EFFECT OF PRECIPITATED CALCIUM CARBONATE ON RHIZOCTONIA ROOT AND CROWN ROT IN SUGARBEET

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Rhizoctonia root and crown rot, caused by *Rhizoctonia solani* Kühn, is currently the most damaging and difficult to control disease of sugarbeet (*Beta vulgaris* L.) in the North Dakota and Minnesota. Anastomosis group (AG) 2-2, and intraspecific groups (ISGs) AG 2-2 IV and AG 2-2 IIIB are the most prevalent ISGs in this sugarbeet production area. The diseases has become more widespread and severe over the past decade, probably because of warm and wet summers favorable for disease development and a transition in cropping sequence to now including *R. solani* host crops such as soybean, edible beans and maize. Varieties with high levels of resistance typically have lower yields compared to more susceptible varieties (Panella and Ruppel, 1996). Another important soilborne disease of sugarbeet is Aphanomyces root rot caused by *Aphanomyces cochlioides*. Research showed that application of precipitated calcium carbonate (or spent lime, a by-product of the sugar purification process), applied before planting sugarbeet, resulted in significantly reduced Aphanomyces root rot and increased recoverable sucrose in the presence of *A. cohlioides* (Windels et al., 2007). The seven sugarbeet processing factories in Minnesota and North Dakota produce about 500,000 tons of precipitated calcium carbonate annually, so it is readily available.

The objective of this research was to determine whether precipitated calcium carbonate controls Rhizoctonia root and crown rot in sugarbeet.

MATERIALS AND METHODS

Field trial was conducted in Hickson, ND in 2010. Precipitated calcium carbonate was applied at 0, 5, 10 and 15 tons/A (wet weight) and incorporated in November 2009. The Hickson site was inoculated on May 20, 2010 with *R. solani* AG 2-2 IIIB grown on barley and applied at 32 lbs/A. The inoculum was incorporated to about two inch depth just before planting. The experimental design was a split-plot with different rates of precipitated calcium carbonate as the main plot and a Rhizoctonia susceptible and resistant variety as the sub-plots with four replicates. Precipitated calcium carbonate was applied to blocks that were 44 ft wide and 60 ft long. A glyphosate tolerant Rhizoctonia susceptible and a glyphosate tolerant Rhizoctonia resistant variety (Proprietary materials, Crystal Beet Seed) were planted in the center of each block in strips that were 11 ft wide and 30 ft long. A Rhizoctonia resistant variety was planted as a border on each side of the strips. Plots were planted to stand on 20 May. 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 applied at 11.9 lbs/A to provide protection against insect pests. Weeds were controlled with four applications of glyphosate. The site was fertilized as recommended for sugarbeet on 19 April; the fertilizer was incorporated with a Kongskilde field cultivator on 20 April.

Stand counts were taken during the season and at harvest. The middle two-rows of plots were harvested on 4 October and weights were recorded. The harvested roots were rated (0-7 scale) and 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 conditions resulted in good germination, emergence, and plant stand in early June. First symptoms appeared in early July and included wilting and yellowing of leaves with death of plants occurring later.

There was mortality of both Rhizoctonia susceptible and resistant plants; however mortality was significantly greater in the susceptible variety. As a result, there were significantly greater number of plants in the resistant compared to the susceptible variety at harvest. However, precipitated calcium carbonate did not impact yield nor help in controlling Rhizoctonia root and crown rot. Although there was a significantly greater number of resistant compared to susceptible plants for each treatment, there was no significant differences in yield or recoverable sucrose among the treatments. The susceptible variety tended to produce roots with greater sucrose concentration than the resistant variety.

Soil conditions were favorable for disease development starting at planting time (when the soil temperature at the 4'' depth was 62F). Disease incidence and severity was very high at this site. It is possible that infection started early and the plants were either unable to utilize nutrients from the precipitated calcium carbonate to build-up defense or that infection occurred before the precipitated calcium carbonate could stimulate the plants to develop resistance to the pathogen.

Table 1. Effect of Precipitated Calcium Carbonate (PCC) Applied at Different Rates on Rhizoctonia Root and Crown Rot at Hickson, ND in 2010.

PCC Rate in tons/A and Variety	9 June Stand Count	15 July Stand Count	11 August Mortality Count	4 October Stand Count	Rhizoctonia root rating	Yield	Sucrose concenration	Recoverable sucrose
	beets/60'	beets/60'	dead/60'	beets/60'	0-7	ton/A	%	lb/A
0 ton Susceptible Variety A	101	94	21	54	2.0	18.5	16.9	5721
0 ton Resistant Variety B	105	104	8	74	1.9	19.1	15.8	5596
5 ton Susceptible Variety A	110	107	20	70	2.4	19.4	16.9	6098
5 ton Resistant Variety B	113	118	11	86	1.9	23.1	16.4	6989
10 ton Susceptible Variety A	108	107	33	56	2.4	17.1	17.0	5349
10 ton Resistant Variety B	107	118	7	86	1.9	22.1	16.4	6804
15 ton Susceptible Variety A	105	99	20	59	2.4	20.3	17.1	6337
15 ton Resistant Variety B	111	110	8	88	2.1	22.4	16.3	6828
LSD (P=0.05)	**NS**	**NS**	**6**	**14**	**NS**	**NS**	**0.8**	**NS**

References

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