

INFLUENCE OF GA₄₊₇ BASED PRODUCTS ON THE PRODUCTIVITY OF GOLDEN DELICIOUS APPLE PLANTATION

INFLUENȚA PRODUSELOR PE BAZĂ DE GA₄₊₇ ASUPRA PRODUCTIVITĂȚII PLANTAȚIEI DE MĂR DIN SOIUL GOLDEN DELICIOUS

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Abstract. *The experimental orchard was placed in the “Accesal Group” Ltd., founded in 2009. The study subject was Golden Delicious apple variety grafted on M 26. The trees were trained as slender spindles. The distance of plantation is 4.0 x 2.0 m. The studied gibberellic acid was GA₄₊₇, product Gerlagib LG and Gibbera, SL. To study the influence of the treatment on fructification and quality of Golden Delicious apple variety, four variants were experimented: 1. Control, no treatment; 2. Gerlagib LG, 0.5 l/ha; Gibbera, SL, 0.25 l/ha; Gibbera, SL, 0.50 l/ha. It was demonstrated, that products Gerlagib LG and Gibbera, SL in dose 0.5 l/ha may be included in the technologic system to stimulate fruit formation, productivity and quality of fruits, up to 3 times, starting from petal fall stage and continuing intervals of 7-10 days.*

Key words: Apple, gibberellic acid, russeting, yield, quality.

Rezumat. *Livada experimentală amplasată în SRL „Accesal Group”, a fost înființată în anul 2009. Subiectul studiului a fost soiul Golden Delicious altoit pe portaltoiul M 26. Pomii au fost conduși după coroana fus zvelt. Distanța de plantare este 4,0 x 2,0 m. Acidul giberelic studiat a fost GA₄₊₇, produsele Gerlagib LG și Gibbera, SL. Pentru a studia influența tratamentului asupra fructificării și calității fructelor din soiului Golden Delicious, au fost experimentate patru variante: 1. Martor, fără tratament; 2. Gerlagib LG, 0,5 l/ha; Gibbera, SL, 0,25 l/ha; Gibbera, SL, 0,50 l/ha. S-a constatat, că produsele Gerlagib LG și Gibbera, SL în doza de 0,5 l/ha pot fi incluse în sistemul tehnologic pentru a stimula gradului de legare a fructelor, productivității și calității fructelor, de administrat de 3 ori, începând de la căderea petalelor și de continuat la interval de 7-10 zile.*

Cuvinte cheie: Măr, acid giberelic, rugozitate, producție, calitate.

INTRODUCTION

Gibberellins play an important role in regulating the process of plant growth and development, perform many functions and are increasingly used

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successfully in sustainable fruit growing (Babuc *et al.*, 2013, Neamțu and Irimie, 1991).

Gibberellic acid GA₄₊₇ is formed in large amounts in apical buds and young leaves from buds, in flowers and seeds during their formation, in root meristematic tissues (Chen *et al.*, 2020, Curry, 2012). The gibberellin content of fruits and seeds, especially the immature ones, it is two times higher than in other vegetative organs (Neamțu and Irimie, 1991).

This will lead to an increase in the number of ovaries and fruits (Пештяну Кумпанич, 2021a, 2021b), an increase in development processes, prevention of roughness (Curry, 2012, Peșteanu, 2018), cracking and discoloration of fruits (Knoche, 2011), an increase in the yield and quality of production in apple plantations of the Golden Delicious variety (Peșteanu, 2015) by processing with this active substance.

The appearance of roughness on Golden Delicious apples is the result of the interaction between the structures of the epidermis, more or less sensitive to disturbances in the fruit, which is a predisposing cause of diversity and environmental factors. These include high humidity, atmospheric precipitation during the period of intensive fruit growth, low temperatures at night or phytosanitary treatments with deviations from the recommendations in force (Chen *et al.*, 2020, Knoche, 2011).

MATERIAL AND METHOD

The research was carried out during 2020, in the intensive apple orchard founded near the village of Pepeni, Sangerei district, in the spring of 2009 at the company S.R.L. "Accesal Grup", with trees in the form of rods.

The object of study of the experience was the Golden Delicious apple variety grafted on the rootstock of medium vigor M26. The crown was driven according to the usual spindle system with free growth. Planting distance 4.0 x 2.0 m.

To study the influence of GA₄₊₇ gibberellic acid on the degree of ovary binding, fruiting and fruit quality of the Golden Delicious variety, four variants were experimented: 1. Control, no treatment; 2. Gerlagib LG, 0.5 L/ha; Gibbera, SL, 0.25 L/ha; Gibbera, SL, 0.50 L/ha.

The amount of solution per tree when treated with the growth regulator Gerlagib LG and Gibbera, SL was 0.8 liters. The placement of the plots was done in blocks, each variant having 4 repetitions. Each repetition consisted of 7 trees. At the boundary between the plots and the experimental repetitions, 1 tree was left untreated to avoid the overlap of some variants or repetitions during the treatments.

The research was carried out in field and laboratory conditions according to the accepted method of carrying out experiments on fruit crops with growth regulators.

The main results obtained were processed statistically by the dispersion analysis method.

RESULTS AND DISCUSSIONS

The obtained results show that no significant deviations from the planned number of inflorescences were observed in the studied variants. The recorded number of inflorescences on the trees taken in the research demonstrates that the

plants develop uniformly and experiments can be carried out to study the influence of GA₄₊₇ gibberellic acid on the studied indicators (tab.1).

The number of flowers was directly proportional to the number of inflorescences formed in the crown of the trees and varied between 1755 and 1800 pcs.

Table 1

The influence of growth regulators on the number of inflorescences, flowers, fruits and their binding percentage in the crown of Golden Delicious apple trees

Variant	Number of inflorescences, pcs/tree	Number of flowers, pcs/tree	Number of fruits, pcs/tree	Binding percentage, %
Control, no treatment	355	1775	167	9.4
Gerlagib LG, 0.5 L/ha	358	1790	187	10.5
Gibbera, SL, 0.25 L/ha	360	1800	175	9.7
Gibbera, SL, 0.5 L/ha	351	1755	185	10.5

A smaller number of fruits in the crown of the trees was observed in the control variant - 167 pcs/tree, compared to the variants treated with growth regulators - 175-187 pcs/tree, i.e. an increase of 4.8 - 12.0 was observed % of the index under study.

Studying separately the effect of the growth regulator on the number of fruits formed in the crown of the trees, it can be seen that lower values of the studied indicator were recorded when the plants were treated with the product Gibbera, SL with a dose of 0.25 L/ha - 175 pcs/tree.

A higher number of fruits in the crown of the trees was obtained in the variant treated with the preparation Gerlagib LG with a dose of 0.5 L/ha - 187 pcs/tree and the variant Gibbera, SL with a dose of 0.5 L/ha - 185 pcs/tree.

The study carried out to determine the degree of binding of the flowers shows us that in the control variant the studied index was 9.4%, and in the variants treated with growth regulators it varied from 9.7 to 10.5%. This increase in the degree of binding of flowers allowed obtaining a greater number of fruits compared to the control variant.

The highest degree of flower binding was obtained in the version treated with the products Gerlagib LG and Gibbera, SL with a dose of 0.5 L/ha, where this indicator recorded 10.5%. In the variant treated with the product Gibbera, SL with a dose of 0.25 L/ha, the degree of flower binding was 9.7%, i.e. the average value between the previous variants and the control variant was recorded.

The average weight of the fruits of the studied variants underwent insignificant changes and depended on the number of fruits on the tree and the dose of the preparation used for spraying.

As presented above, the highest number of fruits was obtained in the standard variant treated with the product Gerlagib LG with a dose of 0.5 L/ha - 187 pcs/tree and in the variant Gibbera, SL at a dose of 0.5 L/ha - 185 pcs/tree compared to other variants.

These results demonstrate that products based on gibberellic acid GA₄₊₇ increase the average fruit weight and the yield of the plantation. The basis of this hypothesis is the data obtained in the control variant, where, with the number of 167 fruits per tree, the average weight of the fruits was 170.1 g, i.e. slightly lower than in the variant treated with the product Gibbera, SL in a dose of 0.25 L/ha (tab. 2).

Table 2

The effect of growth regulators on average fruit weight and productivity of the Golden Delicious apple plantation

Variant	Number of fruits, pcs/tree	Average weight, g	Fruit production		In % compared to control
			kg/tree	t/ha	
Control, no treatment	167	170.1	28.4	35.5	-
Gerlagib LG, 0.5 L/ha	187	168.1	31.4	39.3	110.7
Gibbera, SL, 0.25 L/ha	175	171.7	30.0	37.5	105.6
Gibbera, SL, 0.5 L/ha	185	167.5	31.0	38.8	109.3
LDS 0.05	8.3	7.4	1.48	1.91	-

Since in the control variant the lowest number of fruits per tree was recorded, respectively, in this variant, a lower yield was obtained both per tree (28.4 kg/tree) and per surface unit (35.5 t/ha).

When the trees were treated with the product Gibbera, SL in a dose of 0.25 L/ha, the yield recorded was lower compared to variants 2 and 4, but higher compared to the control variant. The registered productivity for this variant was 30.0 kg per tree and 37.5 tons per hectare.

In the variants treated with the products Gerlagib LG and Gibbera, SL at a dose of 0.5 l/ha, due to the higher number of fruits per tree and the insignificantly lower average fruit weight, which is also statistically confirmed, the productivity of grown both per tree and per surface unit. If the productivity of a tree and per surface unit in the version treated with Gerlagib LG at a dose of 0.5 L/ha was 31.4 kg/tree and 39.3 t/ha, then in the version Gibbera, SL, in a dose of 0.5 L/ha, a decrease of 1.3% was observed, constituting 31.0 kg/tree and 38.8 t/ha, respectively.

The data of the investigations carried out during the research (tab. 3) show us that the firmness of the apple pulp at the time of harvesting on the varieties under study was between 7.5-7.8 kg/cm². This proves to us that the respective firmness is optimal for harvesting the fruits of the Golden Delicious variety and placing them in long-term storage.

Studying the effect of the treatment dose on the firmness of the fruits, it can be seen that an increase in the amount of growth regulator Gibbera, SL from 0.25 to 0.5 l/ha increases the firmness of the fruits by 0.2 kg/cm².

The studies show that the amount of soluble dry substances in the fruits of the Golden Delicious variety in the variants studied was 11.8 - 12.1%. The highest amount of soluble dry matter was observed in the control variant - 12.1%. The use of growth regulators Gerlagib LG and Gibbera, SL reduced the studied indicator to 11.8 - 12.0%.

The study carried out further demonstrates that the fruit hydrolysis index on the researched variants varies from 4.8 to 5.1. The highest starch hydrolysis index of 5.1 was recorded in the control variant, and in trees treated with the growth regulators Gerlagib LG and Gibbera, SL ranged from 1.8 to 5.0.

Table 3

The influence of growth regulators on the ripening indices of Golden Delicious apple fruits

Variant	Firmness, kg/cm ²	Soluble dry matter, %	Hydrolysis index (1-10)
Control, no treatment	7.5	12.1	5.1
Gerlagib LG, 0.5 L/ha	7.8	11.8	4.8
Gibbera, SL, 0.25 L/ha	7.6	12.0	5.0
Gibbera, SL, 0.5 L/ha	7.8	11.8	4.9

Increasing the dose of growth regulator Gibbera, SL up to 0.5 L/ha inhibited fruit ripening, and the starch hydrolysis index decreased by 0.2 compared to the control and by 0.1 with the variant Gibbera, SL with dose 0.25 L/ha. This correlation was also recorded in the version treated with the growth regulator Gerlagib LG with a dose of 0.5 L/ha, where the studied indicator decreased by 0.3 compared to the control version.

The studies carried out demonstrate that the weight of fruits without roughness according to the studied variants was 27.4-88.4%. The lowest proportion of fruits without roughness was registered in the control variant - 27.4%. In the varieties treated with the growth regulators Gerlagib LG and Gibbera, SL, an increase in the weight of apples without roughness was observed (tab. 4).

Table 4

The influence of growth regulators on fruit weight depending on the degree of roughness, %

Variant	Without roughness	Up to 20%	Up to 50%	Unconditioned fruits
Control, no treatment	27.4	50.4	16.3	3.0
Gerlagib LG, 0.5 L/ha	88.4	7.3	4.3	-
Gibbera, SL, 0.25 L/ha	60.3	30.1	9.6	-
Gibbera, SL, 0.5 L/ha	87.1	8.0	4.9	-

In the variant treated with Gerlagib LG with a dose of 0.5 L/ha, the proportion of fruits without roughness was 88.4%, higher values by 61.0% compared to the control variant, and in the variant treated with the product Gibbera, SL with dose 0.5 L/ha, apples without roughness constituted 87.1%.

The proportion of apples without roughness in the variant treated with Gibbera, SL with a dose of 0.25 L/ha, was 60.3%, which is 32.9% more than in the control variant and by 26.8-28.1 % less compared to the variants treated with Gerlagib LG and Gibbera, SL with a dose of 0.5 L/ha.

This legitimacy is also attributed to the group of fruits, whose surface is covered with roughness from 20% to 50%. These fruits belong to quality category II. The treatments with the growth regulator Gibbera, SL with a dose of 0.25 L/ha led to the reduction of the studied indicator to 9.6%, in the variant Gibbera SL in a dose of 0.5 L/ha - 4.9%, and in the variant Gerlagib LG in a dose of 0.5 L/ha - up to 4.3%. Low-quality fruits were recorded only in the control variant, whose weight was 3.0%.

CONCLUSIONS

The growth regulators Gerlagib LG and Gibbera, SL, based on gibberellic acid GA₄₊₇ can be included in the technological chain for increasing the degree of fruit binding, intensifying their growth and preventing the formation of roughness on the fruits of the Golden Delicious variety, in a dose of 0.5 L/ha, applied 3 times by spraying. The first treatment to be carried out at the end of flowering, and the next 2 treatments at an interval of 7-10 days after the previous one.

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