

EFFICIENCY OF FOUNDATION AND EXPLOITATION OF THE SUPERINTENSIVE APPLE TREE ORCHARD

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Abstract

Efficiency of foundation and exploitation in apple superintensive orchards is greatly determined by the productivity of cultivated varieties and trees growing system. The investigations were made during the period 2003-2006 in the orchard „Codru-ST” Ltd. founded in 2000 with bench-graftings on rootstock M 9 of the varieties Gala Must, Golden Reinders and Idared. The distance between rows is 4,0 m and that in the row is 1,0 m. There were studied 4 variants of crown formation. The highest cumulated yield in the years 2003-2004 at the varieties under the study was registered at the variant V₂ - 50,04-58,44 t/ha. Respectively, in variant mentioned the capital investments at foundation, keeping up the plantation and value of production were very high. Capital investments recovery took place at all the variants under the study, but the greatest value was registered at pruning's minimalization of crown formation and designing of 2 provisional branches 123-142%. The highest economic efficiency at the varieties under the study during the years 2005-2006 was registered in variant V₂, where due to the high yield of the 41,9-46,2 t/ha t/h, production profitability were registered 280.2-291.2%.

INTRODUCTION

Considerable capital investment recovery in the superintensive apple-tree orchards is largely determined by performance varieties and tree training system [1, 4].

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 [3, 5].

In Moldova is recommended and applied in the superintensive apple-tree orchards improved slender spindle tree training system, provides structuring crown primarily by relatively severe cuts, especially the shortening of the transfer side parting and oriented horizontally. This attenuates the entry of trees on economic growth and harvest of fruit [2].

In this regard improvement of slender spindle type crown formation in sight of stepping up the entry of the trees on economic growth, rapid growth of the crop of fruit and recovery of capital investments in the superintensive

apple-tree orchards is a current problem in fruit-growing development [5].

MATERIAL AND METHOD

Experimental plot is located in the orchard „Codru-ST” Ltd. Planting was conducted in spring 2000 with the bench graftings on the rootstock M9 of Must Gala, Golden Reinders, Idared varieties. The distances between rows 4.0 m and between trees in row 1.0 m. 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 scaffold branches and above the axis at intervals of 20 cm are uniformly located radially fruit-bearing branches, 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

scaffold branches 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.

Plantation productivity was established in the harvesting period (2003-2006 years) for all variants taken into the study. Capital investments recovery were made by determining real expenses when was established fruit growing plantation.

RESULTS AND DISCUSSIONS

Establishment of superintensive apple orchards with high density of trees - 2500 pieces/ha and more, capital investments was considerable - 166612 lei/ha [5].

Table 1. Capital investments volume per 1 ha for establishment of apple tree superintensive orchards, 200-2001 years

Specification	Measure unit	Quantity	Unitary price, leis	Investments, leis
Fertilizer administration :				
-organic	t	50	65	3 250
-with Phosphor	kg	650	2,75	1 788
-with Potassium	kg	500	2,10	1 050
Semi-render ploughing	ha	1	1 200	1 200
Ploughing leveling	ha	2	350	700
Stake of plot for plantation	person/day	4	50	200
Cost of planting material (graftings)	pcs.	2 500	10	25 000
Plantation with hydrophorator	person/day	15	50	750
Care of trees after plantation	person/day	8	50	400
Cost of materials and espalier installation	t	-	-	15 000
Dripping irrigation system installation	ha	1	22 500	22 500
Wire fence installation	ha	1	1 650	1 650
Other expenses	-	-	-	1 644
Sum				75 132

Considering that the very high cost of apple trees, grafted on rootstock M9 - 15 lei/piece or 37500 lei/ha the orchard was planted with bench-graftings and, consequently, seedling investments were reduced up to 25000 lei/ha.

Capital investment for the establishment of 1 ha of orchard, calculated with prices at that time, is about 75132 lei, including: 25000 lei cost material of the bench-graftings; 22500 lei for the drip irrigation; 15000 lei espalier installing and 11924 lei other expenses (Table 1).

The volume of investments for the maintenance of 1 ha young orchard is about 66484 lei, including by years: 2000 - 11924 lei to the grow from mass grafting one year crowned trees; 2001 - trees crowning start - 9394 lei; 2002 - 9724 lei 2003 entry of the trees on economic fructification - 17281 lei; 2004 - 18161 lei.

The amount of capital investment for the establishment and care of 1 ha young orchard for varieties and variations, taken in the study, are 141018 - 142026 lei in variant 1 and 142684 - 144226 lei in variant 2. In variants 3 and 4 the amount of capital investment does not differ essentially from variant 2.

Least significant difference on investment for varieties and variants of formation taken in the study arrive, in substance, from the harvesting costs of the fruit quantity difference (Table 2).

Table 2. Capital investments recovery in apple tree superintensive orchards according to the type of tree crown formation

Variant of crown formation	Cumulated yield, 2003-2004 years, t/ha	Capital investments, 2000-2004, lei/ha	Value production, 2003-2004, lei/ha	Capital investments recovery in 2004, %
<i>Gala Must variety</i>				
V1	46.22	141616	161770	114
V2	55.83	143940	188405	130
V3	51.84	143140	181440	127
V4	51.22	143016	179270	125
<i>Golden Reinders variety</i>				
V1	48.80	142026	170800	120
V2	58.44	144226	204540	142
V3	56.60	143886	198100	137
V4	52.17	142980	182595	128
<i>Idared variety</i>				
V1	41.90	141018	146650	104
V2	50.04	142684	175.14	123
V3	47.55	142146	166.425	117
V4	46.44	142030	162540	114

Varieties of trees and variants taken in the study entered the economic fructification in the third year (2003) from the initiation of crown training.

Harvest was higher in variant 2, were in the 2003 - 2004 years cumulated apples harvest, taken in the study, is 55.83 t/ha, 58.44 t/ha and 50.04 t/ha prevailing the control variant by 8.14 - 9.64 t/ha or 19-21%.

Revenue from sales of apple production in the years 2003 - 2004, calculated at the price of 3500 lei/t, in variant 2 reaches 188405 lei/ha in Gala Must variety, 204540 lei/ha in Golden Reinders variety and 175140 lei/ha to Idared variety.

The amounts shown ensure the recovery of capital investment at 136%, 142% and 123%. In the control these indices have values of 114%, 120% and 104%, or with 16-22% lower.

Given that grafts care investment to get, in the orchard in 2000, one year grafted trees without parting in the crown area, reach 11924 lei/ha which added to the cost of plant grafting – 25000 lei, make 36924 lei. This amount does not differ essentially from the cost of a year trees produced in the nursery.

Thus becomes annoying orchard establishment with mass grafting compared to the planting of one year trees, produced in the nursery. The availability of sufficient financial resources allow planting of orchard with two years trees crowned in a nursery, which enter economic fructification one year prior to those of one year uncrowned and contributes to faster recovery of capital investment.

The investigations demonstrate that in the year 2005, in the control variant the harvest of the fruits constituted at the Gala Must variety - 38.17 t/ha, at the Golden Reinders variety - 40.83 t/ha and at the Idared variety - 33.43 t/ha. The method of crown forming have an influence on fruit production registered the highest values in 2 variant, where the fruit crop of the study varieties constituted respectively 47.15, 48.63 and 41.11 t/ha, or an augmentation with 19-23% depending on control. The fruits harvest in variants 3 and 4 is smaller in comparison with the variant 2, but superior to the control variant, respectively with 12-16%, or 9-10% (Table 3).

In 2006 year, when the trees have reached the full fructification the fruit harvest of the most variants was: 40.75-43.15 t/ha at the Gala Must variety, 40.95-43.81 t / ha at the Golden

Reinders variety and 40.85-42.72 t / ha et the Idared variety. In the indicated limits, superior values were registered in the second variant that outturned the variant control after the fruit yield with 4-7%. In the variants 3 and 4 the fruit yield is approximately at the variant control.

Table 3. Average fruit production in function of the method of crown formation and trees age, t/ha

Variant of crown formation	2005 year	2006 year	Average, 2005-2006 years	In comparison with control, %
Gala Must variety				
V ₁	38.17	40.75	39.46	100.0
V ₂	47.15	43.15	45.15	114.4
V ₃	42.47	42.37	42.42	107.5
V ₄	42.10	41.15	41.63	105.5
LSD _{0,05}	0.55	0.95	-	-
Golden Reinders variety				
V ₁	40.83	40.95	40.89	100.0
V ₂	48.63	43.81	46.22	113.0
V ₃	46.34	42.17	44.22	108.1
V ₄	44.57	41.76	43.17	105.6
LSD _{0,05}	1.20	0.77	-	-
Idared variety				
V ₁	33.43	40.85	37.14	100.0
V ₂	41.11	42.72	41.92	112.9
V ₃	37.33	41.91	39.62	106.7
V ₄	37.09	41.95	39.52	106.4
LSD _{0,05}	1.15	0.92	-	-

Diminution of fruits yield in comparison with control variant is because, with advancing trees age, cutting were made by reduction of provisional frameworks branches, decreased the number of horizontal shoots by inclination to avoid thicken of the crowns, which reached the maximum size. Simultaneously with the entry into the full fructification the apple trees in 2005 year partially and completely in 2006 year, beginning the cutting of the fructification, which in the all variations have on the base the principle of the cycle rejuvenation of 3-4 years branches [2].

The influence of the crown formation manifests on the economic efficiency of the fruit production in the apple superintensive orchard in the early years (2005-2006) after the trees entering in the full fructification period (Table 4). During this period, the consumption of production, calculated to 1 ha on average 2005-2006 years in variant 1, constituted 40000 lei at the Must Gala variety, 41459 lei at the variety Golden Reinders and 37628 lei at the Idared variety. The higher volume production of consumption was received in variant 2 were the valour on the studies varieties constituted respectively 41140 lei/ha, 42525 lei/ha and

38583 lei/ha. In variants 3 and 4, the volumes production of consumption is higher in compared to the variant 1, but lower than variant 2.

In the structure of the consumption of production on average by varieties, variants and years to study the more substantial weight to combating diseases and pests 32%, 14% for drip irrigation, and 29% for harvesting and thinning of the fruits.

Table 4. Economic efficiency of the fruit production in function of the o crown formation method in the superintensive apple orchard

Variant of crown formation	Income from sales of the production, lei/ha	Costs of production, lei/ha	Profit, lei/ha	Production profitableness, %
Gala Must variety				
V ₁	138287	40000	98110	245.3
V ₂	158025	41166	119869	291.2
V ₃	148470	40606	107863	265.6
V ₄	145887	40482	105405	260.4
Golden Reinders variety				
V ₁	143115	41459	101656	245.2
V ₂	161770	42551	119218	280.2
V ₃	154892	42148	112744	267.5
V ₄	151077	41824	109253	261.2
Idared variety				
V ₁	129990	37628	92362	245.5
V ₂	146702	38543	108159	280.6
V ₃	138670	38089	100589	264.1
V ₄	138570	38123	100447	263.5

The mean profit on varieties and years taken in the study in the control variant is 97376 lei/ha, and the profitableness production - 245%. The higher valour of profits and profitability have been registered in variant 2, which constituted 114750 lei/ha (282%), exceeding the control variant respectively 17373lei (37%). Lower indices of profit (107061 lei/ha) and the profitability of production (265%) occurred in variant 3, but is higher than control variant respectively 9 685 lei/ha (20%). In the variant 4 investigated indices prevailing the control variant on 9150 lei/ha or 19.5%.

CONCLUSIONS

1. The volume of the capital investments for the establishment and care of the superintensive apple orchard constituted a mean on the study varieties 141482 lei / ha. In the structure of this volume, about 33% is the cost of seedlings, 30% installing drip irrigation system, 20%

artificial support installing and 8% by planting land preparation.

2. The higher indices in the recovery of capital investments, the averaged on varieties and study years of 123-142% was dated in the variant where at the base of the slender spindle crown formation is minimizing cutting and designing of two provisional scaffold branches, forced inclination into the free space of the crown of the shoots and branches with vertical growth. This crown formation increased yield and, respectively, the receipt from the fruits sale on the study varieties by 26635-33740 lei/ha in comparison to the control variant.

3. Structuring crown by minimizing the cutting degree, forced inclination of branches and shoots into space on the shaft is manifest in the first 2 years (2005-2006) after entering trees during full fructification. In this variant, the volume of production consumption was on the varieties 38543-425551 lei/ha, the profit-114750 lei/ha, the profitability of production-280,2-291.2%.

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