

THE RESPONSE OF NAJDARED APPLE CULTIVAR TO BRANCHING IN THE TREE NURSERY ACCORDING TO THE APPLIED TECHNIQUES

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ABSTRACT

The experiment was carried out in the years 2021 - 2022, in a commercial nursery of the company SRL "Vindex Agro", where Najdared trees grafted on the M9 T337 rootstock served as biological material. Planting of rootstocks was carried out in the spring of 2021. The grafting method was Chip budding and planting distance was 0,8x0,35 m. In order to intensify the formation of the anticipated shoots in the area of the crown formation, various technological processes were used: V1. Free eyelid growth (control); V 2. Progerbalin LG, 25 ml; V 3. Progerbalin LG, 25 + 25 ml; V 4. Progerbalin LG, 25 ml + topping of apical leaves; V 5. Progerbalin LG, 25 + 25 ml + topping of apical leaves; V 6. Gerba 4 LG, 25 ml; V 7. Gerba 4 LG, 25 + 25 ml; V 8. Gerba 4 LG, 25 ml + topping of apical leaves; V 9. Gerba 4 LG, 25 + 25 ml + topping of apical leaves. It has been established that the most reasonable garnishing of the crown formation with anticipated shoots at Najdared cultivar was obtained by topping the apex area once when the graft reaches 65-70 cm height combined with twice sprays with Progerbalin LG and Gerba 4 LG growth regulators. The first treatment was done after topping the apical leaves and the next at 5-7 days late.

INTRODUCTION

For a high-quality tree, the presence of a sufficient number of side branches on the stem is necessary, because in the latter the terminal buds formed in the second field of the fruit nursery are floral and allow us to obtain fruit from them in the first year after planting (Elfving 2010; Robinson et al. 2006;). Additionally, side-branching trees facilitate earlier formation of canopy structure, the degree of pruning is simpler, and orchard management costs are reduced (Robinson 2007). Apple growers worldwide are advocating the technology of growing lateral-branched seedlings (Wertheim & Webster 2003).

In the range of apple varieties, there are multiple cultivars that are characterized by a low branching capacity in the nursery (Hrotko et al. 2000; Sazo & Robinson, 2011). For a more uniform branching, it is possible to intervene on the terminal bud through various technical procedures and treatments with growth regulators, which leads to the inhibition of apical dominance (Peșteanu & Bostan 2019; Sazo & Robinson, 2011) and the start of growth of the anticipated shoots which, at the end of the vegetation period, will transform into annual lateral branches (Cline 1997; Volz et al. 1994).

Auxin is mainly synthesized in the shoot apex in young leaves and is subsequently transported basipetal and plays an important role in the dominance of

apical growth, which can be overcome by cytokinin treatments (Cline 1997). The application of 6-benzylaminopurine (BA) affects the flow of auxins (Muller & Leyser, 2011) and temporarily prevents tree growth in height (Sazo & Robinson, 2011), which overcomes the phenomenon of apical dominance and creates favorable conditions for the formation of anticipated shoots.

In low-branching apple cultivars, BA either alone or in combination with GA4+7 plays an important role in inhibiting apical dominance and the production of branched seedlings in field II of the tree nursery (Hrotko et al. 2000; Peșteanu & Bostan 2019; Sazo & Robinson, 2011).

MATERIAL AND METHODS

The experiment was carried out in the years 2021 - 2022, in a commercial nursery of the company SRL "Vindex Agro", located in the village of Malaiești, Orhei district, where Najdared trees grafted on the M9 T337 rootstock served as biological material.

The rootstock taken in the research was of the certified organic category, imported from the Netherlands and planted at the beginning of April. The method of grafting used in field I of the tree nursery was the eyelet in plywood 15 cm above the ground. Planting distance – 0.8x0.35 m.

The experiment was laid out in randomized blocks with four replications, each represented by five plants (20 variant plants).

In order to establish the reaction of the cultivar to different intervention techniques on the apex of the tree to increase the emission rate of anticipated shoots in field II of the tree nursery, the following variants were studied: V 1. Free growth (control); V 2. Progerbalin LG, 25 ml; V 3. Progerbalin LG, 25+25 ml; V 4. Progerbalin LG, 25 ml + topping of apical leaves; V 5. Progerbalin LG, 25+25 ml + topping of apical leaves; V 6. Gerba 4 LG, 25 ml; V 7. Gerba 4 LG, 25+25 ml; V 8. Gerba 4 LG, 25 ml + topping of apical leaves; V 9. Gerba 4 LG, 25 + 25 ml + topping of the apical leaves. The product Progerbalin LG has two active substances in its composition (GA4-7 1.8% + BA 1.8%), and Gerba 4 LG only one (BA 4%).

The treatment was carried out with the help of a sprayer. The research was carried out according to the methods recommended for carrying out the experiments under field conditions in the fruit nursery.

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

RESULTS AND DISCUSSIONS

The development of apple trees in the nursery has an obvious importance on the quality of this planting material, as well as on its behavior after planting in the orchard.

The data obtained regarding the height of trees of the Najdared cultivar show that the index studied is influenced by the method of crown formation (table 1). Lower values of the studied index were recorded in the control variant (149.0 cm) compared to the other variants (163.0-173.0 cm). Within the variants with a different crown formation method, higher values were obtained in the variants treated with the Progerbalin LG product (169.0-173.0 cm) compared to those where the Gerba 4LG growth regulator was used (163.0- 173.0 cm). Within the varieties treated with the product Progerbalin LG, the trees on the varieties studied did not register significantly higher values. When treating the trees with the product Gerba 4LG, higher values of

the studied index were registered in the variant when the apex was treated by treating it twice with a dose of 25 ml/liter (173.0 cm), then in decreasing order the V6 variant was placed (168.0 cm) and V8 (164.0 cm) and V9 (163.0 cm) variants.

The trees in the control variant did not form a trunk, while in the variants with the use of different methods of crown formation in the school of trees, no significant difference was recorded.

The length of the crown formation zone was determined by the number of anticipated branches formed in that zone. In the control variant, the area of crown formation on the tree trunk was not recorded, but in the variants where the apex was intervened by various methods, the index in the study varied from 16.1 to 25.3 cm. Lower values of the area of crown formation in the product Progerbalin LG were recorded in the variants V 2 (18.1 cm) and V 4 (16.1 cm), and of the growth regulator Gerba 4LG in the variant V 8 (15, 4 cm). In the other variants, the length of the crown formation zone varied from 21.3 to 25.3 cm.

Table 1

The structure of the tree stem by height depending on the method used to form the crown, cm

Method of crown formation	Tree height	Trunk height	The length of the crown zone	Arrow length
V 1 (c)	149	-	-	149.0
V 2	169	55.8	16.1	95.1
V 3	171	56.7	22.3	92.0
V 4	173	58.7	16.1	98.2
V 5	171	54.8	21.3	94.9
V 6	168	58.1	23.4	86.5
V 7	173	56.1	22.1	94.8
V 8	169	58.2	15.4	90.4
V 9	163	55.1	25.3	82.6
LDS 0,05	6.37	2.30	0.76	3.78

The length of the arrow of the trees on the variants taken in the study was correlated with the height of the trees, the trunk and the length of the zone of crown formation, which varied from 82.6 to 98.2 cm.

The diameter of the rootstock (21.0-24.0 mm) recorded higher values within the structure of the tree. Within the variants studied, a smaller diameter was obtained in the trees of the control variant (21.0 mm) and in the other variants studied, values from 22.0 to 25.0 mm were recorded.

The law described for the diameter of the rootstock is also valid for that of the graft, only with the registration of smaller values. If, in the control variant, the studied index was 18.0 mm, then in those with different crown formation methods it varied from 15.0 to 19.0 mm. Lower values of graft diameter were obtained in the variants treated with the product Gerba 4LG (15.0-17.0 mm), compared to the growth regulator Progerbalin LG (16.0-19.0 mm). Depending on the intervention method on the apex of the tree, a more developed diameter of the graft was recorded in the variants V 4 (19.0 mm), V 5 (18.0 mm), V 8 (16.0 mm) and V 9 (17.0 mm). The values of the studied index in the other variants were lower compared to the control variant.

The study carried out on the diameter recorded under the crown of the tree highlights a decrease in the index taken in the research, but the legitimacy previously

exposed is valid, varying from 12 to 14 mm.

The diameter of the axis above the crown recorded the smallest values (10.0-13.0 mm) and was correlated with the number of branches in the crown formation zone. The larger diameter above the crown was recorded in the variants V 2 and V 4 treated with the product Progerbalin LG in different doses (11.0 mm), and Gerba 4LG in the variants V 8 (13.0 mm) and V 9 (11, 0 mm).

Anticipated branches were not obtained in the control variant, where the apex of the eye was not intervened, it grew freely. A different number of branches was recorded in all the other variants studied, ranging from 2.0 to 6.0 pcs/tree (table 2).

More obvious effectiveness on the formation of anticipated branches in the area of the crown of the trees in the Najdared cultivar was obtained in the V 9 variant, when the apex of the tree was treated 2 times with the product Gerba 4LG in the dose of 25 ml plus the topping of the bee leaves (6.0 pcs/tree). The single treatment with the product Gerba 4LG in the dose of 25 ml plus the topping of the bee leaves recorded lower values than in the previous version (2.0 pcs/tree).

Table 2

The number of anticipated branches, their average and total length in field II of the tree nursery depending on the method of crown formation in the Najdared cultivar

Method of crown formation	Number of anticipated branches, pcs/tree	Length of anticipated branches	
		Average, cm	Total, cm/tree
V 1 (c)	2.0	27.0	54.0
V 2	3.0	17.3	52.0
V 3	5.0	17.4	87.0
V 4	3.0	18.0	54.0
V 5	4.0	29.3	117.0
V 6	5.0	17.4	87.0
V 7	5.0	15.8	79.0
V 8	2.0	27.5	55.0
V 9	6.0	28.3	169.8
LDS 0,05	0.37	0.96	4.32

Treatment once with the growth regulator Progerbalin LG in a dose of 25 ml (V 2) and with the same amount of product plus the topping of the bee leaves (V4) in both variants had a negative influence on the number of anticipated branches formed in the crown area (3.0 pcs/tree). A higher number of anticipated branches (5 pcs/tree) was recorded in the variants treated twice with the product Progerbalin LG in the dose of 25 ml (V 3) and with Gerba 4 LG once and twice in the dose of 25 ml (V 6; V 7).

Within the variants treated with the product Progerbalin LG, higher values of the total length of anticipated branches and confirmed by statistical data were recorded when the apex of the trees was treated with two treatments in a dose of 25 ml (117.0 cm) at an interval of 5 days from the previous one plus the topping of the bee leaves. The variants V 2 and V 4 had a total length of the anticipated branches of 52.0 and 54.0 cm, respectively, and in the variant V 3 the index values taken in the study constituted 87.0 cm.

Within the variants treated with the product Gerba 4LG and interventions by topping the bee leaves, higher values were obtained when 2 treatments with the studied growth regulator were carried out and additionally the bee leaves of the tree

were broken (169.8 cm). In the variant with a single treatment with the product under study plus the topping of the bee leaves, the lowest value (55.0 cm) was recorded. In the V 6 and V 7 variants, the total length of the anticipated increases was average and constituted 87.0 and 79.0 cm, respectively.

The number of fruit formations registered within the crown of apple trees in the second field of the school of trees is also influenced by the method of crown formation (table 3). If in the control variant no fruit formations were obtained, then in the variants where the apex of the tree was intervened by various techniques to suppress the formation of auxin, the index taken in the study varied from 8 to 15 pcs/tree.

Table 3

The number of fruit formations and their type in apple trees of the Najdared cultivar, in field II of the nursery depending on the method of crown formation

Method of crown formation	Type of fruit formations			Total
	spurs	dards	brindlle	
V 1 (c)	-	-	-	-
V 2	8	1	1	10
V 3	6	5	-	11
V 4	10	3	2	15
V 5	8	1	3	12
V 6	6	2	3	11
V 7	5	1	5	11
V 8	7	2	2	11
V 9	4	1	3	8

Depending on the product used in the treatment, insignificantly higher number of fruit formations in the cultivar Najdared was obtained after treatment with the product Progerbalin LG compared to Gerba 4LG. If, in the version of Progerbalin LG in the dose of 25 ml plus the topping of the bee leaves, the number of fruit formations was 15 pcs/tree, then when treated with the product Gerba 4LG in the same version, the index in the study was 11 pcs/tree, a decrease of 36.2%. This legality is also maintained in the case of variants V 5 and V 9 when two treatments were performed plus the topping of the apical leaves, where the number of fruit formations was 12 and 8 pcs/tree, respectively, a decrease of 50.0%.

Within the variants treated with the studied products and the supplemental application of topping the bee leaves, we note that within the Progerbalin LG (V 4; V 5) product, the number of fruit formations increased compared to the V 2 and V 3 variants. Treating the trees with the Gerba product 4LG and the topping of bee leaves maintained at the same level or decreased the number of fruit formations within the crown of the trees, constituting in the V variant 8 - 11 pcs/tree, and in the V variant 9 - 8 pcs/tree.

Depending on the type of fruit formations registered within the crown of the trees in the second field of the fruit nursery, an obvious legality was recorded on the variants taken into study. Within the variants treated with the Gerba 4LG product, fewer spurs (4-7 pcs/tree) and more dards (2-5 pcs/tree) are found in the crown, and when we intervened with the growth regulator Progerbalin LG we record spurs (6-8 pcs/tree), dards (1-5 pcs/tree) and fewer brindilles (1-3 pcs/tree).

CONCLUSIONS

The producers of apple trees in the second field of the tree nursery, in the Najdared apple cultivar at the formation of the base of the crown from 5 branches anticipated to intervene on the apex of the feather when it is 60-65 cm high by treating twice with the growth regulator Progerbalin LG or Gerba 4LG in a dose of 25 ml/liter of water.

When planning a larger number of anticipated branches in the area of crown formation, to intervene on the apex of the feather by apical topping of the terminal leaves when it is 60-65 cm high plus treating twice with the growth regulator Gerba 4LG in a dose of 25 ml/ liter of water. The first treatment to be carried out simultaneously with the topping of the apical leaves, and the next at an interval of 5-7 days from the previous one.

REFERENCES

- Cline M. G., 1997. Concepts and terminology of apical dominance. *American Journal of Botany*, 84 (9): 1064-1069.
- Elfving D. C., 2010. Plant bioregulators in the deciduous fruit tree nursery. *Acta Horticulturae*, 884: 159-166.
- Hrotko K., Magyar L., Ronay Z. 2000. Improved feathering on apple nursery trees by BA application. *Acta Horticulturae*, 514: 113-119.
- Muller D., Leyser O. 2011. Auxin, cytokinin and the control of shoot branching. *Annals of Botany*, 107 (7): 1203-1212.
- Peşteanu A., Bostan M. Perfecţionarea unor elemente tehnologice la producerea materialului săditor pentru fondarea livezilor moderne de măr. In: *Ştiinţa Agricolă*. 2019, nr. 1, p. 52-59.
- Robinson T. L., Hoying S. A., Reginato, G. H. 2006. The tall spindle apple production system. *New York Fruit Quarterly*, 14 (2): 21-28.
- Sazo M., Robinson T. 2011. The use of plant growth regulators for branching of nursery trees in NY State. *New York Fruit Quarterly*, 19 (2): 5-9.
- Volz R. K., Gibbs H. M., Popenoe J. 1994. Branch induction on apple nursery trees: Effects of growth regulators and defoliation. *New Zealand Journal of Crop and Horticultural Science*, 22 (3): 277-283.
- Wertheim S. J., Webster A. D. 2003. Propagation and nursery tree quality. In: *Apples: Botany, Production and Uses*, CABI Publishing, Cambridge, pp. 125-15.