

INFLUENCE OF VARIETY TOLERANCE, APPLICATION TIMING AND FUNGICIDE EFFICACY ON CONTROL OF CERCOSPORA LEAFSPOT IN MICHIGAN

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Introduction

Cercospora leaf spot caused by the fungus *Cercospora beticola* is the most damaging foliar disease of sugarbeets in the Michigan Sugar Company growing region. Yield and quality losses of up to five tons per acre and 2 points of sugar occur with severe infestations. The disease is managed with an integrated program which includes proper rotations, varietal tolerance and fungicide sprays. Most of the varieties in Michigan have relatively good tolerance to Cercospora, however, our highest producing varieties are quite susceptible to the disease. Triazole and strobilurin fungicides provide effective control of Cercospora when applied properly. Michigan growers benefit from the predictive model BEETcast, which monitors leaf wetness and temperatures at over 50 locations and predicts optimum fungicide application timings. Cercospora infection levels were high in 2005 and 2006 then trended lower until 2010 when disease levels increased significantly. For the most part, Cercospora leafspot is adequately controlled in Michigan. However, with the introduction of high producing varieties that have less disease tolerance some control problems have occurred. More aggressive Cercospora control programs have been implemented by the Cooperative which have been successful in protecting varieties with low levels of Cercospora resistance from yield and quality losses.

Research Objectives

Trials have been conducted in recent years to evaluate three objectives with respect to Cercospora leafspot: 1) Identifying varietal tolerance to Cercospora; 2) Efficacy of fungicides for Cercospora control; and 3) Timing of fungicide applications.

Materials and Methods

Cercospora variety tolerance trials are conducted at four Michigan locations each year. These are small plot replicated trials with plot sizes of 2 rows X 25 feet with 6 replications. The plots are inoculated with Cercospora at row closure and evaluated by several individuals. We normally make around 10 separate ratings for each trial.

Fungicide efficacy trials are conducted in Michigan to evaluate registered and experimental fungicides for control of Cercospora leafspot. Two trials are conducted each year. The plot size is 6 rows X 38 feet with 6 replications. Fungicide applications are made with a tractor mounted compressed air plot sprayer at 22.5 gpa and 100 psi. The trials are inoculated when conducted on Michigan Sugar Company property which is about half of the time. Cercospora ratings, yield and quality measurements are taken.

Fungicide timing trials (BEETcast) are conducted each year in Michigan. At least two and as many as eight trials are conducted each year. The plot size is 6 rows X 38 feet with 6 replications. The treatments are applied with a tractor mounted compressed air plot sprayer at 22.5 gpa and 100 psi. The treatments are based on BEETcast disease severity values (DSV's) which are taken from the BEETcast website www.michiganbeets.com The Michigan Sugar

Company growing region is divided into high, moderate and low Cercospora risk zones and the spray treatments are different for each zone.

Results and Discussion

Variety Trial Cercospora Research

Four Cercospora variety trials were planted each year and three trials produced reliable information in 2010 while two trials produced reliable data in 2009 and 2008. Table 1 illustrates the range of Cercospora tolerance available to Michigan growers. The varieties in (Table 1) are available for growers to plant.

Table 1. Cercospora Variety Trials Conducted by Michigan Sugar Company from 2008 to 2010 ¹				
Variety	0-9 Ratings ² Avg 3 Years	0-9 Ratings 2008	0-9 Ratings 2009	0-9 Ratings 2010
C RR840	3.22	2.53	2.79	4.34
B 18RR26	3.31	2.32	3.27	4.34
HM 131RR	3.47	2.94	3.48	3.98
HM 27RR	3.52	3.46	3.32	3.77
HM 133RR	3.56	3.13	3.59	3.96
SX 1281RR	3.61	3.10	3.51	4.22
HM 28RR	3.73	2.98	3.62	4.60
HM 110RR	3.76	3.27	3.69	4.32
SX 1260RR	3.92	3.24	3.93	4.60
B 17RR32	4.43	3.74	4.07	5.49
B 18R4N	4.49	3.57	4.57	5.33
C RR824	4.52	4.30	4.00	5.26
C RR827	4.56	3.92	3.87	5.86
LSD 5%	0.17	0.29	0.14	0.44
CV	4.2	8.3	3.6	8.9
Mean	3.85	3.27	3.67	4.62

¹Selected varieties that are currently being planted. Most years we evaluate between 45 and 50 varieties.

²Cercospora 0-9 Ratings: 0 = no spots; 1 = very few spots; 2 = light infestation (many leaves with no spots); 2.5 = moderate infestation (up to 25 spots/leaf); 3 = heavy spotting (over 100 spots/leaf but spots not coalescing); 4 = spots coalescing and up to 10% of leaf area dessicated; 5 = up to 25% of leaf area dessicated and flagging (leaves cupping and folding over); 6 = up to 50% of leaf area dessicated, 7 = up to 75% of leaf area dessicated; 8 = up to 90% of leaf area dessicated and 9 = leaf completely dessicated. Re-growth begins around stage 5 and the plant eventually grows a new canopy. Regrowth is not considered in the ratings. Ratings are complete when re-growth makes evaluations difficult. We rate with ¼ points intervals up to stage 3, ½ point intervals up to stage 6 and full point intervals from stages 6 through 9. Yield losses can be measured at level 2.75 to 3.0.

A highly resistant variety would have a rating under 3 compared to the varieties in (Table 1). Cercospora spray recommendations are less intense for highly resistant varieties. The top four varieties in table 1. with ratings of 3.5 or less have good levels of Cercospora tolerance and spray recommendations can be modified slightly without risking leafspot damage. Our standard recommendations are based on varieties with moderate levels of Cercospora tolerance which would be the varieties in table 1 with ratings between 3.5 and 3.9. High risk varieties (ratings over 4) require a more intense spray schedule to prevent yield and quality losses from Cercospora leafspot.

Fungicide Efficacy Trials

Fungicide efficacy trials are conducted each year to monitor the effectiveness of available fungicides for controlling Cercospora leaf spot in Michigan.. Triazole and strobilurin fungicides continue to provide good Cercospora control throughout our growing region. Table 2 shows the level of Cercospora control with fungicides at two locations in 2010. These results are similar to

Table 2. Efficacy of Fungicides for Controlling Cercospora Leaf Spot (CLS) 2 Locations in Michigan in 2010.							
Fungicide Treatments ¹	Rate	Cerc 0-9	Income \$/Acre ²	RWSA Lb/Acre	Tons/ Acre	% Sucrose	% CJP ³
Inspire XT	7 fl oz/A	2.10	1978	9402	34.53	18.60	95.4
Eminent	13 fl oz/A	2.33	1933	9192	34.63	18.30	95.2
Proline + NIS	5.7 fl oz/A 0.125%	2.38	1914	9106	34.29	18.31	94.9
Headline	9.2 fl oz/A	2.60	1973	9379	35.19	18.30	95.1
Gem SC	3.6 fl oz/A	2.90	1934	9199	34.73	18.16	94.9
Super Tin	5 oz/A	2.98	1845	8694	32.70	18.29	95.2
Dithane	2 lb/A	3.63	1802	8446	32.60	18.05	94.5
Untreated		6.60	1689	7831	30.95	17.40	94.9
LSD: 5%		0.29	102.9	477.3	1.57	0.38	0.38
CV		10.9	7.5	7.4	6.4	2.8	0.5
Mean (w/o check)		2.7	1911	9060	34.10	18.29	94.9
¹ Each fungicide is sprayed twice, with a Super Tin application in-between (3 total applic)							
² Income: Net income after subtracting out fungicide costs							
³ %CJP: Clear juice purity							

previous work with the exception of Gem which has been more effective in previous trials. When considering the Cercospora rating, RWSA and income there is not much difference between Inspire, Eminent, Proline, Headline and Gem. The timing of applications is more important than which fungicide to choose from the top group. Several growers consider which product will provide suppression of Rhizoctonia when choosing a fungicide for their first leafspot spray. It is important to rotate the fungicide groups to delay the onset of resistance.

Sugarbeet leaf samples are collected each year and are analyzed by Michigan State University for resistance to Cercospora. Widespread resistance to Topsin M has been documented in our growing region. The triazole and strobilurin fungicides appear to be holding up well in Michigan at this point.

Fungicide Application Timing Research

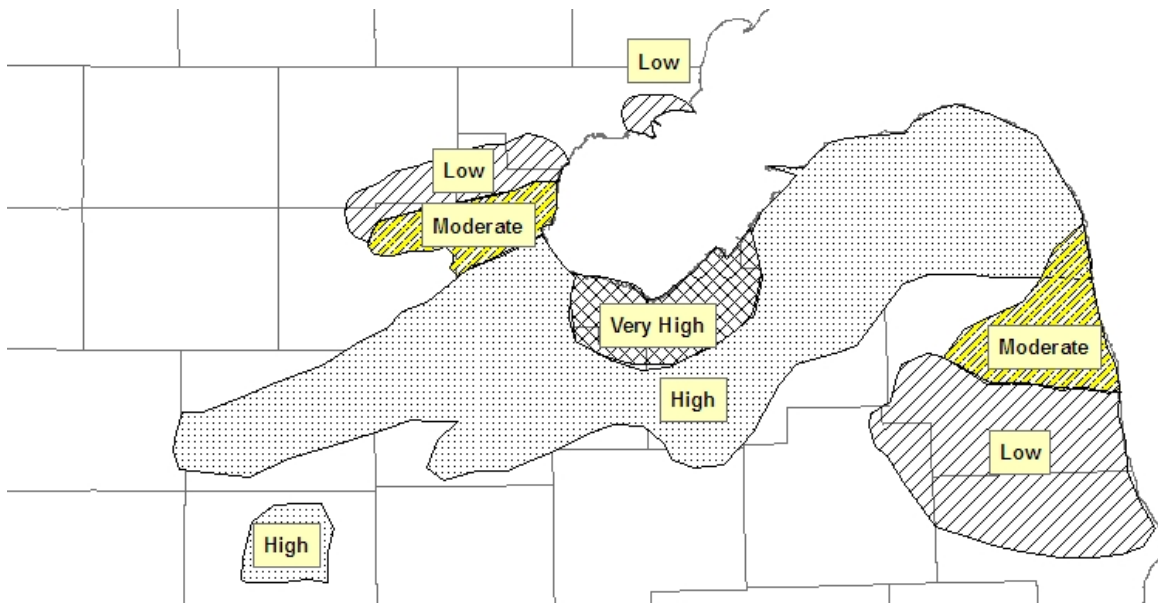
Michigan Sugar Company has been evaluating a Cercospora leafspot spray timing model and adapting it to our growing region since 2002. The model is called BEETcast and measures leaf wetness and temperatures at over 50 sites in our growing region. Table 3 shows results from the initial group of BEETcast trials that were conducted from 2002 to 2004. Based on the initial

Table 3. BEETcast Application Timing Trials for Controlling Cercospora Leafspot in Sugarbeets - 5 trials conducted in Michigan from 2002-2004								
Treatment DSV's ¹	Income \$/Acre ²	CLS 0-9	# Applic	RWSA Lb/Acre	RWST Lb/Ton	Tons / Acre	% Sucrose	% CJP
55 / 35	1391	1.34	3.2	7186	283	25.4	20.03	92.6
55 / 55	1337	2.04	2.6	6869	279	24.6	19.90	92.3
55/70	1308	2.50	2.0	6668	275	24.2	19.77	92.0
1 st spot / label	1275	2.11	3.0	6590	274	24.1	19.85	91.6
70 / 35	1272	2.11	3.2	6592	275	23.9	19.94	91.6
70 / 55	1258	2.37	2.2	6438	272	23.7	19.75	91.5
70 / 70	1254	3.32	2.0	6399	271	23.6	19.67	91.6
1 st spot + 14 days / label	1243	2.92	2.0	6348	272	23.4	19.78	91.5
Untreated	1170	5.46	0	5809	261	22.3	18.98	91.6
LSD: 5%	46.8	0.16	.001	232.6	4.7	0.78	0.21	0.43
CV	3.0	4.9	.03	2.9	2.9	2.7	0.9	0.4
Mean (w/o untreated)	1294	2.34	2.53	6636	275.1	24.11	19.84	91.8
¹ DSV's – disease severity values are determined for each day and are accumulated and are used to determine fungicide application timing dates								
² Income – net income after cost of fungicide sprays are subtracted. Based on 2010 payment levels								

trial information 55/55/55 DSV's (initial application at 55 DSV then repeat applications at 110 DSV's, 165 DSV's and 220 DSV's). has become the standard recommendation for most of the growing region. Most years three applications will be required following the 55/55 spray schedule. The program has never called for a 4th spray when following the 55/55 schedule. Average DSV values from 2004 to 2010 were: 146, 179, 174, 157, 160, 137 and 199. The level of leafspot damage in research plots each year correlates fairly well with the DSV levels. Approximately 50 small plot replicated trials were conducted between 2002 and 2010. The main findings from these trials are: 1.) the 55/55 spray schedule is valid for most growing areas; 2) our sugarbeet growing area has distinctly different levels of Cercospora risk; and 3) the high producing but poor disease tolerant varieties need a more aggressive spray schedule to prevent yield and quality losses. It is interesting to note that growers who follow the BEETcast 55/55

schedule not only have better Cercospora control but also make fewer fungicide applications compared to growers who utilize scouting and follow the fungicide label for re-applications (Table 3). The growing region beneath the Saginaw Bay generally has the worst Cercospora problems (Very High Risk) in our growing area. The majority of our growing region is considered high risk for Cercospora and we have two separate growing areas where the disease level is lower (see Figure 1.).

Figure 1. Relative Cercospora risk zones for the Michigan Sugar Company growing area.



The Michigan sugarbeet growing region is color coded with respect to Cercospora risk and can be viewed at www.michiganbeets.com which is the BEETcast website. Trials have been conducted with high yielding and high quality varieties including nematode varieties. These varieties have poor Cercospora tolerance and the 55/55 spray schedule does not always prevent yield and quality losses. A DSV schedule of 45/45 does protect these varieties from Cercospora damage. Table 4 shows the recommended Cercospora spray schedules for the Michigan Sugar Company growing region. Growers in Green Zones (lower Cercospora risk) can wait until spots are found on or near thief fields before making the initial application. After the initial application fungicide sprays should be based on DSV's. Cercospora sprays based on DSV timings also vary by varietal tolerance. It is very important that growers take the steps to protect their sugarbeet crop from Cercospora leaf spot. Growers can lose up to five tons per acre and 2 points of sugar if Cercospora is uncontrolled. Tables 5 shows the estimated yield and quality losses that can be expected from different levels of Cercospora infections. This information is based on results from multiple years of Cercospora leafspot trials conducted in Michigan.

Table 4. Michigan Sugar Company recommended Cercospora leafspot application timings based on variety tolerance and Cercospora risk Zone				
Variety Tolerance to Cercospora	Very High Cercospora Risk	High Cercospora Risk	Moderate Cercospora Risk	Lower Cercospora Risk
Good (a Few Varieties)	60 / 55 DSV	60 / 55 DSV	65 / 55 DSV	75/55 DSV or 1 st Spot / 55 DSV
Fair to Good (Approved Varieties)	55 / 55 DSV	55 / 55 DSV	65 / 55 DSV	70/55 DSV or 1 st Spot / 55 DSV
Poor (new High Yield and High Quality Varieties)	45 / 45 DSV	45 / 45 DSV	50 / 55 DSV	65/55 DSV or 1 st spot / 45 / 55 DSV

Table 5. Expected Sugarbeet Yield and Quality Losses at Different Cercospora Infection Levels		
Cercospora 0-9 Rating	Expected Loss in Tons/Acre	Expected Loss in Sucrose
2 or less	0	0
2.5	Not detectable	Not detectable
3	1 ton	0.25 pts
4	1.5 tons	0.5 pts
5-6	2 tons	0.75 to 1.0 pts
7-8	3.5 tons	1.5 pts
9	5 tons	2 to 2.5 pts

Some growers resist spraying in early September when the BEETcast model calls for a spray. Depending upon the year (weather) Cercospora infestations will continue to increase up until harvest time. Table 6 demonstrates how the disease keeps developing during September and October with “normal” weather conditions when a late season fungicide application is not made. If the Cercospora 0-9 level has a rating of a 2 at the end of August and BEETcast recommends

an early September spray (which is not applied) the disease level would be expected to increase to a 2.5 rating by mid September and to a 3.5 rating by mid October.

Table 6. Expected Progression of Cercospora Infections Over Time When a Recommended Late Season Spray is not Applied		
Cerc 0-9 Rating Late August	Cerc 0-9 Rating Mid September	Cerc 0-9 Rating Mid October
1.0	1.5	2.0
2.0	2.5	3.5
3.0	3.5	5.0
4.0	5.0	6.0

Summary and Conclusions

Poorly controlled Cercospora leafspot infections will cause significant yield and quality losses in sugarbeets. In many cases better timed applications or one additional application will increase grower profits by one to two hundred dollars per acre. The cost of one additional spray is around twenty dollars. Michigan growers can choose from a wide range of varieties with different levels of Cercospora tolerance. When planting highly susceptible varieties aggressive control measures are needed. Triazole (InspireXT, Eminent, Proline) and strobilurin (Headline and Gem SC) fungicides provide effective control of Cercospora when applications are applied properly. Both of these fungicide groups are susceptible to the development of Cercospora resistance if used repeatedly. The BEETcast predictive model is the most effective way for growers to time their fungicide applications. It is important to make late season fungicide applications when recommended. Growers need to weigh the risks and benefits of the varieties they plant and how they manage the disease.