COMPARISON OF POSTEMERGENCE FUNGICIDES FOR CONTROL OF RHIZOCTONIA CROWN AND ROOT ROT OF SUGARBEET

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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 sugar beet growing areas of Minnesota and North Dakota. The disease can cause damping-off on seedlings and infect older roots throughout the growing season. Warm (65°F+) soil combined with excess moisture conditions favor infection and disease development. Control methods include rotating with non-host (cereal) crops such as wheat, sowing partially resistant varieties, and the use of seed treatment, in-furrow, and/or postemergence fungicides. Recently, more postemergence fungicides have become registered for use on sugarbeet to control Rhizoctonia, including some generic azoxystrobin products. Data is needed to compare these new fungicides alongside established postemergence fungicides.

OBJECTIVES

A field trial inoculated with *R. solani* AG 2-2 was established to evaluate postemergence application of several registered fungicides for control of Rhizoctonia crown and root rot and effect on sugarbeet yield and quality.

MATERIALS AND METHODS

The trial was established at the University of Minnesota, Northwest Research and Outreach Center, Crookston on a Hegne-Fargo complex silty clay soil. The trial was sown with the Rhizoctonia-susceptible cultivar 'HM 4303RR' in six-row plots (22-inch row spacing) on May 8 at 4.5-inch seed spacing. Counter 20G (8 lb/A) was applied at planting for control of root maggot and glyphosate (4.5 lb product ae/gallon) was applied on May 28, June 10, June 23, and August 17 (22 oz/A) for control of weeds. Treatments were assigned to plots (6 rows wide, 30 ft long) arranged in a randomized block design with four replicates. Postemergence fungicide applications were made in a 7-inch band at 1:00 pm on June 30 using 10 gallons of water/A. Fungicides included 7 and 14 fl oz/A rates of Equation (a generic azoxystrobin), 14 fl oz/A Satori (a generic azoxystrobin), 14 fl oz/A Quadris (azoxystrobin), 6.7 fl oz/A Priaxor (fluxapyroxad + pyraclostrobin) with and without Preference non-ionic surfactant (NIS) at 0.125% by volume, and 5.7 fl oz/A Proline (prothioconazole) with Preference NIS at 0.125% by volume. Plots were inoculated later in the afternoon of the same day by applying *R. solani*-infested ground barley inoculum (28 g/30 ft of row) over each of the center four rows with a Gandy granular applicator in two passes opposite in direction. Two no-fungicide controls, inoculated and non-inoculated, were also included. Baseline stand was counted on the morning of June 30.

Cercospora leafspot was controlled by Supertin + Topsin M (6 + 7.5 oz product in 17 gallons of water/A) applied with 8002 flat fan nozzles at 90 psi on August 3. The trial was harvested on September 17 and data were collected for number of harvested roots, yield, and quality. The number of harvested roots and baseline stand counts prior to inoculation were used to calculate percent stand loss. 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). Disease incidence was reported as the percent of rated roots with a root rot rating of 3 or higher.

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). The non-inoculated control data is shown for comparison, but was not included in the statistical analysis.

RESULTS AND DISCUSSION

Harvest data is summarized in Table 1. A large rainfall (2.16 inches) was received on July 5 (5 days after inoculation), and timely rainfalls were received through the rest of July for a total rainfall of 4.96 inches in July. This July rainfall combined with the Rhizoctonia-susceptible cultivar resulted in excellent infection. Rainfall in August and September was 1.1 and 0.27 inches, respectively, resulting in reduced disease pressure from *R. solani* later in the season. Percent stand loss, disease incidence, Rhizoctonia crown and root rot rating, root yield, and recoverable sucrose A^{-1} were significantly different (P = 0.05) among treatments (Table 1). Percent stand loss was lower for the 14 fl oz rates of Quadris and both generic azoxystrobin products (Equation and Satori) compared to the untreated control (Table 1). Priaxor with and without NIS, Proline and the 7 fl oz rate of Equation were intermediate. Disease incidence was highest in the untreated control (74%), lowest for the azoxystrobin products (25-38%), and intermediate for Priaxor and Proline treatments (54-59%) (data not shown). Root rot ratings were highest for the untreated control (5.5), lowest in plots treated with 14 fl oz of azoxystrobin fungicides, and intermediate for other fungicides (Table 1). Similarly, root yield and recoverable sucrose A^{-1} were highest for the 14 fl oz rates of azoxystrobin fungicides, lowest for the untreated control, and intermediate for other fungicides (Table 1). Percent sucrose and recoverable sucrose ton^{-1} were fairly low and not significantly different among all treatments.

Table 1. Effect of postemergence fungicides on percent stand loss, RCRR ratings, and root and sucrose yields in a sugar beet field trial inoculated with *Rhizoctonia solani* AG 2-2 on infested ground barley grain (28 g/30 ft of row).

Treatment[W]	Chemistry	Percent stand loss[X]	RCRR[X] (0-7)	Yield[X] T/A	Sucrose[X] %	Sucrose[X] lb/ton	Sucrose[X] lb recov./A
Non-inoculated [Y]							
No-fungicide control	-	35	3.4	24.3	14.8	257	6263
R. solani-inoculated							
No-fungicide control	-	55 a	5.5 a	14.0 c	14.0	244	3411 c
Equation @ 7 fl oz/A	azoxystrobin	33 abc	3.3 cd	26.3 ab	14.8	261	6898 ab
Equation @ 14 fl oz/A	azoxystrobin	22 bc	1.9 d	31.0 a	14.7	261	8066 a
Satori @ 14 fl oz/A	azoxystrobin	20 c	2.4 d	29.6 a	14.9	266	7790 a
Quadris @ 14 fl oz/A	azoxystrobin	25 bc	2.4 d	29.9 a	15.0	265	7908 a
Priaxor @ 6.7 fl oz/A	fluxapyroxad + pyraclostrobin	49 a	4.8 ab	21.0 bc	14.1	246	5112 bc
Priaxor @ 6.7 fl oz/A + NIS[Z]	fluxapyroxad + pyraclostrobin	34 abc	4.0 bc	23.4 ab	14.9	261	6177 ab
Proline @ 5.7 fl oz/A + NIS[Z]	prothioconazole	44 ab	4.7 abc	20.4 bc	13.5	232	4677 bc
ANOVA *P*-value		0.043	0.0001	0.004	0.829	0.804	0.002
LSD (*P* = 0.05)[Z]		23.6	1.4	8.3	NS	NS	2284

[W] Postemergence fungicide applications were made on June 30 using 10 gallons of water/A in a 7-inch band; plots were inoculated later on the same day by applying *R. solani*-infested ground barley inoculum (28 g/30 ft of row) over each of the center four rows with a Gandy granular applicator in two passes opposite in direction.

[X] For each column, numbers followed by the same letter are not significantly different according to Fisher's Protected Least Significant Difference (LSD); NS = not significantly different; percent stand loss = percent of stand present at the time of inoculation that died by harvest; Rhizoctonia crown and root rot (RCRR) ratings on a 0-7 scale, 0 = no disease, 7 = root completely rotted and plant dead.

[Y] Non-inoculated control shown for comparison, but not included in the statistical analysis.

[Z] Application included Preference non-ionic surfactant at 0.125%.

The 14 fl oz rate of all azoxystrobin fungicides including Quadris and two generic products, Equation and Satori, were consistently the best performers, giving similar results for both control of Rhizoctonia and harvest parameters in this postemergence fungicide test. Priaxor and Proline (both with NIS) have performed better in previous trials than they did in this trial. Priaxor performed better with addition of NIS than without. Without NIS Priaxor was not significantly different from the untreated control for disease control and yield but with NIS, Priaxor resulted in reduced disease ratings and increased yield (Table 1). Proline + NIS was not significantly different from the untreated control for any disease control or harvest parameter.

Fungicides that resulted in better disease control also resulted in higher root yield and recoverable sucrose A^{-1}. In this trial there was very strong correlation between disease control and both root yield and recoverable sucrose A^{-1}, illustrated in Fig. 1 for recoverable sucrose A^{-1}.

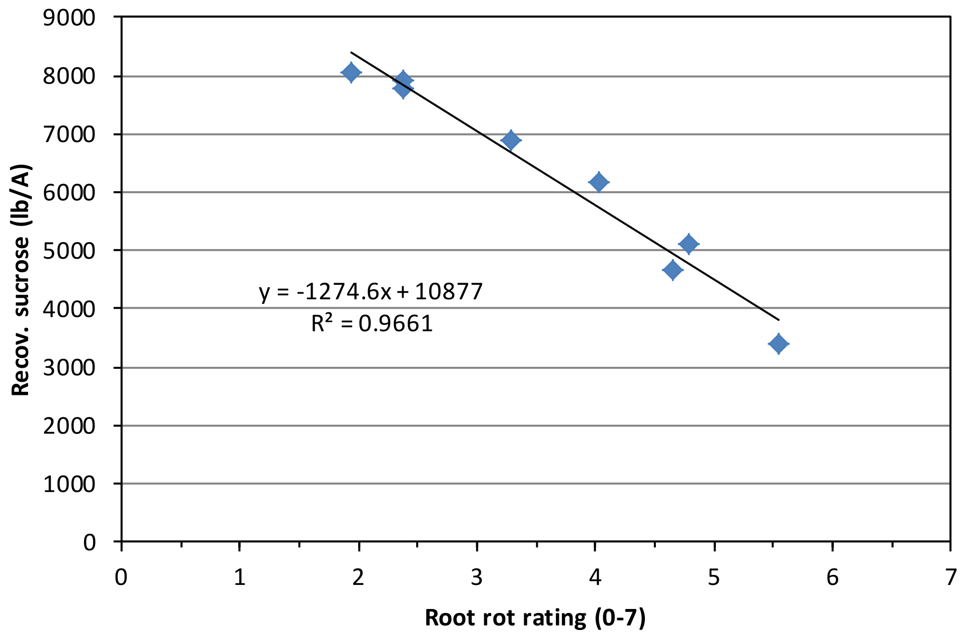

Fig. 1 Scatter plot of recoverable sucrose A^{-1} vs. Rhizoctonia crown and root rot rating in a field trial inoculated with *Rhizoctonia solani* illustrating strong (significant at P = 0.01) negative correlation between sugar yield and disease. Data points represent the mean of 4 replicate plots for eight different postemergence fungicide treatments.

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