

# PRELIMINARY RESULTS ON THE CONTROL OF CERCOSPORA LEAF SPOT ATTACK IN SOME SUGAR BEET HYBRIDS WITH DIFFERENT DOSES OF FUNGICIDES

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**Abstract.** To the National Institute of Research and Development for Potato and Sugar Beet Brasov, in 2023, two polyfactorial experiments were carried out on the sugar beet crop which aimed to determine the effect of fungicides, full dose, respectively half dose, on beet plants affected by the pathogen *Cercospora beticola*. The experiments included five variants each, an untreated (control) variant, two variants with the recommended dose of fungicide (250 g/l difenoconazole active substance, respectively 14.1 g/l *Bacillus subtilis* strain QST 713) and two variants with 50% of the recommended fungicides dose. Four treatments were performed at an interval of 14 days, starting on July 14<sup>th</sup>. The assessment of *Cercospora* leaf spot attack intensity were made using a scale of 1 to 9. The highest efficacy was presented by Score fungicide applied at full dose (94.74%, respectively 93.33%), and the lowest by Serenade at half dose (80.26%, respectively 78.67%). Also, the yield obtained was between 70.75 t/ha to Score full dose (Belamia hybrid) and 43.75 t/ha for the control variant (Rosadda hybrid). The sugar content of the experimental varieties ranges between 13.90% (untreated Belamia hybrid) and 17.10% (Score product to Rosadda hybrid). The aim of our research was to investigate the way in which the obtained results offer technological solutions to farmers to contribute to increasing the economic efficiency of sugar beet cultivation.

**Keywords:** *Cercospora beticola*, doses, fungicides, sugar beet, yield

## INTRODUCTION

Sugar beet (*Beta vulgaris* L.) is a herbaceous dicotyledonous plant, mainly grown for the production of sugar (sucrose content up to 18%) in temperate regions (Trebbs and McGrath 2004, Kusstatscher et al., 2019). Sugar beet is an economically important crop, being the only plant that provides raw material for sugar production in the continental temperate climate, especially in the European countries (Moldovan et al., 2015). Due to daily demand for sugar, there is a need to increase the production of sugar beet crop.

The imperfect fungus *Cercospora beticola* Sacc. causes *Cercospora* leaf spot (CLS), is the most important leaf disease of sugar beet (*Beta vulgaris*) worldwide (Holtschulte, 2000) and may produce up to six generations within a growing season (Oerke et al., 2019).

The disease reduces root and extractable sucrose yields, and increases impurity concentrations resulting in higher processing losses. The losses in recoverable sucrose as high as 30% are common under heavy disease conditions and revenue losses as high as 43% have been reported (Lamey et al., 1996).

*Cercospora* leaf spot is managed by planting disease tolerant varieties, reducing inoculum by crop rotation and tillage, and fungicide applications (Miller et al., 1994). Application of new agricultural techniques, rotation with non-host crops, using a

resistant sugar beet cultivar and frequent use of fungicides can help in controlling the disease (Tedford et al., 2019; Morsy et al., 2022).

Based on study of the literature, it was assumed that using fungicides during the sugar beet growing season improves leaf health, reduces pathogen damage, increases leaf weight and increases canopy LAI (leaf area index). However, the effects of fungicide protection depend on environmental conditions, including the weather, the type of fungicide, active ingredient used, and the number of applications (Jaskulska et al., 2023).

## MATERIALS AND METHODS

The aim of the research was to determine the occurrence of symptoms of leaf infestation by pathogens, root yield and sugar content as result of the foliar application of fungicides.

Two field trials, at distance about 10 km one each other, were conducted in 2023 to National Institute of Research and Development for Potato and Sugar Beet Brasov. The experimental design was a randomized complete block with four replicates using Belamia and Rosadda sugar beet hybrids.

The previous crop was winter wheat. The soil was conventionally tilled, being ploughed with shallow stubble cultivation and deep pre-winter ploughing. Field plots comprised of seven 6 m long rows spaced 45 cm apart. Plots were sowed on 25 April 2023.

All treatments for *Cercospora* leaf spot started on 14<sup>th</sup> July. Treatments that were on a 14 day application interval were applied on 28<sup>th</sup> July, 1, 11, and 25 August 2023.

Two fungicides, with different active ingredients, Score 250 EC and respectively Serenade Aso (Table 1) were used. Two variants were with the full recommended dose of fungicide and two variants with 50% of the same recommended fungicides dose.

Table 1  
Fungicides used for control of *Cercospora* leaf spot of sugar beet

Fungicide	Active ingredient	Dose (l/h)
Score 250 EC	250 g/l difenoconazole	0.3
Serenade Aso	14.1 g/l <i>Bacillus subtilis</i> strain QST 713	2-4

*Cercospora* leaf spot severity was rated on the 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 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.

The efficacy of each fungicide was estimated by the following formula (El-Shemi, 2003 and Frolich, 1979):

$$\text{Efficacy}\% = \frac{\text{Average disease severity of untreated fungicide plot} - \text{Average disease severity of treated plot}}{\text{Average disease severity of untreated fungicide plot}} \times 100$$

The semi-mechanized harvesting was done with the beet digger on 29 September in first location, respectively 3 October in the second one. After dislocation, the following operations were performed manually. The middle two rows of each plot were harvested and weighed for root yield. For all samples, sugar content was measured according to polarimetry method.

Statistical analysis. Calculations and results interpretation were done after consecrated statistical methods like variance analysis. The Duncan multiple comparison test was also used, using each variant as witness for the all of the others (ANOVA program).

## RESULTS AND DISCUSSIONS

In the area of Bârsa Country, where the fields of experiments were established Cercospora leaf spot is the most important foliar disease of sugar beet.

The climatic conditions in 2023, during the sugar beet vegetation period were not the most favorable for the development of the culture, considering that the temperature was above long term average with 1.9 °C and the rainfalls was below long term average (50 years) with 38.1 mm (Table 2).

Table 2

Air temperature and rainfalls during the experiment

Year	Month						
	April	May	June	July	August	September	
	Air temperature (°C)						Average
2023	7.3	13.8	17.6	20.5	20.9	16.9	16.17
MAA	8.5	13.6	16.5	15.9	17.5	13.6	14.27
	Amount of rainfall (mm)						Total
2023	83.1	77.5	111.1	59.1	77.5	11.0	419.3
MAA	50.0	82.0	96.7	99.8	76.4	52.5	457.4

First Cercospora leaf spot symptoms were observed in middle July. Fungicide treatments started on July 14<sup>th</sup> when disease began to be observed in the untreated (control) plots. After, Cercospora leaf spot progressed rapidly in the untreated check.

The fungicides application contribute to a significant decreases in disease severity of Cercospora leaf spot compared with the untreated plots. Treatments applied to hybrid Belamia with Score exhibited high levels of leaf spot control since the disease severity was in between 4% and provided control efficacy higher than 94.74%. Serenade Aso, also provided high control reached more than 92.11% with disease severity ranged from 5-6%. Fungicides used at 50% rates were less effective, with disease severity ranging between 80.26-86.84%.

Also treatments applied with Score to hybrid Rosadda exhibited high levels of leaf spot control since the disease severity was 5% and provided higher efficacy than 93.33%. Serenade Aso, also provided high efficacy reached more than 89% with disease severity ranged from 7-8%. Fungicides used at 50% rates were less effective, with disease severity ranging between 78.67-84%.

High levels of disease severity (75-76%) were observed on untreated fungicide plots (control) during all the season (Table 3).

Table 3  
Disease severity (%) and control efficacy (%) - Cercospora leaf spot  
(Braşov, 2023)

Treatment	Belamia hybrid		Rosadda hybrid	
	Disease severity (%)	Efficacy (%)	Disease severity (%)	Efficacy (%)
Untreated	76d*	0	75d	0
Score	4a	94.74	5a	93.33
Serenade Aso	6a	92.11	8a	89.33
Score (half dose)	10b	86.84	12b	84.00
Serenade Aso (half dose)	15c	80.26	16c	78.67

\*Mean of each column followed by the same letter are not significantly different at  $p=0.05$  according to Duncan's multiple range test

Significant loss in root weight as well as in sugar content were associated with an increasing disease severity. Among the variants studied, the lowest average root yields were characteristic for untreated (control) in both experiment, been registred 45.5 t/ha to Belamia variety and 43.75 t/ha to Rosadda variety. The maximum yield was recorded for the both hybrids in the variant treated with Score in the recommended dose of 250 g/l difenoconazole active substance. The sugar content of the experimental varieties ranges between 13.90% (untreated Belamia hybrid) and 17.10% (Score product to Rosadda hybrid) (Table 4).

Table 4  
Root weight (t/ha) and sugar content (%)  
(Braşov, 2023)

Treatment	Belamia hybrid		Rosadda hybrid	
	Root weight (t/ha)	Sugar content (%)	Root weight (t/ha)	Sugar content (%)
Untreated	45.5c*	13.90	43.75c	14.00
Score	70.75a	16.60	68.75a	17.10
Serenade Aso	65.5a	15.70	65.75a	16.10
Score (half dose)	56.12b	14.40	53.20b	14.60
Serenade Aso (half dose)	54.37b	15.20	50.00b	15.60

\*Mean of each column followed by the same letter are not significantly different at  $p=0.05$  according to Duncan's multiple range test

## CONCLUSIONS

Cercospora leaf spot control requires a holistic approach which includes crop rotation, [planting tolerant sugarbeet varieties](#) and spraying a mixture of fungicides.

Application of fungicides significantly decreased the severity of cercospora by average 96-92% to the recommended dose and by average 88-84% at 50% rates. High levels of disease severity (75-76%) were observed on untreated plots (control) during all the season.

Fungicide treatments contributed to significantly higher root yield (between 70.75 t/ha to the recommended dose and 50.0 t/ha to 50% rates) and sugar content (between 17.10% to the recommended dose and 14.40% to 50% rates) compared to the untreated check (43.75 t/ha and 13.90% sugar).

So, any suppression of disease development will lead to save yield reduction or increasing yield components than that of untreated plots. Our results are consistently with that of other researchers (Khan and Smith, 2005; Gouda and Negar, 2014) who pointed that the disease severity is closely related to the reduction of root yield and sugar content.

The obtained data will be supplemented with results of the following years so that complex technological solutions are available to farmers to contribute to increasing the economic efficiency of sugar beet cultivation.

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