REDUCING POWDERY SCAB INFECTION ON POTATOES WITH SEED-PIECE AND SOIL TREATMENTS

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Abstract

Experiments to evaluate the effects of seed-piece and soil-applied treatments on powdery scab infection and control were planted May 29, 2003 and June 7, 2004 in an area known to be infected with powdery scab at the Powell Butte site of Central Oregon Agricultural Research Center (COARC). Although there were no statistically significant differences among the treatments in the 2003 experiment, the Maxim® and Wet Sol Gro® treatments reduced the number of tubers with powdery scab lesions. The scab index for those treatments also trended lower than the scab index for the Evolve® and meadowfoam meal treatments. There was a greater degree of powdery scab infection in the 2004 experiment. There were no statistically significant differences among the treatments in 2004, but the Wet Sol Gro treatment had fewer infected tubers and a lower scab index than the check and Evolve seed-piece treatments.

Introduction

Powdery scab, caused by *Spongospora subterranea* (Wallr.) Lagerh. f. sp. *subterranea* Tomlinson, is believed to have originated in the Andean highlands of South America and has spread to almost all potato growing regions in the world. The fungus continues to spread primarily through infected seed tubers. In the past few years, the disease has been observed on potatoes in areas of the United States where it was previously not known to occur. It can potentially cause significant economic losses to fresh market potato producers by making tubers nonmarketable or by lowering the grade. Tubers with superficial scab lesions can be utilized for processing, but peeling costs for infected tubers are greater than costs for uninfected tubers. Seed lots infected with powdery scab may or may not be certified depending on the regulations of the certifying agency and the degree of infection. Infected tubers may develop dry rot or more scab lesions in storage and are predisposed to infection by other organisms that cause rot in storage.

The control of powdery scab with metallic compounds, fungicides, and other compounds applied to the soil has generally not been successful under field conditions (Burnett et al. 1991). However, tuber infections were reduced when infested soils were treated with soil fumigants methyl bromide, metham sodium, and chloropicrin. Seed-piece treatments containing zinc compounds and seed-piece dips with formalin and sodium hypochlorite reduced the number of tuber surface spores but were largely ineffective on spores beneath the tuber surfaces (Burnett et al. 1991, Mohan et al. 1991).

Potato varieties differ in their susceptibility to powdery scab; generally, light-skinned and red-skinned varieties are most susceptible (Christ 1993). Powdery scab has been observed in Oregon on several chipping varieties: reds, Shepody, and Ranger Russet.

The trend toward growing varieties other than Russet Burbank may, in part, contribute to increased observations of powdery scab. If this trend continues, powdery scab could become an increasing problem in Oregon.

This study was designed to explore the effect of various soil and seed-piece treatments in controlling powdery scab infection.

Materials and Methods

An experiment to evaluate the effects of five treatments on powdery scab infection and control was planted May 29, 2003 in an area known to be infected with powdery scab at the Powell Butte site of COARC. Thirty seed pieces of the red-skinned cultivar Dark Red Norland were planted 9 inches apart in each of the 2 plot rows (60 seed pieces/plot). Seed pieces contained powdery scab spores and lesions on the periderm surface. Treatments included an untreated check and two seed-piece treatments; Evolve (thiophanate-methyl, mancozeb, cymoxanil, Gustafson) applied at 0.75 lb/100 lb of cut seed pieces and Maxim (fludioxonil, Syngenta) applied at a rate of 0.50 lb/100 lb of cut seed pieces. A fourth treatment, meadowfoam meal, was worked into the top 4 inches of soil at a rate of 5 lb/100 ft^2 prior to planting. Finally, Wet Sol Gro solution (biodegradable non-toxic blended non-ionic surfactant-type soil conditioner that contains bio-stimulants, B-Complex vitamins, hormones, and fermentation products, Schaeffer) was applied to seed pieces at a rate of 4 oz/5 gal water and allowed to dry overnight before planting. In addition, plot foliage was sprayed with Wet-Sol solution (2 oz Wet Sol/15 gal water) on July 7, August 4, and Sept 2 (Wet Sol Gro treatment only). The trial area was sprinkler irrigated and managed with cultural practices common in central Oregon. The stand in each plot was recorded on July 7, 2003. The experiment was desiccated with Reglone® (1 1/2 pt/acre) on September 11 and harvested on October 6. The tuber production from each plot was weighed and total yield, U.S. No. 1 yield, and other grade categories were calculated. An unbiased sample of 20 tubers from each plot was rated for tuber scab lesions.

The 2004 experiment was planted on June 7, 2004 with 26 seed pieces per plot of the red-skinned cultivar Red LaSoda arranged in a complete randomized block design with four replications. Seed pieces were heavily infected with powdery scab. Treatments included an untreated check, Evolve applied at 0.75 lb/100 lb of cut seed pieces, and Wet Sol Gro solution. The Wet Sol Gro was initially applied to the open furrows prior to planting the seed pieces at a rate of 65 oz Wet Sol/acre (80 gal of solution/acre, 0.8 oz of Wet Sol/gal). In addition, plot foliage was sprayed with Wet-Sol solution (2 oz Wet Sol/15 gal water) on July 12 and August 4 (Wet Sol Gro treatment only). The trial area was sprinkler irrigated and managed with cultural practices common in central Oregon. The stand in each plot was recorded on July 8, 2004. The experiment was desiccated with Reglone (1.5 pt/acre) on September 8 and harvested on October 6. The tuber production from each plot was weighed and total yield, U.S. No. 1 yield, and other grade categories were calculated. An unbiased sample of 30 tubers from each plot was rated for tuber scab lesions.

Results and Discussion

*2003 Experiment*Seed pieces treated with Maxim had the highest percent stands on July 7, 2003. Percent stands were 70, 80, 83, 76, and 77 percent for the check, Evolve, Maxim, Wet Sol Gro, and meadowfoam meal treatments, respectively.

There were no differences among the five treatments in yield, grade, or specific gravity (Table 1). The plots treated with Wet Sol Gro produced the lowest yields, while the yields of all other treatments were nearly identical.

Tuber powdery scab lesion ratings are shown in Table 3. Although there were no statistically significant differences among the treatments, the Maxim and Wet Sol Gro treatments reduced the number of tubers with powdery scab lesions. The scab index was also lower for those treatments. Wet Sol Gro was applied directly to seed pieces prior to planting. Performance of the product may be enhanced by applying the product in the furrow prior to covering the seed pieces.

2004 Experiment

Seed pieces treated with Evolve had the highest percent stands on July 7, 2004. Percent stands were 81, 92, and 81 percent for the check, Evolve, and Wet Sol Gro treatments, respectively.

There were no differences among the three treatments in yield, grade, or specific gravity except for the undersize tubers (Table 2). The plots treated with Evolve had significantly more undersized tubers than the untreated check treatment.

The degree of powdery scab infection in the 2004 experiment was much higher than that observed in the 2003 experiment. Tuber powdery scab lesion ratings are shown in Table 4. Although there were no statistically significant differences among the treatments, the Wet Sol Gro treatment reduced the number of tubers with powdery scab lesions and had a lower scab index than the other treatments.

References

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Table 1. Potato yield and specific gravity for treatments applied to control powdery scab, Powell Butte, Oregon, 2003.

Treatment	<4oz	<---- 4-6	Ones 6-12	-----> 12+	Twos	Culls	Total yield	Specific gravity
	<----------cwt/acre---------->							
Check	54	32	134	124	5	138	487	1.070
Evolve	54	31	148	101	8	146	488	1.067
Maxim	36	26	186	141	1	97	488	1.071
Wet-Sol Gro	42	35	129	108	1	137	453	1.068
Meadowfoam	37	23	124	157	5	142	489	1.070
LSD (5%)	ns	ns	ns	ns	ns	ns	ns	ns

Table 2. Potato yield and specific gravity for treatments applied to control powdery scab, Powell Butte, Oregon, 2004.

Treatment	<4oz	<---- 4-6	Ones 6-12	-----> 12+	Twos	Culls	Total yield	Specific gravity
	<----------cwt/acre---------->							
Check	28	35	136	63	2	87	352	1.065
Evolve	41	42	134	62	2	76	358	1.067
Wet Sol Gro	33	40	138	66	4	64	344	1.069
LSD (5%)	8	ns	ns	ns	ns	ns	ns	ns

Table 3. Effects of potato seed-piece and soil treatments on powdery scab, Powell Butte, Oregon, 2003.

Treatment	Percent of tubers with powdery scab	Scab index[a]
Check	54	1.86
Evolve	50	1.65
Maxim	28	1.33
Wet Sol Gro	33	1.47
Meadowfoam meal	51	1.66
LSD (5%)	ns	ns

[a] Scab index = sum of ratings (1 = none, 5 = severe)/total number of tubers rated.

Table 4. Effects of potato seed-piece and soil treatments on powdery scab, Powell Butte, Oregon, 2004.

Treatment	Percent of tubers with powdery scab	Scab index[a]
Check	95	3.28
Evolve	97	3.33
Wet Sol Gro	93	3.04
LSD (5%)	ns	ns

[a] Scab index = sum of ratings (1 = none, 5 = severe)/total number of tubers rated.