

THE EFFECT OF THE TREATMENT WITH NAD AND ANA BASED PRODUCT ON THE PRODUCTIVITY AND QUALITY OF LARGE FRUIT

EFACTUL TRATĂRII CU PRODUSUL PE BAZĂ DE NAD ȘI ANA ASUPRA PRODUCTIVITĂȚII ȘI CALITĂȚII FRUCTELOR DE MĂR

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Abstract. *The study subject of the experience was Idared apple variety grafted on M9, trees were trained as slender spindles for distance 3.5 x 0.8 m. To study influence of growth regulator Auxiger (NAD – 1.5 g/L + ANA – 0.6 g/L) on average weight of fruits, fruit production and fruit size were experimented the following variants of treatment: 1. Control – without treatment; 2. Auxiger, 0.9 L/ha; 3. Auxiger, 1.8 L/ha. Growth regulator was sprayed one time, during the period of intensive fruit growing, when the fruits diameter was 22-25 mm (09.06.16). The research was conducted during the period of 2016 year. In the present research work, we demonstrated that Auxiger increase average weight of fruits, fruit production and fruit size and may be included in the technology system for cultivation of apple, applied one spray at 1.8 L/ha when the fruits diameter was 22-25 mm.*

Key words: apple, growth regulator, production, color

Rezumat. *Ca obiect de studiu a fost luat soiul de măr Idared altoit pe portaltoiul M9, pomii au fost conduși ca fus zvelt ameliorat, distanța de plantare 3,5 x 0,8 m. Pentru a studia influența regulatorului de creștere Auxiger (NAD – 1,5 g/L + ANA – 0,6 g/L) asupra greutateii medii, productivității plantației de măr și diametrului mediu a fructelor au fost montate următoarele variante: 1. Martor - fără tratare; 2. Auxiger, 0,9 l/ha; 3. Auxiger, 1,8 L/ha. S-a efectuat un singur tratament în perioada de creștere intensivă a fructelor, când diametrul lor era de 22-25 mm (09.06.2016). Cercetările au fost efectuate pe parcursul anului 2016. Cercetările, au demonstrat, că regulatorul de creștere Auxiger sporește greutatea medie, producția de fructe și diametrul mediu a lor și poate fi inclus în sistemul tehnologic de cultivare a mărului aplicat o singură dată în doza de 1,8 L/ha când diametrul lor va fi de 22-25 mm.*

Cuvinte cheie: măr, regulator de creștere, producție, culoare

INTRODUCTION

A high quality fruits production can be registered only by using the appropriate modern technologies, according to the specific conditions of each field sector (Babuc, 2012, Cimpoieș, 2012).

In addition to modern techniques and technologies aimed at increasing the production of fruits in quantitative and qualitative terms, an important role is

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played by regulators of growth (Babuc *et al.*, 2013; Ghena *et al.*, 2004).

The growth regulators influence and guide the growth and development processes of fruit species, allow increasing the resistance of plants to stress factors etc. (Pesteanu *et al.*, 2017a). Their use in modern agriculture, with high biological and economic efficiency, becomes a necessity (Pesteanu *et al.*, 2017b).

MATERIAL AND METHOD

The research was conducted during the year of 2016, in the apple orchard founded in autumn 2012 at the enterprise "Codru ST", with knot boom trees.

The object of study of the experience was Idared apple variety grafted on the M9 rootstock. The crown was conducting after the slender spindle system. Planting distance was 3.5 x 0.8 m.

According to the research program within the undertaking concerned of the influence of the NAD + ANA growth regulator, Auxiger product of "L. Gobbi" S.R.L., Italy, the following variants were tested on fruit growing processes (tab. 1).

Table 1

The scheme of experiments to determine the effectiveness of the Auxiger growth regulator for growing and fruiting apple trees

Variants	Activ ingredient	Application method
Control, without treatment	-	-
Auxiger – 0.9 L/ha	NAD – 1.5 g/L + ANA – 0.6 g/L	By spraying during the intensive growth of fruits, (09.06.2016)
Auxiger – 1.8 L/ha		

The location of plots was made in blocks, each variant having 4 replicates. Each rehearsal consisted of 7 trees. At the border between parcels and experimental replicates, one untreated tree was left to avoid overlapping variants or rehearsals during the treatments.

Trees treatments were handled with the portable sprinkler in the hours without wind, in the morning with 0.3 liters of solution per tree.

The investigations were conducted in the field and laboratory conditions according to the accepted method of experimentation with growth regulators.

Statistical data processing was performed by the dispersion analysis method.

RESULTS AND DISCUSSIONS

The growth regulators based on NAD and ANA, are actively involved in the synthesis of chlorophyll, the photosynthesis process and the vegetation of fruit plants.

Treatments with the Auxiger growth regulator have positively influenced the content of chlorophyll "a" and "b" and their sum, as well as the carotenoid content.

In the control variant, the content of chlorophyll "a" was 2.57 mg/dm², and chlorophyll "b" was 0.81 mg/dm². The amount of chlorophyll "a" and "b" in this variant constituted 3.38 mg/dm², and carotenoids 1.20 mg/dm² (tab. 2).

After the application of the Auxiger growth regulator during the intensive growth period of the fruits, there was an increase in the content of chlorophyll and

carotenoids in the leaves.

In case of treatment with the Auxiger growth regulator at 0.9L/ha and 1.8L/ha, the content of chlorophyll "a" in leaves increased by 8.9% and 16.3%, respectively, compared to control variant. The above exposure also applies to chlorophyll content "b".

Table 2

Auxiger growth regulator influence on chlorophyll and carotenoid content in Idared apple variety

Variants	Content of chlorophyll pigments, mg/dm ²			Content of carotenoids, mg/dm ²
	„a”	„b”	„a” + „b”	
Control, without treatment	2.57	0.81	3.38	1.20
Auxiger – 0.9 L/ha	2.80	0.88	3.68	1.27
Auxiger – 1.8 L/ha	2.99	0.96	3.95	1.37

The amount of chlorophyll "a" and "b" in variants treated with the Auxiger growth regulator increased by 8.9-16.8% compared to the control variant.

Treating trees with the Auxiger growth regulator also increased the carotenoid content of the plant, increasing to 1.27 - 1.37 mg/dm². The investigations show that higher levels of chlorophyll "a", "b", "a" + "b" and carotenoids were recorded in the variant treated with the Auxiger growth regulator at a dose of 1.8 L/ha.

Fruit production is the index, which demonstrates how all agro-technical measures have been carried out in the Idared apple plantation.

The amount of fruits in the crown of the trees included in the research does not differ on the variants taken into consideration (tab. 3), because the normalization of the fruit load was made to obtain more reliable data.

The lowest average weight of a fruit was recorded in the control variant, without treatment - 162.8 g. Followed by the variant treated with the Auxiger growth regulator in 0.9 L/ha - 170.1 g and the variant treated with the Auxiger growth regulator at a rate of 1.8 l/ha, where the average weight of a fruit constituted 175.3 g, or an increase of 12.5 g compared to the control variant.

Studying the influence of the treatment dose, we note that with an increase in the amount of product administered from 0.9 L/ha to 1.8 L/ha, the average fruit weight increases, but not as essentially as observed between the variant witness and tested variants. The results outlined above are also confirmed by statistical processing.

Fruit production on a tree and on a surface unit correlates directly with the number of fruits and their average weight. The smallest fruit production was recorded in the control variant, constituting 10.75 kg/tree or 38.4 t/ha.

When treating with Auxiger growth regulator at 0.9 L/ha, the fruit production was 11.23 kg/tree or 40.1 t/ha, or an increase of 4.3% compared to the control variant.

In the variant treated with the Auxiger growth regulator at the rate of 1.8 l/ha, the increase in production was 7.6% compared to the control variant.

Table 3

Auxiger growth regulator influence on the average quantity, average weight and fruit production of Idared apple variety

Variants	Quantity of fruits, pcs/tree	Average weight, g	Fruit production		In %, compared to the witness
			kg/tree	t/ha	
Control, without treatment	66	162.8	10.75	38.4	100.0
Auxiger – 0.9 l/ha	66	170.1	11.23	40.1	104.3
Auxiger – 1.8 l/ha	66	175.3	11.57	41.3	107.6
DL 5%	2,8	7.1	0.45	1.52	-

The difference between the variant treated with the Auxiger growth regulator at a dose of 0.9 L/ha and at a dose of 1.8 L/ha was 3.3%, then between the control variant and the variant treated with Auxiger at a dose of 0.9 L/ha recorded 4.3%.

The results obtained (tab. 4) show that the fruit production obtained from the variants in the study differs from one another, registering higher values in case of treatment with the Auxiger growth regulator.

Table 4

Auxiger growth regulator influence on the redistribution of fruits by their diameter on Idared apple trees

Variants	The share of fruits (%) according to their diameter (mm)					Average diameter, mm
	61-65	66-70	71-75	76-80	81-85	
Control, without treatment	5.5	24.7	31.3	30.7	7.8	72.5
Auxiger – 0.9 l/ha	-	25.0	33.4	31.5	1.1	74.0
Auxiger – 1.8 l/ha	-	22.7	33.1	32.5	1.7	74.4

Treating trees with Auxiger has improved the quality of fruit production compared to the control variant. That is, in the variant treated Auxiger in dose of 0.9 L/ha the weight of grade I quality fruit was 25.0% and the "extra" category - 75.0%. The above-mentioned law also applies to the Auxiger version at a rate of 1.8 L/ha.

The average fruit diameter is an indicator that correlates directly with the average weight of the yield obtained. A smaller average diameter was recorded in the control variant, where the studied index constituted 72.5 mm, and the highest values were obtained in variants treated with the Auxiger growth regulator, constituting 74.0-74.4 mm, or with 2.1-2.6% higher compared to control variant.

The data of the investigations carried out (tab. 5) shows that the firmness of the apple pulp on the variants in the study at the time of the harvest constituted 7.1-7.4 kg/cm². The smallest firmness of the pulp was recorded in the control variant without treatment - 7.1 kg/cm².

When treating with the Auxiger growth regulator, we record approximately the same values of pulp firmness, 7.3 - 7.4 kg/cm².

The dry matter content of the Idared variety, on variants in the study, is 15.7 - 15.9%. The smallest value of the weight of dry substances was recorded in the control variant - 15.7%. Treatment with the Auxiger growth regulator increased the study index by only 0.2% compared to the control variant.

Table 5

The influence of the Auxiger growth regulator on the biochemical and coloring indexes of apple Idared variety

Variants	Firmness, kg/cm ²	Dry matter, %	Soluble dry substance, %	Titrateable acidity, %	Coloring Index (Points)
Control, without treatment	7.1	15.7	13.6	0.53	3.4
Auxiger – 0.9 L/ha	7.3	15.9	13.7	0.51	4.3
Auxiger – 1.8 L/ha	7.4	15.9	13.8	0.50	4.7

The amount of soluble dry matter in the Idared variety on the variants in the study constituted 13.6 - 13.8%. The smallest value of the weight of the soluble dry substances was recorded in the control variant - 13.6%. In variants treated with the Auxiger growth regulator, we record an increase of the index in the study by 0.1 - 0.2%, compared to the control variant.

Decreasing the amount of soluble substances in fruits increases the share of titrateable acids, registering higher values in the control variant - 0.53%.

In the variant treated with Auxiger growth regulator in dose of 0.9 L/ha, the amount of titrateable fruit in the fruit constituted 0.51%, and the increase of the dose to 1.8 L/ha was 0.50%.

Treating with the Auxiger growth regulator at a dose of 0.9 L/ha increased the coloration to 4.3 points, and with the increase of the dose to 1.8L/ha, the given index constituted 4.6 points.

Simultaneously, with the intensive growth of fruits occurs and the anthogenic induction in plants, that is, the phenophase of initiation of the formation of flowering buds, which can go more reasonably if the plant is assured with an optimal quantity of auxins.

The investigations revealed that the smallest quantity of fruit formations was obtained in the control variant - 117 pcs/tree (tab. 6). In the variants treated with Auxiger growth regulator at 0.9 L/ha, the amount of fruit formations was 133 pieces/tree, but with the increase of the dose to 1.8 L/ha, the study index was 139 pcs/tree.

A more significant difference compared to the control variant was recorded in the variant treated with the Auxiger growth regulator at a rate of 1.8L/ha, where an increase of 18.8% was obtained. This difference between these variants is explained by the fact that the Auxiger growth regulator, whose active ingredient is ANA and NAD, favors the excitability of the axial buds and the obtaining of a larger amount of fruit formations.

Table 6

The amount and weight of fruit formations in the crown of Idared apple trees under the influence of the Auxiger growth regulator

Variants	Total quantity, pcs / tree	The share of different types of fruit formations,%			
		Spurs	Brindles	Long shoots	Burses
Control, without treatment	117	43.6	11.1	16.3	29.0
Auxiger – 0.9 l/ha	133	49.6	9.0	11.7	29.3
Auxiger – 1.8 l/ha	139	51.0	9.3	11.6	28.1

The type of fruit formations formed in the crown of apple trees is influenced only by the growth regulator used for the treatment and not by the dose administered to a surface unit.

Treatments with the Auxiger growth regulator recorded an increase in the weight of the spurs against the brindles and long shoots compared to the control variant. The share of burses did not make any major changes to the variants in the study.

CONCLUSIONS

1. The experimental results revealed that the Auxiger growth regulator can be included in the technological system for improving the physiological processes in the plant, increasing the average weight and the quantity of apple fruit in the dose of 1.8 L/ha.

2. Apply the product once by foliar spraying during the intensive growth of fruits when their diameter is 20-25 mm.

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