EFFECT OF PRECIPITATED CALCIUM CARBONATE ON FUSARIUM YELLOWS IN SUGARBEET

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Fusarium yellows is caused by *Fusarium oxysporum* f. sp. *betae* and a novel uncharacterized *Fusarium* sp. *novum* (Khan et al., 2003; Rivera et al., 2008). The disease has become a serious problem for sugarbeet growers in the Glyndon, Sabin, and Moorhead Minnesota areas and has been positively identified in some areas of southern Minnesota and the Minn-Dak factory districts. Fusarium yellows causes severe reduction in plant stand, yield, and recoverable sucrose. Currently there are no fungicides which effectively control Fusarium yellows. Growers should use Fusarium yellows resistant varieties for fields with a known history of the disease. *Aphanomyces cochlioides* is another important soilborne pathogen which causes Aphanomyces damping-off and root rot in sugarbeet. Research showed that application of precipitated calcium carbonate (or spent lime, a by-product of the sugar purification process), applied before planting sugarbeet, significantly reduced Aphanomyces root rot and increased recoverable sucrose in *A. cohlioides* infected soil (Windels et al., 2007).

The objective of this research was to determine whether precipitated calcium carbonate (PCC) controls Fusarium yellows in sugarbeet.

MATERIALS AND METHODS

Field trial was conducted in Moorhead, MN. Precipitated calcium carbonate was applied at 0, 5, 10 and 15 tons/A (wet weight) and incorporated on April 22, 2010. The experiment was set up in a randomized complete block design in a split-plot arrangement with different rates of precipitated calcium carbonate as the main plot and a Fusarium yellows 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 Fusarium yellows susceptible and a glyphosate tolerant Fusarium yellows resistant variety (Proprietary materials, Crystal Beet Seed, and Syngenta Seeds) were planted in the center of each block in strips that were 11 ft wide and 30 ft long. A Fusarium yellows resistant variety was planted as a border on each side of the strips. Plots were planted to stand on 17 May with seeds 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 at 11.9 lbs/A was also applied to provide protection against insect pests. Urea fertilizer was broadcast at 120 lb/A and incorporated on 17 May, prior to planting. Weeds were controlled with glyphosate applications on 20 June, 18 July, and 11 August.

Sugarbeet samples were collected from the site (rows two and five) on 6 June and 8 July to test for the presence of Fusarium species. Stand counts were taken during the season and at harvest. Ten feet of each of the middle two rows of plots were hand harvested on 30 August and weights were recorded. Harvested roots from each plot 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 rapid emergence by the end of May. First symptoms were severe yellowing of the first two true leaves and darkening and tapering of the distal tip of the tap root. Seedling death was observed by the end of June and severe scorching, interveinal chlorosis, yellowing and necrosis of half of the leaf on one side of the midrib were common on many of the surviving Fusarium yellows susceptible plants by 8 July. Diseases severity increased as the season progressed to harvest. Symptoms were observed and infection was confirmed very early in the season. This suggests that plants had no opportunity to grow or develop a physical or chemical barrier against the pathogen. The addition of PCC to the soil did not improve plant stand or yield for either susceptible or resistant varieties. The Fusarium yellows resistant variety had significantly greater plant stand, yield, sucrose concentration, and recoverable sucrose compared to the susceptible variety.

This is the second year of a three-year study. Data from year one (2010) showed that stand, yield, sucrose concentration, and recoverable sucrose of the resistant variety were not affected by any PCC rate applied. In year one the susceptible variety did not have harvestable beets for any PCC rate applied. Data from year two (2011), shows that stand, yield, sucrose concentration, and recoverable sucrose of the susceptible variety were not affected by any PCC rate applied. The resistant variety, however tended to show decreased recoverable sucrose as PCC rate increased. This indicates that the addition of PCC to the soil did not provide adequate protection against Fusarium Yellows. The use of Fusarium yellows tolerant varieties is very important for disease management in areas with a history of the disease.

Table 1. Effect of Precipitated Calcium Carbonate (PCC) applied at different rates on Fusarium Yellows in sugarbeet at Moorhead, MN in 2011.

PCC rate in tons/A and Variety	8 June Stand Count	17 June Stand Count	1 July Stand Count	30 August			
				Stand Count	Yield	Sucrose Concentration	Recoverable Sucrose
	beets/100'	beets/100'	beets/100'	beets/100'	ton/A	%	lb/A
0 ton Susceptible variety A	155	148	104	84	7.6	9.5	1077
0 ton Resistant variety B	184	180	179	219	18.6	13.4	4480
5 ton Susceptible variety A	142	131	103	85	8.0	9.9	1236
5 ton Resistant variety B	172	172	172	203	15.8	13.1	3729
10 ton Susceptible variety A	107	99	80	54	4.3	7.7	739
10 ton Resistant variety B	157	168	170	193	14.3	13.2	3506
15 ton Susceptible variety A	145	146	107	84	5.9	10.8	1138
15 ton Resistant variety B	179	181	179	196	12.5	13.0	2954
LSD (P= 0.05)	**28**	**22**	**23**	**33**	**3.6**	**2.0**	**840**

References

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