Growth and Feathering of Some Apple Cultivar-Rootstock Combinations in a Fruit-tree Nursery

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Abstract

The planting of well feathered trees are crucial in a high density orchard, than unbranched rods. Lateral bud-brake can be effectuated by several agro-technical methods in order to overcome apical dominance. Main targets of the researches were to investigate the feather induction by removing the apical leaves and to study a proper basic and foliar fertilization scheme. The highest mean height of the trees with significant differences was achieved by untreated Florina, followed by variants of Florina treated with Solfert, untreated control Idared and Florina with NPK and Fertitel. The number of feathered trees was higher in Florina than in Idared. The best results were obtained with Solfert and NPK followed by Fertitel. The growth in height was not affected by the lack of fertilizers in the control variants, but in other fertilization variants where branching was observed the height of the trees was reduced.

Keywords: branching, cultivar, tree height

Introduction

The planting of healthy well feathered trees are crucial in a high density orchard, than unbranched rods (Robinson, 2007). Feathers provide new branching structures which could bear higher yield in the first years, than rods (Tromp, 1996).

Lateral bud-brake can be effectuated by several agro-technical methods like pinching or applying benzyladenin and gibberellin hormones in order to overcome apical dominance (Gudarowska and Szewczuk, 2004).

In many European countries there are used several pinching techniques effectuated manually, applied at different physiological development stages or by applying phytohormones together with pinching.

Aims. Taking into account some previous experiments, our aim was to investigate non hormonal means to induce feathering by removing the apical leaves which could increase lateral

branching of the nursery stock material, and to study an appropriate fertilization scheme.

Materials and Methods

Researches were performed in a nursery near Somes river on a sandy loam soil during 01.03.2018-30.09.2018. The undertaken study was a bifactorial experiment with a completely randomized block design using three repetitions, each one containing 33 trees with a total of 99 trees per variant. One of the factors was represented by the cultivar (Florina and Idared) grafted on M106 rootstock, the other factor was represented by fertilization (NPK solid basic fertilizer, Fertitel and Solfert leaf fertilizers) and control variant. At the foliar leaf fertilizer Fertitel variant, dosage was 20 ml dissolved in 6 L of water on 100 m². Fertitell fertilizer contained macroelements of nitrogen (N)- 6,7% ; phosphorus (P₂O₅) – 6,0% ; potassium (K₂O)-4,2 % and oligoelements: copper

Figure 1. Idared control variant trees conducted on bamboo shoots

Figure 2. Idared with lateral branches

Figure 3. Florina-ramification with lateral shoots

Table 1. Mean values of tree height (cm) by variants

Variant	LS means (tree height)	Groups
S2F4	174.8	A
S2F3	162.9	B
S1F4	161.9	B
S2F1	161.8	B
S2F2	156.8	B
S1F2	148.8	C
S1F3	145.9	C
S1F1	133.3	D

Note: Different letters between variants denote significant differences (Duncan's test, $p < 0.05$)

(Cu) 0,025% ; iron (Fe) 0,100% ; manganese (Mn) 0,010%; zinc (Zn) 0,008%; chelated with EDTANa; boron (B) 0,02% and molybdenum (0,001%). At the leaf fertilizer Solfert variant the dosage was 30 g dissolved in 6 L water on 100 m². Solfert fertilizer contained macroelements as nitrogen (20%), phosphorus (P₂O₅) – 20%; potassium (K₂O) - 20% and oligoelements: boron (B)-0,01% ; copper (Cu)-0,0055%, iron (Fe)-0,05%; manganese (Mn)-0,025%; molybdenum (Mo)-0,035% and zinc (Zn) – 0,075%. At the solid basic fertilizer NPK, dosage was 3 kg/100 m². NPK fertilizer contained macroelements of nitrogen (16%), phosphorus (P₂O₅) – 16,0%; potassium (K₂O)-16%. Thus resulted the following experimental combinations: S1F1-Idared/NPK; S1F2-Idared/Fertitel; S1F3-Idared/Solfert; S1F4-Idared control; S2F1- Florina/NPK; S2F2- Florina/Fertitel; S2F3- Florina/Solfert;

S2F4- Florina control. Solid basic fertilization was made with NPK in March (12.03.2018) and April (10.04.2018) resulting thus 2 applications. There were made 4 foliar fertilizations, in April (17.04.18), May (14.05.2018), June (15.06.2018) and July (16.07.2018). At the beginning of July (05.07.18) was executed the pinching of the apical leaves. At the end of the growth period (05.09.18) the lateral shoots were counted and the height of the grafted trees was measured. The registered data were statistically analysed by XLSTAT – Duncan's multiple comparison test.

Results and Discussion

The highest mean height, as presented in Table 1, was achieved in S2F4 – untreated Florina cultivar variant (174,88 cm), followed by the Florina with Solfert leaf fertilizer variant (162,96 cm), untreated Idared variant (161,92 cm), Florina

Table 2. Experimental data on grafted nursery planting material parameters

Variant	Feathered trees (%)	Number of feathers/tree
S1F1	24	2.4
S1F2	18	1.8
S1F3	35.2	2.1
S1F4	8	2.3
Average	21.3	2.1
S2F1	42	2.8
S2F2	30	2.0
S2F3	46	2.6
S2F4	23	2.9
Average	35.2	2.6

with NPK (161,80 cm) and Florina with Fertitel (156,86 cm). Distinctive C group was represented by Idared treated with Fertitel (148,84 cm) and Solfert (145,96 cm) leaf fertilizers. On the last position were the trees of Idared fertilized with NPK basic solid chemical formulation fertilizer (133,38 cm).

The results of analysing the percentage of feathered trees in our experiment showed that Florina cultivar branched better than Idared cultivar after pinching, between 23-46% (Tab. 2). The best results were obtained with Solfert (46%) and NPK formulation (42%), followed by Fertitel (30%) and finally from the control variant, produced by natural tendency of feathering (23%). In Idared cultivar feathered trees were between 8-35% (Fig. 2). Good results were also achieved with Solfert (35,2%) followed by variants with NPK (24 %) and Fertitel (18%). The results of the control variant (S1F4) were the weakest, only 8%.

Conclusions

The growth in height was continuous and the high values achieved in the control variants were

not affected by the lack of fertilization. Thus in the older fruit tree planting material scheme with rods whitout feathers, high values of height could be achieved. On the contrary growth is greatly influenced in the variants with sylleptic shoots, thus the height of trees were reduced. The difference in height is probably due to physiological processes, nutritional resources being used more intensely in the feathered trees compared to the untreated control variant. Former and actual experiments showed that the natural tendency of sylleptic shoot development of some cultivars is not enough to suport the high nutritional requirement of feathering process. Thus for the lateral branching of nursery trees is required a well-balanced fertilization scheme. In our experiment in 2008 feathering by pinching technique gave better results for Florina, compared to Idared. It seems that Florina cultivar has good characteristics for forming sylleptic shoots.

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