USING POST FUNGICIDE APPLICATION AND SEED TREATMENTS FOR CONTROL OF RHIZOCTONIA SOLANI

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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 compered 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*.

The objective of this research was to evaluate the fungicidal seed treatments with and without a post-application fungicide their effectiveness at controlling *R. solani* and impact on yield and quality in sugarbeet.

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 known susceptible variety. Seeds were treated with Tachigaren at 45 g/kg seed to provide early season protection against *Aphanomyces cochlioides*, and Poncho Beta to provide early season insect control. Counter 20G was also applied at 9 lb/A at planting to control insect pests. Weeds were controlled on 1 and 13 June 10 July. Fungicides were sprayed to control Cercospora leaf spot on 24 July and 2 August.

The fungicides treatments and rates of fungicide used are listed in Table 1. Different commercial seed treatments were used alone and with a post fungicide applied in a 7-inch band application. The band-applications were made on 12 June at the eight leaf stage using 17 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

Dry conditions after planting resulted in delayed emergence. The first significant rainfall was 22 days after planting on May 25 and again on May 30. Plant stand was very variable in all treatments and counts taken on June 7 indicated variable stands but no significant differences among treatments. Seedling damping-off was not observed in June, probably because the dry conditions were not favorable for disease development. Rainfall on July 11 (2.84'') and 19 (0.52'') resulted in conditions more favorable for infection by *R. solani*. Typical symptoms of Rhizoctonia root rot including leaf wilting, yellowing, followed by death of leaves and then entire plants were observed starting in August. It should be noted that infection was not uniform in plots.

In the non-diseased conditions which prevailed early in the growing season, there were no significant differences in plant stand among seed treatments. At harvest, plant stand, although not statistically significantly, were lower in treatments which had only fungicide seed treatment(s) or no seed treatment compared to treatments with a post fungicide application Quadris application at the 8-leaf stage. The environmental conditions and visual symptoms on infected pants indicated that there was some *R. solani* infection later in the growing season. It was likely that post application of Quadris provided some protection of plants from the later season Rhizoctonia root rot and the trend for higher plant stand, tonnage, sucrose concentration and recoverable sucrose. Overall dry conditions with favorable growing degree days along with adequate soil moisture resulted in relatively high tonnage, sucrose concentration and recoverable sucrose in all treatments, including the non-treated check. The benefits of using Quadris was best demonstrated where the fungicide was used only as a post application compared to the treatment using no fungicidal seed and post treatments (non-treated check). Since it is not known what environmental conditions will prevail during the growing season, and that none of the recommended fungicides are curative (that is, will not control *R. solani* after symptoms are observed), the prophylactic use of seed treatments and a post fungicide application when plants are at the 4- to 8-leaf stage should provide effective protection from *R. solani*.

References

Anderson, N. A. 1982. The genetics and pathology of *Rhizoctonia solani*. Annu. Rev. Phytopathol. 20:329-347.

Brantner, J. and Windels, C.E. 2002. Band and broadcast applications of quadris for control of Rhizoctonia root and crown rot on sugarbeet. In: 2001 Sugarbeet Res. Ext. Rep. Fargo, ND: NDSU Ext. Serv. 32:282-286.

Jacobsen, B. J., Zidack, N. K., Mickelson, J. and Ansley, J. 2002. Integrated management strategies for Rhizoctonia crown and root rot. In: 2001 Sugarbeet Res. Ext. Rep. Fargo, ND: NDSU Ext. Serv. 32:293-295.

Nelson, B., T. Helms, T. Christianson, and I. Kural. 1996. Characterization and pathogenicity of *Rhizoctonia solani* from soybean. Plant Dis. 80:74-80.

Panella, L. and E. G. Ruppel. 1996. Availability of germplasm for resistance against *Rhizoctonia* spp. Pages 515-527, *In*: *Rhizoctonia* Species: Taxonomy, molecular biology, ecology, pathology and disease control. B. Sneh, S. Jabaji-Hare, S. Neate, and G. Dijat, eds. Kluwer Academic Publishers, Dordrecht, Netherlands.

Windels, E. W. and H. A. Lamey. 1998. Identification and control of seedling diseases, root rot, and rhizomania on sugarbeet. Univ. Minnesota and North Dakota State Univ. Ext. Serv. Bull. PP-1142 , BU-7192-S.

Windels, C. E., and D. J. Nabben. 1989. Characterization and pathogenicity of anastomosis groups of *Rhizoctonia solani* isolated from *Beta vulgaris*. Phytopathol. 79:83-88.

Table 1. Effect of seed treatments and post fungicide application for control of Rhizoctonia root rot on sugarbeet at Hickson, ND in 2017

Product and Rate in fl oz/A	19 June Stand Count	9 August Stand Count	11 September Stand Count	11 September Yield	11 September Sucrose concentration	11 September Recoverable sucrose
	beets/100'	beets/100'	beets/100'	Ton/A	%	lb/A
Untreated	207	188	144	30.7	17.7	9,799
Kabina 14g	207	193	149	32.3	17.2	9,832
Vibrance	214	199	148	32.0	17.5	10,041
Metlock + Rizolex + Kabina 7g	207	199	149	32.5	17.0	9,809
Quadris 9.2 fl oz	193	204	162	35.7	17.8	11,426
Kabina 14g **fb** Quadris 9.2 fl oz	202	211	167	32.1	17.7	10,223
Vibrance **fb** Quadris 9.2 fl oz	209	205	164	32.3	17.7	10,332
Metlock + Rizolex + Kabina 7g **fb** Quadris 9.2 fl oz	215	229	171	34.9	17.4	10,922
LSD (P=0.10)	**12**	**20**	**NS**	**3.6**	**0.67**	**1095**

*Treatment applied POST on 2 June.