Progress Report to the Maine Potato Board Research Subcommittee
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Project Title:

Evaluation of New Potato Varieties (2015 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, helps support the potato variety development efforts of commercial potato growers in Maine. During 2015, 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 available upon request.

During 2015, 22 commercial-scale trials representing 8 new potato varieties (3 chippers, 1 round-white, 3 russets, and 1 specialty types) and 102 acres. The varieties by market classification were: chippers – AF4157-6, AF4648-2; fresh market and out-of-field chipper – Sebec (AF0338-17); russets and processing types – Caribou Russet (AF3362-1), AF4296-3, and Easton (AF3001-6); fresh market, round-white – AF4138-8; and one specialty types – AF4659-12. These trials were conducted as part of the new potato variety challenge grant program. Growers submit detailed reports of management practices, yield, quality, and pest incidence.

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 2015. The standard varieties Norwis (R), Russet Burbank (S), and Russet Norkotah (VS) behaved as expected. Russet Burbank had weak symptom expression during 2015 and Russet Norkotah symptom expression was poor. AF4124-7, a russet, did not pick up any PVY during the 2014/2015 trial, though we know from past trials and experience that it is susceptible and readily shows symptoms. AF4124-4 and AF4386-16 were moderately susceptible to PVY based on their low infection levels in the inoculated trial (1.7%). Both had normal symptom expression. AF4138-8, AF4296-3, AF4342-3 were susceptible (~10% infection), while AF4532-9 was very susceptible (30%). PVY symptom expression was weak in all of these varieties during 2015. Symptoms were visible, but inconsistent in AF4138-8, AF4296-3, and AF4532-9; however, symptom expression was very poor in AF4342-3. AF4296-3 and AF4342-3 also had the weakest symptom expression in the 2013/2014 PVY trial. I would recommend caution and use of lab testing as seed production of AF4296-3 continues. My

recommendation is to remove AF4532-9 and AF4342-3 from commercialization trial and variety development partly due to their PVY problems.

Project Objectives:

1. Test new potato selections on commercial farms at several locations in Maine.

2. Provide challenge grants and technical support to help growers test the most promising new potato breeding lines.

3. Evaluate PVY symptom expression and susceptibility of promising new potato clones.

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 2015 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, not a storage chipper, but chips very well from the field in the Southeastern U.S.
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. 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, PVY, and GN resistant. It also has moderate late blight and pink rot resistance. Susceptibility to greening was a problem in 2015 trials.
NY154	Also known as NYH15-17, this clone is late maturing with good 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 2016: AF5040-8 (high yields, good gravity and chip color, outstanding in 2014 and 2015 national trials).

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 external defects, moderately susceptible to scab. Unfortunately, Sebec green quickly 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	Smooth skin, bright appearance, round to oblong tubers, possible chipping and fresh market use, mid-season, very good common scab resistance plus PVY and GN resistance. Susceptibility to greening was a problem in 2015 trials.
Other	Promising fresh market whites that will be tested again in 2016: AF4552-5 (early maturity, moderate scab resistance, good yields, netted skin); AF5280-5 (medium early, bright, moderate scab resistance, large tubers); AF5426-3 (mid-season, bright, moderate scab resistance); AF5450-7 (late maturity, bright, good scab resistance).

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.
Easton	Tested as AF3001-6, this clone produces long, netted to lightly russeted tubers that have excellent fry color. It has very high yields, good tuber size, medium to high gravity, and good resistance to verticillium. Susceptibility to tuber late blight and rot have been weaknesses.
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.
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.
Other	Promising russet and long-white candidates that will be tested again in 2016: AF4124-7 (russet, processing, large tubers, possible dual purpose); AF4172-2 (russet, processing, smaller tuber size profile, bruise resistant, possible dual purpose); AF4872-2 (russet, good yields and excellent processing quality); AF4953-6 (russet, good yields, possible dual-purpose); and many more coming; 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 processing); AF5179-4 (russet, good yields, possible fry processing); AF5312-1 (russet, good yields and scab resistant, fresh market); AF5406-10 (russet, good yields and fry color, processing); AF5407-13 (russet, good yields and fry color, possible dual use); AF5464-4 (russet, good yields, fresh market); WAF10073-3Rus (russet, good yields and scab resistance, possible fry processing).

Reds and Specialty

NY150	Very small, bright "creamer-type" white-skinned potatoes. PVY, scab (moderate resistance), and GN resistance.
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.
AF4985-1	Bright red skin with a smooth, attractive skin finish, white flesh, good cooking quality, medium to medium-late vine maturity. Yields are often good, but have been inconsistent due to external tuber defects (primarily greening and growth cracks).
Other	Promising red and specialty candidates that will be tested again in 2016: AF4831-2 (red, white flesh, scab resistance); AF5215-2 (yellow flesh, pink eyes, small tubers, scab susceptible);

AF5245-1 (purple, white flesh, scab resistant); AF5412-3 (purple flesh, some late blight resistance); AF5414-1 (reddish flesh, scab resistance, some late blight resistance); BNC244-10 (purple and yellow skin, mottled purple flesh), interesting appearance, but mixed reviews on mottled, light purple flesh; NDAF102573-2 (red, white flesh).

2015 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. During 2015, 22 commercial-scale trials representing 8 new potato varieties (3 chippers, 1 round-white, 3 russets, and 1 specialty types) and 102 acres. The varieties by market classification were: chippers – AF4157-6, AF4648-2; fresh market and out-of-field chipper – Sebec (AF0338-17); russets and processing types – Caribou Russet (AF3362-1), AF4296-3, and Easton (AF3001-6); fresh market, round-white – AF4138-8; and one specialty types – AF4659-12. These trials were conducted as part of the new potato variety challenge grant program. We allocated a total of $10,500 in challenge grants (funding provided by the Maine Department of Agriculture via the Maine Potato Board) directly to growers in support of these commercial tests. Growers submitted detailed reports of management practices, yield, quality, and pest incidence. When needed each of the growers will be 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. Lines from other states are included as appropriate. The following is a brief summary of 2015 results by clone:

Caribou R. Tested as AF3362-1. Caribou Russet is a high yielding, mid-season, dual-purpose russet with moderate scab resistance. Tuber appearance is fair to good in ME. It is being evaluated for dual-purpose French fry processing and fresh pack use. It has been in seed grower trials from 2010 to 2015. It has had good yields, tuber type, and appearance. Tubers have been medium-sized to large with very little bruise damage or hollow heart. There have been few quality problems beyond slight incidence of off shapes and sunburn. It was grown in a 1 acre processing trial during 2011. The grower had stand problems in this field, but liked the yield and size. It was field delivered and successfully processed into fries at McCain Foods. Yield, type, early sizing, and bruise resistance are strengths, while PVY susceptibility has proven to be a serious limitation that has reduced seed supplies and the pace of commercialization. In Maine, AF3362-1 does best for fresh and processing use with a 12-inch seedpiece spacing and moderate N rates. Narrower seed spacing should be considered for seed production.

Easton This clone was tested as AF3001-6 and was named Easton in late 2013. It is a high yielding, late-season, netted long white with excellent fry color and good verticillium resistance. Tuber appearance is fair in ME and it is moderately susceptible to scab. Although it has good cooking quality, it is primarily being evaluated for French fry processing use. We supported a seed grower trial during 2012 (1.9 acres) and three seed grower trials in 2013 (13 acres). Seed growers reported good yields, large tuber size, and nice tuber type though 2013. Seed growers noted that they will close up their in-row spacing in the future and reduce their fertilizer rates to get better maturity. It was in 8 seed grower trials during 2014 (74 acres). Emergence was typically slow and stands were often poor (50, 70, 80, 80, 85, 85, 90 and 90%). Late- season vigor was very good. Seed rot problems and poor stands often limited early growth and production. Tuber type was typically good for a long type, tuber size was large, and relatively few tuber defects were observed. Four of the eight seed growers noted problems with bruising and skinning at harvest. Several indicated that they would use less fertilizer in the future. One seed grower had late blight (foliar and tuber) during 2014 and felt that it may be too susceptible for their production system.

Easton was in a processing trial during 2013 (8 acres). It had good yield, size, appearance, and quality at harvest. The fry color was very good and gravity was marginal at 1.078. It had serious fusarium problems coming out of storage. It was in another processing trial during 2014 (35

acres). It had poor stands (70-75%) and large tuber size. Seed decay problems developed after cutting. The tuber type, internal quality, fry color, and specific gravity were good and the crop was successfully processed into fries. The vines were not completely dead at harvest and a significant amount of skinning and shatter bruise were observed at harvest. Based on these observations, Easton may need more skin-set time than Russet Burbank and less N fertilizer to assure quality going into storage.

In research trials, tuber late blight problems were noted during 2011 and softrot has sometimes caused problems. Only one grower has had tuber late blight problems to date; however, this variety appears to be susceptible to tuber rot, so growers will need to work hard on late blight control, take steps to assure maturity, limit bruising at harvest, and avoid their wettest ground. Seed rot and vigor problems observed during 2014 also indicate that seed management practices will need to be adjusted. This variety needs less N than Russet Burbank and we are currently suggesting that growers reduce N rates by 40 to 50 lbs per acre compared to Russet Burbank. A 12-inch seedpiece spacing is recommended for processing, while 8- to 10-inch spacing should be used for seed production. Easton is susceptible to herbicide injury. Use moderate rates of pre-emergence herbicides and avoid postemergence applications of metribuzin.

Sebec This clone was tested as AF0338-17 and was named Sebec in late 2013. It is primarily intended as an alternative to Atlantic for out-of-field chipping, but it can also go as a round-white for fresh market. It has slightly netted to netted skin, round to oblong tubers, medium to medium-late maturity, moderate specific gravity, and good yields. It has been very similar to Atlantic in yields throughout the East, but has much lower incidence of hollow heart and internal heat necrosis than Atlantic. Specific gravity averages about 0.004 lower than Atlantic. It was in seed grower trials during 2011 to 2014. The grower has typically noted attractive, round tubers, and relatively few tuber defects, but did have rot problems in one of the two seed plots grown during the wet 2013 growing season. The grower suggests avoiding the wettest ground when growing Sebec. He also noted shatter bruise problems in 2013 that had not been seen in 2011, 2011 or 2014. Poor stands were observed during 2014 due to seed rot problems, but the crop looked good otherwise going into storage. This clone has been chipped at Wise Foods and several other chip plants in the mid-Atlantic and Southeast U.S. and it has received excellent reviews as an out-of-field chipper. In Maine, Sebec does best with an 8- to 9-inch seedpiece spacing and moderate N rates.

AF4138-8 This is a round-white, fresh market clone with bright appearance, slightly netted skin, round to oblong tubers, and excellent boiled quality. It has early to mid-season maturity, moderate scab resistance, and higher yields than Superior. Its size profile can be smaller than Superior. AF4138-8 was in a small-scale organic grower trial during 2014. The grower reported excellent appearance with round, medium-large tubers. Customers loved it and came back repeatedly asking for more. It was also grown in a 1.2A commercial, fresh market trial during 2014. The grower noted that it better tuber appearance and shape than Superior, but that it had slightly smaller tuber size and slightly later maturity. The crop looked good and was placed in storage for a marketing trial. It was in one fresh market trial during 2015, but we have not received a report from the grower at the date of this writing. In Maine, AF4138-8 does best for fresh market when grown with a 10-inch or slightly wider seedpiece spacing and moderate N rates.

AF4157-6 This chipping clone is early maturing with 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 yield for an early, but has been inconsistent. It was in a seed grower trial in 2014. Early vigor was good and the grower reported good tuber appearance and no significant tuber defects. It was in one seed increase trial during 2015, but we have not received a report from the grower at the date of this writing. The clone has market potential as an early in chipping areas, but the grower is concerned about the scab risk. In Maine, AF4157-6 does best for chipping when grown with a 10-inch or slightly wider seedpiece spacing, moderate N rates, and on fields with a low risk of common scab.

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. Production and quality in seed trials has been acceptable. It is scheduled for initial commercial-scale fry processing trials in 2016. PVY symptom expression was acceptable late in the season during 2013 and 2014, but was very poor in 2015.

AF4648-2 Smooth skin, bright appearance, round to oblong tubers, possible chipping and fresh market use, mid-season, very good common scab resistance plus PVY and GN resistance. Susceptibility to greening was a problem in 2015 trials. It was in one seed increase trial during 2015, but we have not received a report from the grower at the date of this writing.

AF4659-12 This is a red and yellow-skinned, yellow-fleshed, specialty clone with fingerling type tubers. It is excellent either boiled or roasted. It has very small to small tubers and late maturity. It was grown in small-scale, organic grower trials from 2011 to 2014. The potatoes were marketed directly to consumers at farmers' markets and roadside stands. The consumers have really liked it and keep coming back for more. The grower plans to grow it again as it has done well for him under difficult growing conditions. Susceptibility to stolon-end rot has been a weakness, especially under wet conditions, though only a small percentage of tubers have required culling for the defect. A 10- to 12-inch seedpiece spacing and low to moderate N rates are recommended.

Variety Description, Management Profiles, Management Studies. Variety descriptions and profiles have been developed for nine 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).

PVY Susceptibility Experiment. Because PVY has become such an industry-wide problem, we expanded our screening for PVY susceptibility and symptom expression since 2010. The experiments have been planted 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 inoculums 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 over the past few 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 2014-2015 PVY experiments showed that all of the test clones were susceptible to PVY except that AF4124-7 did not pick up any PVY from the inoculating plants (Table 1). The standard varieties Norwis (R), Russet Burbank (S), and Russet Norkotah (VS) behaved as expected. Russet Burbank had weak symptom expression during 2015 and Russet Norkotah symptom expression was poor. AF4124-7, a russet, did not pick up any PVY during the 2014/2015 trial, though we know from past trials and experience that it is susceptible and readily shows symptoms. AF4124-4 and AF4386-16 were moderately susceptible to PVY based on their low infection levels in the inoculated trial (1.7%). Both had normal symptom expression.

AF4138-8, AF4296-3, AF4342-3 were susceptible (~10% infection), while AF4532-9 was very susceptible (30%). PVY symptom expression was weak in all of these varieties during 2015. Symptoms were visible, but inconsistent in AF4138-8, AF4296-3, and AF4532-9; however, symptom expression was very poor in AF4342-3. AF4296-3 and AF4342-3 also had the weakest symptom expression in the 2013/2014 PVY trial. I would recommend caution and use of lab testing as seed production of AF4296-3 continues. My recommendation is to remove AF4532-9 and AF4342-3 from commercialization trial and variety development partly due to their PVY problems.

The same approach was used in 2015-2016 PVY screening experiment (Table 2) though "grow out" results won't be available until summer 2016. The varieties screened were: Norwis, Russet Burbank, Russet Norkotah, AF4124-4, AF4124-7, AF4138-8, AF4296-3, AF4342-3, AF4386-16, andAF4532-9. During 2014, we tested background PVY infection levels and found that the incoming seedlots of Norwis, R. Burbank, AF4124-4, AF4124-7, and AF4398-16 were free of PVY. The remaining lots had PVY incidence ranging from 1.7 to 11.7%. Symptom expression was weak, especially during early rating dates, for Russet Norkotah, AF4296-3, AF4342-3, and AF4532-9. AF4296-3 and AF4342-3 are promising processing clones. Their PVY symptom expression will continue to be monitored, while processor interest remains high. AF4532-9 will be dropped due to marginal agronomic performance during 2014 and weak PVY symptom expression. AF4138-8 has pale foliage and was relatively hard to read during 2014, but has been acceptable during past seasons.

Table 1. Summary Results from the 2014-2015 PVY Susceptibility and Symptom Expression Study

	2014 Field-season Evaluation		2015 Plant-back from 2014 PVY Spread Study				
			ELISA	Field Reading[1]		Disease	Symptom
	Visual % Mos.	ELISA % PVY	% PVY	7/9	7/15	Reaction	Expression
Norwis	0.0	0.0	1.7	5.0	3.3	R	n/a
R. Burbank	0.0	0.0	8.3	6.7	8.3	S	weak
R. Norkotah	1.7	1.7	6.7	6.7	3.3	S	very weak
AF4124-4	0.0	0.0	1.7	1.7	3.3	S	good
AF4124-7	1.7	0.0	0.0	0.0	1.7	S in past	n/a
AF4138-8	10.0	5.0	10.0	6.7	6.7	S	weak
AF4296-3	6.9	10.3	13.3	16.7	16.7	S	very weak
AF4342-3	5.0	3.4	12.2	1.7	1.7	S	latent
AF4386-16	1.7	0.0	1.7	0.0	1.7	S	weak
AF4532-9	8.3	11.7	30.0	41.7	36.7	VS	weak

[1]Total 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 2015-2016 PVY Susceptibility and Symptom Expression Study (initial seedlot PVY symptoms and infections)

	2015 Field-season Visual Symptoms[1](%)			July 17	Expected	Symptom
	7/9	7/15	8/6	ELISA % PVY	Disease Reaction	Expression
Norwis	0.0	0.0		0.0	R	n/a
R. Burbank	0.0	0.0		0.0	S	n/a
R. Norkotah	3.3	0.0		3.3	S	weak
AF4296-3	3.4	0.0		23.3	S	latent
AF4342-3	0.0	0.0		0.0	S	n/a
AF4532-9	3.4	9.8		12.5	S	weak
AF4648-2	0.0	0.0		0.0	R	n/a
AF4659-12	0.0	0.0		0.0	S	n/a
AF4953-6	0.0	0.0		0.0	S	n/a
AF4985-1	8.6	6.9		10.2	S	good

[1]Total of obvious and mild symptoms. Herbicide injury and rhizoctonia created some false positives. Approximately 60 plants per cultivar.

Future Plans:

We hope to continue this program during the 2016 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.