SEED TREATMENT AND INFURROW FUNGICIDES FOR RHIZOCTONIA CONTROL

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Rhizoctonia root and crown rot, caused by *Rhizoctonia solani* Kühn, is currently the most devastating soil borne disease of sugarbeet (*Beta vulgaris* L.) in North Dakota and Minnesota. In the bi-state area, *R. solani* anastomosis group (AG) 1, AG-2-2, AG-4 and AG-5 cause damping off and AG-2-2 causes root and crown rot of sugarbeet (Windels and Nabben 1989). *R. solani* survives as thickened hyphae and sclerotia in organic material and is endemic in soils where sugarbeet is grown. *R. solani* has a wide host range including broad leaf crops and weeds (Anderson 1982; Nelson et al. 2002). Crop rotations of three or more years with small grains planted before sugarbeet is recommended to reduce disease incidence (Windels and Lamey 1998). In fields with a history of high disease severity, growers may plant varieties that are more resistant but with significantly lower yield potential compared to more susceptible varieties (Panella and Ruppel 1996). Research showed that timely application of azoxystrobin provided effective disease control but not when applied after infection or after symptoms were observed (Brantner and Windels, 2002; Jacobsen et al. 2002). Fungicidal seed treatments were developed and commercialized starting in 2013 to provide early season protection from *R. solani* and to facilitate the practice of using a liquid starter fertilizer at planting and speed-up the rate of planting. It will be useful to know whether seed treatments are compatible with in-furrow fungicides when needed for areas with high disease pressure, whether seed treatments provide season long disease protection, and whether multiple post-fungicide applications provide better disease control compared to one post-application at the 4-leaf stage.

The objective of this research was to determine whether seed treatments are compatible with in-furrow fungicides when needed for areas with high disease pressure, whether seed treatments provide season long disease protection, and whether multiple post-fungicide applications provide better disease control compared to one post-application at the 4-leaf stage.

MATERIALS AND METHODS

A field trial was conducted at Hickson, ND in 2017. The site was inoculated on 28 April with *R. solani* AG 2-2 IIIB grown on barley. Inoculum was broadcast using a three-point mounted rotary/spinner type spreader calibrated to deliver 58 lbs/A of inoculum. The inoculum was incorporated with a Konskilde field cultivator to about the two-inch depth before planting. The experimental design was a randomized complete block with four replicates. Field plots comprised of six 25-foot long rows spaced 22 inches apart. Plots were planted to stand on 3 May with a Rhiaxoctonia susceptible variety. Seeds were treated with Tachigaren at 45 g/kg seed to provide early season protection against *Aphanomyces cochlioides*, and Poncho Beta. Counter 20G was also applied at 9 lb/A at planting to control insect pests. Weeds were controlled on 1 and 13 June and 10 July. Fungicides were sprayed to control Cercospora Leaf Spot on 24 July and 2 August.

The fungicides and rates used are listed in Table 1. Treatments were applied as an in-furrow application. The in-furrow applications were made on 3 May (at planting) using 7.1 gal of spray solution/A.

Stand counts were taken during the season and at harvest. The middle two-rows of plots were harvested on 11 September and weights were recorded. Samples (12-15 roots) from each plot, not including roots on the ends of plots, were analyzed for quality at American Crystal Sugar Company tare laboratory at East Grand Forks, MN. The data analysis was performed with the ANOVA procedure of the Agriculture Research Manager, version 8 software package (Gylling Data Management Inc., Brookings, South Dakota, 2010). The least significant difference (LSD) test was used to compare treatments when the F-test for treatments was significant.

RESULTS AND DISCUSSIONS

The first significant rainfall was 20 days after planting on May 25 and again on May 30. Emergence was non-uniform and occurred over a wide range of dates resulting in plant stand ranging from 158 to 182 on June 7 and 165 to 193 on June 23; however, there were no significant differences in plant stand among treatments on June 23 nor at harvest. It should be noted that dry conditions at and after planting were not favorable for infection and disease development by *R. solani* and Rhizoctonia damping-off was not observed. Later in the season, after mid-July, Rhizoctonia root rot symptoms and death of plants in some treatments were observed. There were no significant differences in tonnage nor in sucrose concentration among treatments. There were significant differences in sugar loss to molasses which resulted in significant differences in recoverable sucrose among treatments. The seed treatments which had no post-fungicide applications all had lower tonnage compared to the same seed treatments with post-fungicide applications. Likewise, the check with no seed treatment also had lower tonnage than the non-treated seed with a post-fungicide application. Since Rhizoctonia root rot was observed later in the season, it is likely that the post fungicide applications provided better disease protection in those treatments leading to higher recoverable sucrose. In this trial, the seed treatments used alone did not result in as high recoverable sucrose per acre as seed treatments with post-application fungicides, or treatments with post-application fungicides. It was safe to use seed treatments with in-furrow fungicides. Based on the field data, it will be useful for growers to continue to use fungicide seed treatments to provide protection in years when conditions are favorable for Rhizoctonia damping-off. However, seed treatments do not provide season long protection against R. solani, so post-fungicide applications will still be necessary. In this trial, two post-fungicide applications (at the 4-6 and at the 8-10 leaf stages) resulted in the highest recoverable sucrose per acre. Research will continue to determine the best time and number of post fungicide applications for effective control of R. solani and highest recoverable sucrose

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Table 1. Effect of fungicides from in-furrow applications and seed treatments on Rhizoctonia root rot at Hickson, ND in 2017

Product and Rate in fl oz/A	Application dates	12 June Stand Count	11 Sept Stand Count	11 Sept Yield	11 Sept Sucrose concentration	11 Sept SLM	11 Sept Recoverable sucrose
		beets/100'	beets/100'	Ton/A	%	%	lb/A
Untreated	-	205	179	31.0	17.7	1.66	9,871
Kabina	Seed trt	200	162	32.6	17.6	1.70	10,385
Vibrance	Seed trt	210	164	31.3	17.9	1.61	10,205
Metlock + Rizolex + Kabina	Seed trt	214	174	33.5	17.9	1.57	10,920
Systiva	Seed trt	202	175	30.5	18.0	1.65	9,947
Kabina/ Quadris 9.2 fl oz	Seed trt/ 12 June	197	195	31.1	18.3	1.61	10,357
Vibrance/ Quadris 9.2 fl oz	Seed trt/ 12 June	212	166	32.2	17.7	1.59	10,333
Metlock + Rizolex + Kabina/ Quadris 9.2 fl oz	Seed trt/ 12 June	206	190	32.0	17.9	1.65	10,349
Systiva/ Quadris 9.2 fl oz	Seed trt/ 12 June	211	165	33.5	17.9	1.60	10,947
Kabina/ Quadris 9.2 fl oz/ Proline 5.7 fl oz + NIS 0.125% v/v	Seed trt/ 12 June/ 20 June	212	189	33.1	17.6	1.58	10,614
Vibrance/ Quadris 9.2 fl oz/ Proline 5.7 fl oz + NIS 0.125% v/v	Seed trt/ 12 June/ 20 June	216	193	31.8	18.1	1.62	10,476
Metlock + Rizolex + Kabina/ Quadris 9.2 fl oz/ Proline 5.6 fl oz + NIS 0.125 % v/v	Seed trt/ 12 June/ 20 June	216	189	34.5	17.7	1.67	11,020
Systiva/ Quadris 9.2 fl oz/ Proline 5.7 fl oz + NIS 0.125% v/v	Seed trt/ 12 June/ 20 June	216	192	32.2	18.1	1.59	10,578
Quadris 9.2 fl oz	12 June	207	173	31.5	17.9	1.66	10,192
Quadris 9.2 fl oz/ Proline 5.6 fl oz + NIS 0.125% v/v	12 June/ 20 June	212	164	31.7	18.2	1.55	10,538
Quadris 9.2 fl oz IF	3 May	218	193	33.4	17.9	1.73	10,749
Quadris 9.2 fl oz IF/ Proline 5.7 fl oz + 0.125% v/v	3 May/ 12 June	217	184	32.3	17.9	1.59	10,524
Quadris 9.2 fl oz IF/ Proline 5.7 fl oz + 0.125% v/v/ Priaxor 6.7 fl oz	3 May/ 12 June/ 20 June	204	168	35.3	17.6	1.69	11,215
Kabina +Quadris 9.2 fl oz IF	Seed trt/ 3 May	209	161	30.4	17.6	1.59	9,778
Vibrance + Quadris 9.2 fl oz IF	Seed trt/ 3 May	195	179	31.9	17.8	1.66	10,223
Metlock + Rizolex + Kabina + Quadris 9.2 fl oz IF	Seed trt/ 3 May	199	167	27.8	18.2	1.64	9,172
Systiva + Quadris 9.2 fl oz	Seed trt/ 3 May	213	175	32.1	18.3	1.66	10,679
Kabina + Quadris 9.2 fl oz IF/ Proline 5.7 fl oz + NIS 0.125% v/v	Seed trt/ 3 May/ 12 June	205	187	30.0	18.5	1.58	10,126
Vibrance + Quadris 9.2 fl oz IF/	Seed trt/ 3 May/	181	170	33.0	18.2	1.55	10,993

Proline 5.7 fl oz + NIS 0.125% v/v	12 June						
Metlock + Rizolex + Kabina + Quadris 9.2 fl oz IF/ Proline 5.7 fl oz + NIS 0.125% v/v	Seed trt/ 3 May/ 12 June	198	163	32.2	18.3	1.63	10,682
Systiva + Quadris 9.2 fl oz/ Proline 5.7 fl oz + NIS 0.125% v/v	Seed trt/ 3 May/ 12 June	207	169	32.4	17.9	1.68	10,419
LSD (P=0.10)	**-**	**15**	**NS**	**NS**	**NS**	**NS**	**NS**