PRELIMINARY REPORT ON EFFECT OF FUNGICIDES USED AT DIFFERENT WATER VOLUMES IN THE CONTROL OF CERCOSPORA LEAF SPOT

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Cercospora leaf spot (CLS), caused by the fungus *Cercospora beticola* Sacc., is the most economically damaging foliar disease of sugarbeet in Minnesota and North Dakota. The disease reduces root yield and sucrose concentration and increases impurity concentrations resulting in reduced extractable sucrose and higher processing losses (Smith and Ruppel, 1973; Khan and Smith, 2005). Roots of diseased plants do not store well in storage piles that are processed in a 7 to 9 month period in North Dakota and Minnesota (Smith and Ruppel, 1973). Cercospora leaf spot is managed by integrating the use of tolerant varieties, reducing inoculum by crop rotation and tillage, and fungicide applications (Khan et al; 2007). It is difficult to combine high levels of Cercospora leaf spot resistance with high recoverable sucrose in sugarbeet (Smith and Campbell, 1996). Consequently, commercial varieties generally have only moderate levels of resistance and require fungicide applications to obtain acceptable levels of protection against Cercospora leaf spot (Miller et al., 1994) under moderate and high disease severity. Since the advent of glyphosate tolerant sugarbeet, growers typically use low water volume (5 GPA) and effectively controlled weeds. Some growers are using low water volume with fungicides for control of CLS.

The objective of this research was to evaluate the efficacy of fungicides with different water volumes (and different nozzles) for controlling Cercospora leaf spot.

MATERIALS AND METHODS

A field trial was conducted at Foxhome, MN in 2019. The experimental design was a randomized complete block with four replicates. Field plots comprised of six 30-feet long rows spaced 22 inches apart. Plots were planted on 14 May with a variety susceptible to Cercospora Leaf Spot. Seeds were treated with Tachigaren (45 g/kg seed), Kabina, Metlock Rizolex and Nipsit Suite. Seed spacing within the row was 4.7 inches. Weeds were controlled with herbicide applications (Roundup Powermax @ 28 fl oz; Outlook @ 6 fl oz; Class Act 2.5 %v/v; Interlock @ 4 fl oz per acre) on 10 June and (Roundup Powermax @ 28 fl oz; Outlook @ 6 fl oz; Class Act 2.5% v/v; Interlock @ 4 fl oz per acre) 27 June as well as hand weeding throughout the summer. Quadris (14.3 fl oz per acre) was applied on 5 June and 19 June to control *Rhizoctonia solani*. Plots were inoculated on 12 July with *C. beticola* inoculum.

Fungicide spray treatments were applied with a CO_2 pressurized 4-nozzle boom sprayer with 11002 TT TwinJet nozzles, 11002 Turbo Tee Jet nozzles and 8002XR nozzles calibrated to deliver 5, 10, 15, 20 and 25 gpa of solution to the middle four rows of plots. Fungicide treatments were initiated on 23 July. Treatments included four fungicide applications on 23 July, 6 August, 19 August and 30 August. Fungicide treatments were the same over all treatments while the nozzles and gallons per acre changed and are listed in Table 1. The fungicide sequence was Minerva Duo (16 fl oz) followed by Super Tin (8 fl oz) + Topsin (20 fl oz) followed by Proline (5.7 fl oz) + Badge SC (2 pt) + NIS (0.125% v/v) followed by Mankocide (4.3 lb).

Cercospora leaf spot severity was rated on the leaf spot assessment scale of 1 to 10 (Jones and Windels, 1991). A rating of 1 indicated the presence of 1- 5 spots/leaf or 0.1% disease severity and a rating of 10 indicated 50% or higher disease severity. Cercospora leaf spot severity was assessed five times during the season. The rating performed on 13 September is reported.

Plots were defoliated mechanically and harvested using a mechanical harvester on 25 September. The middle two rows of each plot were harvested and weighed for root yield. Twelve to 15 representative roots from each plot, not including roots on the ends of the plot, were analyzed for quality at the American Crystal Sugar Company Quality Tare Laboratory, East Grand Forks, MN. The data analysis was performed with the ANOVA procedure of the Agriculture Research Manager, version 2019.4 software package (Gylling Data Management Inc., Brookings, South Dakota). The least significant difference (LSD) test was used to compare treatments when the F-test for treatments was significant.

RESULTS AND DISCUSSIONS

Later than normal planting and unfavorable growing conditions resulted in slow plant growth and row closure in mid-July. Likewise, development of *C. beticola* was very slow after inoculation with first observed symptoms about 10 days later. On 20 August, CLS rating for the non-treated check was 5.8, still below the CLS rating (6.0) at which economic losses typically occur. Warmer conditions in late-August and September resulted in more favorable conditions for rapid disease development as indicated by a CLS rating of 9.5 for the non-treated check on September 13 (Table 1).

The average disease severity ratings, tonnage, sucrose concentration and recoverable sucrose for the different water volumes (5, 10, 15, 20, 25 gpa) using three different nozzle types are summarized in Table 1. All the fungicide treatments resulted in better disease control, higher tonnage, sucrose concentration and recoverable sucrose compared to the non-treated check. Preliminary data suggest that higher water volumes (10 to 25 gpa) resulted in better disease control and higher recoverable sucrose. Research is ongoing to determine the best combination of water volume, nozzle type, application pressure and droplet size that will provide effective control of CLS and high recoverable sucrose.

Table 1. Effect of Gallons/Acre and Nozzle type on Cercospora leaf spot control and sugarbeet yield and quality at Foxhome, MN in 2019.

Treatment and rate/A	CLS	Root yield	Sucrose concentration	Recoverable sucrose
	1-10	Ton/Acre	%	Lb/Acre
5 GPA; 11002 Turbo Twin Jet & Tee Jet & 8002XR Nozzles	5.9	25.9	14.4	6740
10 GPA; 11002 Turbo Twin Jet & Tee Jet & 8002XR Nozzles	5.1	27.1	14.8	7271
15 GPA; 11002 Turbo Twin Jet & Tee Jet & 8002XR	4.6	28.6	15.1	7827
20 GPA: 11002 Turbo Tee Jet & Tee Jet & 8002XR Nozzles	5.0	28.0	14.7	7484
25 GPA; 11002 Turbo Twin Jet & Tee Jet & 8002XR	4.7	29.1	14.7	7748
Non-treated Check	9.5	22.40	13.33	5,399
LSD (P=0.10)	**0.7**	**2.5**	**0.97**	**874**

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