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

Evaluation of New Potato Varieties (2014 Growing Season)

Investigators:

Gregory A. Porter and Paul C. Ocaya; School of Food & Agriculture, University of Maine.

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 2014, 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 2014, 19 commercial-scale trials were conducted representing 10 new potato varieties (4 chippers, 1 round-white, 2 russets, 1 red, and 2 specialty types) and 92 acres. The varieties by market classification were: chippers – AF4157-6, NY140, and NY148; fresh market and out-of-field chipper – Sebec (AF0338-17); russets and processing types – AF3362-1, and Easton (AF3001-6); reds -- Dakota Ruby; fresh market, round-white – AF4138-8; and two specialty types – NY150 and 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 conducted within this project. The trials were used to evaluate the relative susceptibility and symptom expression of 10 varieties during 2014. AF4138-8 was moderately susceptible to PVY, while all other clones could be judged as susceptible or very susceptible. The standard varieties Norwis (R), Russet Burbank (S), and Russet Norkotah (VS) behaved as expected. Most of the susceptible varieties showed good symptom expression during 2014, though symptom expression of all clones improved as the plants grew and the season progressed. Russet Norkotah and two experimental russets, AF4296-3 and AF4342-3, had the weakest symptom expression in the trial. In all three clones, symptom expression improved as the plants grew and the season progressed. AF4296-3 and AF4342-3 have been flagged for weak symptom expression and will be monitored carefully during 2015.

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, 38 clones and varieties) and northern Aroostook County (St. Agatha, Labrie Farms, 87 clones and varieties). This work compliments trials conducted at Aroostook Research Farm in Presque Isle (63 clones and varieties). 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 Aroostook Research Farm 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 regional and 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 2014 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 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 scab, PVY, and GN resistant. It also has moderate late blight and pink rot resistance.
NY148	Also known as NYE106-4, this clone is late maturing with good yields, gravity, and chip color. Tubers are round with a relatively dark, netted skin. It has relatively little hollow heart, but can get internal heat necrosis. It has scab, PVY, and GN resistance, but is susceptible to shatter and blackspot bruise.
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.
Other	Promising chipping candidates that will be tested again in 2015: AF4442-4 (mid-season, verticillium resistance, good appearance, marginal specific gravity); BNC182-5 (good yields,

gravity, and tuber size, probably more of a southern chipper than one for northern areas); AF4975-3 (high yields, good gravity and chip color, good in 2013 national trials, but not in 2014); AF5040-8 (high yields, good gravity and chip color, outstanding in 2014 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, large tuber size, low external defects, moderately susceptible to scab**.**
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 scab resistance plus PVY and GN resistance. It also has moderate late blight and pink rot resistance.
Other	Promising fresh market whites that will be tested again in 2015: MSQ086-3 (late maturity, late blight resistance, good yields, pretty); AF5280-5 (medium early, bright, moderate scab resistance, large tubers).

Russets or Long Whites

D. Trailblazer	A long to oblong russet that could possibly go dual purpose; good yields, good sizing, late blight and verticillium resistance, very late vine.
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 high yields, good appearance, and good processing potential. It has moderate scab and fuarium resistance, but is reportedly susceptible to shatter bruise and softrot.
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.
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 2015: AF4113-2 (long white, processing, bright appearance); AF4124-7 (russet, processing, large tubers, possible dual purpose); AF4172-2 (russet, processing, smaller tuber size profile, bruise resistant, possible dual purpose); AF4609-1 (long white, high yields, AF4872-2 (russet, good yields and excellent processing quality); AF4950-2 (russet, good yields and excellent processing quality, some hollow heart); AF4953-6 (russet, good yields, possible dual-purpose); and many more coming.

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.
Other	Promising red and specialty candidates that will be tested again in 2015: AF4550-2 (purple, white flesh); AF4985-1 (red, white flesh). B2676-2 (red, white flesh), nice appearance, but too many misshapes and too susceptible to blackspot. NY136 (red skin, white flesh), nice red skin, but too susceptible to external defects and skinning. BNC244-10 (purple and yellow skin, mottled purple flesh), interesting appearance, but mixed reviews on mottled, light purple flesh.

2014 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 2014, 19 commercial-scale trials were conducted representing 10 new potato varieties (4 chippers, 1 round-white, 2 russets, 1 red, and 2 specialty types) and 92 acres. The varieties by market classification were: chippers – AF4157-6, NY140,

and NY148; fresh market and out-of-field chipper – Sebec (AF0338-17); russets and processing types – AF3362-1 and Easton (AF3001-6); reds -- Dakota Ruby; fresh market, round-white – AF4138-8; and two specialty types – NY150 and 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) 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 2014 results by clone:

Dakota Ruby This is a pretty red for fresh market. It was in a 2014 seed grower trial. Early and late-season vigor were good. The grower reported very good tuber appearance, smooth bright skin, good yields, small tuber size, and no significant defect problems. The grower expressed concern about the late maturity for a red and subsequent skinning susceptibility. It was grown with N at 90 lbs/A and a 10-inch seedpiece spacing.

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.

AF3362-1 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 2014. 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.

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. 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. 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.

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.

NY140 This is a late-season chipping and fresh market clone with large tubers that can run to oblong shapes. It has high yields, good internal quality, and moderate to moderately-low specific gravity. Scab susceptibility is a weakness. 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. Tubers were large, round, and bright. The grower felt that it could go well for fresh market. Late maturity and skinning were observed. The grower had used 156 lbs N per acre and felt that a lower rate may be needed for seed production. In Maine, NY140 does best for chipping when grown with a 8-inch or slightly wider seedpiece spacing and moderate N rates.

NY148 Also known as NYE106-4, this clone is late maturing with good yields, gravity, and chip color. Tubers are round with a relatively dark, netted skin. It has relatively little hollow heart, but can get internal heat necrosis. It has scab, PVY, and GN resistance, but is susceptible to shatter and blackspot bruise. It was in a seed grower trial in 2014. Slow emergence was noted and late-season vigor was fair. The tubers were dark, heavily netted, round, and fairly large. It had good yields and no significant tuber defects. The grower had used 156 lbs N per acre and felt that it may need a bit more N. In Maine, NY148 does best for chipping when grown with a 10-inch seedpiece spacing and moderate N rates; however, growers will need to be very careful during harvest and handling as there is evidence that this clone is very susceptible to bruising.

NY150 This clone produces very small, bright "creamer-type" white-skinned potatoes. It has PVY, scab (moderate resistance), and GN resistance. It was in a seed grower trial in 2014. It had good early- and late-season vigor. The tubers were small, bright, and round. No significant defect problems were noted. The small tubers create harvest challenges; however, there is interest in specialty "creamer" potatoes and this clones fits this market well.

Variety Description, Management Profiles, Management Studies. Variety descriptions and profiles were recently developed for six of the top clones in the program. Three of the clones remain in the program. 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 will be posted on our project website (under development).

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 (presumably PVY_0) per plot served as inoculum. 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 did 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 - res , Russet Burbank - susc, and Russet Norkotah - susc). The inoculation system continued to work well. PVY infection increased from 2013 to 2014 in 8 of 9 susceptible varieties in the experiment.

Results of the 2013-2014 PVY experiments showed that all of the test clones were susceptible to PVY (Table 1). AF4138-8 was moderately susceptible while all other clones could be judged as susceptible or very susceptible. The standard varieties Norwis (R), Russet Burbank (S), and Russet Norkotah (VS) behaved as expected. Most of the susceptible varieties showed good symptom expression during 2014, though symptom expression of all clones improved as the plants grew and the season progressed (%ELISA versus % obvious mosaic symptoms for July 17, July 24, and August 6 were 3.0, 2.4 and -2.4%, respectively). Russet Norkotah and two experimental russets, AF4296-3 and AF4342-3, had the weakest symptom expression in the trial. In all three clones, symptom expression improved as the plants grew and the season progressed. These two processing clones have been flagged for weak symptom expression and will be monitored carefully during 2015.

The same approach was used in 2014-2015 PVY screening experiment (Table 2) though "grow out" results won't be available until summer 2015. 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 2013-2014 PVY Susceptibility and Symptom Expression Study

	2013 Field-season Evaluation		2014 Plant-back from 2013 PVY Spread Study				
			ELISA	Field Reading[1]		Disease	Symptom
	Visual % Mos.	ELISA % PVY	% PVY	7/24	8/6	Reaction	Expression
Norwis	0.0	0.0	1.7	0.0	0.0	R	n/a
R. Burbank	8.5	5.0	8.3	8.3	8.3	S	Good
R. Norkotah	0.0	0.0	19.0	23.5	26.8	VS	Weak early
AF4013-3	10.0	11.7	11.7	20.0	21.7	S	Good
AF4124-7	1.7	1.7	9.1	12.6	16.3	S	Good
AF4138-8	0.0	0.0	5.0	6.7	13.3	MS	Good
AF4157-6	0.0	0.0	23.6	22.9	21.2	VS	Good
AF4172-2	1.7	0.0	17.5	19.2	19.2	VS	Good
AF4296-3	0.0	3.4	23.3	22.0	27.2	VS	Weak early
AF4342-3	0.0	0.0	13.3	6.7	20.0	S	Weak early

[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 2014-2015 PVY Susceptibility and Symptom Expression Study (initial seedlot PVY symptoms and infections)

	2014 Field-season Visual Symptoms[1](%)			July 17 ELISA % PVY	Expected Disease Reaction	Symptom Expression
	7/17	7/24	8/6			
Norwis	0.0	1.8	0.0	0.0	R	n/a
R. Burbank	26.7	1.7	0.0	0.0	S	n/a
R. Norkotah	0.0	0.0	1.7	1.7	S	weak early, better late
AF4124-4	20.0	0.0	0.0	0.0	S	n/a
AF4124-7	0.0	0.0	1.7	0.0	S	n/a
AF4138-8	3.3	1.7	10.0	5.0	MS	n/a
AF4296-3	0.0	0.0	6.9	10.3	S	weak early, better late
AF4342-3	1.7	0.0	5.0	3.4	S	weak early, better late
AF4386-16	6.7	0.0	1.7	0.0	S	n/a
AF4532-9	1.7	5.0	8.3	11.7	S	weak early, better late

[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 2015 growing season with: 1) small-plot variety trials conducted in Exeter, St. Agatha, and Presque Isle; 2) commercial challenge grants for the most promising lines identified from research trials. Our goal is to support approximately 14 commercial trials during 2015 at $750 each. We will again request support for the grower grants ($10,500) from the Maine Department of Agriculture]; and 3) research on PVY susceptibility and symptom expression.