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APPLICATION OF GEM FOR CONTROL OF RHIZOCTONIA ROOT AND CROWN ROT

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Rhizoctonia solani AG-2-2 (= *R. solani*) is a soilborne fungus that causes diseases on sugarbeet throughout the growing season, especially in warm, wet weather. In recent years, *R. solani* has been predominantly causing mid- to late-season rot and crown rot, which is an increasing problem in Minnesota and North Dakota. Several strobilurin fungicides are applied on sugarbeet to control Rhizoctonia root and crown rot (Quadris) or Cercospora leaf spot (Headline, Gem). There is interest in managing these fungicides for optimal control of both pathogens.

OBJECTIVE

Our objective was to evaluate efficacy of two applications of Gem, as band and broadcast treatments (beginning at the 6- to 8-leaf stage) for control of Rhizoctonia root and crown rot of sugar beet caused by *R. solani* AG-2-2.

MATERIALS AND METHODS

The trial was established at the University of Minnesota, Northwest Research and Outreach Center, Crookston. Plots were fertilized for maximum sugarbeet yield and quality and then sown with seed of VDH 66240 on May 21, 2003. Seeds were sown at a 1.25-inch spacing in four-row plots (rows 30 ft long, 22 inches apart), with four replicates per treatment in a randomized block design. Counter (1.8 lb/A) was applied at planting to control the sugarbeet root maggot. Microrates of herbicides were applied on June 2, 9, and 13 and included Betamix, UpBeet, Stinger, Select, and MSO (0.5 pint, 0.125 oz, 40 ml, 60 ml, and at least 1.5 pint/A, respectively) per application. Plots also were cultivated on June 17. Plants were thinned to the equivalent of 150 plants/100 ft of row on July 1 (at the 6-8 leaf stage).

Treatments included: 1) inoculation with *R. solani* and application of Gem (0.1 oz a.i./1000 ft of row in a 7-inch band) at the 6-8 leaf stage, followed by a broadcast application of Gem (7 oz product = 0.0234 oz a.i./1000 ft in a 7-inch band) 2 weeks after canopy closure; 2) inoculation with *R. solani* and a broadcast treatment of Gem (7 oz product/A) at the 6-8 leaf stage, followed by a second broadcast application 2 weeks after canopy closure; 3) inoculation of plants with *R. solani* at the 6-8 leaf stage and no fungicide as a control; and 4) an untreated control.

Inoculum of *R. solani* was grown on sterile barley grains for 3 weeks and then air-dried. The first application of *R. solani* and Gem was made on July 2 after plots were thinned. Sixteen grams of *R. solani*-infested barley grains were sprinkled along the 30-ft length of each of two middle rows per plot. Soil was lightly raked into the row to prevent drying of inoculum. Band applications of Gem were made with a three-nozzle row applicator at 30 psi (one center nozzle was directly over the row and two side nozzles were angled at 45 degrees toward the crown). Broadcast applications of Gem were made in 20 gal of water/A at 100 psi. The second broadcast treatment of Gem was made on August 6. Cercospora leaf spot was controlled by application of Eminent on July 23 (at canopy closure), Super Tin on August 6 (except for plots treated with a broadcast application of Gem), Eminent on August 22, and Super Tin on September 5 (13, 5, 13, and 5 oz/A, respectively).

Baseline stand was determined on July 1 and then on July 8, 15 and 22 and August 1, 12, and 19. Plots were harvested on September 30. Data were collected for number of roots harvested, severity of Rhizoctonia root and crown rot on surviving roots (0 to 7 scale, 0 = healthy and 7 = root completely rotted and foliage dead), root yield, and sucrose yield. Data were subjected to Analysis of Variance and if significant ($P = 0.05$), means were separated by Least Significant Difference.

RESULTS AND DISCUSION

Baseline stands averaged 88 plants/60 ft of row at time of inoculation with *R. solani* and the first application of Gem on July 2. There were no significant differences among treatments until July 22 when stand loss was significantly

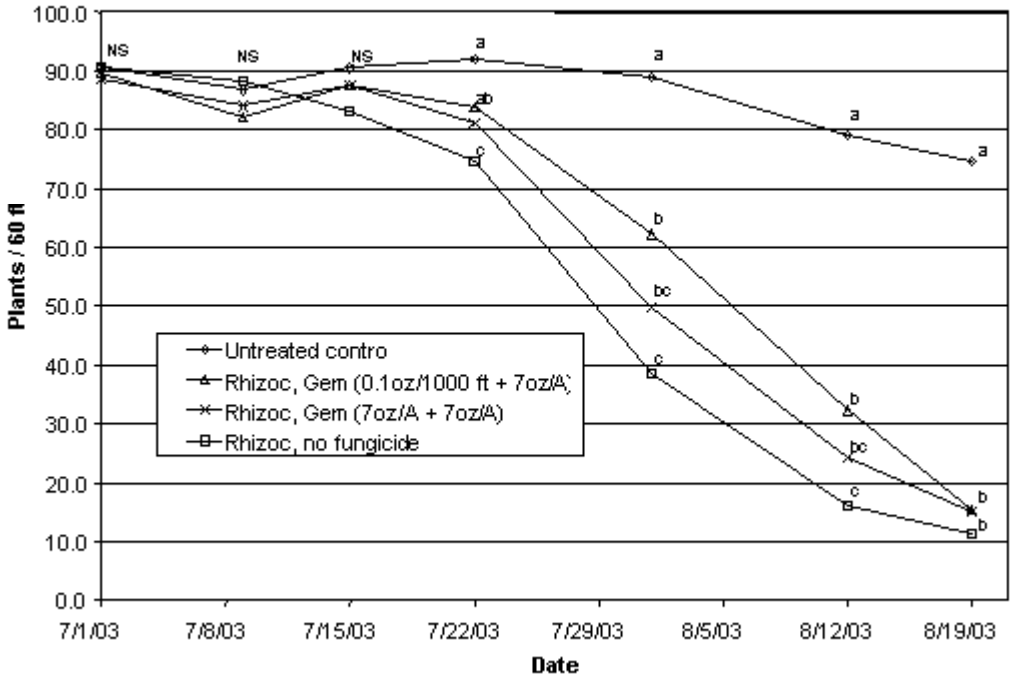

Fig. 1. Plant stands in plots inoculated with *Rhizoctonia solani* AG-2-2 (16 g barley inoculum/30 ft row) and treated with the first application of Gem (band or broadcast) when sugarbeet plants were at the 6- to 8-leaf stage on July 1, followed by a second broadcast application of Gem on August 6, 2003 compared to controls (*R. solani*-inoculated plots and an untreated control). Each data point is based on an average of four replicates; for each date, data points followed by the same letter are not statistically different, $P = 0.05$).

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Table 1. Harvest yield and disease ratings of plots inoculated with *Rhizoctonia solani* AG-2-2 and treated with the first application of Gem (band or broadcast) when sugarbeet plants were at the 6- to 8-leaf stage on July 1, followed by a second broadcast application of Gem on August 6, 2003 compared to controls (*R. solani*-inoculated plots and an untreated control).

	Number	Root rot	Root	
	harvested/	rating	yield	Sucrose yield

Treatment[W,X]	60 ft row	(0-7 scale)[Y]	(T/A)	Percent	LTM	lb/T	lb/A
Untreated control	80	1.7	24.4	16.7	1.4	307	7455
R. solani + Gem (7 oz/A, broad-cast) + Gem (7oz/A,broadcast)	12	4.4	4.1	14.1	1.7	249	1053
R. solani + Gem (0.1 oz a.i./ 1000 ft row, banded) + Gem (7 oz/A, broadcast)	13	5.2	3.5	12.7	1.6	222	767
R. solani, no fungicide	9	5.7	1.8	6.0	0.9	102	313
LSD ($P = 0.05$)[Z]	10	0.8	3.0	5.1	NS	107	839

W Each value based on four replicates.

X *R. solani* was applied along the row (16 g barley inoculum/30 ft row) and then soil was lightly raked in the row to cover it.

Y Root rot rating on a 0 – 7 scale, 0 = root healthy, 7 = root completely rotted and foliage dead.

Z LSD = Least Significant Difference; if significant, LSD value provided for mean separations; NS = not significant.

lower in the *R. solani*-inoculated control compared to the untreated control; both Gem applications had stands intermediate between the controls (Fig. 1). *R. solani* was active and plant stands continued to decline precipitously across all treatments except the untreated control (which also lost some stand because of naturally occurring *R. solani*). By August 1 (5 days before the second Gem application, stands were significantly highest in the untreated control, lowest for the inoculated control, and intermediate for the 0.1 oz band application of Gem (which had a slightly higher stand than the early-broadcast application). The second application of Gem did not reduce or halt stand loss and by August 19, stand was highest for the untreated control and was equally low for the Gem treatments and inoculated control (Fig. 1).

Harvest data are shown in Table 1. Numbers of harvested roots were highest for the untreated control and similarly low for both Gem treatments and the *R. solani*-inoculated control. Root rot ratings were high for all treatments, except the untreated control, which had a low disease rating. Plots receiving two broadcast applications of Gem had a statistically significant lower root rot rating (4.4) compared to the inoculated control (5.7), but these ratings represent severe disease. Root yields (tons/A) were statistically higher for the untreated control compared to the Gem treatments and inoculated control, which were equally low. All treatments were statistically the same for loss to molasses. Percent sucrose and pounds of sucrose/ton were statistically the same for the untreated control and Gem treatments compared to the *R. solani*-inoculated control. Pounds of sucrose recovered/A were statistically highest in the untreated control compared to other treatments, although the Gem treatments tended to have slightly higher sucrose yields than the untreated control.

CONCLUSIONS

Application of Gem and *R. solani* on the same day initially delayed stand loss, especially when Gem was applied in a 7-inch band at 0.1 oz a.i./1000 ft.

Application of Gem after disease was established did not retard or reduce disease development.

Two applications of Gem (band and then broadcast) slightly reduced Rhizoctonia root and crown rot and slightly increased yield, although yield increases were marginal compared to the *R. solani*-inoculated control.

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