COMPARING AIR-ASSIST AND CONVENTIONAL SPRAYERS FOR CERCOSPORA LEAF SPOT CONTROL IN SUGARBEET

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Cercospora leaf spot, caused by the fungus *Cercospora beticola* Sacc., is the most damaging foliar disease of sugarbeet (*Beta vulgaris* L.) in Minnesota and North Dakota. The disease reduces root yield and sucrose concentration resulting in reduced recoverable sucrose (Smith and Ruppel, 1973; Lamey et al., 1987; Shane and Teng, 1992; Lamey et al., 1996; Khan and Smith, 2005). Profitability is further reduced since roots of diseased plants do not store well in storage piles (Smith and Ruppel, 1973). Cercospora leaf spot is managed by planting disease tolerant varieties, reducing inoculum through crop rotation and tillage, and fungicide applications (Miller et al., 1994; Khan et al; 2007). It is difficult to develop sugarbeet varieties with high levels of Cercospora leaf spot tolerance and high yield (Smith and Campbell, 1996). Consequently, commercial varieties generally have moderate levels of tolerance and require fungicide applications to obtain acceptable levels of protection against Cercospora leaf spot (Miller et al., 1994).

The objective of this research was to compare Cercospora leaf spot control on sugarbeet with fungicides using air-assist and conventional sprayers.

MATERIALS AND METHODS

Field trials were conducted at Foxhome, MN in 2005, 2006, and 2007. 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 in late April or early May with a Betaseed variety resistant to Rhizomania but susceptible to Cercospora leaf spot. Terbufos (Counter 15G) was applied modified in-furrow at 12 lbs/A during planting to control sugarbeet root maggot (*Tetanops myopaeformis* von Röder; Diptera: Ulidiidae). Plots were thinned manually at the 6-leaf stage to 41,580 plants per acre. Weeds were controlled with recommended herbicides (Khan, 2005), and hand weeding. Plots were inoculated with inoculum provided by Margaret Rekoske (Betaseed, Shakopee, MN) in the first week of July.

Treatments included fungicides applied with conventional nozzles, Spray Air™ sprayer, and an untreated check. The fungicides applied in an alternation program were tetraconazole (Eminent 125SL, Sipcam Inc., USA) at 13 fl oz/A, triphenyltin hydroxide (SuperTin 80WP, Du Pont,) at 5 oz/A, and pyraclostrobin (Headline 2.09 EC, BASF, Raleigh, NC) at 9 fl oz/A. Fungicides were applied in 10 and 15 gpa of solution. The conventional boom sprayer was operated at 47 psi with 8002 nozzles at 4 and 6 mph to deliver 15 and 10 gpa of solution, respectively. The air assist treatments were applied by a Spray Air™ sprayer using an air pressure of 20 inches of water. A speed of 3 mph and 60 psi liquid pressure was used to deliver 15 gpa of solution, and 4 mph and 40 psi was used to deliver 10 gpa of solution. Fungicides were applied to the middle four rows of plots. Fungicide applications commenced at first symptoms and were applied at about 14 day intervals.

Cercospora leaf spot severity was rated on the KWS scale of 1 to 9. A rating of 1 indicated no disease, a rating of 3 indicated that all outer leaves displayed typical symptoms and was at the early stages of economic loss level, and a rating of 9 indicated that the plants had only new leaf growth, all earlier leaves being dead. Cercospora leaf spot severity was assessed throughout the season. However, the rating done three days prior to harvest is reported.

Plots were defoliated mechanically and harvested using a mechanical harvester in late September. The middle two rows of each plot were harvested and weighed for root yield. Twelve to 15 random 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 6.0 software package (Gylling Data Management Inc., Brookings, South

Dakota, 1999). The least significant difference (LSD) test was used to compare treatments when the F-test for treatments was significant (P=0.05).

RESULTS AND DISCUSSIONS

Cercospora leaf spot symptoms were observed in mid July. Fungicide treatments commenced on July 23 when disease incidence was uniform in all plots. CLS progressed slowly in July and August then rapidly in September in the untreated check and at harvest had a KWS Cercospora leaf spot rating of 8.0 which was significantly higher than the fungicide treatments (Table 1). Fungicide treatments resulted in higher root yield, sucrose concentration, and recoverable sucrose compared to the untreated check. There was no significant advantage in terms of disease control and thus recoverable sucrose in using the air assist sprayer compared to the conventional sprayer. Fungicides applied at the higher water volume resulted in slightly better disease control compared to when applied at the lower water volume.

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Table 1. Cercospora leaf spot control at Foxhome in 2007 with labeled fungicides.

Treatment and rate/A	App. interval (days)	CLS*	Recoverable (lb/A)	Sucrose (lb/T)	Root yield (t/A)	Sucrose concentration (%)	LTM** (%)	Return ($/A)***
15 gpa Conventional application	14	3.3	7655	334	23.1	18.1	1.42	1018
15 gpa Air-assist application	14	3.3	7514	329	23.1	17.9	1.43	999
10 gpa Conventional application	14	3.8	7515	331	23.0	18.0	1.45	999
10 gpa Air-assist application	14	3.5	7831	324	24.3	17.7	1.50	1042
Untreated Check		8.0	6706	307	22.1	16.8	1.48	892
LSD (*P*=0.05)		0.8	644	21	1.7	1.1	NS	86

*Cercospora leaf spot rating
**Loss to Molasses
***Gross return in dollars per acre based on Minn-Dak payment system