

2015 Research Progress Report to Maine Potato Board

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Screening Potato Varieties for Pink Rot, Soft Rot, and Dry Rot Resistance

1. Pink rot trial

A field trial was conducted in Aroostook Research Farm, Presque Isle, ME in 2015, in studying pink rot resistance of 25 varieties of potato. Randomized complete block design was applied in the trial with three blocks. Plots size was one 3-ft-wide row with 10 feet in length and one foot of plant space. Inoculum of *Phytophthora erythroseptica* were prepared before planting. Three isolates of *P. erythroseptica* were incubated in mushroom spawn bags containing 6 L of vermiculite, and 3 L V8 broth (200 ml low sodium V8, 800 ml of distilled water, 2 g CaCO₃, and 30 µg β-sitosterol per liter) for four weeks at 22°C. During planting, six liters of vermiculite inocula of *P. erythroseptica* were evenly hand-distributed in-furrow in each row. Fertilizer (N:P:K = 14:14:14) was applied at 1,100 lb/A. All plots were treated with insecticides and herbicides as standard practice to the area. Bravo WeatherStik (1260 ga/ha) was applied to the foliage during the season to prevent the spread of late blight. The emergence and vigor of potato were evaluated on 26 June. The plant vigor was estimated relative to the plot with the best vigor in each block. Potato vines were killed on 25 August. Potato tubers in each plot were harvested on 5 September. The harvested tubers were examined for disease and yield. Pink rot was evaluated by calculating the incidence of disease. Data were analyzed using SAS (version 9.2). Tukey's range test was performed to separate means and compare the effects of treatments at $\alpha = 0.05$. Results showed that Pike and Snowden are tolerant to pink rot, but 'Red Gold', 'Russet Norkotah', and 'Dark Red Norland' are more susceptible. Some breeding lines, such as AF4648-2, AF4157-6, and several others were tolerant to pink rot (Table 1).

Table 1. Evaluation of potato varieties and lines in response to pink rot

Variety	Emergence	Vigor (%)	Yield (cwt/A)	Disease index (%)
AF0338-17	9.7 a ^z	88.3 ab	332.9 abc	1.0 cd
AF3001-6	9.3 a	73.3 abcd	352.7 a	10.7 abcd
AF3317-15	10.0 a	90.0 ab	292.3 abc	1.9 cd
AF3362-1	9.3 a	81.7 abc	333.7 abc	3.1 bcd
AF4124-7	7.3 ab	78.3 abc	190.5 abcde	15.8 ab
AF4138-8	10.0 a	85.0 ab	255.0 abcd	4.0 abcd
AF4157-6	9.7 a	93.3 ab	252.8 abcd	0.3 d
AF4172-2	6.7 ab	30.0 de	233.1 abcde	3.0 bcd
AF4296-3	5.0 ab	38.3 cde	263.4 abcd	1.8 cd
AF4648-2	8.7 a	81.7 abc	319.8 abc	0.4 cd
AF4953-6	7.0 ab	55.0 bcd	296.1 abc	5.1 abcd
AF4975-3	9.7 a	100.0 a	349.6 ab	3.5 abcd
AF4985-1	5.0 ab	30.0 de	162.8 cde	9.9 abcd

AF5215-2	9.7 a	90.0 ab	337.2 abc	1.9 cd
AF5225-1	2.3 b	10.0 e	60.1 e	13.6 abc
AF5275-1	8.7 a	58.3 abcd	198.9 abcde	2.1 cd
AF5278-3	9.3 a	68.3 abcd	254.4 abcd	2.8 bcd
AF5280-5	9.0 a	91.7 ab	267.6 abcd	1.2 cd
AF5320-1	10.0 a	85.0 ab	245.0 abcde	2.1 cd
Atlantic	4.7 ab	31.7 de	164.9 bcde	1.4 cd
Dark Red Norland	8.3 a	68.3 abcd	228.7 abcde	5.8 abcd
Pike	6.7 ab	60.0 abcd	248.3 abcd	0.0 d
Red Gold	10.0 a	98.3 ab	99.8 de	16.8 a
Russet Nortkotah	9.7 a	81.7 abc	170.2 abcde	10.0 abcd
Snowden	9.7 a	85.0 ab	343.1 abc	2.7 bcd

^z Mean values with different letters are significantly different ($\alpha = 0.05$).

2. Fusarium trial

The experiments were conducted under laboratory conditions at the University of Maine, Orono, ME in 2015. 34 potato varieties were tested for *Fusarium* dry rot resistance in the lab. One *Fusarium* isolate obtained from diseased potato tuber on Aroostook farm, Presque Isle, ME was used as inoculum for this project. *Fusarium* spp. isolate was grown on potato dextrose agar (PDA) plate and incubated at 22 ± 2 °C for six days. 2 ml sterile distilled water was poured on the plate to wash and harvest conidia. The final concentration of spore suspension was adjusted to 10^6 conidia/ml. Six disease-free potato tubers of each variety were used in this experiment (3 as control, 3 as treatment). The tubers were surface-disinfected with 0.6% sodium hypochlorite and rinsed three times with sterile distilled water. Each tuber was inoculated at three points between the stem and the bud end, with 0.1 ml of spore suspension. Sterile hole puncher was used to make three 5 mm deep wound on the tuber. Then the tuber tissue inside the wound was removed to make a 5x5 mm hole on the tuber. 100 ul spore suspension was added to each hole on the tuber. Sterile water was used as control. Then the holes were covered with the removed tuber tissue. Vaseline was used to completely close the holes after inoculation. The treated tubers were incubated for 6 weeks at 10°C. The tubers were cut through the inoculation points and the size of extended rot lesion was measured using a ruler. Data were analyzed using SAS (version 9.2). Tukey's range test was performed to separate means and compare the effects of treatments at $\alpha = 0.05$.

Table 2. Evaluation of potato varieties and lines in response to *Fusarium* dry rot

Variety	Lesion size (mm)	Variety	Lesion size (mm)	Variety	Lesion size (mm)
AF0338-17	7.33 a ^z	AF4615-5	2.06 bcd	Katahdin	1.78 bcd
AF4659-12	6.17 ab	AF4552-5	3.50 abcd	AF4040-2	2.11 bcd
Green mountain	4.83 abc	AF4172-2	3.44 abcd	AF4198-2	1.78 d
AF3001-6	4.50 abcd	AF4442-4	3.39 abcd	AF3362-1	2.00 bcd
AF4124-7	0.78 cd	AF4138-8	3.22 abcd	AF4950-2	1.72 bcd
AF3317-15	4.00 abcd	Shepody	3.11 abcd	AF4975-3	1.61 bcd
AF4157-6	1.78 d	Atlantic	1.83 bcd	AF4609-1	2.72 abcd
AF4872-2	3.56 abcd	Dark Red Norland	4.17 abcd	Sebago	2.67 abcd

AF4296-3	1.56 bcd	Yukon Gold	1.00 cd	AF4532-9	1.56 bcd
AF4648-2	0.72 cd	AF4342-3	0.83 cd	AF4113-2	1.11 cd
AF4953-6	1.50 bcd	Russet Burbank	0.44 cd	Snowden	9.70 bcd
AF4124-4	0.33 cd				

^z Mean values with different letters are significantly different ($\alpha = 0.05$).

3. Soft rot trial

The experiments were conducted under laboratory conditions at the University of Maine, Orono, ME in 2015. 34 potato varieties were tested for dry rot/blackleg resistance in the lab. *Dickeya dadantii* strain 3937 was used as inoculum for this project. 3937 was grown on tryptic soy agar (TSA) plate and incubated at 22 ± 2 °C for 24 hours to get the pure culture. A single colony was transferred to autoclaved 15 ml tube containing 10 ml triptic soy broth (TSB), and multiplied in TSB at 28 ± 2 °C over night. Disease-free potato tubers of each variety were washed using tap water and cut vertically into 5 mm thick discs. The discs were surface-disinfected with 0.6% sodium hypochlorite and rinsed three times with sterile distilled water. Sterile hole puncher was used to make 5 mm deep wound on the tuber slice. 40 ul bacterial suspension was added to each hole on the tuber slice. Sterile water was used as control. The treated tubers were incubated in a mist chamber for 3 days at 22 ± 2 °C. After incubation the size of extended rot lesion was measured using a ruler. Data were analyzed using SAS (version 9.2). Tukey's range test was performed to separate means and compare the effects of treatments at $\alpha = 0.05$. Results showed that AF4615-5 was the most tolerant to soft rot, followed by AF4552-5, AF4198-2, AF4609-1, and 'Norland.'

Table 3. Evaluation of potato varieties and lines in response to soft rot

Variety	Lesion size (mm)	Variety	Disease index (%)	Variety	Disease index (%)
AF0338-17	32.1 ab ^z	AF4615-5	3.9 i	Katahdin	19.9 bcdefgh
AF4659-12	14.4 fgghi	AF4552-5	11.8 hi	AF4040-2	20.8 bcdefgh
Green					
mountain	15.9 efghi	AF4172-2	22.9 bcdefgh	AF4198-2	12.4 hi
AF3001-6	17.3 cdefgh	AF4442-4	29.8 abcd	AF3362-1	21.3 bcdefgh
AF4124-7	22.6 bcdefgh	AF4138-8	14.4 fgghi	AF4950-2	26.1 abcdef
AF3317-15	20.3 bcdefgh	Shepody	17.4 cdefgh	AF4975-3	23.6 abcdefgh
AF4157-6	19.6 bcdefgh	Atlantic	23.8 abcdefgh	AF4609-1	12.9 ghi
		Dark Red			
AF4872-2	27.8 abcde	Norland	12.1 hi	Sebago	24.3 abcdefgh
AF4296-3	28.9 abcd	Yukon Gold	25.1 abcdefg	AF4532-9	18.8 cdefgh
AF4648-2	15.3 efghi	AF4342-3	29.8 abc	AF4113-2	17.1 defgh
AF4953-6	35.4 a	Russet Burbank	17.9 cdefgh	Snowden	14.6 fgghi
AF4124-4	25.3 abcdefg				

^z Mean values with different letters are significantly different ($\alpha = 0.05$).