COMPARING PROTECTANT AND SYSTEMIC FUNGICIDES USING DIFFERENT APPLICATION TIMINGS FOR MANAGEMENT OF CERCOSPORA LEAF SPOT IN THE NEBRASKA PANHANDLE

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ABSTRACT

Cercospora leaf spot is the most important and destructive foliar disease of sugar beets in western Nebraska. There is a wide range of fungicides available for growers, but there have been questions regarding identifying the spray program that most effectively controls the disease, while also managing fungicide resistance in the pathogen. Thus, a study was conducted during 2000 and 2001 with the objective of comparing a systemic fungicide (Benlate/Topsin) with a protectant (Super Tin) applied at different times during the season. Two other newer fungicides (Headline and Eminent) were additionally evaluated in 2001 based on a previously developed forecasting system. The 2000 study used furrow irrigation while the 2001 study employed sprinkler irrigation. Both studies relied upon natural infection, and disease severity was measured by a leaf rating using a non-linear scale of 0-9. Additional data collected included root and sucrose yields, and sucrose percentages. Compared to controls, significant differences were observed from disease severity ratings in all fungicide treatments during both years, however yield differences were seen only in 2001. Early fungicide treatments in 2001 resulted in significant increases for both root and sucrose yields, but not sucrose percentage. Results from both years suggest that the timing of the fungicide application is more important for reducing disease effects than the type of fungicide employed. The results also show that during years when conditions are favorable for Cercospora leaf spot to occur, early applications can significantly improve sugar beet yields and profitability.

INTRODUCTION

Cercospora leaf spot, caused by the fungal pathogen, *Cercospora beticola* Sacc., is a serious disease of sugar beets (*Beta vulgaris* L.) in the eastern and central production areas of the United States (Windels et al., 1998; Wysong et al. 1968). It is now the most important and destructive foliar disease of sugar beets in Nebraska, and was a primary reason for the shift of production moving from eastern Nebraska to the western Panhandle during the 1960's (Kerr and Weiss, 1990; Kerr and Weiss, 1998).

Disease incidence, severity, and yield loss in this area have varied over the last 20 years. However, during the last decade, the incidence of the pathogen has been increasing, necessitating more frequent fungicide applications. Compounding this problem has been the discovery of pathogen biotypes that exhibited tolerance to several types of fungicides, particularly the systemic benzimidazoles.

There have also been questions concerning the development of the most effective spray program for managing the disease while also minimizing further fungicide resistance in the pathogen population in Nebraska. Thus, a field study was conducted during 2000 and 2001 with the objective of comparing different application timings and alternating sequences of systemic and protectant fungicides.

MATERIALS AND METHODS

Both studies utilized "early" applications (one week prior to anticipated symptom appearance), and "late" applications (two weeks after early applications) (Tab. 1 and Tab. 2). Benlate (benzimidazole) was used as the systemic fungicide and Super Tin (triphenyl tin hydroxide) represented the protectant fungicide. In 2001, another set of treatments involving newly developed fungicides – Headline (pyraclostrobium) and Eminent (tetraconazole) was evaluated and applied based on a previously established disease forecasting system (Kerr and Weiss, 1990; Weiss and Kerr, 1989) (Tab. 2). All fungicide applications utilized a backpack sprayer and no systemic fungicide was used more than once each year to help prohibit resistance development. Plots consisted of 3 rows (7.5 m in length on 56 cm centers) in a randomized complete block design with 6 replications per treatment, and were planted each year in mid-April using the Cercospora leaf spot susceptible cultivar Betaseed 4546. The 2000 study utilized furrow irrigation while the 2001 study employed sprinkler irrigation.

Both studies relied on natural infection and disease evaluations consisted of sampling 2 leaves from each of 5 plants within each plot. Collected leaf samples were individually rated on a non-linear scale of 0-9 (Tab. 3). Plots were evaluated 6 times in 2000 and 4 times in 2001. Plots were harvested each year in mid-October and data collected included sucrose percentage and root (metric tons/ha) and sucrose yields (kg/ha).

RESULTS

Higher levels of disease were present in 2001, due to the better conditions for disease development from mid-July through mid-August. Significant differences were observed from disease severity ratings for all fungicide treatments compared to untreated controls during both seasons of the study. However, yield differences (both root and sucrose yields) were observed only during the 2001 season. Few differences were seen in either year regarding sucrose percentages. Applying the new fungicides (Headline and Eminent) based on the Cercospora forecast system during 2001 resulted in disease severity reductions and yield increases that were compatible with the early applications treatments (Tab. 2).

Tab. 1. Results of disease ratings and yield components for 2000 Cercospora leaf spot study.

Treatment	Disease Rating[a]	Root Yield (t/ha)	Sucrose %	Sucrose Yield (kg/ha)
(1) Control	16.6a	75.8a	14.6a	11,002.8a
(2) Super Tin[begh] Benlate[df] (early)	1.3b	77.6a	15.3b	11,895.5a
(3) Benlate[bde] (early) Super Tin[f]	2.1b	78.5a	15.1ab	11,810.4a
(4) Super Tin[cfh] Benlate[dg] (late)	2.9b	80.5a	14.6ab	11,757.8a
(5) Benlate[cdf] Super Tin[gh] (late)	5.0c	82.3a	14.9ab	12,335.7a

[a]Cumulative average of 6 disease evaluations; [b]early treatment; [c]late treatment; [d]Benlate added with manzate as a tank mix; [e]applied 7/14/00; [f]applied 7/31/00; [g]applied 8/14/00; [h]applied 8/28/00. Means followed by the same letter are not significantly different according to LSD test (P=0.05).

Tab. 2. Results of disease ratings and yield components for 2001 Cercospora leaf spot study.

Treatment	Disease Rating[a]	Root Yield (m/ha)	Sucrose %	Sucrose Yield (kg/ha)
(1) Control	15.8a	60.1d	14.1ab	8,460.7c
(2) Super Tin[bfj] Benlate[eh] (early)	3.2d	78.7a	3.9ab	10,932.1a
(3) Benlate[bef] Super Tin[hj] (early)	4.1cd	77.8a	14.0ab	10,840.5a
(4) Super Tin[ch] Benlate[ej] (late)	9.3b	69.1bc	14.4ab	9,890.6ab
(5) Benlate[ceh] Super Tin[j] (late)	8.1b	66.2cd	13.7b	9,075.1bc
(6) Headline[dgk] Eminent[i]	6.7bc	75.4ab	14.0ab	10,523.4a
(7) Eminent[dgk] Headline[i]	5.1cd	75.6ab	14.6a	10,990.1a

[a]Cumulative average of 4 disease evaluations; [b]early treatment; [c]late treatment; [d]conventional treatment; [e]Benlate added with manzate in tank mix; [f]applied 7/23/01; [g]applied 8/3/01; [h]applied 8/9/01; [i]applied 8/17/01; [j]applied 8/30/01; [k]applied 8/31/01. Means within a column followed by the same letter are not statistically different according to LSD test (P=0.05).

Tab. 3. Cercospora leaf spot rating system

Rating	Symptoms
0	No disease (0% = leaf area affected)
1	1-10 lesions (<1%)
2	11-50 lesions (1-2%)
3	51-100 lesions (2-3%)
4	101-175 lesions (3-4%)
5	5% - 15% (leaf area affected)
6	16% - 40%
7	41% - 65%
8	66% - 90%
9	>90%

CONCLUSIONS

No differences were observed among treatments in root or sucrose yields in 2000. This is presumably due to the drier conditions and later onset of disease than was observed in 2001. It may also be due to the furrow irrigation employed in 2000 compared with the sprinkler irrigation used in 2001. However, significant differences were recorded in 2000 for disease ratings between controls and fungicide treatments. This illustrates the benefits of using fungicides, even in years with low levels of disease. Similar results were seen in 2001 regarding disease severity differences, but yield differences among treatments were also obtained because of an overall higher disease pressure.

Data from both seasons suggest that timely fungicide sprays may be more important for improving yields and reducing disease incidence and severity than the type or application sequence of fungicides employed. The compatible results obtained after comparing the early application treatments with those based on the Cercospora forecasting system are very encouraging. They further corroborate the value of the forecasting system for predicting time periods when fungicide applications would be needed to most effectively manage the disease (Kerr and Weiss, 1990; Weiss and Kerr, 1989) and provide more a specific time schedule for making effective applications. Results also show that early applications can significantly improve yields and profitability in years when conditions for disease are favorable.

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