COMPATIBILITY, SAFETY AND EFFICACY OF FUNGICIDES MIXED WITH GLYPHOSATE FOR CONTROLLING CERCOSPORA LEAF SPOT ON SUGARBEET

Mohamed F. R. Khan[1], Peter Hakk[2] and Aaron L. Carlson[2]

[1]Extension Sugarbeet Specialist, North Dakota State University & University of Minnesota
[2]Research Technician, Plant Pathology Department, North Dakota State University

Cercospora leaf spot, caused by the fungus *Cercospora beticola* Sacc., is the most damaging foliar disease of sugarbeet in Minnesota and North Dakota. The disease reduces root yield, sucrose concentration, and extractable sucrose (Khan and Smith, 2005) which reduce profitability of the crop. 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 (Miller et al., 1994; Khan et al; 2007). The first fungicide application for controlling Cercospora leaf spot is made after row closure which may be in June or July at which time a final glyphosate application may be necessary for effective weed control. No information is available on the compatibility and efficacy of fungicide mixtures to which glyphosate is added for weed control.

The objective of this research was to evaluate the compatibility, safety and efficacy of fungicide mixtures and glyphosate on Cercospora leaf spot of sugarbeet.

MATERIALS AND METHODS

A field trial was conducted at Foxhome, MN in 2012. 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 10 May with Beta 89RR10 (resistant to Rhizomania and with a Cercospora leaf spot KWS rating of 5.0). Seeds were treated with Tachigaren (45 g/kg seed) and Poncho beta. Seed spacing within the row was 4.7 inches. Weeds were controlled with two applications (24 May and 21 June) of glyphosate at 32 fl oz and 22 fl oz respectively. Plots were inoculated on 3 July with grounded *C. beticola* inoculum not previously exposed to fungicides (Betaseed, Shakopee, MN).

Fungicide spray treatments were applied with a CO_2 pressurized 4-nozzle boom sprayer with 11002 TT TwinJet nozzles calibrated to deliver 17 gpa of solution at 60 p.s.i pressure to the middle four rows of plots. Quadris was applied to all plots on 22 May at 16 fl oz; all other fungicide treatments were initiated on 17 July. In the first two applications for CLS control, glyphosate was added to the fungicides. Please note that the fungicides Manzate Pro Stick and Inspire and herbicide glyphosate mixture was not compatible and could not be applied. Treatments were repeated without glyphosate in the mixtures in the final application on 17 August. Treatments were applied at rates indicated in Table 1.

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 during the season. The rating done on 29 August is reported.

Plots were defoliated mechanically and harvested using a mechanical harvester on 27 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 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

Environmental conditions were favorable for development of *C. beticola* and first symptoms were visible in mid-July. Fungicide treatments were initiated on July 17. Cercospora leaf spot progressed very rapidly in the non-

treated check and reached economic injury level by early-August. By mid-August, the non-treated check had severe disease and a Cercospora leaf spot rating of 10 which was significantly greater than the fungicide treatments (Table 1). None of the treatments resulted in phytotoxicity to the plants. All of the fungicide treatments provided similar effective disease control and significantly higher tonnage, sucrose concentration, and recoverable sucrose compared to the non-treated check. The Manzate flowable mixed well with the other fungicides and glyphosate. However, the Manzate ProStick was not compatible with the other fungicides and glyphosate and could not be used. The efficacy of glyphosate was not compromised with the mixing of the fungicides (flowables and SC) resulting in effective weed control. This research indicates that Inspire, Proline and Headline fungicides can be mixed with a flowable formulation of manzate and with glyphosate to provide effective disease and weed while reducing application costs by not conducting a separate application of glyphosate for weed control.

Table 1. Effect of fungicides on Cercospora leaf spot control, and sugarbeet yield and quality at Foxhome, MN in 2011

Treatment and rate/A (A) 17 July, (B) 2 August, (C) 17 August	App. Interval (days)	CLS*	Root yield (t/A)	Sucrose concen-tration(%)	Recoverable sucrose (lb/t)	Recoverable sucrose (lb/A)
Manzate Flowable 3.2 pt + Inspire XT 7 fl oz + PowerMax 22 fl oz + Class Act NG 2.5% v/v A, B, C**	14	5	25.9	18.8	337	8691
Manzate Flowable 3.2 pt + Proline 5 fl oz + NIS 0.125% v/v + PowerMax 22 fl oz + Class Act NG 2.5% A, B, C**	14	5	25.7	19.1	346	8896
Manzate Flowable 3.2 pt + Headline SC 9 fl oz + PowerMax 22 fl oz + Class Act NG 2.5% v/v/ A, B, C**	14	5	26.5	19.9	361	9569
Inoculated Check	-	10	20.7	16.6	293	6079
LSD (P=0.05)	-	1	2.0	1.4	30	705

*Cercospora leaf spot measured on 1-10 scale (1 = 1- 5 spots/leaf or 0.1% severity and 10≥50% severity) on 29 August.
** PowerMax and Class Act NG not included in C application

References

Jones, R. K.., Windels, C. E. 1991. A management model for Cercospora leaf spot of sugarbeets. Minnesota Extension Service. University of Minnesota. AG-FO-5643-E

Khan, J., del Rio, L.E., Nelson, R., Khan, M.F.R. 2007. Improving the Cercospora leaf spot management model for sugar beet in Minnesota and North Dakota. Plant Dis. 91, 1105-1108.

Khan, M.F.R., Smith, L.J. 2005. Evaluating fungicides for controlling Cercospora leaf spot on sugarbeet. J. Crop Prot. 24, 79-86.

Miller, S.S., Rekoske, M., Quinn, A., 1994. Genetic resistance, fungicide protection and variety approval policies for controlling yield losses from Cercospora leaf spot infection. J. Sugar Beet Res. 31, 7-12.

Smith, G.A., Ruppel, E.G., 1973. Association of Cercospora leaf spot, gross sugar, percentage sucrose and root weight in sugarbeet. Can. J. Plant Sci. 53, 695-696.