Effect of Plant Bed, Prebedding Air, and Fungicide Dip Temperature in Controlling Scurf on Sweetpotatoes

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ABSTRACT

Plant bed temp exerts a marked influence on the effectiveness of fungicide dips and on the incidence of scurf developing on sweetpotatoes. Scurf was most severe and the dip treatments less effective on plants developing from sprouts grown in cool beds (24 C). Increasing the temp of the fungicide dip also improved significantly the effectiveness of the treatment in controlling this disease. Air treatments of the duration used (1 to 4 days at 40.5 C) were of doubtful value. Phytopathology 60:1474-1476.

Sweetpotato scurf (Jersey stain) caused by *Monilochaetes infuscans* (Hals.) has a long history of adversely affecting the value of the New Jersey sweetpotato crop. Poole (8) estimated that in the 1920's at least one-half the New Jersey crop was stained by this disease. Due to improved control measures, coupled with a tendency on the part of farmers to maintain a warmer plant bed, scurf became a rarity during the 1950's. But without alteration of dipping practices, scurf has become a serious problem on a few farms where plant bed temp were reduced to give more stocky plants. In addition, one farmer reported that he had reduced disease incidence by raising the temp of his plant beds from 75 to 85 F (24 to 29.5 C) coupled with the use of a 90 F (32 C) fungicide dip of his bedding stock. This report, together with the fact that chemicals become increasingly more reactive with an increase in temp, prompted this study.

The effect of temp of the fungicide dip on the efficiency of disease control in sweetpotato has not been investigated. Working with *Ceratocystis fimbriata* (black rot), Cooley & Kushman (1) and Smith & Michael (9) reported that temp of 105 F (40.5 C) and above have a lethal effect on the organism. Cooley & Kushman (1) believed that temp of 105 F (40.5 C) and 110 F (43 C) during the storage period were of some value. Daines et al. (5) found that prebedding heat treatments of sweetpotatoes infected with *C. fimbriata* were freed of the pathogen by a 110-F (43-C) treatment of 2 or 3 days' duration or by 102.5-F (39-C) treatment of 5 days. Martin (7) working in Louisiana confirmed these results.

Daines (2, 3) and Daines et al. (4) found that the temp of the plant bed significantly affected the incidence of sprouts affected with black rot (*C. fimbriata*), Java black rot (*Diploidia tubericola*), and dry rot (*Diaporthe batatatis*). In these studies, fungicide dips were more effective on fleshy roots when the plant bed was maintained at a temp unfavorable for disease development.

Kushman & Hildebrand (6) eliminated scurf by dipping sprouts in water at 120 F (49 C) for 10 min or for 2 hr at 110 F (40.5 C), but hot water treatments of fleshy roots used for "seed" failed to control this disease.

Materials and Methods.—To determine whether the temp of the plant bed would affect the incidence of sweetpotatoes showing scurf in the resulting crop, three electrically heated plant beds containing loamy sand were planted each year with badly scurfed and variously treated sweetpotatoes. The cultivars used were Oklamar (1967-1968) and Julian (1969). The temp of the beds was thermostatically controlled at 75, 85, and 90 F (24, 29.5, and 32 C) for the entire sprout-producing period. The various treatments were separated by boards. After each experiment, the sand was removed and the plant beds and surrounding areas were drenched with a formaldehyde solution. New sand was used for each test. In the test to study the effect of high prebedding air temp, the sweetpotatoes were dipped in the appropriate fungicide, placed in a room held at 105 F (40.5 C) for 1 to 4 days, then bedded as indicated in Table 2. Fleshy roots used in the plant bed temp and the dip temp studies were dipped in a fungicide suspension in tap water at 65 F (18.3 C) or in tap water heated to either 90, 100, 105, 110, or 120 F (32, 37.7, 40.5, 43, or 49 C). When dry they were bedded as indicated in Tables 1, 2, and 3. Fungicides used were: Semesan Bel (hydroxymercurichlorophenol 3.8%, hydroxymercurinitrophenol 12.5%); thiram [bis (dimethylthiocarbamoyl) disulfide]; ferbam (ferric dimethyldithiocarbamate), and captan [*N*-(trichloromethylthio)-4-cyclohexene-1,2-dicarboximide]. Each lot of sprouts was treated with the same unheated fungicide dip used on the fleshy roots from which they originated, except those used in the heated fungicide dip sprout treatment (Table 3). The sprouts used in this treatment were from untreated plots. The seed and sprout treatments were used at the same concn, except in the case of Semesan Bel. The Semesan Bel sprout treatment was 1 lb. (453.6 g) in 10 gal (37.9 liters) of water.

The sprouts were planted 18 inches (45.7 cm) apart in the rows, in sandy loam soils, and each treatment consisted of four randomized single-row plots. These replications were from 250 ft (76.2 m) to 300 ft (91.4 m) long. At harvest time, disease counts were made in the field of eight 100-ft (30.5 m) sections for each treatment. All data were analyzed statistically.

Results and Discussion.—*Plant bed temp.*—The plant bed temp studies were continued over a period of 3 years; however, only two are reported in Tables

1 and 2. These data demonstrated that plant bed temp had a significant effect on the incidence of scurf that developed on the resulting crop. The greatest amount of scurf developed on plants taken from the plant bed held at the lowest temp, and decreased as the temp was increased. There was a significant decrease in scurf on the stems of untreated plants maturing from the sprouts produced in the bed at 90 F as compared with those from the 85- and 75-F beds (Table 1).

The data taken on the harvested fleshy roots showed a significant reduction in scurf with each increase in plant bed temp. In addition, the fungicide dip treatments exhibited significant improvement in disease control on both stems and fleshy roots over the untreated check at all bed temp. Semesan Bel was significantly superior to thiram and captan in scurf control on the main stems, and nearly so on the harvested roots from the plants taken from the beds held at 85 and 90 F. In the 75-F bed, the difference between these treatments was not significant. Also in the 75-F bed, neither Tersan nor Semesan Bel provided protection against scurf, and in the 85 F bed only the latter provided appreciable control of the disease. At the higher temp, both fungicide dips provided good control of this disease. The incidence of scurf on plants taken from all three plant bed temp are significantly different from each other, and fungicide dip treatments are a significant improvement over the untreated check treatments (Table 2). In this experiment, the ferbam-captan treatment proved to be as effective in scurf control as the Semesan Bel treatment, and control was much more effective in the warmer beds. The fungicide treatments again proved to be of little commercial value on seed potatoes planted in the 75-F bed.

Air temp treatment.—Holding sweetpotatoes at a temp of 105 F for 1 to 4 days after dipping in a fungicide treatment (Tersan-captan) prior to placing in the plant bed was of questionable value in the control of scurf. Possibly more than 4 days of exposure at 105 F or a higher humidity during the heat treatment are required for significant influence.

Temperature of dip treatment.—In the treatments recorded in Table 2, ferbam-captan as a dip treatment was used in water at 65 as well as 90 and 105 F. The seed potatoes dipped in the fungicide treatment at these three temp were all planted in the 75-F bed. Scurf was most severe at the lowest dip temp, and was almost completely controlled at the highest temp. Improved disease control at the higher temp dips also occurred on the main stems.

TABLE 1. Effect of plant bed temp and fungicide treatments on the occurrence of scurf on the stems and fleshy roots of Oklamar sweetpotatoes at harvest time

Dip treatments[a]—fleshy roots	% Showing scurf[b]	
	Stems	Roots
75 F bed (24 C)		
Untreated—check	99.3 e	97.8 f
Thiram, 0.5 lb. (227 g); captan, 0.5 lb.; 5 gal water (18.9 liters)	78.5 c	47.2 d
Semesan Bel, 0.5 lb.; 7.5 gal (28.4 liters) water	49.8 c	39.6 cd
85 F bed (29.5 C)		
Untreated—check	95.3 e	87.0 e
Thiram, 0.5 lb.; captan, 0.5 lb.; 5 gal water	48.8 c	26.5 bcd
Semesan Bel, 0.5 lb.; 7.5 gal water	7.8 ab	4.2 ab
90 F bed (32 C)		
Untreated—check	81.7 c	57.3 d
Thiram, 0.5 lb.; captan, 0.5 lb.; 5 gal water	18.5 b	12.7 abc
Semesan Bel, 1 lb. (453.6 g); 7.5 gal water	1.3 a	0.5 a

[a] Sprouts received same treatment as fleshy roots except that Semesan Bel sprout treatments were 1 lb. in 10 gal (37.9 liters) of water.
[b] Groups of treatments sharing a letter in common are judged not significantly different at the 95% level by Duncan's multiple range test.

TABLE 2. Effect of fungicides, plant bed temp, dry heat prebedding treatments, and the temp of the fleshy root seed-dip treatments on the occurrence of scurf on Oklamar sweetpotatoes at harvest time

Dip treatments[a]—fleshy roots	% Showing scurf[b]	
	Stems	Fleshy roots
75 F bed (24 C)		
Check—untreated	99.9 j	93.3 i
Semesan Bel, 1 lb. (227 g) —7.5 gal (28.4 liters)	76.1 hi	61.1 g
Ferbam, 0.5 lb.; captan, 1 lb.; 5 gal	75.8 hi	60.0 g
Ferbam-captan, 90 F (32 C) dip for 15 min	59.1 gh	30.9 ef
Ferbam-captan, 105 F (40.5 C) dip for 15 min	0.5 a	2.6 a
Ferbam-captan, 1 day at dry heat	56.4 gh	41.2 f
Ferbam-captan, 4 days at dry heat	37.9 fg	38.5 f
85 F bed (29.5 C)		
Check—untreated	85.1 i	68.9 gh
Semesan Bel	22.1 def	17.8 cde
Ferbam-captan	27.0 def	15.4 bcd
Ferbam-captan, 1 day at 105 F dry heat	24.6 def	13.8 bcd
Ferbam-captan, 2 days at 105 F dry heat	22.0 def	15.7 bcd
Ferbam-captan, 4 days at 105 F dry heat	15.7 cde	13.6 bcd
90 F bed (32 C)		
Check—untreated	42.6 g	58.8 g
Semesan Bel	8.8 abcde	9.4 abc
Ferbam-captan	7.7 abcd	3.0 a
Ferbam-captan, 1 day at 105 F dry heat	10.4 bcde	5.8 ab
Ferbam-captan, 2 days at 105 F dry heat	16.9 cde	9.5 abc
Ferbam-captan, 4 days at 105 F dry heat	1.7 ab	2.5 a

[a] Sprouts received same treatment as fleshy roots except Semesan Bel sprout treatments were 1 lb. in 10 gal of water. All dips were at 65 F, except where otherwise indicated.
[b] Groups of treatments sharing a letter in common are judged not significantly different at the 95% level by Duncan's multiple range test.

The efficiency of fungicide dip treatments in water of elevated temp is further reflected in the data recorded in Table 3. In this experiment, the 100-F dip treatment lasting 15 min reduced the incidence of disease by 75%, whereas the 90-F treatment reduced the amt of disease by about 44% as compared with the 65-F dip. With each increase in temp of the dip treatment, the incidence of scurf was reduced; however, the reduction was not significant between the 100-F dip and those of 110 F and 120 F. The 110-F and 120-F dip treatments resulted in a sharp reduction in the number of sprouts produced by the treated seed potatoes. This reduction was not observed at the 100-F treatment.

TABLE 3. The effect of temp of ferbam-tersan dip treatment used on fleshy roots and sweetpotato sprouts on the occurrence of scurf on the resulting crop[a]

Dip treatment and temp[b]	% Fleshy roots showing scurf[c]
Seed potatoes	
Check—untreated	69.5 d
Ferbam, 0.5 lb. (227 g)—Tersan 0.5 lb.—65 F (18.3 C) dip for 15 min	26.4 c
Ferbam—Tersan, 90 F (32 C)—15 min	14.9 b
Ferbam—Tersan, 100 F (37.7 C)—15 min	6.9 a
Ferbam—Tersan, 110 F (43 C)—15 min	3.9 a
Ferbam—Tersan, 120 F (49 C)—15 min	3.4 a
Sprouts	
Ferbam—Tersan, 100 F dip for 3 min	3.0 a

[a] The Julian sweetpotatoes used in this test were planted in an 85-F plant bed.

[b] Sprouts received same treatment as flesh roots except in a single sprout test where sprouts from untreated check roots were used. All treatments consisted of ferbam 0.5 lb. —Tersan 0.5 lb. in 5 gal (18.9 liters) of water.

[c] Groups of treatments sharing a letter in common are judged not significantly different at the 95% level by Duncan's multiple range test.

The treatment involving a heated sprout-dipping solution (Table 3) proved to be highly effective against this disease. The sprouts for this treatment were pulled from the untreated check square, and the white base portion of each sprout was dipped in a 100-F ferbam-tersan suspension for 3 min.

The low incidence of scurf that persisted through all the most effective treatments may have resulted from field infection.

The increased efficiency in disease control exhibited by the heated dip treatments indicated the importance of testing higher temp for shorter exposures for both seed-root and sprout-dip treatments. Such investigations are being continued.

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