CONTROL OF RHIZOCTONIA CROWN AND ROOT ROT ON SUGARBEET WITH POSTEMERGENCE BAND-APPLIED FUNGICIDES

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Rhizoctonia crown and root rot (RCRR) caused by the soilborne fungus *Rhizoctonia solani* AG 2-2 is a common problem in the sugarbeet-growing areas of Minnesota and North Dakota. The disease can kill seedlings (damping-off) or infect older roots (RCRR) throughout the growing season. Warm (65°F+), wet soil conditions favor infection and disease development. Control methods include rotating with non-host (cereal) crops, sowing partially resistant varieties, and applying in-furrow or more commonly, postemergence fungicides.

OBJECTIVES

A field trial was established to compare postemergence band applications of four fungicides for control of RCRR.

MATERIALS AND METHODS

The trial was established at the University of Minnesota, Northwest Research and Outreach Center, Crookston. The trial was sown with a Rhizoctonia-susceptible cultivar (2-year RCRR rating = 4.4) in six-row plots (22-inch row spacing) on April 27 at a 2.4-inch seed spacing. Counter 20G (6 lb A^{-1}) was applied at planting for control of root maggot and glyphosate (4.5 lb product ae/gallon) was applied May 22 and June 25 (22 oz A^{-1}) for control of weeds. Plots were thinned to the equivalent of 180 plants per 100 ft of row on May 30. Cercospora leafspot was controlled by Super Tin 80WP + Topsin M 4.5F (6 oz + 7.6 fl oz product) and Headline (9 oz product) in 20 gallons of water A^{-1} with a tractor-mounted sprayer with TeeJet 8002 flat fan nozzles at 100 psi on July 27 and August 17, respectively.

Treatments were applied June 13 when plants were at the 10-leaf stage and included plots treated with Fungicide 1 at three rates (0.0223, 0.0446, and 0.0892 lb a.i. A^{-1}), Priaxor (14.3% fluxapyroxad + 28.6% pyraclostrobin, 8 fl oz product A^{-1} + 0.25% Induce nonionic surfactant), Quadris (azoxystrobin, 14.3 fl oz product A^{-1}), Vertisan (penthiopyrad) at three rates (9.5, 19, and 28.5 fl oz product A^{-1} + 0.063% Induce nonionic surfactant). Fungicides were applied at 10 gal A^{-1} total volume in a 7-inch band using a bicycle sprayer at 30 psi with TeeJet 6501 nozzles. After fungicides were applied (3 hr), plots were inoculated by spreading *R. solani* AG 2-2-infested ground barley grain (28g/30-ft of row) using a Gandy granular applicator. Soil then was hand-raked into the row to cover inoculum at the base of the sugarbeet crowns. There were two controls: plots that were not inoculated and not treated with fungicide and plots that were inoculated with *R. solani* AG 2-2 and not treated with fungicide. The trial was harvested September 27 and data were collected for number of harvested roots, yield, and quality. Twenty roots per plot also were arbitrarily selected and rated for severity of RCRR using a 0 to 7 scale (0 = healthy root, 7 = root completely rotted and foliage dead).

Data were subjected to analysis of variance using SAS Proc GLM (SAS Institute, Cary, NC). Means were separated by Fisher's Protected Least Significant Difference ($P = 0.05$).

RESULTS

Disease pressure was severe so RCRR ratings were very high and all harvest parameters were low for the inoculated, untreated control compared to all fungicide treatments and the non-inoculated control (Table 1). The number of harvested roots was highest for inoculated plots treated with all fungicides except the 9.5 fl oz rate of Vertisan, which was intermediate along with the non-inoculated control. Root rot ratings were lowest for the non-inoculated control and inoculated plots treated with all three rates of Fungicide 1, Quadris, and the 28.5 fl oz rate of Vertisan; intermediate for Priaxor and the 19 fl oz rate of Vertisan; and highest among fungicide treated plots for the 9.5 fl oz rate of Vertisan. Results for all yield and quality parameters and revenue followed a similar trend with inoculated plots treated with all fungicides except lower rates of Vertisan being similar to the non-inoculated control. The lower rates of Vertisan showed a rate response with lower yield and quality compared to the 28.5 fl oz rate of Vertisan.

Table 1. Number of harvested roots, RCRR ratings, root, and sucrose yields for sugar beet plots in a field trial not inoculated or inoculated with *Rhizoctonia solani* AG 2-2 and treated with postemergence band fungicides or untreated.

Treatment and rate[Y]	No. harv. root/100 ft[Z]	RCRR[Z] (0-7)	Yield[Z] T A^{-1}	Sucrose[Z] %	Sucrose[Z] lb ton^{-1}	Sucrose[Z] lb recov. A^{-1}	Revenue[Z] (A^{-1})
Non-inoculated control	137 b	1.4 de	33.9 a	18.5 ab	336 ab	11374 ab	1962 ab
Inoculated							
Untreated control	15 c	6.7 a	3.9 c	15.9 c	275 c	1082 d	149 d
Fung. 1 @ 0.0223 lb a.i. A^{-1}	179 a	1.2 e	35.9 a	18.6 ab	336 ab	12051 a	2085 a
Fung. 1 @ 0.0446 lb a.i. A^{-1}	172 a	1.4 de	34.5 a	19.2 a	349 a	12021 a	2149 a
Fung. 1 @ 0.0892 lb a.i. A^{-1}	188 a	1.3 de	34.2 a	18.5 ab	337 ab	11526 ab	2000 a
Priaxor @ 8 fl oz A^{-1}	161 ab	1.8 cd	31.8 ab	18.7 ab	341 ab	10843 ab	1901 ab
Quadris @ 14.25 fl oz A^{-1}	182 a	1.4 de	33.6 a	18.7 ab	336 ab	11250 ab	1938 ab
Vertisan @ 9.5 fl oz A^{-1}	139 b	3.5 b	28.0 b	17.9 b	321 b	8983 c	1491 c
Vertisan @ 19 fl oz A^{-1}	177 a	2.0 c	31.7 ab	17.7 b	318 b	10117 bc	1666 bc
Vertisan @ 28.5 fl oz A^{-1}	174 a	1.7 cde	33.0 a	18.8	340 ab	11198 ab	1953 ab
ANOVA p-value	<0.0001	<0.0001	<0.0001	0.0003	0.0001	<0.0001	<0.0001
LSD ($P = 0.05$)[Z]	27	0.5	4.9	1.2	25	1502	298

[Y] Fungicides and inoculum were applied on June 13, 2012. Fungicides were applied in a 7-inch band using 30 psi and 10 gal A^{-1} total volume. Plots were inoculated with *R. solani* AG 2-2-infested ground barley grain (28 g/30 ft of row in two opposing passes) using a Gandy granular applicator.

[Z] For each column, numbers followed by the same letter are not significantly different according to Fisher's Protected Least Significant Difference (LSD).

DISCUSSION AND CONCLUSIONS

Disease pressure in this trial was very high because plots were inoculated with an aggressive isolate of *R. solani* AG 2-2 and high soil moisture encouraged root infections. The NWROC received 1.4 inches of rain 3 days before inoculation and 0.32, 0.22, and 0.41 inch of rain 1, 3, and 7 days after inoculation, respectively. The rest of the growing season was much drier than normal with monthly rainfall amounts 1.25, 0.8, 0.9, and 2.3 inches less than normal for June, July, August, and September, respectively. Despite these dry conditions, infections that occurred when soil moisture was high continued to develop and resulted in severe disease and almost no yield when no postemergence fungicide was used (RCRR of 6.7 on 0-7 scale and 3.9 ton yield, Table 1).

Overall, all fungicides did an excellent job in controlling Rhizoctonia crown and root rot under severe disease conditions. Several new fungicides were comparable to the industry standard, Quadris, for disease control and effect on yield and quality. Although the 28.5 fl oz rate of Vertisan was comparable to Quadris for control of RCRR and effect on root and sucrose yield, the lower rates of Vertisan resulted in a stepwise decrease in disease control and yield and quality. Rates of Vertisan below 19 fl oz are not recommended.

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