

INCREASING THE ECONOMIC PERFORMANCE BY PROMOTING HIGH-DENSITY APPLE ORCHARDS IN THE DÂMBOVIȚA FRUIT BASIN

Gheorghe PETRE¹, Valeria PETRE¹, Adrian ASĂNICĂ²

¹Research and Development Station for Fruit Growing Voinești, 387 Main Street, Voinești, Romania

²University of Agronomic Sciences and Veterinary Medicine of Bucharest, 59 Mărăști Blvd, District 1, 011464, Bucharest, Romania

Corresponding author email: asanica@gmail.com

Abstract

The researches carried out at the Research and Development Station for Fruit Growing Voinești in the period 2015 - 2017, had as objective the evidence of modern plantations established after 2007 by the producers of SC Mere de Voinești SRL; Owner Dan Ionescu, and I.I. Luminita Marin from Malu cu Flori. The tree culture in high density system extends mainly to apple trees in the Dâmbovița fruit-tree basin, the interest of fruit growers is evident in the promotion of productive varieties, well adapted to the pedoclimatic conditions of the area, grafted on M.9 rootstock planted at a distance of 3,5 x 1 m, with a density of 2,857 trees/ha. The biggest yield belonging to SC Mere de Voinești SRL were harvested from following varieties: 'Golden delicious' (43.2 t/ha), 'Braeburn' (35.4 t/ha) and 'Gala' (35.2 t/ha), trees that are 9-11 years old, in comparison with 'Gala' apple varieties (36.2 t/ha) and 'Idared' (33.8 t/ha) of 7-8 years old. In the apple tree orchard for 3 years, in the 'Golden delicious' and 'Jonaprince' varieties, production of 40.2 t/ha and 38.6 t/ha was achieved in 2017. At the Owner Dan Ionescu, with 8 years old trees, the most productive varieties were: 'Golden delicious' (38.9 t/ha), 'Idared' (34.7 t/ha) and 'Gala' (32.7 t/ha), and the producer I.I. Luminita Marin, located in Malu cu Flori, with trees in the 4th year after planting, recorded 34.3 t/ha in the 'Red Gala' variety, 46.8 t/ha in 'Golden delicious' and 42.8 t/ha to 'Pinova'. The high density apple system is recommended for expansion in the well-established fruit-growing areas of our country, including the Dâmbovița fruit basin, due to the high yield and efficiency, the way of periodic and rapid replacement of the assortments, demanded more and more by consumers.

Key words: high apple density system, apple assortment, yield, crop systems.

INTRODUCTION

Fruit growing remains one of the field of horticulture of great interest to growers in the traditional fruit-growing areas in Romania. Both from an economic and social point of view, the cultivation of trees and in particular the apple trees provides permanent activity and manages to capitalize inappropriate areas for other agricultural crops.

The extension of modern apple culture systems with higher precocity and short-term exploitation is a way of periodic and rapid replacement of the assortments (Petre Gh., 2006). In this regard, introduction of modern techniques and novelties in the production adapt better the apple to the high quality European standards (Comanescu D., 2015; Petre Gh. et al., 2005).

Apples are nowadays cultivated in high density system and faster expand in Romanian fruit growing areas, the results achieved confirm its

full economic efficiency. The generalization of the high-density apple system (Petre Gh. et al., 2009), represents the upgrade of the modernization of the fruit growing sector in our country, including the Dâmbovița basin.

MATERIALS AND METHODS

By implementing the fruit tree thematic subprogram of PNDR in the period 2015 - 2020, the aim is to increase the technical and economic competitiveness in fruit growing sector, by promoting technologies adapted to the pedoclimatic conditions in Romania, with the goal to set up new apple plantations, including in the Dâmbovița fruit basin.

In order to emphasize the interest of the Dâmbovița fruit growers in the promotion of modern culture systems, during the period 2015-2017 some high-density apple plantations, established after 2007, by some apple producers from Dâmbovița fruit basin

were highlighted: SC Mere de Voinești SRL; Owner Dan Ionescu; I.I. Luminita Marin from Malu cu Flori.

Data on the planted area, varieties and rootstocks used, planting distances, soil maintenance, crown shape, phytosanitary treatments scheme, fertilization etc. were recorded. Also, the production potential of the apple trees was monitored, especially since the newly established plantations used trees from Italy or Netherland, with varieties different from the ones regularly cultivated in Romania.

RESULTS AND DISCUSSIONS

The high density apple system offers the possibility of easy change the assortment (due to the short period of cultivation), pedestrian labour in the orchard, increased performance in terms of yield and production quality.

In recent years, in the Dâmbovița fruit tree basin, especially apple tends to generalize the

high density culture system, the interest of the fruit growers is evident through the establishment of new modern plantations, using European varieties, proved to be well adapted to the pedoclimatic of the county.

Evidence of high-density apple systems in the Dâmbovița fruit basin

The significant successes achieved in the world fruit tree, but especially in the European one in recent years, as well as the valuable experience gained, led some of the farmers in the Dâmbovița fruit basin to show interest in expanding the apple-tree system, replacing the old plantations with over aged trees characterized by a low production potential.

The tendency to expand the high-density apple orchards to some of the Dâmbovița fruit growers is outlined in Table 1 by planted areas, the age of trees and the density of planting.

Table 1. The examples of high density apple orchards in the Dâmbovița County

No	Owner	Area planted (ha)	Year of planting	Trees age (years)	Planting distances (m)	Trees/ha
1	SC Mere de Voinești SRL	4	2007	11	3.5 x 1	2,857
		4	2009	9	3.5 x 1	2,857
		2	2010	8	3.5 x 1	2,857
		7	2011	7	3.5 x 1	2,857
		6	2015	3	3.5 x 1	2,857
2	Dan Ionescu	5	2010	8	3.5 x 1	2,857
3	I.I. Luminita Marin - Malu cu Flori	1.50	2014	4	3.5 x 1	2,857

From the data presented in the above table, SC Mere de Voinești SRL has an area of 23 ha, cultivated with apple in a high density system, with trees aged from 3 to 11 years, planted at a distance of 3.5 x 1 m, of 2,857 trees/ha. At the same planting density (2,857 trees/ha), but with the age of trees of 4-8 years old, there are apple orchards belonging to Dan Ionescu farmer, with a surface of 5 ha and I.I. Luminita Marin - Malu cu Flori with a surface of 1.5 ha.

The 23 ha, cultivated with apple at SC Mere de Voinești SRL, are equipped with a 3-wire trellising system, the first one placed at 60 cm from the ground, on which the drip irrigation system of 2.2 l/h is tied up.

The irrigation system can be used for fertilizers. The apple assortment consists of varieties 'Braeburn', 'Gala', 'Ionaprince', 'Granny Smith', 'Golden delicious', 'Stark' group of different types

grafted on M9 rootstock. The fruit trees were purchased from Italy.

The area of 5 ha cultivated with apple by Dan Ionescu, the assortment consists of the apple varieties 'Golden delicious', 'Idared', 'Granny Smith', 'Braeburn', 'Gala' grafted on the M9 rootstock. The Dutch system is present with a wood tutor for each individual tree.

The irrigation system is layered on the ground and provide a flow rate of 2 l/h.

At the I.I. Luminita Marin from Malu cu Flori, the assortment consists of 'Pinova', 'Red Gala' and 'Golden delicious' varieties grafted on M9. The support system has 2 wires, the first wire is situated at 60 cm from the ground level, on which the drip irrigation pipes are installed and work with a flow rate of 2 l/h. Each tree is supported by a bamboo stick.

Apples cultivated on these plots, are susceptible to diseases.

Therefore, to ensure a proper phytosanitary state, a number of 16-18 phytosanitary treatments have been applied annually.

In the overproduction years, the chemical thinning of the fruit, followed by a manual thin, was applied to obtain fruits with valuable appearance and price on the market.

In all of these apple orchards, the trees are trained as Spindle bush and the soil is maintained between the rows covered with grass and clean within the row using different herbicides.

Evaluation of production potential in apple-tree orchards in the Dâmbovița fruit basin

In 2017, due to the low temperatures below the freezing threshold recorded in the area, the yields were substantially reduced depending on the variety and age of the trees.

Analyzing the productions obtained by SC Mere de Voinești SRL during the 3 years of study (2015-2017), it is obvious that the most productive apple varieties in the 9-11 years old trees were 'Golden delicious' with 43.2 t/ha, followed by the 'Braeburn' apple variety with 35.4 t/ha and 'Gala' with 35.2 t/ha (Table 2).

Table 2. The apple yield obtained at the varieties cultivated in the high density system between 2015-2017 by SC Mere de Voinești SRL

Apple trees age (years)	Trees/ha	Variety/M9	Yield (t/ha), year			Average (t/ha)
			2015	2016	2017	
9 - 11	2,857	'Gala'	42.0	47.1	16.5	35.2
		'Golden delicious'	36.0	75.1	18.6	43.2
		'Braeburn'	48.0	50.0	8.3	35.4
		'Stark delicious'	20.0	45.1	15.0	26.7
		'Granny Smith'	21.0	41.7	12.0	24.9
7 - 8	2,857	'Gala'	36.8	53.1	18.6	36.2
		'Stark delicious'	20.6	40.3	28.6	29.8
		'Ionaprince'	20.4	45.1	15.2	26.9
		'Idared'	35.6	47.1	18.6	33.8
3	2,857	'Golden delicious'	18.2	14.6	40.2	24.3
		'Stark delicious'	15.4	12.8	28.3	18.8
		'Ionaprince'	12.6	15.7	38.6	22.3

In the 7-8 years old trees, the highest yields, averaging 3 years of production, were recorded by 'Gala' variety with 36.2 t/ha, followed by the 'Idared' variety with 33.8 t/ha. In the apple orchard with 3 years old trees, in 2017, the 'Golden delicious' variety, recorded a production of 40.2 t/ha and 38.6 t/ha for the 'Ionaprince' variety. The production was considered as normal because the flower buds in the frozen moment was in the balloon stage and were not affected.

Dan Ionescu, in 2017, in 8-year-old trees, registered a drastically reduced production compared to the previous year due to the frost phenomena. The smallest production was recorded in the 'Braeburn' variety by 8 t/ha (considered less adapted to the climatic conditions in the Voinești area). The highest yields, were obtained by 'Golden Delicious' with 31.3 t/ha, followed by 'Idared', with 20.6 t/ha (Table 3).

Table 3. The apple yield obtained at the varieties cultivated in the high density system between 2015-2017 by Dan Ionescu and I.I. Luminita Marin - Malu cu Flori

Apple trees age (years)	Trees/ha	Variety/M9	Yield (t/ha), year			Average (t/ha)
			2015	2016	2017	
8	2,857	'Golden delicious'	25.0	60.3	31.3	38.9
		'Idared'	18.3	65.1	20.6	34.7
		'Granny Smith'	18.2	30.3	15.5	21.3
		'Braeburn'	24.3	59.4	8.0	30.6
		'Gala'	24.8	58.8	14.6	32.7
4	2,857	'Pinova'	30.0	35.7	42.8	36.2
		'Red Gala'	30.0	25.1	34.3	29.8
		'Golden delicious'	29.8	30.0	46.8	35.5

Analyzing the production recorded over the 3 years of study, the highest yields were recorded in the ‘Golden delicious’ apple variety with 38.9 t/ha, ‘Idared’ by 34.7 t/ha and ‘Gala’ with 32.7 t/ha.

Luminita Marin, located in Malu cu Flori, harvested from the 4th year trees, in 2017 34.3 t/ha to 46.8 t/ha, depending on variety, as follows: ‘Red Gala’ - 34.3 t/ha, ‘Golden delicious’ 46.8 t/ha and ‘Pinova’ 42.8 t/ha. Analyzing the productions recorded during the 3 years of study, ‘Pinova’ was the most productive apple variety with 36.2 t/ha close to next one ‘Golden delicious’ with 35.5 t/ha.

The efficiency of the high-density apple system compared to other cultivation systems

The intensification of the fruit growing sector in our country must accept as an important objective the introduction of new intensive crop cultivation systems adapted to the new socio-economic conditions and to the continuously developing technical and material basis.

In connection with the introduction of new crop systems, it should be noted that the conventional or classic culture system has a number of limits beyond which it is not overpassed, regardless of the applied technologies.

The production of fruit is delayed in the classical orchards, from 8-10 years onwards after planting. Some high-volume main works, such as pruning and harvesting fruit, require excessive workload due to the high tree height, 7-10 m, which forces growers to use large and inconvenient stairs. The mechanized execution of phytosanitary treatments, soil maintenance is hampered by the globular form of the crown or is realised with low efficiency and uneconomically.

Intensive crops and, above all, high-density plants offer greater flexibility in changing fruit varieties due to the lower economic exploitation period of these orchards (22 to 30 years in intensive orchards, 15-16 years to high density ones).

The yields of the high density production of apple during the exploitation period are superior, reflected by the productive potential differences compared to the intensive and classic culture systems (Figure 1).

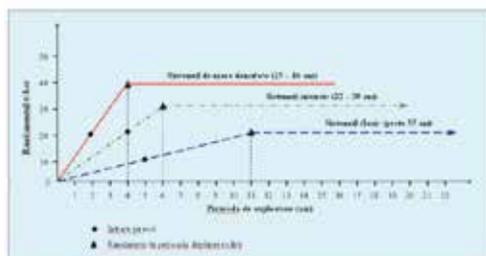


Figure 1. The efficiency and the exploitation period of apple orchards in different cultural systems

The differences between the apple culture systems are quite obvious in terms of fruit input of the trees, the economic growth and the level of production during the full production period, as well as the upper limit of the exploitation period.

What really differentiates apple cultivation systems is the precocity. The classic system start be economically after 10-12 years from planting, to the intensive system after 6-7 years, and to the high density after 3-4 years.

If we take into consideration the first 10 years since planting, it is clear that the yields produced significantly differences in the apple culture systems. If the high-density and even intensive system yields/ha is high as a result of the rapid entry of the fruit trees and the achievement of a large productive volume of the crown through the planting density itself, the classic system should expect much more for both the bearing of fruit trees and the formation of the skeleton branches for yield bearing.

The high density apple system is recommended for extension in the well-established fruit-growing areas of our country, including the Dâmbovița fruit basin, due to the high yield and efficiency, the way of periodic and rapid replacement of the assortments, but also the obtaining of bigger apples volumes demanded more and more by consumers.

CONCLUSIONS

The high density system expands mainly to apple trees in the Dâmbovița fruit basin, the interest of fruit growers is evident in the promotion of productive varieties well adapted to the pedoclimatic conditions of the area, grafted on the M9 rootstock planted at a

distance of 3.5 x 1 m, with planting density of 2,857 trees/ha.

Although the production was diminished by the low temperatures recorded during the flowering period in 2017, the highest average production for three years period belonging to SC Mere de Voinești was recorded in 9-11 years old apple trees by the varieties: 'Golden delicious', 'Braeburn' and 'Gala' and in 7-8 years old apple trees, the varieties 'Gala' and 'Idared'.

In the apple tree orchard for 3 years, the 'Golden delicious' and 'Ionaprince' varieties produced 40.2 t/ha and 38.6 t/ha in 2017.

In Dan Ionescu orchard, the 8 years old trees performed better in varieties such as: 'Golden delicious', 'Idared' and 'Gala'.

Luminita Marin from Malu cu Flori, highlight the 4th year trees, that produced from 34.3 t/ha to 46.8 t/ha It was remarked 'Red Gala', 'Golden delicious' and 'Pinova'.

REFERENCES

- Comănescu D.N., 2012. Cercetări privind sistemul de mare densitate la măr, în scopul obținerii de producții adaptate la cerințele de comercializare, Teză de doctorat.
- Petre Gh., 2006. Cerințele pomiculturii moderne. Revista Amsem, nr.7, decembrie.
- Petre Gh, Andreiș N, Petre V., 2005. Tehnologia obținerii unor producții de mere competitive. Editura Pilner Târgoviște.
- Petre Gh, Petre V., Comănescu D.N., 2009. Promovarea sistemelor moderne la măr, în pomicultura românească. Revista Agricultorul român, nr.9.

