GENERIC FUNGICIDES AND STARTER FERTILIZER MIXTURES

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Rhizoctonia solani is a soil-borne fungal pathogen which attacks many economic crops worldwide including sugar beet (*Beta vulgaris* L.) (Yang and Li, 2012). In North Dakota and Minnesota, Rhizoctonia root rot has been listed as one of the most important production problems by growers since 2009 (Carlson et al., 2009; Hakk et al., 2015). Significant yield loss occurred when no measures were applied to control this disease (Khan et al., 2010; Kirk et al., 2008; Strausbaugh et al., 2011; Windels and Brantner, 2005). *R. solani* infected sugar beet results in significantly lower sucrose concentration, reduces respiration rate of sugar beet in storage and reduces extractable sucrose (Büttner et al., 2004; Campbell et al., 2014; Strausbaugh et al., 2011).
Azoxystrobin was one of the first registered fungicide to be used foliarly and in-furrow for effectively managing *R. solani*. Research shows that azoxystrobin applied preventatively and in a timely manner consistently provided effective control of R. solani on sugar beet in greenhouse and field studies (Liu and Khan, 2016; Noor and Khan, 2015; Stump et al., 2004; Windels and Brantner, 2005). Azoxystrobin (Quadris®) has been the most widely used fungicide by sugar beet producers in sugar beet producing states, including Michigan, Montana, Minnesota and North Dakota, for controlling *R. solani* (Carlson et al., 2010; Harveson et al., 200; Kirk et al., 2008; Hakk et al., 2015).
In 2014, generic azoxystrobins including Aframe™ (azoxystrobin 22.9%, Syngenta) and Satori® (azoxystrobin 22.9%; Loveland Products, Inc. Greeley, CO) became available to sugar beet growers who wanted to know whether these products were as effective as Quadris® considered as the industry's standard. Although the main and percent active ingredient in the widely used Quadris® was the same as in the generics, it was possible that the inert ingredients may be different which may impact efficacy and safety of the generics.

The objective of this field study was to evaluate the efficacy of generic azoxystrobins applied in-furrow and band applications at controlling *R. solani* on sugar beet compared to the industry's standard Quadris®.

MATERIALS AND METHODS

A field trial was conducted at Hickson, ND in 2016. The site was inoculated on 2 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 35 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 5 May with Crystal 101RR. Seeds were treated with Tachigaren at 45 g/kg seed to provide early season protection against *Aphanomyces cochlioides*, and Poncho Beta. Counter 20G was also applied at 9 lb/A at planting to control insect pests. Weeds were controlled on 9 June, 7 and 25 July.

The fungicides and rates used are listed in Table 1. The in-furrow applications were made on 5 May (at planting) using 7.1 gal of spray solution/A.

Stand counts were taken during the season and at harvest. The middle two-rows of plots were harvested on 26 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

The first significant rainfall was 20 days after planting on May 25 and again on May 30. Plant stand in all treatments taken in June and in September at harvest indicated variable stands (156 to 187 plants /100 ft of row in June and 143 to 191 plants /100 ft row at harvest) but no significant differences among treatments. Dry conditions continued in

June resulting in no observation of seedling damping-off. Dry conditions at planting may have delayed emergence and plant stand in a few treatments including those with Quadris and 10-34-0 and Kabina treated seeds with Satori and 10-34-0. However, on and after June 22, there were no significant differences in plant stand. There was no significant reduction in tonnage or recoverable sucrose when the industry's standard (Quadris) was compared with the generics. The results indicated that the generic azoxystrobins were similar to Quadris in all the parameters evaluated.

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Table 1. Effect of fungicides from in-furrow applications on Rhizoctonia root rot at Hickson, ND in 2016

Product and Rate in fl oz/A	22 June Stand Count	26 September Stand Count	26 September Yield	26 September Sucrose concentration	26 September Recoverable sucrose
	beets/100’	beets/100’	Ton/A	%	lb/A
Untreated	178	167	35.9	15.4	9,738
Aframe 9.2 fl oz	172	175	37.5	15.2	9,953
Satori 9.2 fl oz	174	163	31.2	14.5	7,806
Equation 9.2 fl oz	185	183	35.5	14.7	8,922
Quadris 9.2 fl oz	186	191	36.5	14.5	9,070
Aframe 9.2 fl oz + 10-34-0 3 gal	174	166	34.4	14.3	8,333
Satori 9.2 fl oz + 10-34-0 3 gal	176	169	32.6	14.2	7,821
Equation 9.2 fl oz + 10-34-0 3 gal	163	159	33.7	14.6	8,431
Quadris 9.2 fl oz + 10-34-0 3 gal	156	156	34.2	14.8	8,689
Aframe 9.2 fl oz*	181	170	33.1	15.1	8,728
Satori 9.2 fl oz*	184	181	32.9	14.4	8,069
Equation 9.2 fl oz*	166	153	33.3	15.0	8,567
Quadris 9.2 fl oz*	187	177	35.7	14.5	8,781
Aframe 9.2 fl oz + 10-34-0 3 gal*	186	172	35.1	14.7	8,992
Satori 9.2 fl oz + 10-34-0 3 gal*	158	148	33.5	15.2	8,865
Equation 9.2 fl oz + 10-34-0 3 gal*	185	154	27.3	14.9	7,032
Quadris 9.2 fl oz + 10-34-0 3 gal*	171	143	29.9	15.1	7,857
Kabina 14 g	168	151	31.5	14.4	7,669
LSD (P=0.10)	**NS**	**NS**	**4.04**	**NS**	**1,344**

*Seeds treated with Kabina @ 14g/100,000 seeds.