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EFFICIENCY OF CHEMICAL THINNING IN DIFFERENT TREATMENT DOSE ON GALA MUST VARIETY WITH PRODUCTS BASED ON NAD, ANA AND BA

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ABSTRACT

The study subjects were Gala Must apple variety grafted on M 9 rootstock and thinning active substances such as NAD (Geramid-New), NAA (Dirager) and BA (Gerba 4LG), using in different doses and thinning periods. During the research, such indicators as the number and average weight of the fruit, the yield per tree and per unit area and the average fruit diameter were studied. It was established that, the spray with Geramid-New in dose 1.2 l/ha when 80 % of the petals have fallen + 2-3 days, Dirager in dose 0.3 l/ha when the king fruit diameter was 8-9 mm, and Gerba 4LG in dose 2.5 l/ha when the king fruit diameter was 10-15 mm have a significant effect on the number of the fruits, average weight, yield and fruits

INTRODUCTION

In the last decade, clones of the Gala variety are the most cultivated red apple varieties (Pește anu 2015a, Pește anu & Calestru 2020). The Gala Must variety blooms abundantly, forming high yields of inferior quality (Pește anu 2013; Pește anu 2015b, Pește anu & Calestru 2020). To increase the quality of the fruits, it is recommended to intervene by normalizing the fruit load through the chemical thinning method with different growth regulators and treatment doses (Ilie et al. 2016, Pește anu 2013a, Pește anu 2015c, Pește anu & Calestru 2015; Pește anu & Calestru 2017).

The chemical thinning of reproductive organs in clones from the Gala Delicious variety is studied by many researchers, but different phases of treatment with different active substances have not been carried out to be taken into account (Peşteanu 2017a, Peşteanu & Calestru 2020).

To solve this problem, it is necessary to study the use of different growth regulators with the active substance based on NAD, ANA and BA, which allow treatments to be carried out from the fall of the petals until the central fruit in the inflorescence has a diameter of 15 mm (Peşteanu 2013b, Peşteanu 2015d, Peşteanu & Calestru 2020).

MATERIAL AND METHODS

The research was conducted in the intensive apple orchard of the enterprise SRL "Codru-ST" planted in the fall of 2006, with one-year-old trees. As biological material, the Gala Must variety grafted on the M9 rootstock was taken, with the crown guided according to the improved thin spindle system, the planting distance 3.5 x 1.2 m.

To determine the efficiency of chemical thinning of the reproductive organs

in apple trees of the Gala Must variety, growth regulators based on NAD, ANA and BA, produced by the company "L. Gobbi" SRL, Italy, were used and the following experiment was set up (table 1).

Table 1

Experience scheme on thinning method and dose of apple trees treatment with growth regulators

Experience variants	Activ ingredient	Treatment dose, l/ha	Application method
No thinning (m)	-	-	-
Manual thinning	-	-	Manual thinning after physiological fall, when the central fruit reaches 15-20 mm in diameter
Geramid New	NAD (44,8 g/l)	1.2	By spraying, when 80 % of petals fall +2-3 days, when the central fruit reaches 4-7 mm in diameter
		1.5	
		2.0	
Dirager	ANA (37 g/l)	0.2	By spraying, when the central fruit reaches 8-9 mm in diameter
		0.3	
		0.4	
Gerba 4 LG	6BA (41 g/l)	2.0	By spraying, when the central fruit reaches 10-15 mm in diameter
		2.5	
		3.0	

The research was carried out according to the recommended methods for carrying out experiments with fruit species both in the field and in the laboratory.

The trees were treated with a portable sprinkler in the windless hours, in the morning, at a temperature of +18 °C. The amount of solution per tree was 0.42 liters, based on the number of trees per unit area and the recommended amount of water of 1000 l/ha.

The records were focused on determining the number of fruits, the average weight of a fruit, the production per unit area and the average diameter of the fruits, which were carried out during the harvest period. The results were reported to the control variant.

The experimental data were subjected to statistical processing by the method of dispersion analysis with the calculation of the limit difference with the application of the ANOVA and STATGRAPHICS 18.0 program packages.

RESULTS AND DISCUSSIONS

The number of fruits in a tree results from the flower weight, the setting coefficient, the method of normalizing the fruit load and the dose applied for each growth regulator.

The data presented in table 2 highlight that the number of fruits in the crown of apple trees was in direct correlation with the factors taken into study. The number of fruits differs significantly from the method of normalizing the fruit load during the research. Higher values of the number of fruits per tree during the research were recorded in the variant without thinning (145.7 pcs/tree), compared to the manual thinning variant (110.0 pcs/tree). The number of fruits in the manual thinning variant was constant during the research and ranged from 108 to 112 pcs/tree.

Table 2.

Influence of growth regulators and treatment dose on the number of fruits in the crown of apple trees of the Gala Must variety, pcs/tree

Experience variants	Treatment dose (l/ha)	Years				Average 2014-2017
		2014	2015	2016	2017	
No thinning (m)	-	231	65	244	43	145.7
Manual thinning	-	110	112	108	110	110.0
Geramid New	1.2	116	110	114	99	109.7
	1.5	123	117	120	102	115.5
	2.0	137	130	140	105	128.0
Dirager	0.2	130	121	127	108	121.5
	0.3	115	110	118	98	110.2
	0.4	140	131	136	118	131.2
Gerba 4LG	2.0	130	103	133	107	118.2
	2.5	108	91	114	95	102.0
	3.0	95	80	101	90	91.5
LSD 5 %	-	6.01	4.63	7.61	4.21	-

The average weight of a fruit as an indicator of quality (table 3), varied greatly over the years studied, as well as under the influence of the method of normalizing the fruit load. Lower values of this index were recorded in the variants Geramid New, 2.0 l/ha (129.6 g), Dirager 0.4 l/ha (138.4 g) and without thinning (139.4 g) compared to the other variants (147.5-178.8 g).

As a result of treating the trees with the Geramid New 1.2 l/ha product, an average fruit weight of 162.8 g was recorded, in the Geramid New 1.5 l/ha variant, the studied index was at the level of the manual thinning variant 153.0 g, and with the dose increased to 2.0 l/ha, the lowest values were recorded (129.6 g).

Table 3.

Influence of growth regulators and treatment dose on the average weight of a fruit from the crown of apple trees of the Gala Must variety, g

Experience variants	Treatment dose (l/ha)	Years				Average 2014-2017
		2014	2015	2016	2017	
No thinning (m)	-	88.3	191.0	86.3	192.1	139.4
Manual thinning	-	158.1	154.2	149.8	157.1	154.8
Geramid New	1.2	154.6	166.4	151.6	178.8	162.8
	1.5	146.5	150.6	141.9	173.2	153.0
	2.0	122.2	127.3	117.2	151.8	129.6
Dirager	0.2	136.4	149.3	137.5	166.7	147.5
	0.3	152.1	163.0	153.6	175.3	161.0
	0.4	129.0	137.3	125.9	161.5	138.4
Gerba 4LG	2.0	138.7	173.1	132.0	168.4	153.0
	2.5	165.3	183.3	144.6	183.7	169.2
	3.0	182.5	189.3	159.6	183.7	178.8
LSD 5 %	-	6.49	8.26	7.64	7.30	-

When using the Dirager product at a dose of 0.2 l/ha, the average weight of a fruit was 147.5 g, at a dose of 0.3 l/ha - 161.0 g, and at a dose of 0.4 l/ha the lowest values of the studied index (138.4 g) were recorded.

The growth regulator Gerba 4 LG had a more significant action on the average weight of a fruit, recording lower values in the variant with a dose of 2.0 l/ha (153.0 g), then in ascending order the variants Gerba 4 LG 2.5 l/ha (169.2 g) and Gerba 4 LG 3.0 l/ha (178.8 g) were placed.

Fruit production is the main index by which the efficiency of technological elements applied to apple cultivation can be assessed. Fruit production in apple is a complex characteristic, which depends on the way of managing the fruit load, the amount of product applied during chemical thinning, and the way in which these technological elements interacted with environmental factors (Pește anu & Calestru, 2017, Pește anu & Calestru 2020).

The method of normalizing the fruit load influenced fruit production per unit area differently. If the annual average of fruiting production (2014-2017) in the Gala Must variety in the variant treated with the product Geramid New 1.2 l/ha was 42.03 t/ha, then in the control variant, without thinning, the value of the studied index was 37.38 t/ha (table 4).

Identical values of the index studied with the manual thinning variant (40.90 t/ha) were recorded in the variants treated with the products Geramid New 1.5 l/ha (41.30 t/ha), Dirager 0.3 l/ha (41.36 t/ha) and Gerba 4 LG 2.5 l/ha (40.15 t/ha). In the other variants this index was lower or higher compared to the manual thinning variant. The product dose used in chemical thinning in the case of the growth regulators studied had a direct influence on fruit production. If, the fruit production in the case of treating the trees with the growth regulator Geramid New 1.2 l/ha was 42.03 t/ha, then the value of this index in the case of the Geramid New 2.0 l/ha variant was 38.38 t/ha.

Table 4

Influence of growth regulators and treatment dose on fruit production in the Gala Must apple orchard, t/ha

Experience variants	Treatment dose (l/ha)	Years				Average 2014-2017
		2014	2015	2016	2017	
No thinning (m)	-	48.54	29.56	51.45	19.96	37.38
Manual thinning	-	41.48	41.12	39.81	41.21	40.90
Geramid New	1.2	42.69	43.57	39.71	42.14	42.03
	1.5	42.88	41.95	39.52	40.85	41.30
	2.0	39.88	39.40	36.28	37.95	38.38
Dirager	0.2	44.90	43.00	39.62	42.85	42.59
	0.3	41.64	42.69	40.23	40.88	41.36
	0.4	43.00	42.81	39.28	41.52	41.65
Gerba 4LG	2.0	42.93	42.50	41.78	42.39	42.40
	2.5	42.50	39.71	39.26	41.54	40.75
	3.0	41.26	36.05	38.45	39.35	38.78
LSD 5 %	-	1.54	1.48	1.46	1.41	-

Within the variants treated with the Dirager product, slightly higher fruit production was recorded in the Dirager 0.2 l/ha variant (42.59 t/ha), then in decreasing order are the Dirager 0.4 l/ha (41.65 t/ha) and Dirager 0.3 l/ha (41.36 t/ha) variants.

The Gerba 4 LG product also had its contribution to fruit production on the variants studied. Thus, the average fruit production during the research years in the

Gerba 4 LG 2.0 l/ha variant was 42.40 t/ha, in the Gerba 4 LG 2.5 l/ha and Gerba 4 LG 3.0 l/ha variants it was 40.75 and, respectively, 38.78 t/ha, i.e. a decrease of 3.9% and 8.5% compared to the variant with the lowest dose of treatment.

The data obtained allow us to highlight that higher fruit yields with chemical thinning were recorded in the variants Geramid New 1.2 l/ha, Dirager 0.3 l/ha and Gerba 4 LG 2.5 l/ha.

Fruit quality is a particularly important characteristic when approximately identical productions are recorded per unit area and it is necessary to make decisions regarding the influence of the product or treatment dose, which is characterized by various morphological, organoleptic, technological, biochemical characteristics and, finally, by food value.

The method of normalizing the fruit load influenced the average diameter of a fruit. Lower values of this index were recorded in the control variant without thinning (67.9 mm) and in the variants Geramid New, 2.0 l/ha (67.3 mm), Dirager, 0.4 l/ha (68.9 mm) and Gerba 4 LG, 2.0 l/ha (69.7 mm). In the other variants where chemical thinning was performed, the fruit diameter recorded values greater than 70 mm (table 5).

Table 5

Influence of growth regulators and treatment dose on quality expressed by average fruit diameter of the Gala Must variety, mm

Experience variants	Treatment dose,(l/ha)	Years				Average 2014-2017
		2014	2015	2016	2017	
No thinning (m)	-	58.4	77.0	59.0	77.3	67.9
Manual thinning	-	720	71.5	71.8	72.1	71.8
Geramid New	1.2	726	74.0	72.3	76.5	73.8
	1.5	710	72.0	69.7	75.7	72.1
	2.0	653	66.2	64.4	73.2	67.3
Dirager	0.2	682	71.3	68.9	74.8	70.8
	0.3	713	73.4	72.7	75.1	73.1
	0.4	679	69.0	66.6	72.1	68.9
Gerba 4LG	2.0	662	72.7	67.3	72.7	69.7
	2.5	719	74.9	70.0	74.0	72.7
	3.0	739	76.7	71.9	74.0	74.1
LSD 5 %	-	3.09	3.67	3.84	3.15	-

Increasing the product dose when treating with Geramid New and Dirager resulted in a decrease in the average diameter of a fruit. When applying the Gerba 4 LG product, we record that with the increase in the product dose, the index under study increases. Maximum values regarding the index under study are recorded in the Gerba 4 LG variant 3.0 l/ha (74.1 mm).

CONCLUSIONS

Growth regulators based on NAD, ANA and BA in different doses influence the number of fruits, their average weight, their diameter and the productivity of the apple orchard.

For a more efficient regulation of the fruit load in the Gala Must variety trees by the chemical method, when normalizing the fruit load, 1 - 2 growth regulators should be used depending on the mode of action and the application period in order to develop a fruit thinning methodology.

For the Gala Must variety, higher yields and competitive quality were recorded when treating with the Geramid New product at a dose of 1.2 l/ha when 80 % of the petals have fallen plus 2-3 days. If weather conditions are not favorable for the Geramid New product, apply the Dirager growth regulator at a dose of 0.3 l/ha, when the central fruit in the inflorescence is 8-9 mm in diameter. In the case when the number of fruiting bodies in the tree crown is large, it is recommended to treat with the product Gerba 4 LG at a dose of 2.5 l/ha, when the size of the central fruit in the inflorescence is 10-15 mm in diameter.

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