

**Progress Report to the Maine Potato Board Research Subcommittee
January 31, 2017**

Project Title:

Evaluation of New Potato Varieties (2016 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 2016, 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/nrsrch.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 within this project. The trials were used to evaluate the relative susceptibility and symptom expression of 10 varieties during 2016. The standard varieties Norwis (R), Russet Burbank (S), and Russet Norkotah (VS) behaved as expected. Russet Burbank had fair to good symptom expression during 2016, while Russet Norkotah symptom expression was poor. AF4342-3, AF4659-12, and AF4953-6 were moderately susceptible to PVY based on their low infection levels in the inoculated trial (1.7 to 3.3%). All three had acceptable symptom expression. AF4985-1 was susceptible (8.3% infection), while AF4296-3 and AF4532-9 were very susceptible (45 and 25% infection, respectively). PVY symptom expression of AF4985-1 was acceptable, while symptom expression was poor for AF4296-3 and AF4532-9. AF4342-3 also has had weak symptom expression in past years. Based on the PVY results, I will only keep AF4296-3 in the program if processors continue to show interest in it due to its good yields and fry quality. I would recommend caution and use of lab testing if seed production of AF4296-3 continues. I have removed AF4532-9 and AF4342-3 from commercialization trials and variety development partly due to their PVY problems.

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, 34 clones and varieties) and northern Aroostook County (St. Agatha, Labrie Farms, 82 clones and varieties). This work compliments trials conducted at Aroostook Research Farm in Presque Isle (49 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. 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 2016 and recent years were:

Chipping

Sebec	Tested as AF0338-17. It has yields similar to Atlantic in the S.E. with very little internal heat necrosis or hollow heart. It is not a storage chipper, but chips very well from the field and could have market potential as an alternative to Atlantic in the mid-Atlantic and Southeastern U.S. Chip growers need to reduce fertility levels and harvest it slightly later than Atlantic (when Atlantic has gone off grade due to internal defects) to obtain adequate specific gravity for out-of-field chipping.
AF4157-6	Early maturing with moderate to good yields, excellent chip color, good gravity, bruise resistance. It may work well from the field in the South and from storage in the north. Small tuber size and scab susceptibility are weaknesses. It has good yields for an early, but has been inconsistent.
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, pink rot, and soft rot. Susceptibility to greening was a problem in 2015 trials. It has potential for fresh market and as a chipper for conditions when

common scab limits other varieties. Long-term chip color can be quite good as long as it is harvested before chilling conditions occur and then is stored at 50 to 55F. It does not chip well from cool storage and it is quite susceptible to powdery 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. Tuber shape sometimes runs more toward oblong than is desirable.
- Other Promising chipping candidates that will be tested again in 2017: AF5040-8 (mid-season, high yields, gravity \geq Atlantic, and good chip color, outstanding in 2014 and 2015 national trials, probably fits best as an alternative to Atlantic in the South); AF5429-3 (high specific gravity, excellent chip color, and resistance to golden nematode, verticillium wilt, and blackspot bruise).

Fresh market whites

- Sebec Tested as AF0338-17. Widely adapted, medium to medium late, round to oblong tubers, slight net, fair to good appearance, low internal and external defects, moderately susceptible to scab, susceptible to greening under fluorescent lights.
- 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 Described above, smooth skin, bright appearance, round to oblong tubers, mid-season, good internal quality, very good common scab resistance plus PVY, late blight, pink rot, and soft rot resistance.
- Other Promising fresh market whites that will be tested again in 2017: AF4552-5 (early maturity, moderate scab resistance, good yields, netted skin); AF5225-1 (high yields, netted skin, cream colored flesh, verticillium wilt resistance, scab susceptible); AF5280-5 (medium early, bright, moderate scab resistance, golden nematode resistance, large tubers); aF5450-7 (medium-late maturity, bright, 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 golden nematode and 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 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, high yielding russet with large tubers, good processing potential, and moderate scab resistance. Skin russeting is quite light and appearance is variable, but it can sometimes be attractive enough for fresh market.
- AF4172-2 A mid-season, high yielding russet with good processing quality. It has resistance to blackspot bruise, shatter bruise, and net necrosis. It has a relatively heavy tuber set and needs a wide seedpiece spacing (~16" in ME) to achieve a desirable tuber size profile for most markets. It has attractive tuber appearance and good baked quality, but is scab susceptible. Appearance will only work for fresh market on sites where scab is not a problem.
- 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. It has been an outstanding performer in the national fry processing trials (NFPT). It is moderately susceptible to scab, but has moderate verticillium resistance and good bruise resistance.
- AF5312-1 A high yielding, mid-season russet with appearance like Russet Norkotah, good baked quality, and scab resistance. It is also moderately resistant to blackspot and shatter bruise.
- Other Promising russet and long-white candidates that will be tested again in 2016: AF4872-2 (russet, good yields and excellent processing quality); AF5071-2 (russet, good yields and fry quality, processing); AF5091-8 (russet, good yields, possible fry processing); AF5164-19 (russet, good yields, possible dual purpose); AF5179-4 (russet, good yields, possible fry processing); AF5406-7 (russet, good yields, acceptable fry color, late maturity, late blight, pink rot, verticillium, fusarium, and scab resistant, processing); AF5406-10 (russet, good yields and fry color, processing); AF5407-13 (russet, good yields and fry color, possible dual use); AF5468-5 (russet, good yields, fresh market); AAF08434-1 (russet, midseason, good fry color, possible PVY resistance); AAF07521-1 (russet, midseason, good fry color, large tubers, moderate late blight, pink rot, blackspot, and fusarium resistance); WAF10073-3Rus (russet, good yields and scab resistance, possible dual-purpose).

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, oblong tubers, relatively small size profile, white flesh, medium to medium-late vine maturity.
- AF5245-1 Purple skin, white flesh, mid-season maturity, high yields, scab resistant.
- Other Promising red and specialty candidates that will be tested again in 2017: AF5412-3 (purple flesh, late blight, verticillium, and net necrosis resistance); AF5414-1 (red flesh, scab, late blight, and net necrosis resistance); several additional red-skinned, white fleshed clones.

2016 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 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 2015-2016 PVY experiments showed that AF4648-2 is resistant to PVY and that the other six test clones were susceptible (Table 1). These general results were expected. The standard varieties Norwis (R), Russet Burbank (S), and Russet Norkotah (VS) behaved as expected. Russet Burbank had fair to good symptom expression during 2016, while Russet Norkotah symptom expression was poor. AF4342-3, AF4659-12, and AF4953-6 were moderately susceptible to PVY based on their low infection levels in the inoculated trial (1.7 to 3.3%). All three had acceptable symptom expression. AF4985-1 was susceptible (8.3% infection), while AF4296-3 and AF4532-9 were very susceptible (45 and 25% infection, respectively). PVY symptom expression of AF4985-1 was acceptable, while symptom expression was poor for AF4296-3 and AF4532-9. AF4342-3 also has had weak symptom expression in past years. Based on the PVY results, I will only keep AF4296-3 in the program if processors continue to show interest in it due to its good yields and fry quality. I would recommend caution and use of lab testing if seed production of AF4296-3 continues. I have removed AF4532-9 and AF4342-3 from commercialization trials and variety development partly due to their PVY problems.

The same approach was used in 2016-2017 PVY screening experiment (Table 2) though “grow out” results won’t be available until summer 2017. The varieties screened were: Norwis, Russet Burbank, Russet Norkotah, AF4648-2, AF4659-12, AF4872-2, AF4985-1, AF5040-8, AF5179-4, and AF5225-1. No background PVY infection levels were observed in the seedlots of Norwis,

AF4648-2, AF4659-12, AF5179-4, and AF5225-1. Low levels were found in Russet Burbank (3.3%) and AF5040-8 (1.7%). Based on the ELISA tests, AF4985-1 started out the experiment at the certification limit (5%), while Russet Norkotah and AF4872-2 were above certification limits (6.7 and 13.3%), respectively. Russet Burbank symptom expression was weak, while Russet Norkotah had very poor symptom expression. AF4872-2 had mild mosaic symptoms and its leaves are normally quite crinkled, so reading the visual symptoms can be a bit challenging. AF5040-8 had relatively little mosaic, but what was there was hard to see as least partly because this variety's foliage is quite pale. As we have seen in the past, AF4985-1 had good mosaic symptom expression.

Table 1. Summary Results from the 2015-2016 PVY Susceptibility and Symptom Expression Study

	2015 Field-season Evaluation		2016 Plant-back from <u>2015 PVY Spread Study</u>			Disease Reaction	Symptom Expression
	Visual % Mos.	ELISA % PVY	ELISA % PVY	Field Reading ¹ 7/6 7/12			
Norwis	0.0	0.0	0.0	0.0	0.0	R	n/a
R. Burbank	0.0	0.0	8.3	8.3	8.3	S	Fair-good
R. Norkotah	3.3	3.3	25.0	18.3	25.0	S	Difficult
AF4296-3	3.4	23.3	45.0	10.0	10.0	S	Very Difficult
AF4342-3	0.0	0.0	1.7	1.7	1.7	MS	Good
AF4532-9	3.4	12.5	24.9	17.4	26.5	S	Difficult
AF4648-2	0.0	0.0	0.0	0.0	0.0	R	n/a
AF4659-12	0.0	0.0	3.3	6.7	11.7	MS	Good
AF4953-6	0.0	0.0	1.7	0.0	3.3	MS	Good
AF4985-1	8.6	10.2	8.3	8.3	10.7	S	Good

¹Total of obvious and mild symptoms. Herbicide injury and rhizoctonia created some false positives. Approximately 60 plants per cultivar (~10 plants per plot, 6 replications, RCBD).

Table 2. Summary Results from the 2016-2017 PVY Susceptibility and Symptom Expression Study (initial seedlot PVY symptoms and infections)

	2016 Field-season Visual Symptoms ¹ (%)			July ELISA % PVY	Expected Disease Reaction	Symptom Expression
	7/6	7/13	7/19			
Norwis	0.0	0.0	0.0	0.0	R	n/a
R. Burbank	0.0	11.7	1.7	3.3	S	weak
R. Norkotah	0.0	3.3	0.0	6.7	S	very weak
AF4648-2	0.0	0.0	0.0	0.0	R	n/a
AF4659-12	0.0	0.0	0.0	0.0	S	n/a
AF4872-2	8.3	28.3	15.0	13.3	S	fair
AF4985-1	5.1	6.9	6.9	5.0	S	good
AF5040-8	0.0	3.3	0.0	1.7	S	weak
AF5179-4	0.0	0.0	0.0	0.0	S	n/a
AF5225-1	0.0	11.7	0.0	0.0	S	n/a

¹Total of obvious and mild symptoms. Herbicide injury and rhizoctonia created some false positives. Approximately 60 plants per cultivar. AF4872-2 has crinkled leaves that make visual detection of mosaic symptoms difficult (observed mosaic was mild). AF5040-8 has pale foliage that makes visual symptom detection difficult.

Future Plans:

We hope to continue this program during the 2017 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.