USE OF FUNGICIDES IN SUGARBEET FOR MAXIMUM PROTECTION AGAINST RHIZOCTONIA ROOT ROT

Mohamed F. R. Khan[1] and Aaron L. Carlson[2]

[1]Extension Sugarbeet Specialist, North Dakota State University & University of Minnesota
[2]Research Technician, Plant Pathology Department, North Dakota State University

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 determine the best time to apply fungicides for controlling Rhizoctonia root rot in sugarbeet.

MATERIALS AND METHODS

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.

The fungicides used were Quadris, Headline, and Proline. Treatments were applied either as in-furrow application alone; in-furrow application followed by one or more POST applications; and POST applications at different leaf stages. An inoculated check was included as a control. The in-furrow application was made on 18 May (at planting) with a spray volume of 23 gal/A. POST applications were made on 9 and 20 June. POST applications were made using a bike sprayer with flat fan nozzles (4002E) spaced 22'' apart, set 9.5 inches above the soil, and calibrated to deliver 17 gal solution/A at 40 p.s.i pressure to the middle four rows of plots in a 7" band centered over each row. Quadris was used at 9.2 fl oz/A; Proline at 5.7 fl oz/A, and Headline at 6.0 or 9.1 fl oz/A.

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. POST applications scheduled for 4-leaf and 8-leaf sugarbeet had to be applied earlier (cotyledon to 2 leaf, and 4 to 6 leaf stages) 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.

By the end of June, the inoculated check had significantly lower plant stand compared to most of the fungicide treatments. Quadris applied in-furrow resulted in significantly greater plant stand at harvest, and greater recoverable sucrose compared to Headline applied in-furrow. There was a trend of higher plant stand and greater recoverable sucrose when Headline in-furrow was followed by POST applications. Most of the POST applications had significant stand losses but still provided some level of disease control that resulted in greater recoverable sucrose compared to the non-treated check.

The most effective treatment was Quadris applied in-furrow. However, because conditions were favorable for disease development throughout the season, even the best treatment suffered stand loss. It is possible that Quadris in-furrow followed by an effective POST fungicide application would provide better disease control than one in-furrow application when conditions throughout the season are favorable for disease development.

Khan and Carlson (2010) reported that one POST application of Quadris or Proline provided effective control against *R. solani*. However, in this trial, neither one nor two POST applications of fungicide in rotation provided effective disease control. This is probably because the POST applications were made after the fungus became active and infection had occurred (at 65°F soil at 4" depth).

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.

Khan, M. F. R. and Carlson, A.L. 2010. Effect of fungicides on controlling Rhizoctonia crown and root rot of sugarbeet. In: 2009 Sugarbeet Res. Ext. Rep. Fargo, ND: NDSU Ext. Serv. 40:246-247.

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 fungicides from in-furrow or POST 7" band applications on Rhizoctonia root rot at Glyndon, MN in 2011.

Product and Rate in fl oz/A	Application Date(s)	6 June Stand Count	14 June Stand Count	28 September Stand Count	28 September Yield	28 September Sucrose concentration	28 September Recoverable sucrose
		beets/100'	beets/100'	beets/100'	Ton/A	%	lb/A
Inoculated Check	-	206	172	63	12.2	14.8	3132
Quadris 9.2	18 May	197	191	140	22.4	15.5	6126
Headline 9.1	18 May	186	176	103	18.6	14.2	4532
Headline 6	18 May	183	174	95	18.7	14.4	4687
Headline 6 **fb** Quadris 9.2	18 May **fb** 9 June	198	190	108	19.2	14.7	4913
Headline 6 **fb** Quadris 9.2 **fb** [Proline 5.7 + NIS 0.125% v/v]	18 May **fb** 9 June **fb** 20 June	179	182	110	19.6	14.6	5030
Quadris 9.2	9 June	183	169	94	19.1	14.4	4753
Quadris 9.2	20 June	199	179	110	21.5	14.7	5495
Quadris 9.2 **fb** [Proline 5.7 + NIS 0.125% v/v]	9 June **fb** 20 June	207	184	90	16.9	14.8	4391
[Quadris 9.2 + R.U.PowerMax 7 + NIS 0.125%v/v + Amstik 14.5lb ai/100 gal] **fb** [Proline 5.7 + R.U.PowerMax 7 + NIS 0.125% v/v + Amstik 14.5 lb ai/100 gal]	9 June **fb** 20 June	200	177	87	18.8	14.8	4908
LSD (P=0.05)		**14**	**20**	**33**	**5.0**	**0.9**	**1327**