

**Progress Report to the Maine Potato Board Research Subcommittee  
January 26, 2018**

**Project Title:**

Evaluation of New Potato Varieties (2017 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. Commercial-scale grower trials were conducted on these promising lines. The grower trials provide important information on successful management practices and experiences growing, storing, and marketing the new varieties. 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 2017, 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.

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 2017. The standard varieties Norwis (R), Russet Burbank (S), and Russet Norkotah (VS) behaved as expected. Russet Burbank had fair to good symptom expression during 2017, while Russet Norkotah symptom expression was poor. Based on the 2017 results (0% infection) and other data, we know that AF4648-2 is PVY immune. AF4659-12, AF5179-4, and AF5225-1 had low infection (0%) in this trial; however, based on other data we know that they can pick up PVY. Based on our overall research results, these clones have some PVY tolerance (i.e. they do not rapidly pick up PVY). AF5040-8 is also known to be susceptible, but it showed no infection in the 2017 trial. Based on our overall results, I would rate AF5040-8 as moderately susceptible with fair symptom expression. AF4872-2 had 34.4% infection and would be rated very susceptible. AF4872-2 has very crinkled foliage and it may be difficult to detect PVY infection under some conditions. AF4985-1 had 11.7% infection and would be rated as susceptible to very susceptible. Symptom expression is good for this variety.

In the 2017 PVY inoculation phase of the research, both Russet Norkotah and AF5312-1 came in with unexpectedly high PVY infection levels (27.2 and 43.3 %, respectively) despite passing certification during the previous year. Russet Norkotah and AF5312-1 had very poor symptom expression in this initial phase of the trial. High levels coming in from the seed are indicative of symptom expression problems for both of these varieties during the previous year as well as the current year. Based on this, AF5312-1 is on the “watch list” as potentially latent for PVY and may have to be dropped due to high susceptibility and poor PVY expression.

### **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, 35 clones and varieties) and northern Aroostook County (St. Agatha, Labrie Farms, 67 clones and varieties). This work compliments trials conducted at Aroostook Research Farm in Presque Isle (40 clones and varieties in replicated trials and 150 in 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 screen 3<sup>rd</sup> year white clones (146 clones), red clones (53 clones) and 4<sup>th</sup> year russet clones (48 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 available upon request. 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 2018 and recent years were:

#### Chipping

AF4648-2 Mid-season maturity with good yields, chip color, gravity, and bruise resistance. This clone is common scab and PVY resistant with moderate resistance to late blight, early blight, and pink rot

- AF5040-8 Mid-season, high yields, high gravity, good internal quality and chip color. Susceptible to scab. 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 yields, moderate gravity, and good chip color. Tuber appearance is fair to good, but it can have some hollow heart. It has good scab resistance.
- Other Promising chipping candidates that will be tested again in 2018: AF5563-2 (good yields, chip, and gravity; moderate scab, bruise, and verticillium resistance); AF5563-5 (good yields, appearance, and chip; moderate gravity; moderate scab and bruise resistance; B2869-29 (high yields, good gravity and chip color, scab susceptible); B2904-2 (high yields, mid-season, high gravity, chip color to be determined, susceptible to scab); BNC369-4 (high yields, good gravity and chip color); WAF10664-3 (high yields, good gravity and chip color).

#### Fresh market whites

- AF4138-8 Bright appearance with slightly netted, round to oblong tubers, excellent boiled quality, early to mid-season maturity, moderate scab resistance, and higher yields than Superior. Size profile can be smaller than Superior.
- AF4648-2 Mid-season maturity with good yields, chip color, gravity, and bruise resistance. This clone is common scab and PVY resistant with moderate resistance to late blight and pink rot. Susceptibility to greening was a problem in 2015 trials, while powdery scab susceptibility was a problem in several 2016 trials.
- AF5280-5 Medium early, bright, 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, verticillium and bruise resistance, scab susceptible); AF5450-7 (late maturity, high yields, verticillium, bruise, golden nematode, and scab resistance). AF5563-5 (good yields, appearance, and chip; moderate gravity; moderate scab and bruise resistance. good scab resistance); NDAF102629C-4 (early, bright appearance, scab and blackspot resistant).

#### Russets or Long Whites

- Caribou Russet 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 Russet 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 was slow in the St. Agatha trial during 2016.
- Teton Russet A long russet with moderate to high yields, good appearance, and good processing potential. It has moderate scab and fusarium resistance, but is reportedly

- susceptible to shatter bruise and softrot. Yields have been inconsistent in our trials. Fry quality has been good.
- 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.
- AF4296-3 A late maturing, russet with good fry quality, fair tuber appearance, and high yields. Specific gravity is moderate (average of 1.079 in ME trials) and fry color from storage has been good. Fry color uniformity is very good. It is moderately susceptible to scab, but has moderate verticillium resistance and good bruise resistance.
- AF5312-1 A mid-season russet with good appearance, flavor, and fresh market potential. Yield, gravity, and internal quality have been good. It has resistance to scab, blackspot, shatter, and fusarium.
- Other Promising russet and long-white candidates that will be tested again in 2018: AF4872-2 (russet, good yields and excellent processing quality, some oblongs); AF5071-2 (russet, good yields and fry quality, processing, some hollow heart and off shapes, resistant to verticillium and shatter); AF5091-8 (russet, good yields, fry processing, externals, resistant to blackspot, pink rot, fusarium); AF5164-19 (russet, good yields, possible dual purpose, externals, resistant to verticillium and fusarium); AF5179-4 (russet, good yields, processing, resistant to verticillium and fusarium); AF5406-7 (russet, good yields, processing, resistant to late blight, scab, blackspot, shatter, verticillium, fusarium, and pink rot); AF5468-5 (russet, good yields, fresh market, resistant to scab, fusarium, and verticillium); AAF07521-1 (russet, large tubers, good yields, processing, resistant to late blight, blackspot, fusarium, pink rot); WAF10073-3Ru (russet, good yields, processing, resistant to scab, blackspot, shatter, fusarium); TX08352-5Ru (mid-season, good appearance).

### Reds and Specialty

- AF4659-12 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

- NY161 Yellow skin and flesh with purple eyes, high yields, moderate scab resistance, very pretty in 2017 Maine trials, but reportedly gets a lot of growth cracks under some conditions.
- Other Promising red and specialty candidates that will be tested again in 2018: AAF08155-1 (buff skin with a purple blush, late blight resistance); AF5412-3 (purple flesh, late blight and verticillium resistance); AF5414-1 (reddish flesh, scab resistance, moderate late blight resistance); 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); NDAF113484B-1 (red skin, pretty, small tubers for baby red market, blackspot resistance); NDAF113458-2 (buff skin with a purple blush, high yields, bruise resistance);.

**2017 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 of the growers 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 2016-2017 PVY experiments showed that AF4648-2 is resistant to PVY (Table 1). While AF4659-12, AF5179-4, and AF5225-1 are known to be susceptible to PVY, they do show

some field tolerance and pick up PVY slower than most susceptible clones. AF5040-8 is also susceptible and may have a little bit of field tolerance, while AF4872-2 and AF4985-1 are susceptible. The standard varieties Norwis (R), Russet Burbank (S), and Russet Norkotah (VS) behaved as expected. Russet Burbank had fair symptom expression during 2017, while Russet Norkotah symptom expression was poor. Based on this test (0% infection) and other data, we know that AF4648-2 is PVY immune. AF4659-12, AF5179-4, and AF5225-1 had low infection (0%) in this trial; however, based on other data we know that they can pick up PVY. Based on the research results, these clones have some PVY tolerance (i.e. they do not rapidly pick up PVY). AF5225-1 has crinkled foliage and it may be difficult to detect PVY infection under some conditions. AF5040-8 is also known to be susceptible, but it showed no infection in the 2017 trial. Based on these and other results, I would rate AF5040-8 as moderately susceptible. AF5040-8 has pale foliage and it may be difficult to detect PVY infection under some conditions. AF4872-2 had 34.4% infection and would be rated very susceptible. AF4872-2 has very crinkled foliage and it may be difficult to detect PVY infection under some conditions. AF4985-1 had 11.7% infection and would be rated as susceptible to very susceptible. Symptom expression is good for this variety.

**Table 1. Summary Results from the 2016-2017 PVY Susceptibility and Symptom Expression Study**

	2016 Field-season <u>Evaluation</u>		2017 Plant-back from <u>2016 PVY Spread Study</u>				Disease Reaction	Symptom Expression
	Visual % Mos.	ELISA % PVY	<u>ELISA</u> % PVY	<u>Field Reading<sup>1</sup></u> 7/5 7/13				
Norwis	0.0	0.0	0.0	0.0	1.7	(1.7)	R	n/a
R. Burbank	11.7	3.3	8.3	10.0	10.0	(30.0)	S	Fair-good
R. Norkotah	3.3	6.7	15.0	3.3	18.3	(33.3)	S	Difficult
AF4648-2	0.0	0.0	0.0	0.0	0.0	(100.0)	R	n/a, pale
AF4659-12	0.0	0.0	0.0	0.0	0.0	(0.0)	R	n/a, good
AF4872-2	28.3	13.3	34.4	20.0	36.7	(45.0)	VS	Fair, crinkle
AF4985-1	6.9	5.0	11.7	15.0	20.0	(33.3)	S	Good
AF5040-8	3.3	1.7	0.0	0.0	5.0	(67.0)	R	n/a, pale, crk
AF5179-4	0.0	0.0	0.0	0.0	0.0	(0.0)	R	n/a, good
AF5225-1	11.7	0.0	0.0	8.3	10.0	(40.0)	R	n/a, crinkle

<sup>1</sup>Total of obvious and mild symptoms. Herbicide injury and rhizoctonia created some false positives. July 13 ratings are % symptoms (% symptoms plus ???). Approximately 60 plants per cultivar (~10 plants per plot, 6 replications, RCBD).

The same approach was used in 2017-2018 PVY screening experiment (Table 2) though “grow out” results won’t be available until summer 2018. The varieties screened were: Norwis, Russet Burbank, Russet Norkotah, AF4831-2, AF4872-2, AF5040-8, AF5179-4, AF5225-1, AF5312-1, and AF5406-7. No background PVY infection levels were observed in the seedlots of Norwis, AF4831-2, AF4872-2, AF5040-8, AF5179-4, AF5225-1, and AF5406-7. 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 (2.1), which typically

shows fair symptom expression. Unexpectedly, both Russet Norkotah and AF5312-1 came in with high infections levels (27.2 and 43.3 %, respectively) despite passing certification during the previous year. Russet Burbank symptom expression was weak, while Russet Norkotah and AF5312-1 had very poor symptom expression. The trial conditions experienced in 2017 were not very conducive to symptom expression; however, high levels coming in from the seed are indicative of symptom expression problems for both of these varieties during the previous year as well as the current year.

**Table 2. Summary Results from the 2017-2018 PVY Susceptibility and Symptom Expression Study (initial seedlot PVY symptoms and infection)**

	2017 Field-season			July ELISA % PVY	Expected Disease Reaction	Symptom Expression
	Visual Symptoms <sup>1</sup> (%)					
	7/6	7/13	7/13			
		Mos.	Mos. & ???			
Norwis	0.0	0.0	11.8	0.0	R	n/a
R. Burbank	2.1	2.1	8.7	2.1	S	fair
R. Norkotah	5.6	5.6	18.5	27.2	S	**very weak
AF4831-2	0.0	0.0	16.7	0.0	S	n/a
AF4872-2	5.0	1.7	10.0	0.0	S	n/a
AF5040-8	10.0	1.7	5.0	0.0	S	n/a
AF5179-4	0.0	0.0	0.0	0.0	S	n/a
AF5225-1	100	0.0	100	0.0	S	n/a
AF5312-1	0.0	5.0	25.0	43.3	S	**very weak
AF5406-7	0.0	3.3	100	0.0	S	n/a

<sup>1</sup>Total of obvious and mild symptoms. Herbicide injury, poor vigor, and rhizoctonia created some false positives. Approximately 60 plants per cultivar. AF4872-2 and AF5225-1 had crinkled leaves that would potentially make visual detection of mosaic symptoms difficult. AF5040-8 and AF5406-7 had pale foliage that potentially makes visual symptom detection difficult. AF5312-1 had pale foliage and unclear symptoms. The seedlot was badly infected and this made it difficult to determine which plants were healthy.

#### **Future Plans:**

We hope to continue this program during the 2018 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.