2014 Potato Pathology Program – Research Summary (SLV Research Center, CSU)
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Evaluation of Fungicides/Biologicals for Potato Disease Management

Early Blight Fungicide Trial

Spraying schedules that include two or three fungicide applications during the season have worked well in the San Luis Valley for managing early blight. High success at managing early blight can be obtained by applying a strobulirin or Fluopyram + Pyrimethanil (Luna) in combination with fungicides that have different active ingredients through the season. Some of these might include Endura, Bravo, Dithane, Polyram, and Super Tin. Fungicide applications need to begin once the EB degree day threshold has been reached. To maintain good foliar protection, fungicides should be applied every 14 to 21 days, depending on the products being used. Results from the 2014 early blight fungicide trial have confirmed these observations and have indicated that the timing of applications can have as much impact as the product being used for managing early blight.

2014 Early Blight Fungicide Trial Results

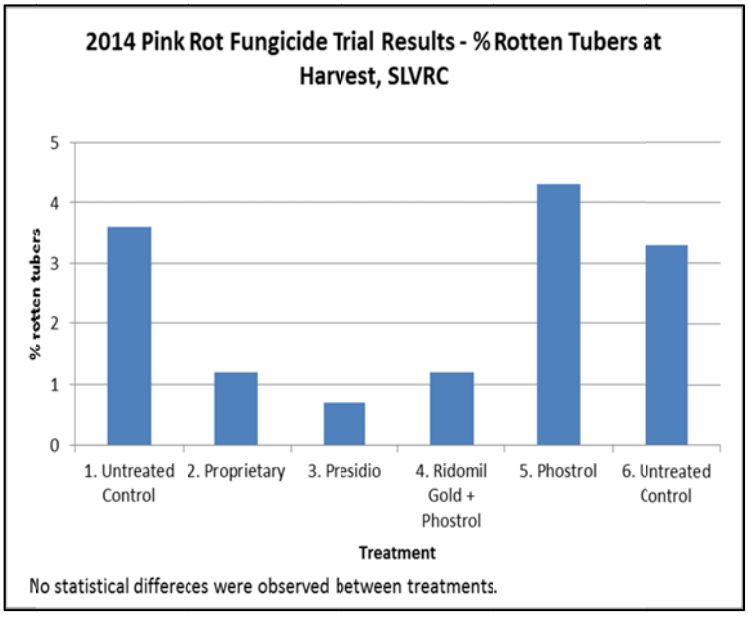
Trt #	Products Applied	AUDPC	Total CWT
1	Untreated Control	1073.0 a	396.2 bc
2	Luna Tranquility	717.4 b	398.9 bc
3	Echo ZN	1000.5 a	385.6 c
4	Luna Tranquility + Scala + Echo ZN (T1)	418.9 d	376.3 c
5	Luna Tranquility + Scala + Echo ZN (T2)	384.2 d	429.6 ab
6	Echo ZN + Endura + Headline	797.5 b	400.0 bc
7	Echo ZN + Dithane	602.9 c	454.2 a
8	Quadris + Endura + Dithane	777.4 b	410.0 bc
LSD (P = 0.05)		0.0001	0.0049

Means followed by same letter are not significantly different at P=0.05.

When yields (cwt/A) are analyzed for the early blight trial, a significant difference can be observed between different fungicide application regimens and the untreated control; however this is not always the case. This can depend on differences between environmental conditions, disease pressure, and fungicide combinations and application timing in any given year. When an effective fungicide program is used to control foliar early blight, yields can be improved.

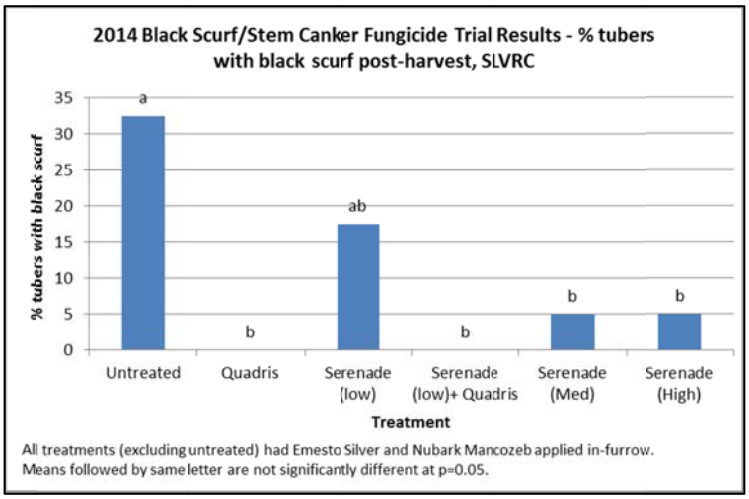
Pink Rot Fungicide Trial

The fungicide Ridomil Gold has worked well at controlling pink rot in the San Luis Valley. However, in recent years the pink rot pathogen has become resistant to Ridomil in many potato growing regions across the United States. Due to the low level of disease pressure here at the station, resistance to Ridomil Gold has not been observed. We have evaluated various fungicide treatments during the last several years and have found a few to be somewhat effective at controlling pink rot, but Ridomil Gold has had the most success. Even though we have had success with this product, we are not recommending at this time for growers to use Ridomil for pink rot control in the San Luis Valley. In the 2014 pink rot fungicide trial, one product, Presidio (a.i. fluopicolide), was found to have the lowest level of pink rot when compared to the untreated control. Due to variability in the field plot, no significant differences were observed when compared with the untreated controls. However, since Presidio provided the best control of pink rot in this year's plots, it should continue to be evaluated to determine its long-term reliability in managing this disease.



Black Scurf/Stem Canker Fungicide Trial

In 2014, two different trials were set up to evaluate the effectiveness of eleven treatments (including several different compounds, rates, and application timings) for the management of black scurf and stem canker caused by *Rhizoctonia solani*. Several products were found to be effective for managing this disease. The use of Quadris, Serenade (a biological product) and a combination of Quadris + Serenade significantly reduced black scurf on tubers, which were evaluated several weeks post-harvest. The compounds, Priaxor and Vertisan, also reduced black scurf as well as stem canker; however this data was not significantly different from the untreated control. These products were also evaluated in 2013 with similar results, indicating that these products represent additional tools the grower can use to manage black scurf and stem canker.



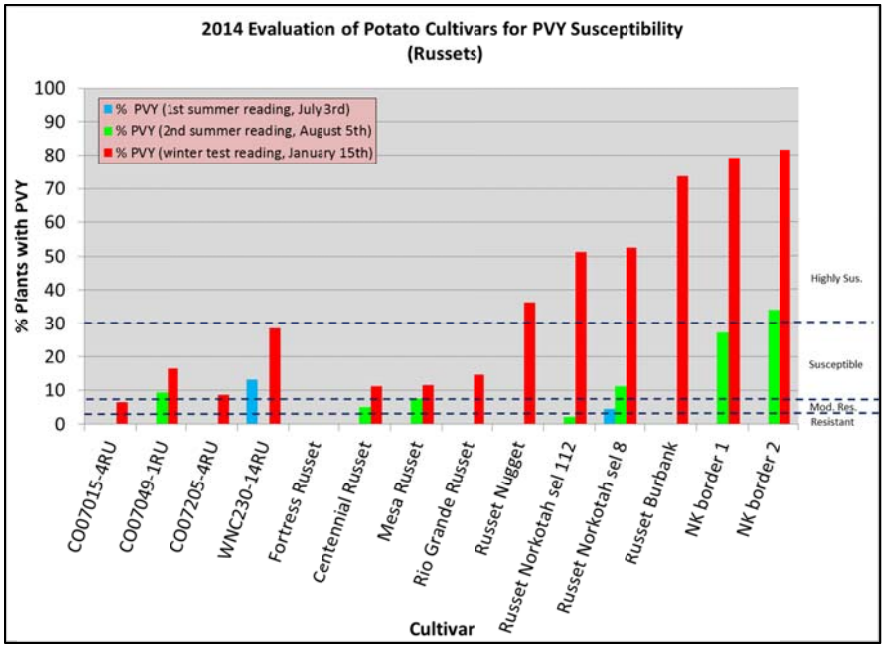
Clonal Evaluations for Resistance Screening

Soft Rot (*Pectobacterium* sp.) & Dry Rot (*Fusarium* sp.)

In 2013, thirty-nine potato clones were evaluated for soft and dry rot resistance. There was a wide range of symptom development in all the clones evaluated. Clones that had relatively low levels of dry rot included AC05175-3P/Y, CO05024-11RU, CO04067-8R/Y, and Rio Grande Russet. Clones with relatively low levels of bacterial soft rot included CO05035-5W/Y, AC05153-1W, CO05175-1RU, CO05228-4R, and Rio Grande Russet. In 2014, there were 25 new clones evaluated for soft and dry rot resistance. These results are still pending.

Potato Virus Y (PVY)

In 2014, a trial was set up to determine the level of PVY resistance in new potato stocks as well as in potato cultivars that are currently being grown in the San Luis Valley. An approach was implemented which took advantage of high PVY inoculum levels and natural aphid spread in a field planted to Russet Norkotah potatoes. Thirty-seven different potato clones and cultivars were evaluated using this strategy. As expected, the Russet Norkotahs that were included in the trial showed a high level of PVY spread. This cultivar has been known to be highly susceptible to PVY, which was confirmed in this trial. Conversely,



Fortress Russet has been known to be highly resistant to PVY, which was also confirmed in this trial. Several new clones from the potato breeding program were evaluated in this trial and showed some moderate resistance to PVY. These clones could be used by growers to manage PVY on their farms where PVY is a concern.

Powdery scab (*Spongospora subterranea*)

In 2014, twenty-six cultivars, including fifteen new clones from the breeding program were evaluated for powdery scab resistance. Unfortunately, the results from this trial are still pending. Results for this study should be available by the end of May, 2015.

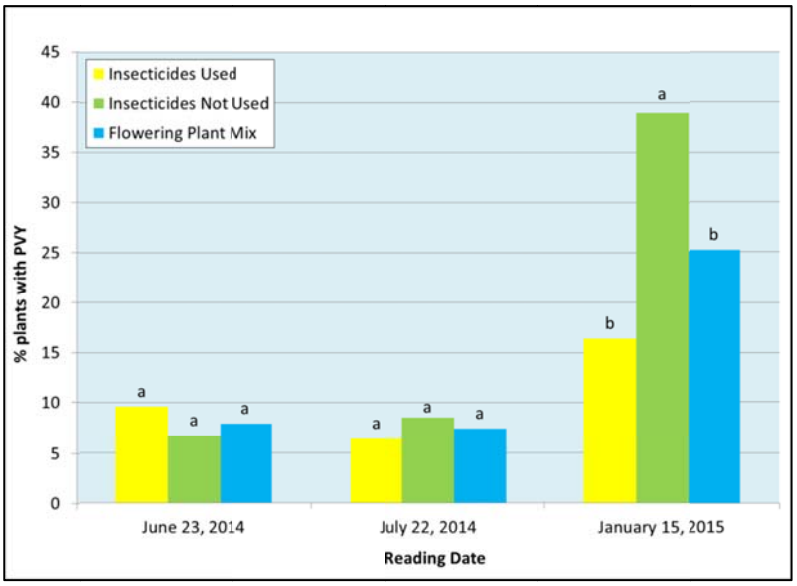
Bacterial Ring Rot (*Clavibacter michigenensis*)

There were a total of 56 different cultivars evaluated for bacterial ring rot expression in 2014. Overall, new clones from the breeding program expressed ring rot symptoms in the foliage prior to the 90 days after planting (DAP) threshold. Ninety DAP is the standard for visually determining whether or not a given seed lot contains any plants that are infected with ring rot. This trial confirms that new potato clones from the breeding program, when grown under SLV conditions, will express ring rot within the 90 DAP timeframe.

PVY Management

PVY Flowering Crop Mix Trial

The purpose of this trial was to evaluate the effectiveness of using a mix of different plant species which produce flowers at different times throughout the course of the season to reduce the spread of PVY in a potato crop. A flowering plant species mix was planted adjacent to four rows of Russet Norkotah sel. 8 potatoes. Two potato plots were evaluated which had different initial PVY levels (roughly 0% and 8% infection). Two control plots were also set up and evaluated (one without insecticide application and one with several insecticide applications through the season). Plants were visually evaluated for PVY two times in the summer and a sample was also collected at harvest and sent to Hawaii for evaluation.



The results indicated that potatoes planted next to a flowering species mix had a final PVY level of 25%, which was more than in the crop where insecticides were applied (16%); however, this difference was not statistically significant. The potatoes without any flowers planted nearby or insecticides applied had a final PVY level of 39%, which was statistically higher than the potatoes planted next to the flowering mix (treatments were analyzed using a LSD mean separation, p=0.05). The use of a flowering species mix, when planted adjacent to potatoes, appears to reduce the spread of PVY. One possible reason this had an impact on PVY levels may be that the addition of the flowering mix attracts beneficial insects, which feed upon aphids. Since aphids are the primary cause of PVY spread in potatoes, the reduction of aphid numbers could explain why the spread of PVY was reduced. Further evaluation of this management strategy will be evaluated again in 2015.

PVY Mechanical Spread Trial

In 2014, a trial was conducted evaluating the potential spread of PVY through cultivation. This study included the cultivars Rio Grande Russet and Russet Norkotah sel. 8. Unfortunately, due to aphid pressure late in the season and some issues with lab testing, the results from this trial are not available. This trial will be repeated again in 2015 with some adjustments.

Andrew's PhD Project

Evaluation of Cover Crops for the Reduction of Bacterial Soft Rot and Black Leg

In 2014, as part of a grant that was funded through EPA and NRCS, different cover crops were evaluated for the effectiveness at managing bacterial soft rot and black leg caused by *Pectobacterium* sp. This is the second year of results from this project. Unfortunately, the final report has not yet been generated, so no conclusions can be made at this time.

Potato tuber expressing bacterial soft rot symptoms (photo courtesy Andrew Houser.

Determining the Source and Potential Management of *Pectobacterium* sp. Numbers in Potato Operations

Starting in 2013, various cultivars were evaluated from different seed grower operations for black leg levels as well as levels of pectolytic bacteria present on the tubers post-harvest. This evaluation has continued through 2014 and will continue through the summer of 2015. The idea behind this project is to determine at what level bacteria populations increase within a seed growers' operation across multiple generations of seed. The results from this project have not yet been tabulated and some data still needs to be collected before conclusions can be made.

Use of Green Manures for Powdery Scab Management

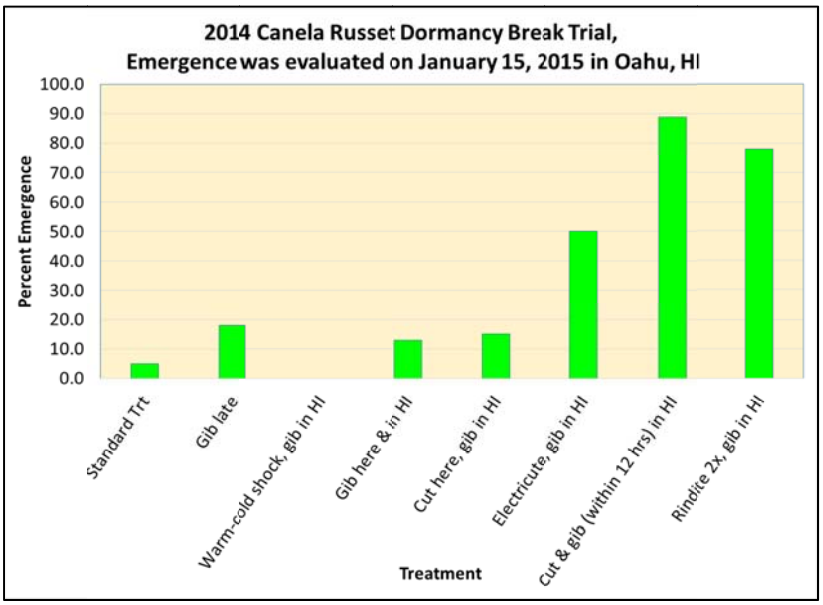
A study was conducted in the greenhouse evaluating the use of different green manures to manage powdery scab (in cooperation with Patrick O'Neil, Agro Engineering). Different green manures were grown the greenhouse using soil with varying levels of *Spongospora subterranea* inoculum. The green manure plants were then incorporated into the soil at around 60 DAP. The susceptible cultivar DT6063-1R was then planted into this soil and readings were taken on the harvested tubers.

Overall, results indicate that the use of green manures can have a positive impact on powdery scab levels. Statistically, every green manure evaluated resulted in lower powdery scab levels on the tubers when compared with potatoes planted in soil where green manures were not used. Although these results are promising, this study was conducted in a greenhouse using sand + bagged soil, which can produce results which are not always repeatable in the field. To further evaluate the use of green manures for powdery scab management, this study needs to be replicated under field conditions.

Evaluation of Using Green Manures to Manage Powdery Scab, SLVRC

	5 sb/g	50 sb/g
Treatment	**Severity Index**	**Severity Index**
1. Control (0 sb/g)	57.5 b	57.5 c
2. Control (5 sb/g)	500.0 a	500.0 a
3. Control (50 sb/g)	500.0 a	500.0 a
4. Monida Oat	143.8 b	233.3 bc
5. Caliente Mustard 61	46.9 b	300.0 b
6. Sordan 79	102.1 b	300.0 b
7. Radish (Defender)	81.3 b	312.5 b
8. Elbon Rye	144.4 b	275.0 b
9. Winfred Turnip	73.8 b	241.7 b
LSD (P=0.05)	0.0001	0.0026

Canela Russet Dormancy Break Trial (with Steve Keller & Greg Hess – CPCS)



Over the last several years, the cultivar Canela Russet has caused problems for the Colorado Potato Certification Service (CPCS) and the seed industry due to difficultly in breaking dormancy in time for the winter test grow-out. Due to increased demand for this cultivar in other regions throughout the U.S., the ability of CPCS to evaluate this cultivar during the winter grow-out becomes even more necessary. All grower samples heading to the winter test plots on Oahu, Hawaii are gassed (using Rindite) and some are also treated with gibberilic acid. This breaks the dormancy for nearly every cultivar, except Canela Russet.

In 2014, different treatments ranging from vinekill date timings to electrical stimulation were evaluated for tuber dormancy break on Canela Russet. Several treatments showed some success, however two treatments showed the most promise. The close proximity of cutting seed tubers to dipping in GA and the double gassing with Rindite had the most success when compared with the other treatments. These results are very encouraging and experiments evaluating the early dormancy break in Canela Russet will continue in 2015.

Early Blight, Root-Knot Nematode, and Late Blight Degree Day Reporting

For early blight, the threshold to apply fungicides was reached on July 4th, which is one day ahead of the 30 year average and about one week behind the 2013 degree day threshold. For Root-Knot Nematode management, the 1440 DD threshold was reached on July 9th in 2014. This was six days later than the 10 year average and 4 days later than 2013. For late blight, monitoring was continued in 2014 in the Blanca, Hooper, and Sargent areas. Conditions favorable for late blight were reached at each of the three sites by mid to late July. This is consistent with findings from previous years and should continue to be monitored in 2015.

ET (Evapo-transpiration) Reporting

The ET report was generated on a daily basis (including weekends and holidays) throughout the 2014 growing season. This report provides an estimation of water use for several different crops grown throughout the valley, based on local weather conditions. To generate this report, weather data (obtained through CoAgMet) is acquired for each site and is plugged into an ET spreadsheet, which calculates an estimated ET for each crop based on planting date. There are three sites currently being reported on (Center, Center 2, and La Jara). The ET program is also set up to report on the Blanca site, however, additional funding is required to make this weather station more reliable. The information generated by this ET program is currently being distributed to the industry through the SLVRC website, phone messages, radio, and newspaper.