Assessment of SaniDate 5.0 application and varietal resistance for potato postharvest disease management in Michigan, 2020-21

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Maintenance of tuber quality over the duration of storage season is important in potato production. In 2021, Michigan produced 20 million cwt of potatoes, with 62% tubers in storage as of December (USDA-NASS, 2021). Postharvest loss occurs each year due to tuber shrinkage and storage disease; in 2020, 8% of stored tubers from December 2019 were reported lost by June the following year. The following experiments were conducted to identify potential management practices to reduce losses to major postharvest diseases.

Materials and Methods

Objective 1: Assessment of SaniDate 5.0 on storage disease management

Potato cv. Mackinaw was inoculated with *Fusarium sambucinum* (Fusarium dry rot), *Pythium ultimum* (Pythium leak), *Phytophthora erythroseptica* (pink rot), and *Pectobacterium carotovorum* (bacterial soft rot), and potato dextrose broth (PDB) as control. Fungal and oomycete cultures (1/4 strength potato dextrose agar and green pea agar, respectively) were grown at ambient room temperature under an 8-hour photoperiod for approximately two weeks. Spore suspensions were prepared in sterile deionized water at a concentration of 2×10^8 conidia or sporangia/ml. Bacterial inoculum was grown in PDB to an optical density corresponding to 8.40×10^9 cfu/ml (OD_{600} = 0.3-0.4). Tubers were washed with two rinses in tap water, one-minute submersion in 10% bleach solution, and one rinse in deionized water, and dried overnight before inoculation. Apical and basal sites were inoculated with 10 µl of inoculum suspensions using a Hamilton glass syringe. Three inoculated tubers were placed in plastic mesh bags and suspended within another mesh bag containing ten non-treated tubers. Samples were suspended in bins 8 and 9 (625 cwt each) in at the MPIC Cargill Potato Demonstrations Storage Facility (95% RH, 48°F) for seven months. Four treatment replicates were arranged at pile depths of 0, 4, 8, and 12-ft. Bin 9 was treated 10 days post-loading with SaniDate 5.0 at 0.95 fl. oz per ton of potatoes via fog application (Gun Valley Ag. & Industrial Services, Inc.). After storage, disease development was assessed by measuring symptomatic tissue with a digital caliper.

Objective 2: Assessment of potato varieties and early-stage germplasm for resistance to storage pathogens

Potatoes from 38 research germplasm and commercial lines were tested for resistance to four major postharvest diseases: Fusarium dry rot (*F. sambucinum*) and pink rot (*P. erythroseptica*), Pythium leak (*P. ultimum*), and bacterial soft rot (*P. carotovorum*). Tubers were washed and inoculated as described above. Treated tubers were incubated for 47 days in a growth chamber at 22°C/71°F. Five tuber subsamples per variety x pathogen combination were inoculated at each of two replicate timepoints. Disease tolerance was assessed by measuring symptomatic tissue with a digital caliper. All data were analyzed in a generalized linear mixed model ANOVA (SAS v. 9.4) and mean comparisons conducted using Fisher's Protected LSD (α=0.05).

Results and Conclusions

Objective 1: Assessment of SaniDate 5.0 on storage disease management

SaniDate 5.0 treatment did not significantly affect progression of Fusarium dry rot or pink rot in Mackinaw tubers ($P > 0.05$). Pythium leak and bacterial soft rot inoculations did not result in significant disease development, however, methods have been optimized and will be evaluated in the 2021-22 storage season.

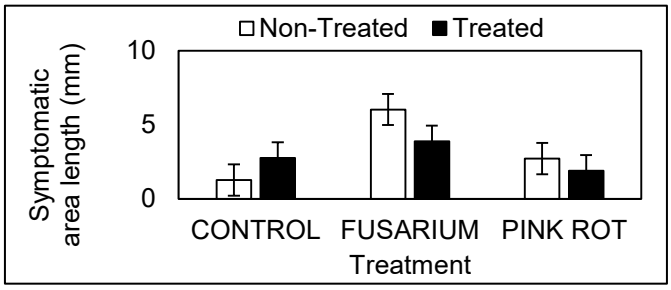

Figure 1. Mean length of symptomatic area measured on Mackinaw tubers seven months post-inoculation. Bars with the same letter are not significantly different based on Fisher's Protected LSD (α=0.05).

Objective 2: Assessment of potato varieties and early-stage germplasm for resistance to storage pathogens

Variable responses were observed in postharvest disease assessments of 38 research and commercial entries ($P < 0.05$). Research germplasm MSW474-1, MSZ242-13 (B), and MSBB058-1 consistently show resistance to Fusarium dry rot and pink rot. The best lines exhibited only 10-25% of the symptoms observed in the worst performing entries ($P < 0.05$).

	Fusarium Dry Rot			Pink Rot	
Variety	Length (mm)	Group	Variety	Length (mm)	Group
MSAA570-3	5.10	g	**Petoskey (B)**	**2.19**	**g**
NY163 (B)	6.66	f-g	**Petoskey (A)**	**6.30**	**e-g**
Snowden (A)	**8.00**	**fg**	MSAFB635-15	4.31	fg
Snowden (B)	**9.21**	**e-g**	MSAA260-3	5.29	e-g
MSW474-1 (B)	8.13	fg	MSAFB605-4	6.00	e-g
MSZ242-13 (B)	8.41	fg	MSZ242-13 (A)	6.04	e-g
Mackinaw (B)	**26.19**	**b-e**	MSBB058-1	6.09	e-g
Mackinaw (C)	**9.15**	**e-g**	**Snowden (B)**	**6.60**	**e-g**
MSAA076-6	9.63	d-g	**Snowden (A)**	**13.47**	**b-e**
Lamoka	**10.21**	**d-f**	**Lamoka**	**7.69**	**d-g**
Lady Liberty	**22.04**	**d-f**	**Lady Liberty**	**8.57**	**d-g**
MSAA217-3	29.89	b-d	**Mackinaw (B)**	**13.20**	**c-f**
MSAFB605-4	38.76	a-c	**Mackinaw (C)**	**11.62**	**d-f**
MSZ219-13	38.90	ab	NY163 (B)	16.63	b-d
Petoskey (A)	**40.53**	**a**	NY166	21.96	a-c
Petoskey (B)	**8.44**	**e-g**	MSBB610-13	22.33	ab
CO11023-2W	50.84	a-c	MSZ219-13	28.00	a

Table 1. Fusarium dry rot and pink rot symptom lengths (mm) for the best five (blue) and worst four (red) germplasm lines, compared to five standard varieties (bolded). Labels (A), (B), and (C) indicate field trial locations: A) SNAC trial at Sandyland Farms, B) Montcalm Research Center, C) commercial planting at Sackett Potatoes. Nonlabeled varieties originated from MRC. Means followed by the same letter are not significantly different based on Fisher's Protected LSD (α=0.05).

Acknowledgements: We would like to thank our grower cooperators for their continued support in furthering our research. Funding is provided by the Michigan Potato Industry Commission, the Michigan Department of Agriculture and Rural Development Specialty Crop Block Grant, and the USDA National Institute of Food and Agriculture, Hatch project 1020281.