ASPECTS REGARDING THE CONTROL OF PATHOGENS ON TOMATO CROPS UNDER HIGH PLASTIC TUNNELS

ASPECTE PRIVIND CONTROLUL AGENŢILOR PATOGENI LA CULTURILE DE TOMATE ÎN SPAŢII PROTEJATE

CENUŞĂ Ana-Emilia[1]*, ŞOVĂREL Gabriela[1], COSTACHE M.[1], HOGEA Simona-Ştefania[1]
*Corresponding author e-mail:ema_april@yahoo.com

Abstract. *In the year 2020, at RDIVFG Vidra, an experiment with tomatoes was set up under high plastic tunnels, in order to study the efficacy of some combinations of fungicides in the control of pathogens. The Prekos F1 tomato hybrid was used. The experience included 5 variants in 4 replications. The experimental variants were the following: V1. Signum 0.15 +Cabrio Top 0.2%; V2. Ortiva Top 0.1% + Switch 0.1%; V3. Cidely Top 0.1% + Prolectus 0.12%; V4. Dagonis 0.1% + Teldor 0.08%; V5. Untreated control. The pathogens present in the tomato crop were Alternaria solani (early blight), Botrytis cinerea (grey mold) and Fulvia fulva (leaf mold). The efficacy of the products combinations was assessed according with the average degree of attack and the obtained yield, which was processed by the variance analysis method.*
Key words: pathogens, tomatoes, fungicides, efficacy

Rezumat. *În anul 2020, la ICDLF Vidra, s-a înfiinţat o experienţă cu tomate în solar, pentru a studia eficacitatea unor combinaţii de fungicide în controlul agenţilor patogeni. S-a folosit hibridul de tomate Prekos F1. Experienţa a cuprins 5 variante în 4 repetiţii. Variantele experimentale au fost următoarele: V1. Signum 0,15% + Cabrio Top 0,2%; V2. Ortiva Top 0,1% + Switch 0,1%; V3. Cidely Top 0,1% + Prolectus 0,12%; V4. Dagonis 0,1% + Teldor 0,08%; V5. Martor netratat. Agenţii patogeni prezenţi în cultură au fost Alternaria solani (pătarea brună sau alternarioza), Botrytis cinerea (putregaiul cenuşiu) şi Fulvia fulva (pătarea cafenie). Eficacitatea combinaţiilor de produse a fost apreciată în funcţie de gradul de atac mediu şi producţia obţinută, care a fost prelucrată prin metoda analizei varianţei.*
Cuvinte cheie: agenţi patogeni, tomate, fungicide, eficacitate

INTRODUCTION

Tomato crops occupies an important area worldwide (4762457 ha), the main cultivating countries being China with 1035709 ha, followed by India, Nigeria, Turkey and Egypt. In Europe, Romania ranks 5th in area (40734 ha) after Italy, Russia, Ukraine and Spain (FAO, 2018).

In tomato crops under high plastic tunnels, the attack of pathogens *Alternaria solani*, *Botrytis cinerea* and *Fulvia fulva* is manifested annually.

The research undertaken at RDIVFG Vidra aimed to identify different combinations of fungicides for the simultaneous control of pathogens present in tomato crop.

[1] Research and Development Institute for Vegetable and Flower Growing Vidra, Romania

Tomatoes are some of the most widespread cultivated species in the *Solanaceae* family. Fruits are appreciate for their high nutritional value, and cultivation is practiced in most countries (Koike *et. al.*, 2007).

In all control measures, chemicals have a particularly important role to play. Most fungicides (contact ones) act preventively against pathogens, and systemic products penetrate and diffuse into plant tissues and have a curative effect (Şovărel *et. al.*, 2020).

In order to obtain competitive yield, it is necessary to manage harmful organisms so that their effects on plants are kept to a minimum level. The losses can be high if control strategies are not implemented in time. Disease management control aims to prevent their occurrence and identify their presence in crops in order to establish appropriate measures to reduce the extent of attacks (Tsitsigiannis *et.al.*, 2008).

MATERIAL AND METHOD

The experiment was performed at RDIVFG Vidra, in 2020, under high plastic tunnels conditions, in the first cycle of crop. The Prekos F1 tomato hybrid was used. The experience included 5 variants in 4 replications. The experimental variants were the following: V1. Signum 0.15% + Cabrio Top 0.2%; V2. Ortiva Top 0.1% + Switch 0.1%; V3. Cidely Top 0.1% + Prolectus 0.12%; V4. Dagonis 0.1% + Teldor 0.08%; V5. Untreated control (tab. 1). 7 treatments were applied, the first on 05.06.2020 and the following at intervals of 7-10 days.

Observations were made on the occurrence and evolution of the attack of pathogens (frequency and intensity of attack%) in correlation with climatic factors and the yield was recorded on variants and replications. The efficacy of product combinations was assessed according with the average degree of attack and the obtained yield, which was statistically processed by the method of variance analysis (Săulescu and Săulescu, 1967).

Tabel 1

The spectrum of action of experienced fungicide combinations

Fungicide combinations (break time)	Concen-tration (%)	Active substance	Spectrum of action
Signum (3) + Cabrio Top (7)	0.15+0.2	boscalid 26.7% / piraclostrobin 6.7% + piraclostrobin 5% / metiram 55%	*A. solani, B.cinerea, F. fulva, Erysiphe* sp., *S. sclerotiorum*[1)], *Ph. infestans*[2)], *S. lycopersici*[3)]
Ortiva Top (7) + Switch (3)	0.1+0.1	azoxistrobin 200 g/l / difenoconazol 125 g/l+ fludioxonil 25% / ciprodinil 37.5%	*A. solani, B. cinerea, F. fulva, Ph. infestans*
Cidely Top (3) + Prolectus (1)	0.1+0.12	difenoconazol 125 g/l / ciflufenamid 15 g/l + fenpyrazamine 50%	*A. solani, B. cinerea, F. fulva, Erysiphe* sp.
Dagonis (3) + Teldor (3)	0.1+0.08	difenoconazol 50 g/l / fluxapiroxad 75 g/l + fenhexamid 500 g/l	*A.solani, B. cinerea, Erysiphe* sp., *S. sclerotiorum, C. coccodes*[4)]

[1)] *Sclerotinia sclerotiorum*, [2)] *Phytophthora infestans*, [3)] *Septoria lycopersici*, [4)] *Colletotrichum coccodes*

RESULTS AND DISCUSSIONS

During the vegetation period, the attack of the pathogens *Alternaria solani*, *Botrytis cinerea* and *Fulvia fulva* was manifested (fig. 1, fig. 2 and fig. 3).

Table 2

The influence of climatic factors on the appearance and evolution of the attack of pathogens on the tomato crop under high plastic tunnels (Vidra, 2020)

Pathogens/ climatic factors	Date of attack	Degree of attack (%)								
		May		June			July			August
		Decade		Decade			Decade			Decade
		II	III	I	II	III	I	II	III	I
Alternaria solani	10.06	0	0	0	0.5	1.2	3.8	8.1	9.7	12.5
Botrytis cinerea	12.06	0	0	0	0.8	2.5	4.6	10.3	13.1	17.1
Fulvia fulva	06.07	0	0	0	0	0	0.8	2.3	5.1	7.2
Minimum temperature (°C)	-	14.5	10.4	12.2	16.8	16.3	17.9	15.5	18.1	17.6
Average temperature (°C)	-	26.1	20.2	23.5	24.9	27.9	29.7	27.0	29.6	29.9
Maximum temperature (°C)	-	39.4	34.5	37.2	37.8	40.6	41.7	39.6	43.0	42.2
Minimum humidity (%)	-	25.2	31.8	30.4	42.1	30.2	25.8	24.8	24.6	18.6
Average humidity (%)	-	54.6	66.1	64.3	74.8	62.7	55.9	54.8	58.7	44.4
Maximum humidity (%)	-	86.2	93.1	93.7	96.7	93.9	89.9	88.3	91.9	77.9

In succession, the appearance of the attack of pathogens was the following: *Alternaria solani* (10.06), *Botrytis cinerea* (12.06) and *Fulvia fulva* (06.07). Their attack evolved gradually, being favored by the high maximum atmospheric humidity from June to July (88.3-96.7%), so that, in the first decade of August, the degree of attack registered the following values: 12.5% (*A. solani*), 17.1% (*B. cinerea*) and 7.2%, respectively (*F. fulva*; tab. 2).

The combinations between the experimented fungicides ensured a good protection of the tomato plants against the attack of the pathogens *Alternaria solani*, *Botrytis cinerea* and *Fulvia fulva*, their average efficacy being between 86.8% (Dagonis 0.1% + Teldor 0.08%) and 96.8% (Signum 0.15% + Cabrio Top 0.2%; tab. 3).

The average efficacy of fungicide combinations recorded the highest values in variants 1 (96.8%) and 2 (94.6%; tab. 3).

Table 3

The efficacy of combinations of fungicides in controlling pathogens on tomatoes crop under high plastic tunnel (Vidra, 2020)

Variant	Concen-tration (%)	Degree of attack (%)			Efficacy (%)			Average efficacy (%)
		Alternaria solani	*Botrytis cinerea*	*Fulvia fulva*	*Alternaria solani*	*Botrytis cinerea*	*Fulvia fulva*	
1. Signum + Cabrio Top	0.15+0.2	0.7	0.7	0	94.4	95.9	100.0	96.8
2. Ortiva Top + Switch	0.1+0.1	1.5	0.7	0	88.0	95.9	100.0	94.6
3. Cidely Top + Prolectus	0.1+0.12	2.7	2.1	0	78.4	87.7	100.0	88.7
4. Dagonis + Teldor	0.1+0.08	2.7	3.1	0	78.4	81.9	100.0	86.8
5. Control untreated	-	12.5	17.1	7.2	-	-	-	-

Regarding the obtained yield, the following variants were noted: 1 (Signum 0.15% + Cabrio Top 0.2%) with 5.705 kg / m^2 and 4 (Dagonis 0.1% + Teldor 0.08%) with 5.571 kg / m^2, compared to 4,983 kg / m^2 in variant 5, untreated control (tab. 4).

Tabel 4

The influence of treatments with different combinations of fungicides on tomato crop under high plastic tunnel (Vidra, 2020)

Variant	Concen-tration (%)	Yield (kg/m^2)	Relative yield (%)	Difference from control (kg/m^2)	Significance
1. Signum + Cabrio Top	0.15+0.2	5.705	114.5	+0.722	***
2. Ortiva Top + Switch	0.1+0.1	5.458	109.5	+0.475	***
3. Cidely Top + Prolectus	0.1+0.12	5.438	109.1	+0.455	***
4. Dagonis + Teldor	0.1+0.08	5.571	111.8	+0.588	***
5. Control untreated	-	4.983	-	-	-

LSD 5%=0.06; LSD 1%=0.09; LSD 0.1%=0.12

Following the statistical calculation, by the method of variance analysis, it was found that the differences in yields obtained in addition to the untreated control variant are very significantly positive.

Fig. 1 *Alternaria solani* attack on tomato leaf

Fig. 2 *Botrytis cinerea* attack on tomato leaf

Fig. 3 Attack of *Fulvia fulva* on tomato leaf

CONCLUSIONS

1. In the tomato crop from the high plastic tunnel, cycle I, the attack of the pathogens *Alternaria solani*, *Botrytis cinerea* and *Fulvia fulva* was manifested.

2. The average efficacy of the fungicide combinations registered the highest values at variants 1 (Signum 0.15% + Cabrio Top 0.2% - 96.8%) and 2 (Ortiva Top 0.1% + Switch 0.1 % - 94.6%).

3. The obtained yield had the highest values for variants 1 (Signum 0.15% + Cabrio Top 0.2%: 5.705 kg / m^2) and 4 (Dagonis 0.1% + Teldor 0.08%: 5.571 kg / m^2), as compared to variant 5, untreated control, in which it was only 4.983 kg / m^2.

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