

**Progress Report to the Maine Potato Board Research Subcommittee  
January 31, 2019**

**Project Title:**

Evaluation of New Potato Varieties (2018 Growing Season)

**Investigators:**

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**Executive Summary:**

Small-plot trials were used to select potato breeding lines with commercial potential for Maine growers. This project, along with Challenge grants provided by the Maine Department of Agriculture and managed by the Maine Potato Board, helps support the potato variety development efforts of commercial potato growers in Maine. During 2018, small-plot variety trials were conducted at three locations in Maine (Exeter, central Maine; Presque Isle, central Aroostook; St. Agatha, northern Aroostook). These trials were used to screen >200 new potato breeding lines to determine which, if any, are worthy of commercial-scale evaluation.

Detailed results from these variety trials are distributed to the industry via email and at meetings. The annual variety report is also posted on our regional project web site (<https://potatoes.ncsu.edu/NEReports.html>). A searchable database of ME and other eastern trial results is available at <https://potatoes.ncsu.edu/nscrch.php>. These web sites are hosted by North Carolina State University. Additional copies of our variety trial report are available upon request. The most promising experimental clones by market type are described later in this report.

Expanded variety screening for PVY susceptibility and symptom expression was continued. The trials were used to evaluate the relative susceptibility and symptom expression of 10 varieties during 2018. The standard varieties Norwis (R), Russet Burbank (S), and Russet Norkotah (VS) behaved mostly as expected. Russet Burbank had fair symptom expression during 2018, while Russet Norkotah symptom expression was weak early and fair at the second rating. Results of the 2017-2018 PVY experiment showed that PVY did not spread dramatically during within our 2017 experiment. The two varieties that had PVY problems in the initial incoming seed lots, Russet Norkotah and AF5312-1, also showed the most dramatic increase in %PVY and had the poorest PVY symptom expression in the 2018 plant back. AF5312-1 should be dropped from the program due to extreme PVY susceptibility and poor symptom expression. Russet Burbank, AF4831-2, AF4872-2, AF5040-8, AF5179-4, and AF5225-1 did not have much PVY, but due to plant stress, herbicide injury, and/or varietal characteristics (slow growth, crinkled foliage, and/or pale color) had many false visual positives. Most of the standards and test varieties were difficult to read under the experimental conditions. Only AF5406-7 had nice looking plants that were easy to read. AF4872-2 has crinkled foliage and it may be difficult to detect PVY infection under some conditions.

## Project Objectives:

1. Test promising new potato clones and varieties at three locations in Maine to select new varieties that will be useful to the Maine Potato Industry.
2. Evaluate PVY symptom expression and susceptibility of promising new potato clones.
3. Assist the industry in conducting initial commercial trials of promising new potato varieties.

## Grant Received:

\$20,000

## Accomplishments to Date:

**Small-plot Trials on Commercial Farms.** Small-plot variety trials were conducted in central Maine (Exeter, Crane Farms, 40 clones and varieties) and northern Aroostook County (St. Agatha, Labrie Farms, 73 clones and varieties). This work compliments trials conducted at Aroostook Research Farm in Presque Isle (51 clones and varieties in regional and advanced clones replicated trials; 72 advanced 6<sup>th</sup>-year clones in replicated breeding program trials; 57 intermediate 5<sup>th</sup>-year clones in replicated breeding program trials; 99 intermediate 4<sup>th</sup>-year clones in replicated breeding program trials; and 330 3<sup>rd</sup>-year breeding clones in unreplicated selection trials). The central Maine trial is focused largely on selection for chipping use. The St. Agatha site is a selection site for russets, French fry processing types, reds, and round-whites. Both trials provide great conditions to screen against common and/or powdery scab susceptibility. We also screened 3<sup>rd</sup> year white clones (122 clones), red and/or specialty clones (43 clones) and 4<sup>th</sup> year russet clones (39 clones) from the ME Potato Breeding Program at the Exeter site to select for adaptation and scab tolerance. A summary of promising lines is presented below and a detailed report from these small-plot variety trials is posted at <https://potatoes.ncsu.edu/NEReports.html>. A searchable database of ME and other eastern trial results is available at <https://potatoes.ncsu.edu/nesrch.php>. The data are used in combination with data from industry trials, national trials, and other trial sites around the eastern United States. The small-plot data are used to help the Maine, USDA-ARS, and New York breeding programs make decisions about lines that are worthy of entry into commercial trials. The results are also used in variety descriptions and management profiles.

Selections that performed particularly well in the regional and advanced trials in 2019 and recent years were:

### Chipping

Niagara	Tested as NY152, Niagara is medium-late maturing with good yields, round tubers, moderate gravity, and outstanding chip color. Tuber appearance is fair to good. It has good scab resistance and PVY resistance. Hollow heart problems have occurred sporadically.
AF5040-8	Mid-season, high yields, high gravity, light yellow flesh, good internal quality and chip color. Susceptible to scab. Because of its high specific gravity, AF5040-8 is a possible alternative to Atlantic in the South and mid-Atlantic states.

- AF5429-3 Medium-late maturity, high yields, medium-high gravity, good chip color, large tubers. Verticillium and blackspot resistance, susceptible to scab.
- NY157 Mid-season maturing with fair to good yields, moderate gravity, and good chip color. Tuber appearance is fair to good, is has low external defects incidence, but it can have some hollow heart. It has moderate to good scab resistance and is resistant to golden nematode.
- Other Promising chipping candidates that will be tested again in 2019: AF5563-5 (good yields, appearance, and chip color; large tubers, moderate gravity; moderate scab and bruise resistance); AF5677-4 (medium-late maturing, high yields, moderate to high specific gravity, good chip color, moderate late blight resistance, internal heat necrosis has been observed in a few trials); B2869-29 (high yields, good gravity, chips out of the field, scab susceptible); B2904-2 (high yields, mid-season, high gravity, chips out of the field, susceptible to scab); BNC182-5 (high yields, mid-season, moderate gravity, chips out of the field, resistant to scab and possibly to PVY); (MSAFB605-4 (late maturing, high yields, fair tuber appearance, moderate to high specific gravity, good chip color, verticillium, scab, late blight and PVY resistance); MSAFB609-12 (medium-late maturing, moderate to high yields, good tuber appearance, moderate to high specific gravity, good chip color, late blight and PVY resistance); MSAFB635-15 (late maturing, high yields, fair tuber appearance, moderate to high specific gravity, good chip color, moderate verticillium, scab, and blackspot resistance); NY162 (medium-late maturing, moderate to high yields, moderate specific gravity, good chip color, moderate scab resistance and resistance to golden nematode); WAF10664-3 (mid-season, high yields, moderate gravity and good chip color).

#### Fresh market whites

- AF4648-2 Mid-season maturity with good yields, chip color, gravity, and bruise resistance. This clone is common scab, golden nematode, and PVY resistant with moderate resistance to late blight and pink rot. Susceptibility to greening and powdery scab can present problems at times.
- AF5280-5 Medium early, bright, high yields, low specific gravity, moderate scab resistance, large tubers, good internal quality. Scab, pink rot, bruise, and golden nematode resistance.
- Other Promising fresh market whites that will be tested again in 2018: AF5225-1 (high yields, cream flesh, light skin netting, internal heat necrosis has been observed in a few southern trials, verticillium and bruise resistance, scab susceptible); NDAF102629C-4 (early, bright skin, moderate scab, shatter, and blackspot resistance); AF5819-2 (mid-season, bright skin, high yields, moderate scab resistance)

#### Russets or Long Whites

- Caribou R. Tested as AF3362-1. A medium-late maturing, dual-purpose russet with fair to good appearance, long to oblong tubers, low external defects, moderate specific gravity, and good fry color. It has high yields, moderate to large tuber size, and good internal quality (except for internal heat necrosis in southern areas). It has moderate scab resistance and is resistant to shatter and blackspot bruise.
- Reveille R. A long-oblong russet with moderate to high yields, good appearance, and late maturity. Specific gravity is relatively low and fry quality is not particularly

- good, so it will probably be useful only for fresh market. Emergence can be slow, but yields and appearance make it worth considering.
- AF4124-7 A mid-season russet with large tuber size and good processing quality. Yield, gravity, and internal quality have been good. It is moderately resistant to common scab, blackspot bruise, and fusarium, but is moderately susceptible to verticillium wilt.
- AF5071-2 A late maturing, russet with good fry quality, fair tuber appearance, and high yields. Specific gravity is higher than Russet Burbank and fry color from storage has been good. Fry color uniformity is very good. It is moderately susceptible to scab and hollow heart, but has moderate verticillium, blackspot, and shatter resistance.
- AF5406-7 A late-maturing russet with good yields, large tubers, and resistance to late blight, scab, blackspot, shatter, verticillium, fusarium, and pink rot. It will most likely be useful for processing markets.
- Other Promising russet and long-white candidates that will be tested again in 2019: AF4872-2 (russet, good yields and excellent processing quality, some oblongs, it is probably best suited to fresh-cut fry production); AF5164-19 (russet, good yields, possible dual purpose, susceptible to common scab, but resistant to verticillium and fusarium); AF5407-13 (russet, long tubers, dual-purpose, medium-late, medium to high gravity, moderate scab, verticillium, and blackspot resistance); AF5468-5 (russet, long tubers, good yields, fresh market, resistant to scab, fusarium, and verticillium); AF5492-6 (russet, long-oblong tubers, dual-purpose, medium-late, medium to high gravity, resistant to scab); AF5521-1 (russet, long tubers, processing, mid-season, medium to high gravity, excellent fry color, susceptible to scab, moderate verticillium and blackspot resistance); AF5661-13 (russet, long-oblong tubers, dual-purpose, mid-season, medium to high gravity, moderate resistance to scab and blackspot); AAF10615-1 (light russeting, long-oblong tubers, processing, outstanding fry color, mid-season, high specific gravity, resistant to PVY and moderate verticillium and blackspot bruise).

### Reds and Specialty

- Pinto Gold Test as AF4659-12, this is a yellow-fleshed “pinto-type” specialty variety with a interesting red and yellow skin pattern. It produces small, fingerling-type tubers that are excellent roasted, boiled, or fried.
- AF4831-2 Bright red skin with a smooth, attractive skin finish, small tubers that tend to be oval to oblong, white flesh, good cooking quality, medium to medium-late vine maturity. It has moderate resistance to scab, verticillium wilt, and blackspot bruise. Short tuber dormancy.
- AF5245-1 Purple skin, white flesh, moderate common scab resistance, small tubers
- NDAF113484B-1A pretty, mid-season, red with bright skin that holds its color well in storage. It is mid-season with moderate scab, shatter, and blackspot resistance)
- NY149 Yellow-fleshed with pink eyes and moderate to high yields. NY149 has a smaller tuber size profile than Yukon Gold along with lower incidence of internal and external defects. It has moderate scab resistance and resistance to golden nematode.
- Other Promising red and specialty candidates that will be tested again in 2019: AF5412-3 (purple flesh, late blight and verticillium resistance, off shapes are common);

AF5414-1 (reddish flesh, scab resistance, moderate late blight resistance, dull red skin and slightly deep eyes); AF5633-2 (purple flesh, round tubers, blackspot resistance); NDAF102696C-5 (red skin, pretty, small tubers for baby red market, moderate resistance to verticillium wilt and blackspot); AF5870-2 (yellow-fleshed, late maturity, bright skin, pretty, high yields, moderate scab and blackspot resistance); AF5891-1 (yellow-fleshed, pink splash on the skin, mid-season, pretty, high yields); NY151 (pale yellow flesh, mid-season, high yields, good tuber appearance).

**2018 Challenge Grants and Commercial Trials.** In addition to the support provided by the Maine Potato Board, the Maine Department of Agriculture provided \$10,500 to support challenge grants directly to growers. These commercial trials and grants are now managed by the Maine Potato Board (Jake Dyer). Growers submit detailed reports of management practices, yield, quality, and pest incidence. When needed each grower is interviewed via phone after the potatoes are moved from storage. Together with small-plot research results, they form the basis for whether to name a new variety and development of management profiles for new varieties which continue in the program. Emphasis is placed on the testing of lines from the Maine, USDA-ARS, and New York potato breeding programs.

**Variety Description, Management Profiles, Management Studies.** Variety descriptions and profiles have been developed for 10 of the top clones in the program and more are being developed. These profiles are developed based on breeding program data, small-plot yield trials, management experiments, and commercial experience. The variety descriptions have been made available to the industry via the ME Potato Board, trade shows (Potato EXPO, ME Agricultural Trade Show, and ME Potato Conference), at field day events, and are posted on our regional potato variety development project website (hosted by NCSU). They are also shared with companies that are interested in using and commercializing our potato varieties.

**PVY Susceptibility Experiment.** Because PVY has become such an industry-wide problem, we expanded our screening for PVY susceptibility and symptom expression. Experiments have been conducted each year to measure PVY spread and symptom expression. We have used a small-plot (10 ft per plot) RCBD with six replications per treatment. Two PVY-infected Shepody or Russet Burbank plants per plot serve as inoculum sources. At harvest, we collect 10 tubers per plot. These tubers are planted during the subsequent year and PVY incidence is determined by visual symptoms and ELISA testing to determine spread during the previous season. This experiment would ideally be conducted with clean starting seed; however, we do not always have clean seed available for all of the clones. Like the industry, we have experienced a difficult “flair up” of PVY inoculum in recent years and are struggling to keep our field-grown seed clean. Each year, we include three standard clones (Norwis - resistant, Russet Burbank - susceptible, and Russet Norkotah – susceptible, latent). The inoculation system continues to work well.

Results of the 2017-2018 PVY experiments showed that PVY did not spread dramatically during within our 2017 experiment. The two varieties that had PVY problems in the initial incoming seedlots, Russet Norkotah and AF5312-1, also showed the most dramatic increase in %PVY and had the poorest PVY symptom expression in the 2018 plant back. AF5312-1 should be dropped from the program due to extreme PVY susceptibility and poor symptom expression. Russet Burbank, AF4831-2, AF4872-2, AF5040-8, AF5179-4, and AF5225-1 did not have much

PVY, but due to plant stress, herbicide injury, and/or varietal characteristics (slow growth, crinkled foliage, and/or pale color) had many false visual positives. They were very difficult to read under the experimental conditions. Only AF5406-7 had nice looking plants that were easy to read.

**Table 1. Summary Results from the 2017-2018 PVY Susceptibility and Symptom Expression Study**

	2017		2018 Plant-back from				Disease Reaction	Symptom Expression
	Field-season		<u>2017 PVY Spread Study</u>					
	<u>Evaluation</u>		<u>ELISA</u>	<u>Field Reading<sup>1</sup></u>				
Visual	ELISA	% PVY	7/18	8/2				
	% Mos.	% PVY						
Norwis	0.0	0.0	1.7	0.0	0.0	(0.0)	R	n/a (1 mix?)
R. Burbank	2.1	2.1	0.0	5.4	17.1	(23.8)	S	n/a, ok some pale
R. Norkotah	5.6	27.2	40.1	8.7	28.4	(35.1)	S	fair, variable
AF4831-2	0.0	0.0	1.7	8.3	8.3	(20.0)	S	??, pale, small
AF4872-2	1.7	0.0	0.0	10.0	20.0	(41.7)	R	n/a, crinkle!
AF5040-8	1.7	0.0	1.7	1.7	11.7	(36.7)	S	??, pale
AF5179-4	0.0	0.0	0.0	0.0	5.6	(15.3)	S	n/a, small
AF5225-1	0.0	0.0	1.7	5.0	10.2	(13.7)	S	??, small
AF5312-1	5.0	43.3	68.3	33.3	40.0	(75.0)	S	weak, pale, variable
AF5406-7	3.3	0.0	3.5	0.0	3.5	(3.5)	S	good, nice plts

<sup>1</sup>Total of obvious and mild symptoms. Small plant size, stress, and/or herbicide injury may have caused false positive visual rating on July 18. August 2 ratings are % good mosaic symptoms (% symptoms plus ???). Small plant size, stress, and/or herbicide injury may have caused false positive visual rating on August 2. Approximately 60 plants per cultivar (~10 plants per plot, 6 replications, RCBD).

The same approach was used in 2018-2019 PVY screening experiment (Table 2) though “grow out” results won’t be available until summer 2019. The varieties screened were: Norwis, Russet Burbank, Russet Norkotah, AF4831-2, AF5225-1, AF5312-1, AF5406-7, AF5071-2, AF5280-5, and AAF07521-1. No background PVY infection levels were observed in the seedlots of AF4831-2, AF5225-1, AF5406-7, and AF5280-5. These results are consistent with those expected for varieties that showed good symptom expression in the previous year’s seed plots. Low levels were found in Russet Burbank (2.2), which typically shows fair symptom expression. Russet Norkotah, AF5071-2, and AF5312-1 came in with high infections levels (19.6, 15.0, and 40.3 %, respectively) despite passing certification during the previous year. Russet Norkotah had poor symptom expression early, but was better at the later rating. AF5312-1 had very poor symptom expression and should be dropped. AF5071-2 had clear symptom expression in the infected plants. AAF07521-1 also had some PVY and had plants that were a bit difficult to read. The trial conditions experienced in 2018 were not very conducive to symptom expression; however, high levels coming in from the seed are indicative of symptom expression problems for Russet Norkotah and AF5312-1.

**Table 2. Summary Results from the 2018-2019 PVY Susceptibility and Symptom Expression Study (initial seedlot PVY symptoms and infection)**

	2018 Field-season			July ELISA % PVY	Expected Disease Reaction	Symptom Expression
	<u>Visual Symptoms (%)</u> 7/6 <sup>1</sup>	7/13 Mos.	7/13 Mos. & ???			
Norwis	2.0	2.0	2.0	2.0 (mix?)	R	n/a
R. Burbank	2.2	4.4	15.2	2.2	S	fair
R. Norkotah	7.4	18.5	22.2	19.6	S	*weak early, OK later
AF4831-2	0.0	0.0	0.0	0.0	S	n/a
AF5225-1	1.8	0.0	0.0	0.0	S	n/a
AF5312-1	0.0	3.6	14.6	40.4	S	**very weak (drop)
AF5406-7	1.7	0.0	0.0	0.0	S	n/a
AF5071-2	15.2	17.0	17.0	15.0	S	good
AF5280-5	0.0	1.8	1.8	0.0	S	n/a
AAF07521-1	5.4	1.8	10.9	7.6	S	**weak

<sup>1</sup>Total of obvious and mild symptoms. Herbicide injury, poor vigor, and rhizoctonia created some false positives. Approximately 60 plants per cultivar. AF5406-7 had nice looking plants that should not be difficult to rogue. AF5071-2 had crinkled leaves, but mosaic was obvious when present. AAF07521-1 and AF5225-1 had crinkled leaves that would potentially make visual detection of mosaic symptoms difficult. Norwis, Russet Burbank, AF5280-5 had pale and crinkled foliage that could make detection difficult. AF5312-1 had pale foliage and unclear symptoms, it should be dropped due to poor PVY expression.

#### **Future Plans:**

We hope to continue this program during the 2019 growing season with: 1) small-plot variety trials conducted in Exeter, St. Agatha, and Presque Isle; 2) research on PVY susceptibility and symptom expression; and 3) continued work with the industry to facilitate commercialization.