

Fungicide Efficacy and Inoculum Load in Late Blight Seed Piece Treatment

Debra Ann Inglis

Washington State University-Mount Vernon REU

The potato tuber is an important means by which the late blight pathogen, *Phytophthora infestans*, survives from season to season. Diseased tubers are a source of inoculum and can contaminate healthy seed pieces during seed handling and cutting operations. Only seed fungicides which have efficacy against *P. infestans* are effective as late blight seed piece treatments i.e., Tops MZ rather than Tops 5D, Maxim MZ rather than Maxim, and several new products including Evolve (with curzate and mancozeb). During 2000 potato seed fungicides for control of seedborne late blight were evaluated at WSU-Mount Vernon using seed pieces inoculated with different inoculum densities of *P. infestans*. Previous findings have shown that high inoculum densities lead to seed piece decay while low inoculum densities are more likely to result in healthy seed pieces, but also, the transmission of *P. infestans* from seed piece to sprout.

With the above in mind, the effect of inoculum density on the efficacy of potato seed piece fungicides for the control of tuberborne late blight were evaluated in a field (Puget silt loam soil) trial planted 25 Apr near Mount Vernon, WA. Four fungicides were compared using four inoculum densities and nontreated inoculated and non-inoculated controls. Each treatment was replicated four times and arranged in a randomized complete block design. Single row plots (10 ft long; 38 in row spacing; 9 in seed spacing) were planted to the susceptible cultivar *Shepody*. Plots were spaced 5 ft apart end-to-end to minimize interplot interference. Whole tubers were cut into 2.5 oz seed pieces and atomized with sterile water or a suspension of 0.5, 2.0, or 4.0 x 10³ sporangia/.03 fl oz *Phytophthora infestans* (Pi) US-11. Approximately 0.006 fl oz of inoculum was delivered to achieve the desired densities of 100, 400, or 800 sporangia/ seed piece. After inoculation seed pieces were immediately placed into a plastic bag and shaken for 1 min until uniformly coated with each fungicide. Planting was done the same day at the 4 in depth. All plots were fertilized with a preplant broadcast application/A of 100 lb. N, 200 lb. KCl, 50 lb. MnSO₄, 10 lb. ZnSO₄, and 15 lb. B. A banded application of 10-34-0 (195 gal/A) also was made at planting. Matrix + Prowl 3.3 EC were applied for pre-emergence weed control at .25 oz and .374 pt a.i./A, respectively, on 26 Apr. Curzate DF (2 oz a.i./A) + Manzate 200 (.35 lb. a.i./A) + LI 700 (16 oz/100 gal), and Bravo Weather Stik (.81 pt a.i./A), were applied on 15 and 22 Jun, and 29 Jun, respectively, to limit development of foliar late blight. Plots were rated daily, 22 May-9 Jun for emergence and transmission. Total rainfall 25 Apr-11 Jul was 6.8 in. The average max and min temperatures 25 Apr-11 Jul were 65.4 and 48.9° F.

Data presented in Table 1 show that the inoculum density x seed piece fungicide interaction was significant at $P = 0.05$. All of the fungicides performed significantly better than the non-treated controls when seed pieces were inoculated. Among the fungicide treatments, inoculum density did not effect

emergence, top weight or percent healthy seed pieces. No difference among the fungicides for AUEPC or yield was evident when seed pieces were inoculated at 100 sporangia/seed piece; Tops MZ had significantly higher AUEPC value than Seed Trt. for Potatoes at 400 sporangia/ seed piece; but, Seed Trt. for Potatoes had significantly higher AUEPC value and tuber yield than Tops MZ at 800 sporangia/seed piece. Tuber yield was significantly higher for Maxim MZ compared to Tops MZ at the high density. When seed pieces were not inoculated, the fungicides and the nontreated control performed similarly except for Tops MZ which had significantly higher AUEPC. All of the non-treated-inoculated seed pieces rotted by 7/11. Transmission of *Pi* from seed piece to sprout was not detected in this study.

In conclusion, all products had a significantly positive effect on rate and final emergence, foliage and tuber yield, and seed piece health when the pathogen was present. Generally, the performance of the products was not affected by inoculum density. This experiment also was done by Dr. Mary Powelson in Oregon with similar results except that there was no difference among products at any density for any variable measured.

Table 1. Effects of inoculum dose of *Phytophthora infestans* on efficacy of late blight seed piece fungicides as measured by emergence, yield and seed piece health.

Treatment and product/cwt	Final % emergence, 6/9	AUEPC ¹ 5/22-6/9	Dry weight (oz/plant), 7/14	Total tuber wt. (lb./plot), 7/11	Percent healthy seed pieces, 7/11
Not inoculated					
Tops MZ 8 oz	100	1287 a	2.19	12.97	97
Maxim MZ 8 oz	98	1163 b	2.32	11.73	85
Evolve 8 oz	94	1130 bc	1.99	13.47	98
Seed Treatment for Potatoes 16 oz	94	1049 c	1.91	12.76	95
Nontreated control	100	1157 bc	1.67	12.18	96
LSD ($P=0.05$) ^{2,3}	NSD	112.3	NSD	NSD	NSD
100 sporangia/seed piece					
Tops MZ 8 oz	94 a	1115 a	2.11 a	12.09 a	92 a
Maxim MZ 8 oz	98 a	1136 a	1.81 a	13.84 a	98 a
Evolve 8 oz	96 a	1073 a	1.77 a	12.24 a	96 a
Seed Treatment for Potatoes 16 oz	96 a	1112 a	1.97 a	13.50 a	100 a
Nontreated control	6 b	50 b	0.69 b	0.44 b	0 b
LSD ($P=0.05$)	6.9	188.9	0.97	2.9	10.3
400 sporangia/seed piece					
Tops MZ 8 oz	96 a	1208 a	2.28 a	12.90 a	94 a
Maxim MZ 8 oz	92 a	1144 ab	2.17 a	12.58 a	90 a
Evolve 8 oz	94 a	1082 ab	1.80 a	11.51 a	94 a
Seed Treatment for Potatoes 16 oz	94 a	985 b	2.10 a	11.65 a	92 a
Nontreated control	0 b	0 c	0.0 b	0.0 b	0 b
LSD ($P=0.05$)	12.0	211.0	0.82	3.6	12.7
800 sporangia/seed piece					
Tops MZ 8 oz	96 a	1031 b	2.07 a	11.82 b	94 a
Maxim MZ 8 oz	96 a	1092 ab	2.06 a	13.29 a	90 a
Evolve 8 oz	98 a	1120 ab	1.86 a	12.60 ab	96 a
Seed Treatment for Potatoes 16 oz	96 a	1230 a	2.02 a	13.14 a	94 a
Nontreated control	8 b	48 c	0.49 b	0.20 c	0 b
LSD ($P=0.05$)	7.9	138.8	0.68	1.3	9.6

¹AUEPC = area under emergence progress curve based on days after planting. ²Numbers within a column followed by the same letter are not significantly different as determined by least significant difference (LSD) test. ³ P value is for analysis of variance.