CONTROL OF PATHOGENS WITH ECONOMIC IMPORTANCE FOR EGGSPLANT CROPS IN THE FIELD

Gabriela Șovărel[*]*, Marcel Costache, Ana-Emilia Cenușă, Simona-Ștefania Hogea*

Research-Development Institute for Vegetable and Flower Growing Vidra, Ilfov, Romania

Correspondence address:
Research and Development Institute for Vegetable and Flower Growing
Vidra, Calea București 22, Ilfov, Romania
E-mail: gabriela_sovarel@yahoo.com

Abstract: The experiment was done at RDIVFG Vidra in 2017. The objective was to develop treatment programs for control of pathogens *Alternaria solani*, *Botrytis cinerea* and *Phytophthora parasitica* which attacks the foliage and fruits of eggplants. The following treatment schemes were used: Variant 1 (T1. Bravo 500SC 0.2%, T2. Melody Compact 49WG 0.2%, T3. Bravo 500SC 0.2%, T4. Melody Compact 49WG 0.2%, T5. Ortiva Top 0.1%, T6. Bravo 500SC 0.2%); Variant 2 (T1. Cabrio Top 0.2%, T2. Melody Compact 49WG 0.2%, T3. Cabrio Top 0.2%, T4. Melody Compact 49WG 0.2%, T5. Ortiva Top 0.1%; T6. Cabrio Top 0.2%); Variant 3 (T1. Polyram DF 0.2%, T2. Melody Compact 49WG 0.2%, T3. Polyram DF 0.2%, T4. Melody Compact 49 WG 0.2%, T5. Ortiva Top 0.1%, T6. Polyram DF 0.2%); Variant 4 (untreated control). Six treatments were applied at 14 - 16 days. The pathogens attack had a slow evolution due to the maximum atmospheric humidity, relatively reduced from July to August (52.4-74.7 %, average of 61.2%) and poor rainfall (15 mm in the first and last ten days of July and in 1-20 August). At the end of September, the frequency of the attacked fruits was 5.9% at *Ph. parasitica* and 8.1% at *B. cinerea* and the degree of attack of the pathogen *A. solani* 10.9%. Under these conditions, the average efficacy of the treatments ranged from 79.7% (V3) to 85.5% (V2). Among variants, the yields of field eggplant crop ranged from 3.872 kg/m^2 (V3) to 3.972 kg/m^2 (V2) and 3.450 kg/m^2 for the untreated control.

Key words: *pathogens, eggplants, field*

INTRODUCTION

Eggplant *Solanum melongena* L. is an important solanaceous vegetable crop cultivated in many tropical, Asian and some European countries (Singh et al., 2009). Knowing the environmental factors favoring the appearance and evolution of the pathogens attack on vegetable crops it is of particular importance for field crops to determine the optimal time to apply treatments (Costache et al., 2007). Most pathogens require high atmospheric humidity to produce infections >90% and among them the fungi that produce the early blight, anthracnose, leaf mold, late blight, gray mold and the presence of water droplets on the susceptible organs of plants (Costache et al., 2018). Of these, very important for eggplant culture are *Alternaria solani* (early blight), *Botrytis cinerea* (gray mold) and *Phytophthora parasitica* (root, stems and fruits rot) which attacks the foliage and fruits.

The objective of this paper was to develop treatment programs to control the pathogens *A. solani*, *B. cinerea* and *Ph. parasitica* in eggplant culture.

MATERIALS AND METHODS

Planting in the field was on May 12, 2017. The experiment was organised according to the Latin square using the Luiza eggplant variety. Six foliar treatments at 12 - 16 days were applied during the growing period. The products used to control the pathogens in the field eggplant crop are presented in table 1 and the scheme of treatments is presented in table 2. The technological variants have been established according to the succession of pathogens appearance in the crop.

Table 1. Products used to control pathogens on eggplant crop in the field (Vidra, 2017)

Product and concentration (%)	Active substance	Waiting period (days)
Bravo 500SC 0.2%	chlorothalonil 500 g/l	3
Cabrio Top 0.2%	pyraclostrobin 5% + metiram 55%	7
Polyram DF 0.2%	metiram 80%	4
Melody Compact 49WG 0.2%	iprovalicarb 8.4% + Cu as oxychloride of Cu 40.6%	7
Ortiva Top 0.1%	azoxystrobin 200g/l + difenoconazole 125g/l	7

Table 2. Variants for controlling pathogens on eggplant crop in the field (Vidra, 2017)

Variant	22.06.2017	06.07.2017	18.07.2017	04.08.2017	22.08.2017	06.09.2017
	Treatment 1	Treatment 2	Treatment 3	Treatment 4	Treatment 5	Treatment 6
1	Bravo 500SC 0.2%	Melody Compact 49WG 0.2%	Bravo 500SC 0.2%	Melody Compact 49WG 0.2%	Ortiva Top 0.1%	Bravo 500SC 0.2%
2	Cabrio Top 0.2%	Melody Compact 49WG 0.2%	Cabrio Top 0.2%	Melody Compact 49WG 0.2%	Ortiva Top 0.1%	Cabrio Top 0.2%
3	Polyram DF 0.2%	Melody Compact 49WG 0.2%	Polyram DF 0.2%	Melody Compact 49WG 0.2%	Ortiva Top 0.1%	Polyram DF 0.2%
4	Untreated control	-	-	-	-	-

RESULT AND DISCUSSIONS

On eggplant crop in the field, the attack of the following pathogens was present: *Alternaria solani* (early blight), *Botrytis cinerea* (gray mold) and *Phytophthora parasitica* (*Phytophthora* root rot).

A. solani (early blight). The attack manifests on the leaves and the fruits at the base of the plants. On the leaves appear large, circular spots, at first yellow, then brown, concentrically zoned, similar to those appearing in tomato crops. On the surface of the fruits appear circular spots of 0.6-1.2 cm in diameter, brown, with the edges precisely contoured. In a more advanced stage, the spots often confluence and form large infected surfaces, which penetrate the fruit's pulp to a depth of 1 cm or more. The attacked tissues are spongy and have a brown or grayish brown color. On the surface of the old spots a dark gray mold appears, and when the fungus spores abundantly the color becomes green-olive (Figure 1).

B. cinerea (gray mold). On fruits, at different stages of development, the attack usually starts at the place of insertion of the peduncle and from there progresses towards their upper part. The attacked tissues become discolored and turn purple with a gray shade. Active lesions have a reddish-purple edge, are relatively strong and those reaching 5-7cm in diameter can penetrate the fruit's flesh to a depth of 1 - 2.5cm. When the atmospheric humidity is high, on the surface of the lesions there appears an abundant fluff, of gray color, formed by the fructifications of the fungus (Figure 2).

P. parasitica (*Phytophthora* root rot). Usually, mature fruits from the basal part of the plants, which touch the soil or are close to it, are attacked. On their surface appear large, brown spots, concentrically zoned, bordered by a clearer area of light color (Figure 3). The strongly attacked fruits fall to the surface of the soil and are a source of infection for those on the upper parts, as the fungus spores abundantly on their surface.

Figure 1. *Alternaria solani* on the leaves

Figure 2. *Botrytis cinerea* on the fruits

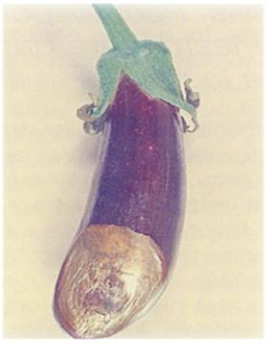

Figure 3. *Phytophthora parasitica* on the fruit

At the end of September, the frequency of fruits attacked by *Ph. parasitica* was 5.9% and the frequency of fruits attacked by *B. cinerea* was 8.1% (Table 3). The degree of attack for *A. solani* was 10.9%. The attack of *B. cinerea* and *A. solani* started in the last ten days of July while the attack of *P. parasitica* started in the first ten days of August. The first pathogen observed in culture was *B. cinerea* (21 July) followed by *A. solani* (24 July) and *P. parasitica* (7 August). The attack of the three pathogens had a slow evolution due to the relatively low maximum atmospheric humidity in July and August (between 52.4 and 74.7%, average of 61.2%) and the poor rainfall from 10 July to 20 August. Under these conditions, the average efficacy of the treatment variants (Table 4) ranged from 79.7% (V3) to 85.5% (V2).

Table 3. The appearance and evolution of the pathogens on the eggplant crop depending on the climatic factors

Pathogens and climatic factors	Date of attack appearance	Degree of attack (%) / month/ ten days period												
		May	June			July			August			September		
		III	I	II	III	I	II	III	I	II	III	I	II	III
Alternaria solani	24.07	0	0	0	0	0	0	1.1	2.3	4.2	5.8	6.7	8.8	10.9
Botrytis cinerea	21.07	0	0	0	0	0	0	1.4	1.9	2.5	3.4	3.9	5.8	8.1
Phytophthora parasitica	7.08	0	0	0	0	0	0	0	0.8	1.5	2.3	3.2	4.4	5.9
Min T°C	-	12.4	15.0	14.0	16.3	15.9	15.9	17.5	21.1	18.3	15.1	13.7	15.3	10.5
Med T°C	-	16.5	20.1	19.8	23.8	22.0	22.0	24.0	30.8	25.6	21.3	20.8	21.5	14.2
Max T °C	-	21.4	27.0	26.0	31.9	28.4	28.9	31.0	36.6	31.8	28.7	28.8	29.4	19.2
Min R.H. (%)	-	57.0	47.5	43.8	36.4	46.0	37.8	35.7	26.9	27.4	30.2	29.3	30.8	41.7
Med R.H. (%)	-	66.9	59.5	56.8	56.4	57.9	47.6	46.8	36.7	38.7	41.7	46.9	44.8	50.7
Max R.H. (%)	-	79.6	77.8	74.4	82.5	74.7	63.6	63.3	52.4	57.0	56.4	72.3	61.7	64.6
Rainfall (mm)	-	7.5	20.0	22.5	1.0	84.0	8.5	6.5	0	0	45.0	30.0	1.0	2.0

Table 4. The efficacy of treatments in controlling pathogens on eggplant in experimental field

Variant	Frequency of attack / degree of attack (%) and efficacy (%)						
	Alternaria solani (DA %)	E (%)	*Botrytis cinerea* (AF %)	E (%)	*Phytophthora parasitica* (AF %)	E (%)	Mean E (%)
1	2.2	79.8	1.3	83.9	1.0	83.0	82.2
2	1.9	82.6	1.0	87.6	0.8	86.4	85.5
3	2.4	78.0	1.5	81.5	1.2	79.7	79.7
4 (untreated)	10.9	-	8.1	-	5.9	-	-

The yields obtained from the eggplant crop in the experimental field ranged from 3.872 kg/m^2 (V3) to 3.972 kg/m^2 (V2); yield of the untreated control variant was 3.450 kg/m^2 (Table 5).

Table 5. The yields of eggplant in the experimental field according to the experimental treatments

Variant	Yield		
	kg/m^2	% as compared to untreated control	difference from untreated control (kg/m^2) and signification
1	3,920	113,6	0,470 ***
2	3,972	115,1	0,522 ***
3	3,872	112,2	0,422 ***
4 (untreated control)	3,450	100,0	-

LD 5% = 0.104; LD 1% = 0.146; LD 0.1% = 0.206

The highest yields were in the variant 2 (3.972 kg/m^2) and in the variant 1 (3.920 kg/m^2). The yield differences obtained as compared to the untreated control variant were very significant, in cases of all variants.

CONCLUSION

In the climatic conditions of 2017, in the eggplant crops of the Vidra area, the attack of following pathogens was manifested: *Alternaria solani* (early blight), *Botrytis cinerea* (gray mold) and *Phytophthora parasitica* (root, stems and fruits rot) which affected the yield quantitatively and depreciated it qualitatively.

Two variants of treatments, V2 (average efficacy of 85.5%, yield 3.972 kg/m^2) and V1 (average efficacy of 82.2%, yield 3.920 kg/m^2) were noted in terms of efficacy of treatments and higher yields.

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