

AIM Research Trial Report: **Effect of Sprayer Tracks on Marketable Yield and PVY Spread**
Working Group: Seed Management
Crop Year: 2020
Author: Ryan Barrett

Project Rationale:

In the winter of 2020, the Seed Management Working Group discussed a project to examine the effect that sprayer tracks have on both marketable yield and mechanical transmission of potato virus Y (PVY). There has been increased discussion on the use of dedicated tramlines or sprayer paths, particularly for seed fields. This is common practices in Europe but less so in North America. In addition, this builds on work done by Mathuresh Singh and his team in New Brunswick that has shown that some of the newer strains of PVY may have the potential to be mechanically spread by tractor or sprayer tires during field operations as potato stems and leaves are damaged and plant liquids/sap comes in contact with other plants further down the row.

Project Overview:

The Project Lead contact two producers growing varieties of potatoes that are known to be more susceptible to PVY infection (Shepody and Mountain Gem Russet). Two fields (one of each variety) were in East Prince. One field (Mountain Gem) was in West Prince. All three fields were commercial fields managed for French fry processing. Both farms utilize self-propelled sprayers with narrow tires and “vine-lifters.” The starting PVY rate was between 1.5 and 2.5 for the seed that was used to plant these fields in the spring of 2020.

In the two East Prince fields, Ryan Barrett and Mary Kay Sonier did a visual inspection approx. 4 weeks ahead of harvest to look for PVY foliar symptoms. Due to lack of moisture and obvious signs of potato early dying in these fields, it was difficult to definitively diagnose mosaic symptoms of PVY in these fields. The West Prince field was also inspected approximately 4 weeks prior to harvest. This field was healthier but was also starting to senesce, so it was difficult to diagnose symptoms of PVY as well.

Samples from all three fields were dug on October 6th. To assess yield and quality, four 10 foot strips were dug for each treatment in each field. The treatments were defined as Check (regular row without sprayer track) and Wheel Track or WT (where sprayer had created a very obvious wheel track with noticeable damage to foliage). In addition, 4-6 plants on either side of each strip were harvested and placed into a separate bag for post-harvest testing for PVY. In addition, a number of other random plants were harvested in adjacent rows to ensure sufficient tuber numbers for testing.

Grading of samples was performed at Cavendish Farms Central Grading under the supervision of the Project Lead. A factor of 13 was used to convert 10-foot yield to cwt/acre. Post-harvest testing was performed by the Potato Quality Institute. 100 tubers were submitted for each treatment. For the Mountain Gem Russet samples from West Prince, 2 or 3 tubers were lost due to rot (due to damage during harvest), resulting in 97 or 98 tubers being successfully tested for PVY.

Results:

Table 1: Comparison with Wheel Track versus Check for Mountain Gem Russets, West Prince field

	% PVY	Total Yield cwt/ac	% defects	% smalls	% 10 oz	Specific Gravity	M. Yield cwt/ac	Payout \$/acre
Check (non-wheel track)	37.8	470.2 a	1.1	2.0	53.7	1.085	460.2 a	5910 a
Wheel Track	39.2	418.5 b	2.3	1.9	50.4	1.090	405.5 b	5336 b
difference	+1.4	-51.7	+1.2	-0.1	-3.3	+0.005	-54.7	-574

Table 2: Comparison with Wheel Track versus Check for Mountain Gem Russets, East Prince field

	% PVY	Total Yield cwt/ac	% defects	% smalls	% 10 oz	Specific Gravity	M. Yield cwt/ac	Payout \$/acre
Check (non-wheel track)	3.0	236.7 a	0.0	8.0	3.8	1.089	217.8	2775
Wheel Track	2.0	213.9 b	0.3	8.0	10.9	1.087	197.1	2485
difference	-1.0	-22.8	+0.3	0.0	+7.1	-0.002	-20.7	-290

Table 3: Comparison with Wheel Track versus Check for Shepody, East Prince field

	% PVY	Total Yield cwt/ac	% defects	% smalls	% 10 oz	Specific Gravity	M. Yield cwt/ac	Payout \$/acre
Check (non-wheel track)	0.0	180.7	0.0 a	7.3	6.4	1.092	167.1 a	2129 a
Wheel Track	2.0	169.4	3.3 b	10.9	6.9	1.091	145.3 b	1852 b
difference	+2.0	-11.3	+3.3	+3.6	+0.5	-0.001	-21.8	-277

For each field, total yield and marketable yield was lower for the wheel track rows than for the regular rows, as we suspected in advance. The percentage of yield reduction for marketable yields by field were relatively consistent (12%, 9% and 13%). Likewise, the percentage reduction in payout per acre was also consistent (10%, 10%, 13%). This is despite a large differential in yields between the two fields in East Prince (with marketable yields well below average) and the field in West Prince (with well above average yields).

Variables that are highlighted in bold are statistically significant at a 90% confidence interval ($p=0.10$). Marketable yield and payout were statistically significant at two out of the three fields. At the third field, marketable yield and payout were close to being statistically significant but values were relatively similar to the other East Prince field.

Across the three fields, there was not much difference observed in the percentage of defects or the percentage of smalls. There was also not a defined trend pointing to an effect on the percentage of 10 ounce potatoes or specific gravity across the fields. The Mountain Gem field in West Prince showed a higher specific gravity for the potatoes in the wheel track compared with the check, which this was not observed at the other two fields. This may be due to the different growing conditions at the West Prince field, with a higher amount of moisture and a slightly different soil type.

For the two fields in East Prince, differences in the percentage of tubers positive for PVY were not great. For both fields, PVY positivity rates were similar to the starting PVY percentage of the field. This seems to indicate that spread was not great in either of these fields (which were close geographically). In the

West Prince Mountain Gem Russet field, PVY positivity rates were extremely high for both the check and the wheel track samples, at 37.8% and 39.2%, respectively. This indicates a very high level of spread from the initial seed inoculum. While Mountain Gem is a PVY susceptible variety, this level of spread is considerable. We can not say with any certainty that the wheel track treatment had a higher level of PVY spread than the rest of the field from these results.

Summary:

From this one-year study, it appears that a modern self-propeller sprayer causes between a 9 and 13% loss in marketable yield and a 10 to 13% loss in payout per acre when compared to rows that were not travelled in. This yield loss appears to be more a factor of total yield than defects or size distribution in these fields.

There was not a consistent trend in PVY positivity between wheel track and non-wheel track samples. This may be due to a limitation of the study, as we were not able to verify that there were infected plants in the areas where sampling was performed. In addition, due to time and operational constraints, we were not able to randomly sample tubers from across the field (or from all wheel tracks) and we were only able to do a post-harvest test on 100 tubers, so this may have been an additional limitation of this study.

Based on one year's data, it appears that there is still a justification for planting an entire field and accepting a small yield reduction in the rows with wheel tracks rather than having dedicated tramlines. However, further research is warranted to validate this, particularly with more sensitive investigation into PVY transmission.

Thank you to the two participating growers and to the staff at the Potato Quality Institute for working with us on this project.