

Research Progress Report to Maine Potato Board

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

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**1. Pink rot trial**

A field trial was carried out on Aroostook Research Farm in Presque Isle in 2017. All 28 clones and 6 standard varieties were used. Potato seed pieces were planted on 19 May, with 10 seed tubers per clone or variety at one-foot planting spacing. Each row was inoculated with 1.5 L of artificially prepared inoculum of mefenoxam-sensitive *Phytophthora erythroseptica* isolates in the furrow. Three replications were applied. Fertilizer (N:P:K = 14:14:14) was applied at 1,100 lb/A. All plots were treated with Bravo Weather Stik (a.i. chlorothalonil) at 16 fl oz product/A and Blackhawk (a.i. spinosad) at 3.6 oz/A to control late blight and insects, respectively, during the season. Emergence was evaluated on June July 7. Potato vines were killed by the application of Reglone on August 21. Potato tubers were dug up by a harvester on September 13 and stored for 25 days. The severity of harvested tubers was rated for pink rot on October 8. The rating scale for disease was based on the percentage of rotted area on tubers: 0 (no symptom), 1 (1 to 5%), 2 (6 to 25%), 3 (26 to 50%), 4 (51 to 75%), and 5 (< 75%). Disease index =  $100 \times \sum(r \times n \times i) / (N \times 5)$ , where N = total number of plants evaluated, r is the level of severity from 0 to 5, and i = specific level of severity (from 0 to 5), n = number of corresponding grade plants evaluated. Data were analyzed using R statistical package (R Foundation for Statistical Computing, Vienna, Austria) and ANOVA with Fisher’s LSD were used to compare the effects of treatments on emergence and yield data at  $\alpha = 0.05$  and Wilcoxon test for disease data at a significance level  $\alpha = 0.05$ .

Some varieties and clones showed highly resistant to pink rot. These potato materials included ‘Atlantic’, ‘Snowden’, ‘Russet Norkotah’, AF4648-2,

**Table 1.** Resistance evaluation of different potato varieties on pink rot.

Variety/clone	Emergence (%)	Total yield (lb)	Pink rot index
AF5179-4	57 ghi <sup>z</sup>	7.90 bcdef	2.33 a
AF4659-12	73 cdefgh	6.28 cdef	1.67 ab
AF5468-5	93 abc	2.89 f	1.67 ab
AF5406-10	87 abcd	10.03 abcde	1.67 ab
AF5225-1	96 ab	5.58 def	0.67 bc
AF4552-5	93 abc	14.45 a	0.67 bc
AF5164-19	93 abc	7.99 bcdef	0.67 bc
AF5280-5	80 abcdef	9.20 abcde	0.67 bc
AF5429-3	87 abcd	9.16 bcde	0.67 bc
AF4831-2	87 abcd	13.16 ab	0.67 bc
Pike	77 bcdefg	12.16 ab	1.00 bc
AF5091-8	63 efghi	8.64 bcde	0.67 bc
AF4872-2	70 defgh	8.73 bcde	0.67 bc
AF5407-13	67 defghi	9.30 abcde	1.00 bc
WAF10073-3RUS	53 hi	8.87 bcde	0.33 c
AF5312-1	80 abcdef	12.88 ab	0.33 c
AF5071-2	63 efghi	5.14 ef	0.33 c

Variety/clone	Emergence (%)	Total yield (Ib)	Pink rot index
AF5040-8	93 abc	5.87 cdef	0.33 c
Red gold	63 efghi	2.80 f	0.33 c
AAF07521-1	70 defgh	5.18 ef	0.33 c
NDAF102629C-4	83 abcde	10.39 abcde	0.00 c
AF4157-6	70 defgh	10.84 abcd	0.00 c
Dark Red Norland	93 abc	9.92 abcde	0.00 c
AF3317-15	80 abcdef	8.89 bcde	0.00 c
AF5450-7	63 efghi	8.16 bcde	0.00 c
AF5245-1	93 abc	10.87 abc	0.00 c
AF4172-2	60 fghi	8.91 bcde	0.00 c
AAF08434-1	60 fghi	9.34 abcde	0.00 c
NDAF092412-3	73 cdefgh	12.71 ab	0.00 c
AF5406-7	70 defgh	9.29 abcde	0.00 c
AF4648-2	57 ghi	10.24 abcde	0.00 c
Russet Norkotah	57 ghi	6.41 cdef	0.00 c
Snowden	47 i	8.03 bcdef	0.00 c
Atlantic	100 a	10.62 abcd	0.00 c

<sup>z</sup> Mean values within each column followed by different letters are significantly different ( $P < 0.05$ ).

## 2. Fusarium dry rot trial

The study was conducted under laboratory conditions at the University of Maine, Orono, ME in 2017. from February 15 to March 21, 2017. *Fusarium* sp. strain 14B16 was grown on PDA plates at 25°C for 1 wk. To prepare an inoculum, the culture was washed by adding 50 mL sterile distilled H<sub>2</sub>O, and scratched by using a glass hockey rod. Residual mycelia were removed and poured through Miracloth attached to a funnel, followed by centrifugation for 10 min at 5000 g, with the supernatant discarded, the precipitate was resuspended by sterile H<sub>2</sub>O. The number of conidia present was detected using a hemacytometer and the final concentration of conidia was adjusted to 10<sup>5</sup> spores/mL. Total of 34 potato clones and 6 commercial varieties were tested. There were 3 replicates per variety. The tubers were surface-disinfected with 0.6% sodium hypochlorite and rinsed three times with sterile distilled water. Tubers were wounded by removal of a plug of tissue with a cork borer, 3 mm in diameter and 5 mm deep, then inoculated with 100 µl of a conidial suspension. Sterile water was used for control. The inoculated tubers were placed in a closed container on an egg crate with wet paper towels underneath, then incubated in an incubator with 100% humidity. Each tuber was labeled either directly with a marker or a sticker. Disease severity was recorded 21 days after incubation by measuring the lesion size after cutting the tuber across the inoculation point. Data were analyzed using SAS.

Af3001-6, AF5091-8, ‘Yukan Gold’, and ‘Russet Burbank’ were most tolerant to dry rot, while AF0752-1 and ‘Atlantic’ were the most susceptible materials.

**Table 2.** Resistance evaluation of different potato varieties on dry rot measured by lesion area [(lesion length x wide) – (control length x wide) on tubers.

Potato	Lesion (cm <sup>2</sup> ) <sup>x</sup>	StdDev	Potato	Lesion (cm <sup>2</sup> )	StdDev
<b>AF3001-6</b>	-0.7 h	0.28	AF4648-2	0.93 bcdefgh	0.26
<b>AF5091-8</b>	-0.2 gh	0.12	AF3362-1	0.99 bcdefgh	0.35
<b>Yukan Gold</b>	0.00 gh	1.05	Dark red Norland	1.00 bcdefgh	0.27
<b>Russet Burbank</b>	0.07 fgh	0.33	AF5414-1	1.10 bcdefgh	0.40

Potato	Lesion (cm <sup>2</sup> ) <sup>x</sup>	StdDev	Potato	Lesion (cm <sup>2</sup> )	StdDev
AF4552-5	0.13 fgh	0.05	AF5245-1	1.10 bcdefgh	0.21
WAF10073-3	0.15 fgh	0.07	AF5040-8	1.14 bcdefgh	0.07
AF5450-7	0.22 fgh	0.32	AF5164-19	1.14 bcdefgh	0.22
AF5225-1	0.28 fgh	0.35	AF5312-1	1.15 bcdefgh	1.38
AF5179	0.29 fgh	0.14	Shepody	1.20 bcdefgh	0.24
AF5071-2	0.32 fgh	0.5	AF5407-13	1.32 bcdefgh	1.41
NAAF102629C-4	0.32 fgh	0.09	AF08434	1.35 bcdefgh	0.72
AF4127-7	0.44 efgh	1.42	AF5412-3	1.73 bcdefgh	1.53
Katadia	0.46 efgh	0.17	AF4172-2	1.86 bcdefg	1.43
AF5406-7	0.50 efgh	0.4	AF4438-8	2.18 bcdefg	1.06
AF4872-2	0.61 defgh	0.39	AF5429-3	2.22 bcdef	0.84
Snowden	0.66 defgh	0.24	AF5406-10	2.59 bcde	0.40
AF4296-3	0.81 cdefgh	0.39	AF4659-12	2.67 bcd	1.88
Green Mountain	0.81 cdefgh	0.19	AF0338-17	2.85 bc	2.28
AF5468.2	0.85 bcdefgh	0.1	AF4831-2	3.01 b	1.75
Sebago	0.87 bcdefgh	0.34	Atlantic	5.39 a	5.72
AF5280-5	0.90 bcdefgh	0.78	AF0752-1	7.14 a	2.74

<sup>x</sup> Mean values followed by different letters are significantly different ( $P < 0.05$ ).

### 3. Soft rot trial

Potato varieties were tested for Soft Rot resistance, using two isolates: *Pectobacterium parmentieri* (i.e. *Pectobacterium wasabiae*) strain WPP163 and *Dickeya dianthicola* strain ME30. Inoculum was prepared by incubating each isolate in a 50 ml tube with sterile tryptic soy broth overnight on a shaker at 180 rpm at 28°C. Three replications were used for each variety. Using a sterile 1-ml pipette tip, 1-cm-deep hole was punched on two sites along the middle line of the tuber. Inoculum (20 µl) of each isolate was placed inside a hole, so that each tuber was inoculated with both isolates, and dielectric grease was used to cover the holes and avoid loss of moisture. The tubers were placed in a 28°C incubator for 3 days, after which they were cut transversally and the decayed tissue was measured in depth and width, and the two measurements multiplied. Varieties were compared within isolates using Tukey's HSD mean comparison,  $\alpha = 0.05$ .

No test varieties showed complete resistance for soft rot pathogens, although there were different levels of susceptibility (Table 3). For *Pectobacterium parmentieri* (*wasabiae*) WPP163, AAF 08434-1 was the most susceptible, followed by AAF 07521-1 (6.17 cm), while the most tolerant were 'Green Mountain' and WAF 10073-3. For *Dickeya dianthicola* ME30, AAF 0752-1 was the most susceptible variety (6.85cm), followed by AF 5468-5 (6.74 cm) while the most tolerant were AF 5179-4 and 'Snowden'.

**Table 3.** Responses of potato varieties and clones to the inoculation of *Dickeya dianthicola* ME30 and *Pectobacterium parmentieri* WPP163 measured by lesion area (length x wide) on tubers.

Potato	ME30 (cm <sup>2</sup> )	WPP163 (cm <sup>2</sup> )	Potato	ME30 (cm <sup>2</sup> )	WPP163 (cm <sup>2</sup> )
AAF 07521-1	6.85 a	6.17 ab	Russet Burbank	2.80 cdefg	4.01 abcde
AF 5468-5	6.74 ab	3.12 bcde	AF 4124-7	2.42 cdefg	4.76 abcde

<b>Potato</b>	<b>ME30 (cm<sup>2</sup>)</b>	<b>WPP163 (cm<sup>2</sup>)</b>	<b>Potato</b>	<b>ME30 (cm<sup>2</sup>)</b>	<b>WPP163 (cm<sup>2</sup>)</b>
AF 4659-12	4.74 abc	4.09 abcde	AF 4552-5	2.28 cdefg	4.69 abcde
AF 5406-10	4.69 abcd	4.40 abcde	F 4157-6	2.23 cdefg	4.69 abcde
AF 4172-2	4.49 abcde	3.34 bcde	AF 5280-5	2.22 cdefg	4.00 abcde
AAF 08434-1	4.32 abcdef	7.05 a	AF 3362-1	2.16 cdefg	3.00 bcde
AF 5071-2	4.30 abcdef	4.34 abcde	AF 5245-1	1.99 cdefg	3.60 abcde
AF 5212-3	3.94 abcdefg	4.89 abcde	AF 0338-17	1.98 cdefg	5.15 abcde
AF 5164-19	3.87 abcdefg	3.66 abcde	NDAF102629C4	1.95 cdefg	4.04 abcde
Yukon Gold	3.83 abcdefg	4.45 abcde	AF 5429-3	1.90 cdefg	2.59 cde
AF 4296-3	3.80 abcdefg	5.40 abcd	AF 4648-2	1.83 cdefg	4.54 abcde
AF 5312-1	3.64 abcdefg	4.14 abcde	AF 4872-2	1.79 cdefg	3.34 bcde
AF 5406-7	3.55 bcdefg	4.58 abcde	Sebago	1.74 cdefg	3.70 abcde
AF 5450-7	3.50 bcdefg	5.41 abcd	WAF 10073-3	1.55 cdefg	1.90 e
AF 5414-1	3.45 cdefg	3.96 abcde	AF 5091-8	1.53 cdefg	4.24 abcde
Atlantic	3.40 cdefg	4.33 abcde	Dark Red Norland	1.46 defg	2.23 de
AF 4831-2	3.35 cdefg	4.47 abcde	Green Mountain	1.40 efg	1.80 e
AF 5225-1	3.24 cdefg	5.25 abcde	Shepody	1.26 efg	2.44 de
AF 5040-8	3.06 cdefg	6.05 abc	Katahdin	1.21 fg	3.70 abcde
AF 3001-6	3.01 cdefg	3.80 abcde	Snowden	1.05 g	2.85 bcde
AF 5407 - 13	2.81 cdefg	6.01 abc	AF5179-4	1.00 g	1.98 de
AF 4438-8	2.80 cdefg	4.73 abcde			

Means with different letters are significantly different ( $P < 0.05$ ).