid species were driving the virus expansion within this plot.

Accomplishments (Imported Seed plot): We evaluated potential symptomless carriers within the imported seed plot. Leaf samples were collected between the second week of July and the third week of July. The U Maine Cooperative Extension staff collected foliage from approximately 100 potato plants per seed lot. The Maine Seed Certification Lab conducted laboratory analysis on these samples using ELISA. Laboratory readings were compared to visual reading in hopes of increasing our understanding of potato varieties that may be symptomless carriers of PVY. Visual detection of PVY proved to be fairly accurate (Figure 3).

(Figure 3) Laboratory readings vs. Visual readings