

## **Productivity of Superintensive Apple-Tree Orchards Depending on the Variety, the Training and Pruning of Trees**

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**Abstract.** Productivity of apple tree superintensive orchards depends on variety's biological features, apple tree leading and pruning system. The investigations were made in the orchard „Codru-ST” Ltd. founded in 2000 with bench-graftings on rootstock M 9 at the varieties Gala Must, Golden Reinders, Idared and Florina. The distance of plantation between rows is 4.0 m, and between trees in the row is 1.0 m. There was studied the productivity of varieties in dependence on crown formation variants. It was established that the varieties Gala Must, Golden Reinders and Idared, the highest productivity of fruits was obtained in the variants with minimalization of pruning's degree at crown formation and design of 2 provisional branches horizontalized through fixation on row direction – 30.38-35.69 t/ha. For the variety Florina the highest indexes of production were registered by pruning's of transfer at lateral ramifications – 27.06 t/ha.

**Keywords:** productivity, apple-tree orchards, varieties, crown formation, pruning.

### INTRODUCTION

Fruit growing development program in the Republic of Moldova until 2020 provides for the establishment of 100 thousand hectares of modern orchards and increasing global production of fruits to 998 thousand tons (Balan et al., 2008).

Around 60% of fruit production and 40% of the fruit-growing plantation area returns to intensive and superintensive apple-tree orchards (Balan et al., 2001). The main objectives of the superintensive system of apple-tree culture are: entering the economic fructification 2-3 years after planting the orchard; rapidly increasing harvest and considerable capital investment recovery (150-160 thousand lei / ha) with the first two crops of fruit; high harvest of quality fruit with high economic indicators (Pesteanu, 2005; Sadowski et al., 2005; Licznar-Malanczuk, 2006).

The listed objectives is achieved by using varieties of performance, application of rational training and cutting of trees, the agrotechnical higher level, including irrigation. Achieving these objectives in terms of the central area of Moldova make up research purposes.

### MATERIALS AND METHODS

Experimental plot is located in the orchard „Codru-ST” Ltd. around Bucovat town on the North - East slope with 3 – 4° inclination. Planting was conducted in spring 2000 with the bench-graftings on the rootstock M9 of Must Gala, Golden Reinders, Idared varieties. Distances between rows – 4.0 m, and between trees in row 1.0 m - 2500 trees ha. In 2000

vegetation grafts reached about 120 cm which allowed initiation of slender spindle crown formation in four variants.

Variant 1. (control) - as recommended in force: the trunk of the trees with 50 - 55 cm and well-developed vertical few zigzag shaped axis; 3-4 frameworks 40 - 50 cm short with inclination angles of about 60° to the vertical; the frameworks and above the axis at intervals of 20 cm are uniformly located radially fruit-bearing branches (fruit branches), horizontal oriented predominantly through lateral transfer side parting cuts, after fructification fruit-bearing branches is to renew the cycle of 3 - 4 years.

Variant 2. Crown bioconstructive base as in the control variant completed with: rational minimizing of the degree of training cuts, placement above the crown of the provisional frameworks alternatively horizontalized fixed on espalier onto the row direction that gradually shortens after fructification stage, transferring them into fruit branches; forced horizontalization of vertically growing scions and branches into the free end of the crown to transfer into fruit branches.

Variant 3. Formation of a crone is made as in variant 2 routing the fruit-bearing branches to horizontal position through lateral transfer side parting cuts.

Variant 4. Formation of a crone basically is made as in variant 2 with the renovation of branches by division fruit-bearing to obtain scions from sleeping buds.

Each variant includes 4 repetition and 8 trees in a row. Between rows are grass and the row strips are loose and herbicide. The fertilization system is on scheduled harvest. Through is drip irrigation.

In the years 2003 - 2008 according to approved methods were studied the production of apples-trees plantation.

## RESULTS AND DISCUSSIONS

Varieties and variants, taken in the study, entered the economic fructification in 2003 from the initiation of crown formation with high harvest in variant two at the Gala Must and Golden Reinders varieties. These varieties had also higher yield of fruit in the years 2004 - 2005. The average harvest from 2003 to 2005 (tab.1) in version 2, the afore mentioned varieties constitute respectively 34.32 t / ha and 35.69 t / ha. The Idared variety's average major harvest of fruits in the years 2003 - 2005, was still in a degree to minimize pruning training and placement above the crown base of two provisional frameworks alternatively horizontalized and attached to espalier to turn, but with absolute value less - 30.38 t/ha.

Tab. 1  
Harvest of apple plantation depending on the training mode of the tree crown, t / ha, average a. 2003 – 2005

Variants	Gala Must	Golden Reinders	Idared	Florina
V <sub>1</sub>	28.31	29.87	25.11	21.96
V <sub>2</sub>	34.32	35.69	30.38	25.04
V <sub>3</sub>	31.43	34.31	28.29	27.06
V <sub>4</sub>	31.10	32.24	27.84	22.81

The Florina variety's average productions of superior fruit were obtained in variant 3 with routing the framework through transfer cuts to side parting - 27.06 t/ha. In other variants, the average fruit yield for the years 2003 - 2005 is greater than control variant, but lower than in variant 2 for Gala Must, Golden Reinders, Idared varieties and variant 3 for Florina variety.

After training the crown in 2005 and entry in full fructification, due to fructification cutting in accordance with the biological particularities of the varieties and adjusting the load of fruit, including hand thinning after falling in June under physiological cross-sectional area of the trunk (5-6 fruits/cm<sup>2</sup>), harvest fruit varieties taken from the study do not differ essentially because they have a high potential productivity (Tab.2).

In all varieties significant differences were recorded by year of study. In 2007, with acute drought, particularly air, trees tied sufficient amount of fruit to obtain the planned harvest, but being smaller apples, fruit production had declined compared with 2006. This year reduced the differentiation of floral buds and diminished harvest in 2008.

On average for the years 2006 - 2008 harvest fruit varieties taken from the study is 31.14 - 32.73 t / ha and can be considered satisfactory for the weather conditions during this period.

Tab. 2

Harvest of fruit in the planting of apple-tree with training provisional crown branches (V<sub>2</sub>), t / ha

Variety	2006	2007	2008	Average 2006-2008
Gala Must	43.15	30.10	22.48	31.91
Golden Reinders	43.81	30.85	18.97	31.21
Idared	42.72	30.87	24.62	32.73
Florina	39.60	36.47	17.35	31.14
DS 5%	2.22	1.87	1.24	-

Gala Must, Golden Reinders and Idared varieties assigned to type III fructification, and the Florina variety to the type IV fructification.

On varieties of type III and IV of fructification, during fructification maximum, fruit-bearing branches elongate and due to terminal buds' fructification become arched, harvest is moving on the periphery of the crown. To exclude these shortcomings in these varieties is recommended staggered cutting of both fruit-bearing branches and fruit branches.

Varieties of type III fructification bearing branches are located on the 2-3 years old fruit-bearing branches. The rate-setting of the load with floriferous buds to be carried out by fructification cutting where cyclical replacement of elongated fruit-bearing branches, that permanently fructificated in the crown, form branches of one, two or three years.

Idared variety with premature arched secondary branches under the weight of harvest requires shortening the knot leaving 1-3 bearing branches.

Fruit-bearing branches with horizontal slope form a large amount of fruit branches when they grow free at least two years and only after that can be shortened to a stake or rod for rate-setting of load of fruit.

For Florina variety, type IV fructification, with great force growth, low bud excitability and ability of shoot formation, when annual branches length greater than 50 – 60cm <sup>3</sup>/<sub>4</sub> from the base, remain ungarnished. For more uniform garnishing with spears and annual rods branches are shortened to 1/4 - 1/3 of their length.

To inhibit the vigorous growth during cyclical renewal cutting of fruit-bearing branches, the replacing knot length on the stock of small force growth should be 8-10 cm long and on the rootstock of subaverage force growth, 15-20 cm to get 3-4 annual 30 - 40 cm branches.

On Golden Delicious varieties and clones, the Alpinist, Florina, etc., when the branches of fruit-bearing insertion angle of 50 - 70° is excessive, or compete with the developing central axis to not practice their ring suppression, but leaving a knot. The cuttings

done at the top of the ring and continue perpendicularly to the bisectrix formed between the suppressed fruit-bearing branch and the tree axis.

On some holes in the crown greedily branches from the area turn into fruit-bearing branches by severe shortening to 4-6 buds to achieve annual increases. Next choose 1-2 lower branches with more favorable location in space to complement the crown and the others are suppressed.

Making the proper cuts of fructification in the superintensive apple-tree orchards allow to maintain the physiological balance between growth and fructification period as long and production is of high quality.

## CONCLUSIONS

Using performance varieties, grafted on M9 rootstocks and led by the improved slender spindle with minimizing the extent of cutting, especially in the biological rest period, the formation of two provisional frameworks horizontalized onto the row direction, forced tilting of some scions and branches of the vertical free space of the crown contribute significantly to expedite the entry of the trees on economic fructification and considerable capital investment recovery.

After completion of crown formation, fructification cutting and rational adjustment of the load of fruit trees, applied in accordance with the varieties' biological particularities and superior agrotechnics to obtain high yields of quality fruit in the center of the Republic of Moldova with frequent dry years.

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