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EFFICACY OF TREATMENTS IN CONTROLLING CERCOSPORIOSIS (*Cercospora beticola* Sacc.) IN SUGAR BEET

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Abstract

Experiments were made in the experimental field from the location Sanzieni, Covasna County, under the conditions of the year 2018 and 2019 and were designed to determine effectiveness of the treatments in combating the pathogen Cercospora beticola of the sugar beet. The biological material was represented by the Damian, Matti, Vangelis and Tatry varieties. Different treatment schemes were tested and efficacy was calculated. The application of the treatments reduced significantlythe attack of cercosporiosis in all beet varieties in the experimental versions. The highest efficacy value of 95.44% was calculated at the Damian variety in 2019 in the Sfera 535 SC (0.35 l/ha) + Bravo 500 SC (1.5 l/ha) + Amistar Gold (0.5 l/ha) experiment.

Key words: *sugar beet, micromycete, control, efficacy.*

INTRODUCTION

Sugar beet (*Beta vulgaris* L.) represents for many states the most important crop for obtaining sugar (Toth & Cristea, 2018). The attack of beet-specific pathogens reduces considerably the roots and sugar production. Cercosporiosis or the leaf spot disease of the beet, caused by the attack of the micromycete *Cercospora beticola*, is considered the most common disease of the sugar beet leaf, wherever this plant is cultivated (Radulescu & Bulinaru, 1957). The attack of the fungi influences the plant growth and production through the fact that it leads to drying of the leaves, and the plants react to this loss by issuing new leaves, which happens at the expense of dry matter content. As a result, a lower accumulation of dry matter in the affected plants takes place and the extractable sugar yield drops compared with infection-free plants. Loss caused by the attack of the pathogen *Cercospora beticola* led to a 42% reduction of raw sugar and to 32% reduction of the root weight (Smith & Martin, 1978). Kelber (1977) estimated a 0.3% increase in yield loss with 1% increase disease severity (Kelber, 1977). Integrated control of pathogen *Cercospora beticola* attack envisages the resistance of the varieties (Rosi, 1995; Doncila, 1995a) the corresponding rotation, crop hygiene, the application of fungicide treatments, paying attention to avoiding the appearance of fungus resistance to administered substances (Shane & Teng, 1992; Wolf & Verreet, 2002; Cioni & Zavanella, 2004; Dovas et al., 1976; Georgopoulos & Dovas, 1973; Ruppel, 1975). Control of cercosporiosis attack envisages forecast of attack and warning of the treatment (Cristea & Gheorghies, 2001). Controlling sugar beet seed is of particular importance, as well, knowing that *Cercospora beticola* is present also on clusters, (Cristea, 2005; Milosecic et al., 2006) as seed pathogens have an important role in the epidemiology of the agricultural plant's disease.

MATERIALS AND METHODS

The research took place in the experimental field within the S.C. Agromiki Sanzieni, Covasna county and consisted in monitoring the influence of some fungicides to combat the pathogen *Cercospora beticola*. The presented data include observations and experimental results for two years 2018 and 2019. The used biological material was represented by the varieties: Damian, Matti, Vangelis and Tatry. Experiments were placed in three repetitions by randomized block scheme. In 2018, the following treatments were monitored: *Experiment 1*: Yamato (1.5 l/ha) + Bravo500 SC (1.5 l/ha) + AmistarXtra 280 EC (0.5 l/ha);

Experiment 2: Bravo 500 SC (1.5l/ha) + Yamato (1.5 l/ha) + AmistarXtra 280 EC (0.5 l/ha).
Experiment 3: AmistarXtra 280 EC (0.5 l/ha) + Bravo 500 SC (1.5 l/ha) + Yamato (1.5 l/ha).
In 2019, these treatments were monitored: *Experiment 1*: Amistar Gold (1.0l/ha) + Sfera 535 SC (0.35 l/ha)+ Bravo 500 SC (1.5 l/ha);
Experiment 2: Bravo 500 SC (1.5 l/ha) + Amistar Gold (1.0l l/ha)+ Sfera 535 SC (0.35 l/ha);
Experiment 3: Sfera 535 SC (0.35 l/ha) + Bravo 500 SC (1.5 l/ha) + Amistar Gold (1.0 l/ha).
The seed was treated with the insecticide Cruiser 600 in dose of 60 g/UG and the fungicide Tachigaren in dose of 10 g/UG in all variants. Observations on the frequency (F%) and intensity (I%) of the attack were made, based on which the degree of damage (GA%)was calculated, by the formulas: F = n x 100/N, where N = number of observed plants (%), n = n° of characteristic symptoms plants (%), I = Σ (i x f)/n (% 0 where, I = percentage for, f = number of plants (organs) with the respective percentage, n = total number of attacked plants (organs).
Intensity was noted in percent.
The degree of attack was calculated by the formula:

$$DA\ (degree\ of\ attack) = \frac{FxI}{100}\ (\%),$$

where: F = attack frequency (%),
I = attack intensity (%),
DA = rate was calculated by:

$$DD\ (degree\ of\ damage) = \frac{FxI}{100}\ (\%)$$

where:
F = attack frequency (%),
I = attack intensity (%).
The efficacy of the treatments was calculated by the formula of Abbott

$$E = \frac{GAm - GAv}{GAm} x100$$

where DAm = control level, DAv = variant attack level.

RESULTS AND DISCUSSIONS

Experiments placed in the experimental field from the location Sanzieni, Covasna county were designed to monitor the action of some fungicides in combating micromycete *Cercospora beticola* in sugar beet, in 2018 (Table1) and in 2019 (Table2).

Table 1. Scheme of Applying Treatments for Sugarbeet in Controlling the Attack of *Cercospora beticola* at SC Agromiki SRL, Location Sanzieni, Covasna County, 2018

Experiment 1				
Treatment No.	**Product**	**Active Substance**	**Dosis (l/ha)**	**Date**
1	Yamato	thiophanate-methyl 233 g/l+tetraconazole 70 g/l	1.5	30 June
2	Bravo 500 SC	chlorothalonil 500 g/l	1.5	16 July
3	AmistarXtra 280 EC	azoxystrobin 200 g/l +ciproconazole 80 g/l	0.5	4 August
Experiment 2				
1	Bravo 500 SC	chlorothalonil 500 g/l	1.5	30 June
2	Yamato	thiophanate-methyl 233 g/l+tetraconazole 70 g/l	1.5	16 July
3	AmistarXtra 280 EC	azoxystrobin 200 g/l +ciproconazole 80 g/l	0.5	4 August
Experiment 3				
1	AmistarXtra 280 EC	azoxystrobin 200 g/l +ciproconazole 80 g/l	0.5	30 June
2	Bravo 500 SC	chlorothalonil 500 g/l	1.5	16 July
3	Yamato	thiophanate-methyl 233 g/l+tetraconazole 70 g/l	1.5	4 August

Table 2. Scheme of Applying Treatments for SugarBeet in Controlling the Attack of *Cercospora beticola* at SC Agromiki SRL, Location Sanzieni, Covasna County, 2019

Experiment 1				
Treatment No.	**Product**	**Active substance**	**Dose (l/ha)**	**Date**
1	Amistar Gold	azoxystrobin 125 g/l + difenoconazole 125 g/l	1.0	17 June
2	Sfera 535 SC	trifloxystrobin 375 g/l+cyproconazole 160 g/l	0.35	3 July
3	Bravo 500 SC	chlorothalonil 500 g/l	1.5	27 July
Experiment 2				
1	Bravo 500 SC	chlorothalonil 500 g/l	1.5	17 June
2	Amistar Gold	azoxystrobin 125 g/l+difenoconazole 125 g/l	1.0	3 July
3	Sfera 535 SC	trifloxystrobin 375 g/l+cyproconazole 160 g/l	0.35	27 July
Experiment 3				
1	Sfera 535 SC	trifloxystrobin 375 g/l+cyproconazole 160 g/l	0.35	17 June
2	Bravo 500 SC	chlorothalonil 500 g/l	1.5	3July
3	Amistar Gold	azoxystrobin 125 g/l+difenoconazole 125 g/l	0.5	27 July

Our observations conducted on the influence of the treatment (Table 3) on the attack of the pathogen *Cercospora beticola* under the conditions of the year 2018, show that the highest frequency of attacks was recorded at the Matti variety, where F = 70% in the second experiment, and the lowest incidence value was calculated for the Tatry variety in the third Treatment experiment (F = 46%). In the case of the Vangelis variety attack frequency values were between 56% in the

third experiment and 62%, respectively, 64% in the second and third treatment experiments. In the case of the Tatry variety attack values of the pathogen *Cercospora beticola* were the lowestones in the second and third experiment, similarly, the frequency value was 56% in the first treatment experiment. Values of the micromycete attack frequency were high, of 100% for the Matti and Tatry varieties and 98% for the Damian variety and 96% for the Vangelis variety. Regarding the intensity of the attack the pathogen under the conditions of the year 2018, data from the same table show that the values were relatively reduced, of 1.84% for the Tatry variety in the third experiment and of 3.4% for the Matti variety within the same treatment experiment. Values of attack intensity of cercosporiosis were around 6% for the analyzed varieties. Consequently, the differences between the varieties were due to the frequency variations attack in the analyzed treatment variants. Thus, under the conditions of the year 2018 subunit values of the attack for the variety Tatry in the third treatment experiment and for the Damian variety in the first treatment experiment were obtained. Application of fungicides continues to be an important instrument in controlling the cercosporiosis in sugar beet (Skaracis et al., 2010; Cristea, 2005). Depending on environmental conditions, resistance of varieties, crop protection may require 1-2 up to 6-7 sprinklings per season (Skaracis et al., 1996; Merrigi et al., 2000).

In the experimented treatment scheme (Table 2), under the conditions of the year 2019, values of the attack frequency were reduced comparatively to that from the previous year. Therefore, the lowest frequency value of 37% in the third treatment experiment was determined for the Matti variety, followed by the Damian variety in the same experiment with the treatments. Frequency values were at about 50% in the case of Vangelis variety in all experimented treatment variants in 2019. Values of the attack intensity were varied, being higher for the Damian, Vangelis and Tatry varieties in the first treatment experiment, for the same varieties in the second and for the Vangelis and Tatry varieties in the third treatment variant. The lowest attack values were calculated in the variants from the third treatment experiment for the Damian and Matti varieties with DA = 0.46% and, respectively, 0.59%. Similarly, the Matti variety registered the lowest attack grade values and in the variants of the first and second experiments, as well. In the witness variants the attack grade value was higher under the conditions of the year 2019, reaching 12.3% for the Vangelis variety.

Table 3. Influence of treatment and application scheme on the attack of *Cercospora beticola* in sugar beet, location Sanzieni, Covasna County, 2018-2019

Experiment		Year 2018/Variety				Year 2019/Variety			
		Damian	Matti	Vangelis	Tatry	Damian	Matti	Vangelis	Tatry
I	Frequency	48	58	64	56	42	40	53	49
	Intensity	1.92	2.9	2.56	2.24	4.1	2.9	4.2	3.8
	Degree attack (%)	0.92	1.68	1.63	1.25	1.72	1.1	2.2	1.86
II	Frequency	66	70	62	58	43	39	51	47
	Intensity	3.3	2.8	2.48	2.32	3.7	1.9	4.9	2.8
	Degree attack (%)	2.17	1.96	1.53	1.34	1.6	0.74	2.5	1.3
III	Frequency	58	68	56	46	38	37	54	49
	Intensity	2.3	3.4	2.24	1.84	1.2	1.6	3.5	2.4
	Degree attack (%)	1.34	2.31	1.56	0.84	0.46	0.59	1.8	1.1
Control	Frequency	98	100	96	100	100	87	98	100
	Intensity	5.88	6.0	5.7	6.0	10.1	8.6	12.6	9.5
	Degree attack (%)	5.76	6.0	5.52	6.0	10.1	7.49	12.3	9.5

Table 4. Treatment Efficacy on the Attack of *Cercospora beticola* in Sugar Beet, Location Sanzieni, Covasna County, 2018-2019

Year		2018		2019	
Variety	Scheme Treatment/ Control	DA (%)	E (%)	DA (%)	E (%)
Damian	I	0.92	84.02	1.72	82.97
	Control	5.76		10.1	
Matti	I	1.68	72.00	1.1	85.31
	Control	6.0		7.49	
Vangelis	I	1.63	77.35	2.2	82.11
	Control	5.52		12.3	
Tatry	I	1.25	79.16	1.86	80.42
	Control	6.0		9.5	
Damian	II	2.17	62.32	1.6	84.15
	Control	5.76		10.1	
Matti	II	1.96	67.33	0.74	90.12
	Control	6.0		7.49	
Vangelis	II	1.53	72.28	2.5	79.67
	Control	5.52		12.3	
Tatry	II	1.34	77.66	1.3	86.31
	Control	6.0		9.5	
Damian	III	1.34	76.73	0.46	95.44
	Control	5.76		10.1	
Matti	III	2.31	61.5	0.59	92.12
	Control	6.0		7.49	
Vangelis	III	1.56	71.73	1.8	85.36
	Control	5.52		12.3	
Tatry	III	0.84	86.00	1.1	88.42
	Control	6.0		9.5	

Regarding the efficacy of the treatments applied in the mentioned variants (Table 4) it can be noticed that in the year 2018 the highest value was registered at the third treatment experiment for the Tatry variety, followed by the treatments applied in the first treatment experiment for the Damian variety. Under the conditions of the year 2019 and for the applied treatment scheme (Table 2) efficacy in controlling the disease was higher, reaching 95.44% for the Damian variety in the third treatment experiment and 92.12% for the Matti variety, when the same treatments were applied. Efficiency calculation of the treatments in controlling the plants' pathogens presents agreat importance in establishing schemes to combat them (Jalobă et al., 2019; Alexandru et al., 2019; Doncila, 1995b).

CONCLUSIONS

Application of the treatments and the variety behavior continue to represent very important steps in controlling cercosporiosis in sugar beet. After applying treatment in vegetation amid seed treatment, the degree of damage decreased significantly in all experimental variants in regard to the witness variant. Under the conditions of experimental years attack frequency had superior values to the intensity for all studied varieties.

Under the conditions of the year 2018, for the Damian variety, in the treatment experiment 1, the highest efficacy value was registered, E = 84.02% and the Tatry variety in the third treatment experiment with E = 86%. Under the conditions of the year 2019, the highest efficacy value was registered for the Damian variety in the third experiment, followed by the Matti variety in the same treatment scheme with E = 92.12% and with E = 90.12% in the second treatment variant.

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