

THE IMPACT OF THE PRODUCT PILARHANCE, SL ON INCREASING THE PRODUCTIVITY OF APPLE ORCHARDS

ACȚIUNEA PRODUSULUI PILARHANCE, SL ASUPRA SPORIRII PRODUCTIVITĂȚII PLANTAȚIILOR DE MĂR

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Abstract.

The investigations were carried out with Gala Buckeye apple trees variety grafted on the M9 rootstock. The planting distance was 3.5 x 0.8 m, with a vertical crown shape. The aim of the research was to study the effectiveness of Pilarhance, SL as a growth regulator in different treatment doses to stimulate fruit growth and development processes in apple orchards. To achieve the planned objective, the following variants were studied: 1. Control, without treatment; 2. Gibbera, SL, 0.5 l/ha; 3. Pilarhance, SL, 1.2 l/ha; 4. Pilarhance, SL, 1.3 l/ha. On the basis of the obtained results, it was established that the growth regulator Pilarhance, SL can be included in the technological scheme for apple cultivation at a dose of 1.3 l/ha, applied 3 times by foliar spraying. The first treatment has to be carried out after flowering, and the next 2 with an interval of 7-10 days between them.

Key words: growth regulator, fruit, production, firmness, quality.

Rezumat.

Investigațiile s-au efectuat cu pomi de măr din soiul Gala Buckeye, altoiți pe portaltoiul M9. Distanța de plantare 3,5 x 0,8 m, forma coroanei ax vertical. Scopul cercetărilor a fost de a studia eficacitatea produsului Pilarhance, SL ca regulator de creștere în diferite doze de tratare pentru a stimula procesele de creștere și de dezvoltare a fructelor în plantația de măr. Pentru atingerea obiectivului planificat, au fost studiate următoarele variante: 1. Martor, fără tratare; 2. Gibbera, SL, 0,5 l/ha; 3. Pilarhance, SL, 1,2 l/ha; 4. Pilarhance, SL, 1,3 l/ha. În baza rezultatelor obținute, s-a stabilit că, regulatorul de creștere Pilarhance, SL poate fi inclus în schema tehnologică pentru cultivarea mărului în doza 1,3 l/ha, aplicat de 3 ori prin pulverizare foliară. Primul tratament de efectuat după înflorire, iar următoarele 2 cu un interval de 7-10 zile între ele.

Cuvinte cheie: regulator de creștere, fruct, producție, fermitate, calitate.

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INTRODUCTION

Plant growth regulators are physiologically active compounds of natural or synthetic origin that can cause, in small quantities, various changes in the process of plant growth and development [Babuc *et al.*, 2010; Babuc *et al.*, 2013; Cimpoieș, 2012; Peșteanu and Calestru, 2025].

Under the influence of active substances, changes directed towards intensive growth of green mass occur, cell regeneration processes are stimulated, vitamin metabolism improves, which over time are better absorbed by the plant [Babuc *et al.*, 2013; Balan *et al.*, 2025; Peșteanu and Calestru, 2025].

Stimulation of the plant's own immunity makes it possible to induce a complex non-specific resistance in plants to many diseases of fungal, bacterial and viral origin, as well as to other unfavorable environmental factors [Burzo *et al.*, 1999; Cimpoieș, 2012; Milică *et al.*, 1983; Neamțu and Irimie, 1991].

Today, the creation of effective plant growth regulators of chemical and biological origin belongs to the current modern direction of scientific research - nanotechnologies, since their use in small doses (mg, g per hectare) can be very effective for stimulating growth *processes* and protecting plants from abiotic stresses. To date, a wide range of growth regulators of different chemical natures have been synthesized, having a wide spectrum of effects on fruit plants [Burzo *et al.*, 1999; Cimpoieș, 2012; Milică *et al.*, 1983; Neamțu and Irimie, 1991].

Growth regulators based on 24-epibrassinolide and gibberellic acid induce cell elongation and balanced development of crops, leaf expansion, fruit growth and reduce the fall of flowers and fruits from the crown of apple trees [Ahammed *et al.*, 2020; Mussig, 2005; Wei and Li, 2016].

MATERIAL AND METHOD

The research was carried out during the growing season of 2023 in the apple orchard of SRL "Vindex Agro", planted in the 2020 with "knip boom" type trees.

The object of the study was the Gala Buckeye apple variety, grafted onto a weak-growing M9 rootstock. Crown formation was carried out according to the vertical axis system. Planting distance 3.5 x 0.8 m.

According to the experimental scheme, in the control variant, trees were sprayed with water. In the second variant, they were treated with the growth regulator Gibbera, SL, 0.5 l/ha. The first treatment of the trees was carried out at the end of the flowering period (07.05.23), and the next 2 with an interval of 7-10 days between them (17.05.23; 26.05.23). In the third and fourth variants, 3 treatments were performed with the growth regulator Pilarhance, SL at a dose of 1.2 and 1.3 l/ha, respectively. The first treatment of the trees was performed after flowering (10.05.23) and the next 2 with an interval of 7-10 days between them (17.05.23; 26.05.23).

The studies were carried out in field and laboratory conditions according to the accepted methodology for conducting experiments with fruit crops with growth regulators.

Data were processed using the ANOVA test and STATGRAPHICS Centurion 18. The differences were considered statistically significant if the probability was greater

RESULTS AND DISCUSSIONS

Post-flowering treatments with the growth regulator Pilarhance, SL had a positive effect on the content of chlorophyll "a" and "b" and carotenoids in apple tree leaves. When apple trees were treated with the growth regulator Pilarhance, SL, 1.2 l/ha, the content of chlorophyll "a" in the leaves was 3.22 mg/dm² or increased by 12.6% compared to the control variant. In the variant treated with the growth regulator Pilarhance, SL, 1.3 l/ha, the chlorophyll "a" content increased by 14.0% compared to the control variant and by 5.2% compared to the Gibbera, SL, 0.5 l/ha variant. Thus, increasing the dose of treatment with the growth regulator Pilarhance, SL had a positive effect on the chlorophyll "a" content in apple tree leaves.

The above-mentioned law is also valid for the content of chlorophyll "b" and the sum of chlorophyll "a" + "b" in apple leaves.

Increasing the dose of treatment with the product Pilarhance, SL from 1.2 to 1.3 l/ha did not significantly affect the content of carotenoids in apple leaves.

The use of the growth regulator PilarHance, SL at a dose of 1.2 and 1.3 l/ha increased the leaf area compared to the control variant (Table 1). In the case of the Pilarhance, SL, 1.2 l/ha variant, the studied index was 8.89 thousand m²/ha, which is 0.43 thousand m²/ha lower than in the Gibbera, SL, 0.5 l/ha variant. In the variant where the trees were treated with the growth regulator Pilarhance, SL, 1.3 l/ha, the leaf area was 9.18 thousand m²/ha, or an increase in this indicator was recorded compared to the control variant of 1.04 thousand m²/ha, and compared to the Gibbera, SL dose 0.5 l/ha variant, this value decreased by 0.14 thousand m²/ha.

Table 1

The effect of the growth regulator PilarHance, SL on leaf area and annual growth in the crown of Gala Buckeye apple trees

Variants	Leaf surface		Length of annual increments	
	m ² /tree	thousand m ² /ha	cm	m/tree
Control	2.28	8.14	40.0	13.6
Gibbera, SL, 0.5 l/ha	2.61	9.32	47.2	16.0
Pilarhance, SL, 1.2 l/ha	2.49	8.89	45.3	15.4
Pilarhance, SL, 1.3 l/ha	2.57	9.18	46.0	15.6
LSD 0.05	0.13	0.45	1.94	0.75

These data indicate that there was a significant difference between the control variety and those varieties that were treated with the growth regulators Gibbera, SL and Pilarhance, SL.

Treatment of trees with growth regulators contributed to the improvement of biochemical processes in the plant and a more uniform development from the physiological point of view of plants.

The average length of annual growth was lower in the control variant (40.0 cm), and higher values in the variants treated with growth regulators Gibbera, SL and Pilarhance, SL. If the average length of annual growth in the Gibbera, SL, 0.5 l/ha variant was 47.2 cm, then in the Pilarhance, SL variants in the dose of 1.2 and 1.3 l/ha it was 45.3 and, respectively, 46.0 cm.

The total length of annual growth is in direct correlation with their average development length, which changed under the influence of treatments with the studied growth regulators.

Studying the effect of treatment doses with the growth regulator Pilarhance, SL, it was found that in the variant treated with a dose of 1.2 l/ha, the total length of annual growths was 15.4 m/pom, and when it grew at 1.3 l/ha, this index was 15.6 m/pom. Increasing the treatment dose of the growth regulator Pilarhance, SL, had a slight effect on the length of one-year growths, which is also confirmed by statistical processing of the obtained data.

The average weight of the fruits varied from 156.0 g in the control variant to 170.8 g in the variant treated with growth regulators Pilarhance, SL, 1.3 l/ha. The difference between the studied variants is also confirmed by statistical data (Table 2).

In the Gibbera, SL 0.5 l/ha variant and in the Pilarhance, SL, 1.2 l/ha variant, the average weight of apple fruits was 162.0 and, respectively, 167.3 g, meaning that there is no statistically significant difference between these two variants.

The lowest yield per tree (4.53 kg) and per unit area (16.18 t/ha) was recorded in the control variant. In the Gibbera, SL, 0.5 l/ha variant, fruit production was lower than in variants 3 and 4, but higher than in the control variant, constituting in this variant 4.70 kg/tree and 16.78 t/ha, respectively.

Table 2

The effect of growth regulator PilarHance, SL on fruit weight and productivity of apple orchard of Gala Buckeye variety

Variants	Average weight, g	Productivity		In % compared to control
		kg/tree	t/ha	
Control	156.0	4.53	16.18	100.0
Gibbera, SL, 0.5 l/ha	162.0	4.70	16.78	103.7
Pilarhance, SL, 1.2 l/ha	167.3	4.85	17.32	107.0
Pilarhance, SL, 1.3 l/ha	170.8	4.95	17.68	109.3
LSD 0.05	6.5	0.21	0.80	-

The difference between the fruit production obtained in the control variant and the variants treated with the growth regulator Pilarhance, SL at a dose of 1.2 and 1.3 l/ha was 7.1% and 9.3%, respectively.

The studies conducted (Table 3) demonstrate that the firmness of the pulp of apple fruits at the time of harvesting in the studied variants was 7.4-7.6 kg/cm². This proves that the studied index is optimal for harvesting fruits of the Gala Buckeye variety and their long-term storage.

The firmness of the fruits of apples of the Gala Buckeye variety changes under the influence of the growth regulators Gibbera, SL and Pilarhance, SL, i.e. the respective products slightly reduce the firmness of the fruit, as can be seen in Table 3. If, in the control variant, the firmness of the apples was 7.6 kg/cm², then in the variants treated with the growth regulators Gibbera, SL and Pilarhance, SL it decreased to 7.4-7.5 kg/cm². Comparing the variants treated with growth regulators studied, it can be observed that the lowest fruit firmness was obtained in the variants Gibbera, SL, 0.5 l/ha and Pilarhance, SL, 1.3 l/ha (7.4 kg/cm²). That is, a decrease in the parameters studied by 0.2 kg/cm² compared to the control variant is observed. In the Pilarhance, SL variant, an average value (7.5 kg/cm²) was recorded compared to the other variants.

Table 3

The effect of the growth regulator PilarHance, SL on morphological indicators and ripening parameters of Gala Buckeye fruits

Variants	Pulp firmness, kg/cm ²	Fruit parameters, mm		Soluble dry matter, %
		Hight	Diameter	
Control	7,6	60,7	70,4	13,1
St. Gibbera, SL, 0.5 l/ha	7,4	63,4	70,1	13,5
Pilarhance, SL, 1.2 l/ha	7,5	62,7	72,0	13,4
Pilarhance, SL, 1.3 l/ha	7,4	63,3	72,8	13,5

During fruit growth, the studied growth regulators had different effects on both fruit height and diameter. Higher fruit height values were recorded in the Gibbera, SL, 0.5 l/ha (63.4 mm) and Pilarhance, SL, 1.3 l/ha (63.3 mm) variants, compared to the control variant (60.7 mm). In the Pilarhance, SL, 1.2 l/ha variant, fruit height was lower compared to the previous variants (62.7 mm). Studying fruit diameter, higher values were noted in the variants treated with the growth regulator Pilarhance, SL dose 1.2 l/ha (72.0 mm) and 1.3 l/ha (72.8 mm). In the variant treated with the product Gibbera, SL, 0.5 l/ha, the fruit diameter was 70.1 mm, which was at the level of the control variant (70.4 mm).

The smallest amount of soluble substances was recorded in the control variant (13.1%). That is, the treatment with the studied growth regulators improves to some extent the ripening of the fruits and increases the content of soluble substances in the fruits by 0.3-0.4% compared to the control variant.

The sales income in the case of the control variant amounted to 105.17 thousand lei/ha, and in the treatment with the studied growth regulators, this figure amounted to 109.07 - 123.76 thousand lei/ha. The highest sales revenue was recorded in the Pilarhance, SL, 1.3 l/ha variant - 123.76 thousand lei/ha. In the variants treated with the growth regulators Gibbera, SL, 0.5 l/ha and Pilarhance, SL 1.2 l/ha, a decrease in sales revenue was recorded (Table 4). The lowest production cost was recorded in the control variant – 51.78 thousand lei/ha. In the variant treated with the product Gibbera, SL, 0.5 l/ha, the production cost was 52.87 thousand lei/ha. The treatment with the product Pilarhance, SL in a dose of 1.2 l/ha

and 1.3 l/ha had a more significant contribution to the studied index (53.44 - 53.78 thousand lei/ha), including the costs for purchasing the product and harvesting additional fruits compared to the previous variants.

Table 4

Economic efficiency of apple fruit production from Gala Buckeye soil in the case of treatment with the growth regulator Pilarhance, SL

Variants	Sales revenue, thousand lei/ha	Production cost, thousand lei/ha	Profit, thousand lei/ha	Profitability level, %
Control	105,17	51,78	53,39	103,1
Gibbera, SL, 0.5 l/ha	109,07	52,87	56,20	106,2
PilarHance, SL, 1.2 l/ha	121,24	53,44	67,80	126,8
PilarHance, SL, 1.3 l/ha	123,76	53,78	69,98	130,1

Greater economic efficiency in the production of Gala Buckeye apples was recorded in the variant when the trees were treated with the product Pilarhance, SL at a dose of 1.3 l/ha.

CONCLUSIONS

Based on the experimental results obtained, we propose to include the growth regulator PilarHance, SL in the technological scheme for cultivating apple plantations at a dose of 1.3 l/ha, applied 3 times by spraying. The first treatment should be carried out after flowering, and the next 2 with an interval of 7-10 days between them.

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