

## **BIOLOGICAL METHOD FOR APPLE-TREE PROTECTION AGAINST SCAB IN TERMS OF WESTERN FORESTSTEPPE OF UKRAINE**

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**Summary.** The preparations of biological efficiency studied in Ukraine against scab on leaves and apple-tree fruits in terms of Western region of Ukraine. The determined biological preparation Planrise, water suspension efficiency against apple scab consisted of 54,3-69,0%. The mix Planrise water suspension with Bai-Si showed efficiency 55,0-69,8%. The Planrise water suspension in nutrient program Stoller received efficiency in the scope of 61,4-73,8%. The mix of solutions Pytdoctor, Gaubsin and Trychodermin together with feeding complex program MASTech showed efficiency against scab 60,7-73,1%.

**Keywords:** *apple-tree, apple scab, biological protection, technical efficiency*

**Purpose:** A lot of diseases damage the apple-tree plantations. They have serious impact on apple-tree productivity. They decrease tree yield tree. They have negative influence on fruit production quality indexes and even may cause to all yield loss or tree die [1]. Scab (*Venturia inaequalis* (Cooke) Wint.) is the spread apple disease in terms of Western Foreststeppe of Ukraine. It defeats leaves, fruits and shoots. Fruits do not grow in defeating places. It cause to oneseid their development and fell down before time [3].

Many different apple protective systems developed through the long term search scab hazard decrease. They based upon the chemical preparations usage. The chemical pesticides usage had a lot of lacks. Among them were: their remnants save in soil and plants, in water, the useful flora and fauna destroyed, the resistance appears in pests. The developing of ecologically friendly protective system is actual problem for today. It will be direct on both two problems at once: to decrease disease harmfulness and pesticide load with following garden agrocenosis treating. The biological plant protection method has important meaning for chemical protection means decrease. The biological

preparations usage in protection system is very necessary, because they allow to stabilize ecological balance in garden agrobiocenosis and optimize volumes of chemical means usage for useful species safe and minimal negative impact on environment [1, 3].

**Materials and methods:** The experiments for determining biological preparations technical efficiency apple-tree protection against apple scab conducted in apple-tree garden of Ukrainian science-research plant quarantine station Institute of Plant Protection NAAS in 2018-2020. They provided on apple-tree plantation of 2005 on variety Idared on stock M-106. The system of growing: 4 x 2,5 m. The system of soil safe is under perennial herbs.

Disease distribution record and spread conducted as per generally approved techniques as per phases of plant-host: buds swelling, green cone, budding, rose bud, blossoming, end of blossoming, forming, growth and fruit ripening [4, 5].

The fungicide efficiency action determined as per official techniques through 7 days [4].

Statistical data processing conducted by variance analysis [2].

There were researches 4 systems of biological protection for apple-tree protection systems.

- biological protection system: phenophase “**fruits forming**”: Planrise, water suspension (bacterium strain AP-33 *Pseudomonas fluorescens*,  $3 \times 10^9$  CFU/cm<sup>3</sup>) – 5,0 l/ha; phenophase “**fruits growing**” (fruit of walnut-size): Planrise, water suspension – 5,0 l/ha; phenophase “**fruit growing**” (July end): Planrise, water suspension – 5,0 l/ha; phenophase “**fruit ripening**” (not later than 3 weeks before harvesting): Planrise, water suspension – 5,0 l/ha.

- Biological protective system + Bai-Si: phenophase “**fruit forming**”: Planrise, water suspension – 5,0 l/ha + growth stimulant Bai-Si – 1,0 l/ha; phenophase “**fruit growing**” (fruit of walnut-size): Planrise, water-suspension – 5,0 l/ha + growth stimulant Bai-Si – 1,0 l/ha; phenophase “**fruit ripening**” (not less than three weeks before harvesting): Planrise, water suspension – 5,0 l/ha.

- biological protection system + microelements and growth stimulants (nutrient technology Stoller): phenophase “**buds separating**”: Fast Start (Zn, organic, free and fulvic amino acids) – 2,0 l/ha; phenophase “**rose bud**”: Planrise, water suspension – 5,0 l/ha + antistressant Bioforge (N (2 %), K<sub>2</sub>O (3 %), diformyl urea) – 0,5 l/ha + Sugar Mover (B(8%) and Mo (0,04%)) – 1,0

l/ha; phenophase **“fruit forming”**: Planrise, water suspension – 5,0 l/ha; phenophase **“fruit growth”**: X-Tra Power (Cu (0,8 %), Mn (0,8 %), Zn (3,2 % i Mg(0,8 %)) – 1,5 l/ha; phenophase **“fruit growth”**: Planrise, water suspension – 5,0 l/ha; phenophase **“fruit ripening”** (not later than three weeks before harvesting): Planrise, water suspension – 5,0 l/ha + Sugar Mover – 1,0 l/ha; **after yield harvesting** Nitrate Balancer (B (9%) and Mo (0,005%) – 2,0 l/ha.

- Biological protective system + technology MASTech: phenophase **“Green cone”**: fungicide FitoDoctor, powder (bacterium *Bacillus subtilis* IMB B-7100 (26D), titer of viable bacterium – not less  $5 \times 10^9$ /g preparation) – 2,0 l/ha fungicide Gaubsin, solution (bacterium *Pseudomonas aureofaciens* B-111 and B-306)titer of viable cells  $1 \times 10^4$ /mgk/preparation) – 8,0 l/ha; Urozhay Zinc (Zn 112 g/l) – 3,0 l/ha; Adjemax – 0,15 l/ha; phenophase **“Green bud”**: fungicide FitoDoctor, powder – 2,0 l/ha; fungicide Gaubsin, solution – 8,0 l/ha; Urozhay Zinc – 3,0 l/ha, Urozhay Fitosad – 2,0 l/ha; Adjemax – 0,15 l/ha; phenophase **«Rose bud»**: fungicide FitoDoctor, powder – 2,0 l/ha; fungicide Gaubsin, solution – 8,0 l/ha; Urozhay Boron – 3,0 l/ha; Urozhay Fitosad – 2,0 l/ha; Adjemax – 0,15 l/ha; phenophase **«Blossoming»**: fungicide FitoDoctor, powder – 2,0 l/ha; fungicide Trychodermin, solution (fungi spores *Trichoderma viride*, strain T-4, spores titer 5billion CFU /  $\text{cm}^3$ ) – 5,0 l/ha; Aminostim – 1,5 l/ha; Adjemax – 0,15 l/ha; phenophase **«Hazelnut»**: fungicide FitoDoctor, powder – 2,0 l/ha; fungicide Trychodermin, solution – 5,0 l/ha; fungicide Gaubsin, solution – 8,0 l/ha; Urozhay Zinc – 3,0 l/ha; Urozhay Fitosad – 2,0 l/ha; Adjemax – 0,15 l/ha; phenophase **«Walnut»**: fungicide FitoDoctor, powder – 2,0 l/ha; fungicide Gaubsin, solution. – 8,0 l/ha; UrozhaySad – 4,0 l/ha; Adjemax – 0,15 l/ha; **«Through 15 days»**: fungicide FitoDoctor, powder – 2,0 l/ha; fungicide Gaubsin, solution – 8,0 l/ha; Urozhay Sad – 3,0 l/ha; Adjemax – 0,15 l/ha; **«Through15 days»**: fungicide FitoDoctor, powder – 1,0 l/ha; fungicide Gaubsin, solution – 8,0 l/ha; UrozhayFitosad – 4,0 l/ha; Urozhay Sad – 3,0 l/ha; Urozhay Zinc – 3,0 l/ha; Adjemax – 0,15 l/ha; **«Through 15 days»**: fungicide FitoDoctor, powder – 1,0 l/ha; fungicide Gaubsin, soution – 8,0 l/ha; Urozhay Fitosad – 4,0 l/ha; Urozhay Sad – 3,0 l/ha; Urozhay Zinc – 3,0 l/ha; Adjemax – 0,15 l/ha; phenophase **«Fruit ripening»**: fungicide Gaubsin, solution – 8,0 l/ha; Urozhay Sad – 3,0l/ha; Adjemax – 0,15g/ha.

The following chemical protection system used as rederence: phenophase **“fruits forming”**: fungicide Delan (Dithianon),water-spray granules – 0,8 kg/ha; penophase **“fruit growing”**: Delan, water-spray granules – 0,8 kg/ha;

phenophase “**fruit growing**”: Delan, water-spray granules – 0,8 kg/ha; phenophase “**fruits ripening**”: fungicide Topsin-M (Thiophanate-methyl), wettable powder – 2,0 l/ha.

**Results and discussions.** The first protection scheme against scab based upon three treatings by preparation Planrise, water suspension at rate 5,0 l/ha at phenophase: “fruit forming”, “fruit growing” (walnut size fruit), “fruit growth” (July end) and “fruit ripening”. The researches results (table 1) showed that the preparation Planrise, water suspension through 7 days after treating. It’s efficiency consisted of on the level: 54,3 %, 69,0 %, 66,6 % and 61,5 %. This system allowed to inhibit the scab causative agent on apple’s leaves, though the received results were less than other studies protection systems. Preparation Planrise, water suspension at rate 5,0 l/ha through 7 days after treating showed the efficiency. It was on the level 67,7 %. It allowed to decrease scab spread on apple-trees fruits. The yield of the present system consisted of 18,3 t/ha.

Elements of apple protection system used together with growth stimulants. They mixed for simultaneous usage study. Biological preparation Planrise, w.s. at rate 5,0 l/ha mixed with biologically active immunoprotector based upon silicon Bai-Si at rate 1,0 l/ha.

Table 1. Fungicide of biological efficiency against scab on apple leaves and fruits in 2018-2020 (average by repeatability)

Variant, norm of rate	* Freqncy of treating	Disease development,%		Efficiency action, %		Yield, t/ha
		L**	F***	L**	F***	
Control (water)	1	1,4		-		16,9
	2	4,2		-		
	3	5,8		-		
	4	6,5	4,8	-	-	
Chemical control: Delan, w-s,g, (0,5 kg/ha) + Topsin-M,w.p.(2,0 kg/ha)	1	0,3		79,3		18,5
	2	0,4		90,7		
	3	1,2		79,2		
	4	0,9	0,7	85,5	85,4	
Planrise, w.s. (5,0 l/ha)	1	0,6		54,3		18,3
	2	1,3		69,0		
	3	1,9		66,6		
	4	2,5	1,55	61,5	67,7	

Planrise, w.s. (5,0 l/ha)+ Bai-Si (1,0 l/ha)	1	0,6		55,0		18,3
	2	1,3		69,8		
	3	2,0		66,4		
	4	2,5	1,5	61,5	68,8	
Planrise, w.s (5,0 l/ha) + nutrient technology Stoller	1	0,5		61,4		20,3
	2	1,1		73,8		
	3	1,7		70,7		
	4	2,2	1,6	65,8	68,7	
Fitodoctor, s (2,0 l/ha) + Gaubsin, s (8,0 l/ha) + Trychodermin, s (5,0 l/ha) + Technology MAStech	1	0,6		60,7		20,1
	2	1,1		73,1		
	3	1,8		69,7		
	4	2,2	1,53	66,5	68,1	
<b>LSD<sub>05</sub></b>	-	0,5	0,3			0,4

Notes: \*Column “Frequency of treating” provided in next phenophases: 1 – “fruits forming”, 2 – during fruits growing (walnut size), 3 – during fruits growth (July end), and 4 – during fruits ripening; L\*\* – leaves; F\*\*\* – fruits.

This mixture efficiency consisted of 55,0 %, 69,8 %, 66,4 % and 61,5 % on apple’s leaves. Planrise’s, w.s. efficiency consisted of 68,8% at rate 5,0 l/ha in mixture with Bai-Si at rate 1,0 l/ha on apple fruits during “fruits ripening”. The present system yield consisted of 18,3 t/ha. The impact of mixture of Planrise, w.s. together with Bai-Si was in average on 0,7-1,1 % higher in comparison with only Planrise, w.s. usage.

Biological preparation Planrise,w.s. showed efficiency 61,4 %, 73,8%, 70,7 % and 65,8 % against scab on apples leaves at rate 5,0 l/ha in complex program of apple nutrition. This program consisted of plant growth stimulants, antistressants, chelated micronutrients (nutrition technology Stoller). It was higher on 2-4% in comparison with only Planrise w.s. usage. It was the highest results among investigated preparations. The efficiency of Planrise, w.s. in mixture with nutrition technology Stoller consisted 68,7 % against apple scab. It was on 1% higher in comparison with Planrise lonely usage. The present yield system consisted of 20,3 t/ha. It was on 2 t/ha higher, in comparison without complex nutrient technology usage.

The mixture's efficiency of PhytoDoctor (Sporophyt), s. at rate 2,0 l/ha, Gaubsin, s at rate 8,0 l/ha and Trichodermin, s at rate 5,0 l/ha together with complex nutrient program showed the level on 60,7 %, 73,1 %, 69,7 % and 66,5 % on 7<sup>th</sup> day after treating. The complex based upon the microelements usage (technology MAStech). The efficiency on apple's fruits was on 68,1 %. The present system yield consisted of 20,1 t/ha.

Contact fungicide Delan (Dithianon), water spray granules at rate 0,5 kg/ha and Topsin-M (Tioponate Methyl), wettable powder at rate 2,0 kg/ha used for control. Delan's efficiency impact apple scabs causative agent on apples leaves consisted of 79,3 %, 90,7 % and 79,2 % through 7 days after usage. Fungicide Topsin-M (tiophinate-methyl), wettable powder showed the following efficiency on apples leaves: 79,3 %, 90,7 % and 79,2 % on 7 days after treating. The efficiency on apples fruits consisted of 85,4%. The present system yield was 18,5 t/ha

Biological preparations mixtures nutrient elements allowed to receive the reliable yield of apple protection from scab. They also increased the protective measures producibility (preparations efficiency increased on 2-4%), resistance to other diseases to acute changes of temperatures and increase yield. The usage of biological preparations together with nutrient technologies Stoller and MAStech allowed to increase yield in scope 20,1-20,3 t/ha. It was on 1,6-1,8 times higher in comparison with chemical protection system usage. The usage of chelate microcompounds, anistressants, adjuvants and amino acids. They allowed to open the genetic potential.

The reliable plantation protection provided on non-resistant variety Idared to scab in spite of not enough spraying in spring-summer period.

**Conclusions.** The investigations results determined that the effectiveness of biological preparation action of biological preparation Planrise, w.s. against scab was 54,3-69,0 % on apples leaves and apple fruits – 67,7%. The mixture Planrise w.s. with Bai-Si showed efficiency 55,0-69,8% on apples leaves and 68,8% on apples fruits. Planrise w.s, usage in complex nutrient program Stoller allowed to receive the efficiency in the scope 61,4-73,8% on apples leaves and 68,7 % on apple fruits. It was on 2-4% higher in comparison withonle Planrise, w.s. usage. The efficiency of FitoDoctor, s., Gaubsim s., Trychodermin, s mixture together with complex nutrient program usage showed 60,7-73,1 % on apples leaves, 68,1 % on apple fruits.

## References

1. Lisovyi M.P. (1999) Dovidnyk iz zakhystu roslyn [Plant protection guidebook.] K:Urozhay. P.144
2. Dospekhov B. A (1985) Metodyka polevoho opyta (s osnovamy statystycheskoi obrabotky rezultatov yssledovanyi) [Technique of field trial(with bases of statistical treatment).5<sup>th</sup> ed.] 5-e yzd., dop. y pererab. M: Agropromizdat. P.351
3. Kalenych F. S. (2005) Ahroekolohichni osnovy interhovanoho zakhystu yabluni vid parshi ta inshykh khvorob.K. Ahrarna nauka. P.248
4. Trybelia. S. O. (2001) Metodyky vyprobuvannia i zastosuvannia pestytsydiv K.: Svit. P.448.
5. Omeliuta V. P. (1986) Oblik shkidnykiv i khvorob silskohospodarskykh kultur [Records of agricultural crops diseases and pests ] K., Urozhay P.293