EFFECT OF BAND AND BROADCAST APPLICATIONS OF FUNGICIDE AT 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). 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).

The objective of this research was to evaluate broadcast vs. one-nozzle vs. two-nozzle band applications of fungicide 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 with a commercially available, glyphosate tolerant variety (Proprietary material, Crystal Beet Seeds) which was resistant to Rhizomania and very susceptible to *Rhizoctonia solani*. Seeds were 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.

Specific treatments are listed in Table 1. Fungicides used were Quadris at 4.6, 9.2, or 15.4 fl oz/A, Proline at 4.3 or 5.7 fl oz/A + NIS at 0.25% v/v, and Headline at 12 fl oz/A. Treatments were applied on 9 June and 20 June. Band applications were made using either one TeeJet 4002 E flat fan nozzle or two TeeJet 4001 E flat fan nozzles per row. When one nozzle per row was used for band applications, then nozzle was centered over the row and operated at 9.5 inches above ground surface for 7 inch bands and 5.5 inches above ground for a 4 inch band. When two nozzles were used for a band application, the nozzles were attached to drop tubes on both sides of a row and orientated in towards the sugarbeet row. Broadcast applications were made using TeeJet 8002 XR flat fan nozzles spaced 20” on center. All treatments were made using a bicycle type sprayer operated at 3 mph and 40 psi.

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

Warm and wet soils resulted in favorable conditions for infection by *R. solani* early in the season. Applications scheduled for 4-leaf and 8-leaf sugarbeet had to be applied earlier (cotyledon to 2 leaf – 9 June, and 4 to 6 leaf – 20 June) because soil temperature at the four inch soil depth climbed to over 70°F in early June. There was some seedling damping-off in early June. Wilting, yellowing of leaves of older plants and plant death started in mid-June and continued throughout the season.

One application of Proline + NIS or Headline made on 9 June resulted in sugarbeet stand and extractable sucrose similar to the inoculated check, regardless of rate or application method.

One band application of Quadris on 9 June gave greater sugarbeet stand compared to the inoculated check at harvest regardless of rate or band width. One broadcast application of Quadris at 15.4 fl oz/A on 9 June gave greater sugarbeet stand compared to the inoculated check at harvest but Quadris at 9.2 fl oz/A did not. One application of Quadris, regardless of rate or application method, did not significantly improve extractable sucrose per acre compared to the inoculated check.

Band and broadcast applications of Quadris at 9.2 fl oz/A made on both 9 June and 20 June resulted in greater sugarbeet stand at harvest and extractable sucrose per acre compared to the inoculated check. Two band applications of Quadris, both with one and two nozzles, tended to give greater extractable sucrose compared to two broadcast applications of Quadris. Two single-nozzle band applications of Quadris at 9.2 fl oz/A always gave greater extractable sucrose compared to one application of Quadris, regardless of application method or rate.

Band applications tended to give better control of Rhizoctonia than broadcast applications but no significant differences occurred. Using two nozzles for band application gave similar Rhizoctonia control to using one nozzle.

It may become necessary to use two applications of Quadris for effective Rhizoctonia root rot control. Further research should include rotation of different chemistries of fungicides for controlling Rhizoctonia root rot, as well as root sampling and testing for pathogen sensitivity to a fungicide when that same fungicide is used multiple times in a growing season.

References

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

Baba, T. and H. Abe. 1966. Influence of preceding crops upon incidence of the sugar beet crown rot. Jpn. Bull. Sugar Beet Res. 7:69-71.

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.

Johnson, D., Halloin, J. and Poindexter, S. 2002. Use of quadris to control natural infestations of Rhizoctonia crown and root in Michigan. In: 2001 Sugarbeet Res. Ext. Rep. Fargo, ND: NDSU Ext. Serv. 32:287-292.

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 band and broadcast applications of fungicide on Rhizoctonia root rot at Glyndon, MN in 2011.

Product and Rate in fl oz/A	Application Date(s)	Band Width	14 June Stand Count	10 Aug Stand Count	28 September Stand Count	28 September Yield	28 September Sucrose	28 September Recoverable sucrose
			beets/100’	beets/100’	beets/100’	Ton/A	%	lb/A
One Nozzle Band								
Quadris 9.2	9 & 20 June	7” band	192	178	159	26.2	15.9	7451
Quadris 15.4	9 June	7” band	175	141	117	19.9	15.0	5169
Quadris 9.2	9 June	7” band	165	117	91	19.0	15.0	4852
Quadris 4.6	9 June	4” band	172	114	91	17.9	14.5	4555
Proline 4.3 + NIS 0.25% v/v	9 June	4” band	167	80	73	16.1	13.7	3712
Proline 5.7 + NIS 0.25% v/v	9 June	7” band	162	90	70	14.0	14.0	3352
Headline 12	9 June	7” band	149	69	66	10.5	14.5	3255
Two Nozzle Band								
Quadris 9.2	9 & 20 June	7” band	173	166	147	24.3	15.9	6869
Quadris 15.4	9 June	7” band	169	131	113	20.5	14.9	5445
Quadris 9.2	9 June	7” band	177	142	113	18.1	15.1	4803
Quadris 4.6	9 June	7” band	182	122	94	18.5	15.3	4884
Broadcast								
Quadris 9.2	9 & 20 June	-	174	158	132	23.0	15.3	6165
Quadris 15.4	9 June	-	167	128	105	18.8	13.5	4340
Quadris 9.2	9 June	-	179	121	83	16.4	14.7	4795
Headline 12	9 June	-	173	71	53	13.2	14.6	3306
Proline 5.7 + NIS 0.25% v/v	9 June	-	164	64	50	9.6	13.7	2611
Inoculated Check			168	68	42	9.4	15.6	3881
LSD (P=0.05)			**NS**	**38**	**45**	**6.1**	**1.4**	**1512**