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 2016. The site was inoculated on 2 May 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 35 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 5 May with Crystal 101RR. 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 9 June, 7 and 25 July. Fungicides were sprayed to control Cercospora Leaf Spot on 25 July, 12 and 24 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 5 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 26 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 2016

Product and Rate in fl oz/A	Application dates	23 June Stand Count	26 Sept Stand Count	26 Sept Yield	26 Sept Sucrose concentration	26 Sept SLM	26 Sept Recoverable sucrose
		beets/100’	beets/100’	Ton/A	%	%	lb/A
Untreated	-	166	152	32.2	15.6	1.77	8,984
Kabina	Seed trt	180	158	32.8	15.7	1.97	8,995
Vibrance	Seed trt	181	150	32.5	15.3	1.99	8,617
Metlock + Rizolex + Kabina	Seed trt	181	155	31.9	15.5	1.99	8,655
Kabina/ Quadris 9.2 fl oz	Seed trt/ 2 June	168	152	33.1	16.2	1.65	9,701
Vibrance/ Quadris 9.2 fl oz	Seed trt/ 2 June	179	166	34.5	15.8	1.82	9,731
Metlock + Rizolex + Kabina/ Quadris 9.2 fl oz	Seed trt/ 2 June	180	174	35.8	15.8	1.86	10,048
Kabina/ Quadris 9.2 fl oz/ Proline 5.7 fl oz + NIS 0.125% v/v	Seed trt/ 2 June/ 15 June	188	186	36.8	15.8	1.74	10,342
Vibrance/ Quadris 9.2 fl oz/ Proline 5.7 fl oz + NIS 0.125% v/v	Seed trt/ 2 June/ 15 June	185	174	36.0	15.8	1.74	10,158
Metlock + Rizolex + Kabina/ Quadris 9.2 fl oz/ Proline 5.6 fl oz + NIS 0.125 % v/v	Seed trt/ 2 June/ 15 June	182	162	34.9	16.1	1.70	10,060
Quadris 9.2 fl oz	2 June	165	165	36.3	15.8	1.77	10,258
Quadris 9.2 fl oz/ Proline 5.6 fl oz + NIS 0.125% v/v	2 June/ 15 June	176	169	36.7	16.1	1.71	10,555
Quadris 9.2 fl oz IF	5 May	184	177	34.3	15.6	1.91	9,419
Quadris 9.2 fl oz IF/ Proline 5.7 fl oz + 0.125% v/v	5 May/ 2 June	182	179	34.1	15.4	1.72	9,316
Quadris 9.2 fl oz IF/ Proline 5.7 fl oz + 0.125% v/v/ Headline 9 fl oz	5 May/ 2 June/ 15 June	184	183	37.3	16.4	1.73	10,946
Kabina +Quadris 9.2 fl oz IF	Seed trt/ 5 May	179	169	33.4	15.6	1.76	9,263
Vibrance + Quadris 9.2 fl oz IF	Seed trt/ 5 May	180	162	34.1	15.4	1.97	9,199
Metlock + Rizolex + Kabina + Quadris 9.2 fl oz IF	Seed trt/ 5 May	193	168	33.2	15.6	1.78	9,219
Vibrance + Quadris 9.2 fl oz IF/ Proline 5.7 fl oz + NIS 0.125% v/v	Seed trt/ 5 May/ 2 June	185	176	37.0	15.6	1.89	10,089
Kabina + Quadris 9.2 fl oz IF/ Proline 5.7 fl oz + NIS 0.125% v/v	Seed trt/ 5 May/ 2 June	193	187	37.6	15.5	1.87	10,246
Metlock + Rizolex + Kabina + Quadris 9.2 fl oz IF/ Proline 5.7 fl oz + NIS 0.125 %v/v	Seed trt/ 5 May/ 2 June	191	184	35.0	15.2	1.96	9,288
LSD (P=0.10)	**-**	**NS**	**NS**	**NS**	**NS**	**0.191**	**1,125**