EFFECT OF IN-FURROW APPLICATION METHOD OF FUNGICIDES FOR CONTROLLING RHIZOCTONIA ROOT ROT IN SUGARBEET

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Rhizoctonia root and crown rot, caused by Rhizoctonia solani Kühn, is currently the most devastating soilborne disease of sugarbeet (Beta vulgaris L.) in the 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. 1996). Severe disease occurs if sugarbeet follows beans or potato (Baba and Abe 1966; Johnson et al. 2002). Crop rotations of 3 or more years with small grains planted before sugarbeet is recommended to reduce disease incidence (Windels and Lamey 1998). However, the acreage of small grains has significantly decreased over the past decade. Research showed that timely application of Quadris and Proline provided effective disease control when applied before infection takes place (Khan and Carlson, 2010). Headline and Quadris fungicides applied in-furrow has also shown to provide effective early season disease control. Many growers typically use a liquid starter fertilizer applied in-furrow at planting. There are reports that the use of fungicides mixed with starter fertilizer result in phytotoxicity.

The objective of this research was to determine the safety and effectiveness of three in-furrow application methods of Quadris and Headline for controlling Rhizoctonia root rot in sugarbeet.

MATERIALS AND METHODS

A field trial was conducted in Glyndon, MN in 2011. The site was inoculated on 18 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 15 lbs/A of inoculum. The inoculum was incorporated with a Konskilde field cultivator to about the two-inch depth just 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 18 May a commercially available, glyphosate tolerant variety (Proprietary material, Crystal Beet Seeds) which was resistant to Rhizomania and very susceptible to *Rhizoctonia solani*. Seeds were also treated with Tachigaren at 45 g/kg seed to provide early season protection against *Aphanomyces cochlioides*, and Poncho-Beta to provide protection against insect pests. Counter 15G was also applied at 11.9 lb/A at planting to control insect pests. Weeds were controlled with glyphosate on 20 June, 6 July and 11 August.

Quadris at 9.2 fl oz/A and Headline at 12 fl oz/A were applied in-furrow using three different nozzle configurations. One configuration used a TeeJet 0004 StreamJet nozzle operated at 3 mph and 15 psi and applied a solid stream of solution at a rate of 23 gallons/A into the furrow approximately 2 inches behind the seed tube. The second configuration used a #35 orifice plate as a nozzle and was also operated at 3 mph and 15 psi, resulting in a solid stream of spray solution being applied into the furrow approximately 2 inches behind the seed tube at 9 gallons/A. The third configuration used a TeeJet 4002 E flat fan nozzle orientated perpendicular to the furrow and operated at 3 mph and 30 psi. This resulted in 16 gallons/A of spray solution applied in a 3 inch T-band in-furrow approximately 2 inches behind the seed tube.

Stand counts were taken during the season and at harvest. The middle two-rows of plots were harvested on 28 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

Conditions starting early in the season, and continuing through the growing season, were favorable for infection by *R. solani*. Stand counts on 6 June showed reduced emergence of sugarbeet treated with Headline under both solid-stream application methods compared to the inoculated check (Table 1). The T-band application of Headline did not cause reduced emergence compared to the inoculated check. Emergence of sugarbeet treated with Quadris was similar to the inoculated check for all three nozzle configurations.

Reductions in stand occurred throughout the season regardless of application method or fungicide. In-furrow T-band applications of Headline and Quadris tended to maintain better stands longer in the season than sugarbeet treated with fungicide from a solid stream configuration. At harvest, sugarbeet treated with Quadris tended to have greater stand than sugarbeet treated with Headline.

The application of Quadris in-furrow, regardless of nozzle configuration, resulted in sugarbeet with 2300 – 2700 lbs greater extractable sucrose per acre than those from the inoculated check. Sugarbeet treated with Headline in-furrow when applied in the 3 inch T-band or in a solid stream with a 9 gallons/A spray volume gave similar extractable sucrose to sugarbeet treated with Quadris. Headline applied in a solid stream of 23 gallons/A spray volume resulted in sugarbeet with significantly less extractable sucrose than those treated with Quadris or the other nozzle configurations of Headline, but significantly greater extractable sucrose than sugarbeet from the inoculated check.

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Table 1. Effect of nozzle configuration and fungicide on sugarbeet stand, yield, and quality at Glyndon, MN in 2011.

Nozzle Configuration & Fungicide	6 June Stand Count	9 Aug Stand Count	28 September Stand Count	Yield	Sucrose Concentration	Extractable Sucrose
0004 – 23 gal/A Solid Stream	**beet/100'**	**beet/100'**	**beet/100'**	**Ton/A**	**%**	**lb/A**
Quadris 9.2 fl oz/A	218	189	159	22.5	16.1	6475
Headline 12 fl oz/A	172	138	98	20.3	15.0	5269
#35 Orifice Plate - 9 gal/A Solid Stream						
Quadris 9.2 fl oz/A	198	172	135	23.5	16.2	6770
Headline 12 fl oz/A	177	159	126	22.9	16.2	6537
4002 E flat fan – 16 gal/A 3" T-band						
Quadris 9.2 fl oz/A	195	205	144	24.7	15.6	6820
Headline 12 fl oz/A	193	188	130	22.0	16.8	6632
Inoculated Check	208	89	58	15.9	15.0	4146
LSD (0.05)	**17**	**33**	**30**	**2.8**	**NS**	**935**