

BUSINESS AND ECONOMIC EFFECT FROM CULTIVATION OF DENSITY-TREES IN APPLE ORCHARD ON SEEDLING ROOTSTOCKS

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Abstract. During the period 1998 - 2003 in a young apple orchard (1-6 year) with trees of cultivars Florina and Freedom grafted on seedling rootstocks of Winter gold Pearmain and wild apple (standard), planted at 8 m x 7m were cultivated. Other trees called further density-trees from the same cultivars grafted on a clonal rootstock MM 106 (in the rows) and M 9 (between the rows) were grown. It was established that the trees from the two cultivars on seedling rootstocks during the third-fourth year entered almost at the same time into initial fruit bearing period with these trees on MM 106 and M 9. The combination Florina on MM 106 was with the biggest quantity of fruits. The quality of the fruits according to the Bulgarian quality standard was high at all the cultivar-rootstock combination. From the density-trees the yield was average 29250 kg/ha high quality fruits, total production of 17550 lv/ha (1 lv-1 Bulgaria Leva = 0.512 Euro), net income – 6529.5 lv/ha and rate of profitability – 59.29%. The amount of net income (margin of profit) covered the loss of planting and growing of the main trees on seedling rootstocks and the value of the drip irrigation system.

Key words: apple, yield, rootstocks, planting, growing

INTRODUCTION

Non effective use of the land during the juvenile years in orchards with trees grafted on seedling rootstocks can be compensate with growing trees grafted on dwarf and semi-dwarf growing rootstocks (2). Dates in this relation are not available in our country, because this problem was no actually for the intensive apple orchards, because of early entering in fruit bearing period of the trees grafted on dwarf and semi-dwarf growing clonal rootstocks and high density of planting. Cultivation of density-trees can be considered as a factor for increasing effectiveness and stability of the apple growing. This problem is actual in connection with coming up drought in the following decades (1), because seedling rootstocks are more resistant to the soil drought.

The aim of our investigation was to establish the business and economic effect of growing density-trees in apple orchards on seedling rootstocks.

MATERIALS AND METHODS

The experimental orchard was planted in the spring of 1998 with apple trees, cultivars Freedom and Florina, grafted on seedlings of Winter gold Pearmain and wild apple. The density-trees were from the same cultivars, grafted on clonal rootstocks MM 106 and M 9. The main trees on the seedling rootstocks were planted at distance 8 m between the rows and 7 m between trees in the row – 179 trees per ha. In the rows, at an interval of a tree in 3.5 m

were planted density-trees, grafted on MM 106 - 179 trees per ha. Between the rows, at 4 m apart of the main row, in every 2 m were planted trees grafted on M 9 – 625 trees per ha. The high- density apple orchard was as follow:

- I. Trees, grafted on seedling generations of Winter gold Pearmain and density-trees, grafted on MM 106 and M 9.
- II. Trees, grafted on seedling generations of wild apple (standard) and density-trees, grafted on MM 106 and M 9.

The experiment was established according to the standard method with 14 trees in every variant, distributed in 4 repetitions. The trees, grafted on seedling rootstocks were formed in a free grown crown and these on clonal rootstocks - as a free spindle, and minimal pruning was applied. Deep subsoil ploughing was applied before planting of the trees. Fertilizers were used before and during the planting. The land was maintained in black fallow. An overhead irrigation was used and plant protection scheme was integrated.

The following indices were used for the assessment of the examined factors: a yield from cultivar-rootstock combination (kg); quality of the fruits according to the Bulgarian quality standard (size); total production (lv/ha – 1 lv-1 Bulgaria Leva = 0.512 Euro); price of realization (0.6 lv/kg); costs for planting and growing (lv/ha); net income (lv/ha); rate of profitability (%).

RESULTS AND DISCUSSIONS

The trees from both cultivars on all kind of rootstocks entered into initial fruiting period during the third-fourth year. The total highest yield for the investigated period was (table 1): for Florina, grafted on clonal rootstock MM 106 – 53.9 kg (9650 kg/ha), followed by in descending order - Florina on wild apple – 48.6 kg (8590 kg/ha), Freedom on seedling rootstocks of Winter gold Pearmain – 44.0 kg (7880 kg/ha).

Table 1
Yield and quality of the fruits according to the Bulgarian quality standard for the period 2000 - 2003

Cultivar	Rootstock	Total yield		Quality according to the Bulgarian quality standard (at size)					
		kg/tree	kg/ha	Extra		I		II	
				kg/ha	%	kg/ha	%	kg/ha	%
Florina	Winter gold Pearmain	35.3	6320	6090	96.36	180	2.85	50	0.79
	Wild apple	48.0	8590	8310	96.74	240	2.79	40	0.47
	GD 5 %	12.01							
	MM 106	53.9	9650	8640	89.53	180	8.40	200	2.07
	M 9	30.8	19250	16970	88.16	2000	10.39	280	1.45
Freedom	Winter gold Pearmain	44.0	7880	7060	89.59	700	8.88	120	1.52
	Wild apple	36.9	6610	6040	91.38	500	7.56	700	1.06
	GD 5 %	NS							
	MM 106	45.6	8160	7310	89.58	710	8.70	140	1.71
	M 9	34.3	21440	19260	89.93	1730	8.06	450	2.10

The yield from both cultivars on clonal rootstock M 9 was the lowest – 30 and 34.3 kg per tree. Similar dates (4) were reported in the region of Plovdiv for the apple cultivars

Golden delicious, Starkrimson and Red Jonathan, grafted on seedling rootstocks and MM 106. The early beginning of the initial fruiting period of the trees on seedling rootstocks can be explained with the characteristic of the cultivars and the slight pruning applied during the juvenile period.

Because of the different number of the trees per ha, the yield from density-trees was more than twice smaller on MM 106 compared with those on M9. The total yield from the main trees on seedling rootstocks and this from density-trees varied between 35220 and 37490 kg/ha, or the difference was small. The yield from the density-trees (grafted on MM 106 and M 9) in both cultivars was almost the same – Florina – 28900 kg/ha and Freedom – 29600 kg/ha. The average yield from both cultivars is 29250 kg/ha.

The seedling rootstocks in both cultivars did not have considerable influence on the quality of the fruits, according to the Bulgarian quality standard (in size). The predominant part of them (over 89%) in Freedom were in grade “extra”, and in Florina – over 96%.

At density-trees on MM 106 and M 9 the relative part of the fruits in “extra” grade in both cultivars was also high – over 88%. However, on the rootstock M 9 the number of the fruits from “extra” grade was considerable higher then the rootstock MM 106, which can be explained with the bigger number of trees per ha. Therefore, the quality of the fruits (in size), according to the Bulgarian quality standard was high at all the cultivar-rootstocks combinations.

The amount of expenses for planting and growing of density-trees in the row was 1864.4 lv/ha, and between the rows – 9156.0 lv/ha (table 2). The difference was determined by the bigger number of the trees, growing between the main rows, and by the circumstances, that the considerable part of expenses for the trees in the row concerns main trees (preparation of the soil before planting, soil management, plant protection, irrigation). The total expenses for the density-trees to the sixth year inclusive were 11020.50 lv/ha. The total production for this period was 17550 lv/ha - 5343.00 lv/ha belong to density-trees on MM 106 growing in the row and 12207.00 lv/ha - to those on M 9, growing between the rows.

Table 2

Yield from the density-trees and economic indices, average for the two cultivars

№	Indices	Measure	In the row - MM 106	In inter-rows – M 9	Total
1.	Total yield	kg/ha	8900.00	20350.00	29250
2.	Total production	lv/ha	5343.00	12207.00	17550
3.	Expenses	lv/ha	1864.40	9156.00	11020.50
	- planting	lv/ha	1074.10	3576.00	4650.10
	- growing	lv/ha	790.40	5580.00	6370.40
4.	Net income	lv/ha	3478.60	3051.00	6526.50
5.	Rate of profitability	%	186.58	33.32	59.29

The net income from growing of density-trees in the row was 3478.60 lv/ha, and in between the rows 3051.00 lv/ha – or total 6526.50 lv/ha. The amount of the total net income covered the loss of planting and growing of the orchard with the main trees on seedling rootstock and the cost of investments for the drip irrigation system (3).

The rate of profitability, as general economic indices was 186.58 % at density-trees, grown in the row and 33.32% for these, growing between the rows. The high value of the rate of profitability for density-trees, growing in the row was determined by the smaller size of the

direct costs. The average value of the rate of profitability total - both density-trees, growing in the row and in between the rows was 59.29 %, which can be consider as high in the apple growing.

CONCLUSIONS

The trees from early fruiting and vigorously growing cultivars Florina and Freedom, grafted on seedling rootstocks of wild apple and Winter gold Pearmain, entered nearly at the same time into initial of fruit bearing during the third – fourth year with these trees on MM 106 and M 9. The combination with the highest yield (3-6 years) is Florina on MM 106, followed by Florina on wild apple, Freedom on MM 106, Freedom on Winter Gold Pearmain, Freedom on M 9 and Florina on M 9. The quality of the fruits according to the Bulgarian quality standard is high at all the cultivar-rootstocks combinations.

From the cultivated density-trees till the end of the sixth vegetation are obtained 29250 kg/ha high quality fruits, total production of 17550 lv/ha, net income – 6529.50 lv/ha, at rate of profitability – 59.29 %. The value of the net income covers the loss of planting and growing of the main trees on seedling rootstocks and the value of the drip irrigation system.

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REZUMAT

EPECTELE ECONOMICE ALE CULTIVĂRII MĂRULUI ÎN LIVEZI DE MARE DENSITATE ȘI PE PORTALTOI GENERATIVI

A fost studiată o livadă înființată în anul 1998, cu soiurile Florina și Freedom altoite pe portaltoi generativi Winter gold Permain și măr pădureț, distanțele de plantare fiind de 8 m x 7 m, pomii fiind altoiți pe MM 106 și M 9. S-a observat că pomii obținuți prin altoirea pe portaltoi generativi au intrat în anii trei-patru pe rod, aproape concomitent cu cei obținuți prin altoire pe MM 106 și M 9. Soiul Florina altoit pe MM 106 a avut fructele cele mai mari. Conform standardelor din Bulgaria, calitatea fructelor a fost ridicată la toate combinațiile soi-portaltoi. Pomii altoiți pe MM 106 și M 9 au dat producții de 29250 kg/ha, cu un venit total de 17550 lv/ha (1 lv-1 Bulgaria Leva = 0.512 Euro), venitul net de 6529,5 lv/ha, iar rata profitului de 59,29%. Profitul a acoperit investițiile făcute la plantarea și întreținerea pomilor altoiți pe portaltoi generativi, precum și cheltuielile făcute cu realizarea sistemului de irigare.