Scientific Papers. Series B, Horticulture. Vol. LXVI, No. 1, 2022
Print ISSN 2285-5653, CD-ROM ISSN 2285-5661, Online ISSN 2286-1580, ISSN-L 2285-5653

RESULTS REGARDING THE EFFICACY OF SOME FUNGICIDES IN CONTROLLING *VENTURIA INAEQUALIS* IN MĂRĂCINENI AREA IN 2016

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Abstract

This paper presents the results recorded following the application in apple culture of different treatment programs with fungicide in order to control Venturia inaequalis, a pathogen recognized for the quantitative and qualitative damages caused. In order to control this pathogen, the chemical measures are necessary in addition to the agro-phytotechnical ones. The efficacy of the new active substance fluopyram, present in Luna Experience, with effect in blocking the pathogen's respiration. The apple variety on which the experiments were carried out is Idared, chosen especially for its sensitivity to the apple scab. The observations took place in 2016 at I.C.D.P. Mărăcineni. The evolution of the meteorological parameters was noted using Watchdog station, the dedicated software and IRFAN VIEW (Freeware). With its help, the dynamics of the infections were graphically highlighted and warnings were elaborated. In the field, observations were made to determine the frequency (F%) and intensity (I%) of the attack, in order to calculate the degree attack (DA%). In the end, the effectiveness of the treatment programs was calculated.

Key words*: fungicide, apple scab, treatments, efficacy, results.*

INTRODUCTION

The apple culture occupies the largest surfaces of fruit species both in the temperate area and Romania. Food and economic value are recognized worldwide, ranking first in world fruit production. The production potential and fruits quality can be affected by the attack of pathogens, *Venturia inaequalis* being one of the most present. The pathogen *Venturia inaequalis* causes the disease known as apple scab. The resistance of the pathogen to different fungicide active substances is one of the most approached topics, this being in continuous change, numerous data being found in research papers like (Amzăr, 1997; Bengtsson et al., 2008; 2006a; 2006b; Braun 1994; Hildebrand et al., 1988; Köller et al., 1997; Köller et al., 2004; Smith et al., 1991).

MATERIALS AND METHODS

The experimental plot was established in the Research Institute for Fruit Growing Pitești-Mărăcineni (44°89′91″N 24°86′08″E). Climatic conditions of Mărăcineni are characterized by the average annual temperature of 9.7°C and the average annual rainfall of 663.3 mm (Butac et al., 2015). The observation took place in an 22 years old apple orchard, 3.5 x 2.5 (1842 trees/ha), sprinkler irrigation and fertilization with 90 kg/ha 16:16:16 and ammonium nitrate 30 kg/ha active substances. The evolution of meteorological parameters in 2016 was noticed using the Watchdog station, the dedicated software and IRFAN View (Freeware). The apple variety on which the experiments were performed is 'Idared', chosen especially for its sensitivity to apple scab attack. For the analysis of some fungicide efficacy in the control of *Venturia inaequalis*, two treatments schemes were proposed, presented in Table 1 and the untreated variant was used as control (blank). For the monitoring of *Venturia inaequalis* the synthesis of three observation models was taken into account Mills, WSU and Cornel NY, for the graphical elaboration of the infection dynamics and the elaboration of warnings for the application of phytosanitary. In the field observation was made to establish the frequency (F%) and intensity (I%) of the attack, in order to calculate the degree attack (DA%). At the end the efficiency of the treatments program was calculated.

Table 1. The treatment variants used

Treatment number	Date	BBCH	Products applied and rate	
			V_1	V_2
1	4.04	55	Antracol 70 WP 4.5 kg/ha	Antracol 70 WP 4.5 kg/ha
2	14.04	57-60	Dithane M-45 2 kg/ha +Shavit 72 WDG 2 kg/ha	Luna Experience 400 SC 0.75 l/ha
3	6.05	69	Flint Plus 64 WG 1.875 kg/ha	Flint Plus 64 WG 1.875 kg/ha
4	13.05	71	Topsin 70 WDG 1.05 kg/ha	Luna Experience 400 SC 0.75 l/ha
5	20.05	72-73	Folicur Solo 250 EC 0.75 l/ha	Folicur Solo 250 EC 0.75 l/ha
6	28.05	73-74	Shavit 72 WDG 2 kg/ha	Luna Experience 400 SC 0.75 l/ha
7	3.06	75	Flint Plus 64 WG 1.875 kg/ha	Flint Plus 64 WG 1.875 kg/ha
8	29.06	77	Antracol 70 WP 4.5 kg/ha	Antracol 70 WP 4.5 kg/ha
9	12.07	78	Flint Plus 64 WG 1.875 kg/ha	Flint Plus 64 WG 1.875 kg/ha
10	21.07	79	Antracol 70 WP 4.5 kg/ha	Antracol 70 WP 4.5 kg/ha
11	5.08	81	Flint Plus 64 WG 1.875 kg/ha	Flint Plus 64 WG 1.875 kg/ha
12	26.08	83	Dithane M-45 2 kg/ha	Luna Experience 400 SC 0.75 l/ha

RESULTS AND DISCUSSIONS

The efficacy of some fungicides on apple scab attack, 'Idared' variety, was monitored in 2016.The climatic conditions of 2016 (year with early spring, which followed a rather mild winter 2015-2016) were favorable for the evolution attack of *Venturia inaequalis*.

The evolution of average temperature, daily values of wind speed, gusts and foliage wetting time are presented in figures 1-3. The average monthly temperature was 6.7°C in March (high of 23.2°C and low of 4.2°C), 13.5°C in April (high of 29.4°C and low of -0.1°C), 14.6°C in May (high of 29.6°C and low of 2.6°C), 20.7 in June (high of 35.4°C and low of 9.9°C), 22.4 in July (high of 33.3°C and low of 11.1°C) and 21.6 in August (high of 35.9 and low of 8.6°C) (Figure 1).

In terms of rainfall days, it was 13 in March, 15 in April, 20 in May, 14 in June, 4 in July and 9 in August. Regarding the amount of precipitation in mm, it was 90.1 in March, 76.7 in April, 134.1 in May, 119.6 in June, 27.9 in July and 40 in August (Figure 2).

The sum of the wetting hours of the foliage was 2.5 h in March, 74.5 h in April, 136.0 h in May, 124.3 h in June, 67.8 h in July and 92 h in August. As a result of the evolution of meteorological parameters, as can be seen in figure 1, the risk of primary infections appeared since the beginning of March, but the temperatures during the night (below 6°C) and humectation period did not allow the attack evolution, the infection throw ascospores not being possible.

Figure 1. The daily values of temperature (source: Watchdog station)

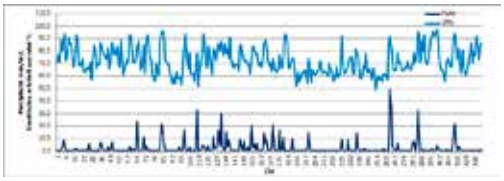


Figure 2. The daily values of precipitation and air relative humidity (source: Watchdog station)

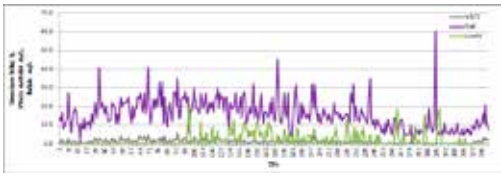


Figure 3. The daily values of wind speed, flurries and leaves time of moistening (source: Watchdog station)

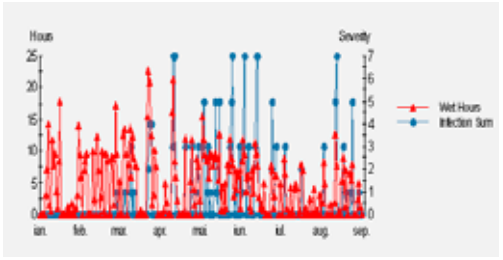
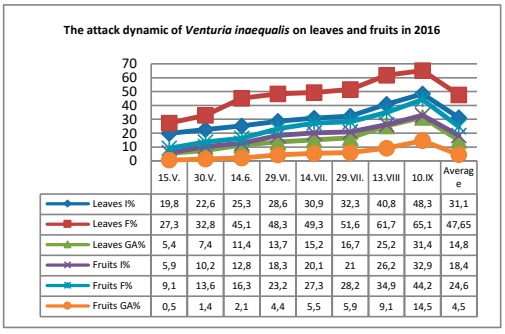


Figure 4. The risk infection with *Venturia inaequalis* between 1.01.-9.09.2016 (source: Watchdog station)

The primary infections set in the first half of April and the second half of the same month conditions were met for the secondary infections, when the foliage wetting time sometimes exceeded 20 hours/day, at the end of the month the severity attack becoming maximum (Figure 4). The risk of secondary infections was moderate in May, but increased sharply in late May and early June remaining so throughout June. The pressure of infections was lower in July but increased again in August, when the amount of foliage wetting hours exceeded 17 hours/day (Figure 4).

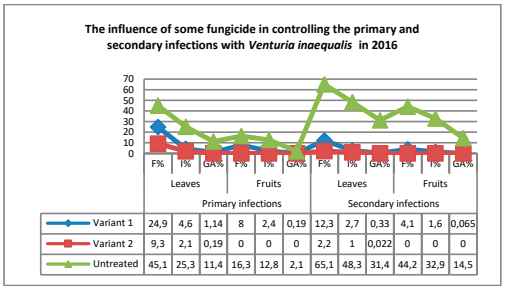
Field determinations found that this year the frequency attack of *Venturia inaequalis* was between 27.3% and 65.1% on leaves and between 9.1% and 44.2% on fruits, depending on the determination date. Data regarding the intensity attack of apple scab on leaves and fruits show a strong attack, the maximum values reaching 40.8% respectively 32.9%, at the last determination (Figure 5). The degree of attack recorded high values on both leaves and fruits. Thus, the value calculated for the leaf attack was between 5.4% and 31.4%, the largest differences from one determination to another being recorded in August because of the climatic conditions. The attack on fruits registered the value of 14.5% on September 10, although in the first two determinations it was weak, of 0.5% on 5 May and 1.4% on 30 May respectively. The dynamics of apple scab attack on leaves and fruits is presented in Figure 5.



	15.V.	30.V.	14.6.	29.VI.	14.VII.	29.VII.	13.VIII	10.IX	Average
Leaves I%	19,8	22,6	25,3	28,6	30,9	32,3	40,8	48,3	31,1
Leaves F%	27,3	32,8	45,1	48,3	49,3	51,6	61,7	65,1	47,65
Leaves GA%	5,4	7,4	11,4	13,7	15,2	16,7	25,2	31,4	14,8
Fruits I%	5,9	10,2	12,8	18,3	20,1	21	26,2	32,9	18,4
Fruits F%	9,1	13,6	16,3	23,2	27,3	28,2	34,9	44,2	24,6
Fruits GA%	0,5	1,4	2,1	4,4	5,5	5,9	9,1	14,5	4,5

Figure 5. The attack dynamics of *V. inaequalis* on untreated leaves and fruits

In V2 variant was applied the fungicide named Luna Experience 400 SC, 0.75 l/ha, in optimal conditions for the realization of secondary infections with apple scab. Regarding the primary infections with apple scab, following the application of fungicide products from the first treatment option, the degree of attack on the leaves was 1.14% and on the fruit was 0.19% (Figure 6). In variant V2, where two treatments with the Luna Experience 400 SC fungicide were applied, the registered attack rate was only 0.19% on the leaves and the fruit attack was not present. In comparison, in the untreated variant, the degree of attack was 11.4% on leaves and 2.1% on fruits (figure 6). In the case of secondary infections, due to the application fungicides from V1, the DA% on the leaves was limited to 0.33% and on the fruit to 0.065% (Figure 6). Following the administration of products of variant V2, which included two other applications of the Luna Experience 400 SC fungicide, the degree of attack on the leaves was 0.022% and on the fruit the attack was completely absent. In the untreated variant the degree attack was 31.4% on leaves and 14.5% on fruit. It is worth noting the very good effectiveness of the Luna Experience fungicide in controlling blight, the fruit attack being absent this year, following the application of four treatments with this product (Figure 6).



	Primary infections						Secondary infections					
	Leaves			Fruits			Leaves			Fruits		
Variant 1	24,9	4,6	1,14	8	2,4	0,19	12,3	2,7	0,33	4,1	1,6	0,065
Variant 2	9,3	2,1	0,19	0	0	0	2,2	1	0,022	0	0	0
Untreated	45,1	25,3	11,4	16,3	12,8	2,1	65,1	48,3	31,4	44,2	32,9	14,5

Figure 6. The influence of some fungicides on primary and secondary infections

In the control of the fungal attack on the leaves, the calculated efficacy was 90% in V1 variant and 98.33% for V2 variant, for the control of primary infections, three treatments with the product Luna Experience were applied (Table 6). For secondary infections, the calculated values were 98.94% in the case of V1 variant and 99.92% in V2, a variant in which at the last treatment (26.08), the fungicide Luna Experience 400 SC was applied again (Table 2). The calculated value of efficacy in the control of primary fruit infections was 90.95% for variant V1 and 100% for variant V2, and for the control of secondary infections the efficacy was 99.55% for V1 and 100% for V2 (Table 2).

Table 2. The efficiency of treatment program against apple scab in 2016

Va	Primary infections				Secondary infections			
	Leaves		Fruits		Leaves		Fruits	
	DA%	E%	DA%	E%	DA%	E%	DA%	E%
V_1	1.14	90%	0.19	90.95%	0.33	98.94 %	0.065	99.55 %
V_2	0.19	98.33%	0	100%	0.022	99.92 %	0	100%
blank	11.4	-	2.1	-	31.4	-	14.5	-

CONCLUSIONS

1. Year 2016 was a favorable year for the infections with apple scab both on leaves and fruits.
2. The fungicide products applied in first variant to control *Venturia inaequalis* significantly reduced the attack level on the leaves, both in the case of primary infections (from 11.4% to 1.14%) and in the case of secondary infections (from 31.4% to 0.33%), and in the case of fruit the degree of attack was reduced from 2.1% to 0.19% for primary infections and from 14.5% to 0.065% for secondary infections.
3. In the V2 variant, the products ensured a total protection at the level of the fruits, both in the case of primary and secondary infections, Luna Experience fungicide proving its superior efficacy. At the same time, this product is recommended as a last treatment due to the break time of only 7 days, compared to other competing products, where it is 14-28 days.

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