EVALUATION OF AT-PLANTING FUNGICIDE TREATMENTS FOR CONTROL OF *RHIZOCTONIA SOLANI*

Ashok K. Chanda[1] and Jason R. Brantner[2]

[1]Assistant Professor and Extension Sugarbeet Pathologist, [2]Senior Research Fellow
University of Minnesota, Northwest Research and Outreach Center, Crookston, MN

Rhizoctonia damping-off and crown and root rot (RCRR) caused by *Rhizoctonia solani* AG 2-2 have been the most common root diseases on sugarbeet in Minnesota and North Dakota for several years (1, 3-5). Disease can occur throughout the growing season and reduces plant stand, root yield, and quality. Warm and wet soil conditions favor infection. Disease management options include rotating with non-host crops (cereals), planting partially resistant varieties, planting early when soil temperatures are cool, improving soil drainage, and applying fungicides as seed treatments, in-furrow (IF), or postemergence. An integrated management strategy should take advantage of multiple control options to reduce Rhizoctonia crown and root rot.

OBJECTIVES

A field trial was established to evaluate various at-planting fungicide treatments (seed and in-furrow) for 1) control of early-season damping-off and RCRR and 2) effect on yield and quality of sugarbeet.

MATERIALS AND METHODS

The trial was established at the University of Minnesota, Northwest Research and Outreach Center, Crookston. Field plots were fertilized for optimal yield and quality. A susceptible variety (HM4303RR) with a 2-year average Rhizoctonia rating of 5.3 was used (6). A randomized complete block design with four replications was used. Seed treatments and rates are summarized in Table 1 and were applied by Germains Seed Technology, Fargo, ND. In-furrow fungicides (Table 1) were applied down the drip tube in 6 gallons total volume A^{-1}. Control included no seed or in-furrow fungicide treatment at planting. Prior to planting, soil was infested with *R. solani* AG 2-2-infested whole barley (35 kg ha^{-1}). The trial was sown in six-row plots (22-inch row spacing, 25-ft rows) on May 04 at 4.5-inch seed spacing. Counter 20G (8 lb A^{-1}) was applied at planting for control of sugarbeet root maggot and 3 gallons A^{-1} starter fertilizer (10-34-0) was applied across all treatment combinations. Glyphosate (4.5 lb product ae/gallon) was applied on May 28, June 16 and 23, and August 17 (22 oz A^{-1}) for control of weeds. Postemergence prothioconazole was applied in a 7-inch band in 10 gallon/A using 4002 nozzles and 39 psi on June 15 (6 weeks after planting). Cercospora leaf spot was controlled by Supertin + Topsin M (6 + 7.5 oz product in 17 gallons of water/A) applied with 8002 flat fan nozzles at 90 psi on August 3.

Stand counts were done beginning 3 weeks after planting through 9 weeks after planting. The trial was harvested on September 22. Data were collected for number of harvested roots, yield, and quality. Twenty roots per plot also were arbitrarily selected and rated for severity of RCRR using a 0 to 7 scale (0 = healthy root, 7 = root completely rotted and foliage dead). Data were subjected to analysis of variance using SAS Proc GLM (SAS Institute, Cary, NC). Treatment means were separated using Fisher's protected least significant difference (LSD) test at a 0.05 level of significance.

RESULTS

There were no significant differences between treatments for initial stands at 3, 5, 6, 7 and 9 weeks after planting (data not shown). There were significant differences (P=0.05) between treatments for root rot rating, number of harvested roots pet 100 ft. of row, yield, and recoverable sugar A^{-1} (RSA) (Table 2). The in-furrow (IF) fungicides Quadris, Headline, Equation (generic azoxystrobin), and Satori (generic azoxystrobin) had lower adjusted root rot rating compared to seed treatments Kabina (7 and 14g), 2g Vibrance, and Metlock + 7g Kabina. One interesting observation from this study is that Metlock Suite performed similar to in-furrow fungicides and better compared to Kabina, Vibrance, and Metlock + 7 g Kabina treatments. Yield was highest for Quadris IF; followed by Headline IF, Equation IF, Satori IF, and Metlock Suite; intermediate for Metlock + 7g Kabina, 14g Kabina, and 2g Vibrance. Highest RSA was observed for all in-furrow treatments and Metlock Suite followed by all other seed treatments. When we performed a contrast analysis of seed treatments vs in-furrow treatments, in-furrow treatments had higher number of harvested roots, lower root rot rating, higher yield, and higher RSA compared to seed treatments (Table 2).

Table 1. Application type, product names, active ingredients, and rates of fungicides used at planting in a field trial for control of *Rhizoctonia solani* AG 2-2 on sugarbeet. Standard rates of Apron + Maxim and 45 g/unit Tachigaren were on all seed. In-furrow azoxystrobin or pyraclostrobin was applied down the drip tube in a total volume of 6 gal/A.

Application	Product	Active ingredient	Rate
None	-	-	-
Seed	Kabina ST	Penthiopyrad	14 g a.i./unit seed
Seed	Kabina ST	Penthiopyrad	7 g a.i./unit seed
Seed	Vibrance	Sedaxane	2.0 g a.i./unit seed
Seed	Metlock Suite	Metconazole + Rizolex	0.21 + 0.5 g a.i./unit seed
Seed	Metlock Suite + Kabina ST	Metcon + Rizo + Penthio	0.21 + 0.5 + 7 g a.i./unit seed
In-furrow	Quadris	Azoxystrobin	10.0 fl oz product A^{-1}
In-furrow	Equation	Azoxystrobin	10.0 fl oz product A^{-1}
In-furrow	Satori	Azoxystrobin	10.0 fl oz product A^{-1}
In-furrow	Headline	Pyraclostrobin	12.0 fl oz product A^{-1}

Table 2. Effects of at-planting (seed or in-furrow) fungicide treatments on Rhizoctonia crown and root rot and sugarbeet yield and quality.

				Sucrose		
Treatment[Y]	No. harv. Roots/100 ft.	RCRR (0-7)[Z]	Yield	%	lb ton^{-1}	lb A^{-1}
Untreated control	80	4.2	19.2	17.0	311	5965
14 g Kabina ST	94	4.3	19.7	15.8	288	5818
Metlock Suite	122	3.4	23.8	16.6	305	7372
Met. Suite + 7 g Kabina	95	4.3	20.6	16.9	309	6419
7 g Kabina ST	83	4.6	19.0	15.7	282	5302
2 g Vibrance	76	4.5	16.2	16.2	294	4766
12 fl oz Headline IF	122	2.9	25.6	16.8	309	7940
10 fl oz Quadris IF	141	2.1	28.4	17.1	317	9023
10 fl oz Equation IF	124	2.9	25.1	16.3	297	7501
10 fl oz Satori IF	123	3.0	22.9	16.0	289	6625
ANOVA P-value	0.0014	0.0301	0.0280	0.1658	0.1565	0.0393
LSD (P = 0.05)[X]	34.6	1.6	7.2	NS	NS	2488
Seed trts. vs in-furrow trts. Contrast analysis P-value	0.001	0.006	0.0032	0.7909	0.8765	0.0148
Mean of Seed trts.	98	3.9	20.1	16.6	304	6181
Mean of In-furrow trts.	127	2.7	25.5	16.5	303	7772

[X] NS = not significantly different
[Y] Values represent mean of 4 plots
[Z] RCRR = Rhizoctonia crown and root rot; 0-7 scale (adjusted rating), 0 = root clean, no disease, 7 = root completely rotted and plant dead

DISCUSSION

Early planting (May 04) into cool and dry soils that had been inoculated with *R. solani* along with average rainfall and cool weather in May accounted for light early-season disease pressure. Four-inch soil temperatures reached 65 °F by June 07 and rainfall in June was average. Most of the damage to the crop was from mid-season infections beginning in July. Rainfall in July was 4.96 inches which is above average and also 4-inch soil temperatures remained above 70 °F. As the season progressed, from July 15, we observed a moderate level of Rhizoctonia diseases pressure until the end of season. Based on one year of data generic azoxystrobin products (Equation and Satori) performed similar to Quadris, but when mixed with starter fertilizer (10-34-0), did not stay in suspension. Postemergence application of prothioconazole on June 15 (6 weeks after planting) was apparently not effective in protecting the susceptible variety in this trial. This trial clearly indicates that Rhizoctonia is a full season pathogen; a susceptible variety needs an at-planting treatment (seed or in-furrow) and a properly timed postemergence fungicide application to effectively manage Rhizoctonia root rot (2).

ACKNOWLEDGEMENTS

We thank the Sugarbeet Research and Education Board of Minnesota and North Dakota for funding this research; Mitsui Chemicals Agro, Inc., Valent, Cheminova, Loveland, BASF, and Syngenta for providing products; Hilleshog for providing seed; Germains Seed Technology for treating seed; the University of Minnesota, Northwest Research and Outreach Center, Crookston for providing land, equipment and other facilities; Jeff Nielsen for plot maintenance; Hal Mickelson, Brandon kasprick, Tim Cymbaluk, Katie Sheetz, and Irwin Sylvah for technical assistance; American Crystal Sugar Company, East Grand Forks, MN for NWROC site sugarbeet quality analysis.

LITERATURE CITED

1. Brantner, J.R. 2015. Plant pathology laboratory: summary of 2013-2014 field samples. 2014 Sugarbeet Res. Ext. Rept. 44:138-139.

2. Brantner, J.R. and A.K. Chanda. 2015. Integrated management of Rhizoctonia on sugarbeet with varietal resistance, seed treatment, and postemergence fungicides. 2014 Sugarbeet Res. Ext. Rept. 44: 142-146

3. Brantner, J.R. and C.E. Windels. 2011. Plant pathology laboratory: summary of 2009-2010 field samples. 2010 Sugarbeet Res. Ext. Rept. 41:260-261.

4. Brantner, J.R. and C.E. Windels. 2009. Plant pathology laboratory: summary of 2007-2008 field samples. 2008 Sugarbeet Res. Ext. Rept. 39:250-251.

5. Crane, E., Brantner, J.R., and Windels, C.E. 2013. Plant pathology laboratory: summary of 2011-2012 field samples. 2012 Sugarbeet Res. Ext. Rept. 43:169-170.

6. Niehaus, W.S. 2015. Results of American Crystal’s 2014 Official Coded Variety Trials. 2014 Sugarbeet Res. Ext. Rept. 44:176-223.