COMPORTAREA UNOR SOIURI DE MĂR CU REZISTENȚĂ GENETICĂ LA BOLI, ÎN SISTEM DE MARE DENSITATE, ÎN CONDIȚIILE DE LA VOINEŞTI - DÂMBOVIȚA

THE BEHAVIOUR OF SOME GENETIC DISEASE RESISTANT APPLE TREE CULTIVARS, IN HIGH DENSITY SYSTEM, UNDER THE CONDITIONS IN VOINEŞTI - DÂMBOVIȚA

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Abstract

The researches undertaken at the Research Station for Growing Fruit Growing (RSFG) Voineşti, by setting up in the year 2007 a high density apple tree plantation, with diseases resistant assortment, opens up new perspectives for extending in the private farms of the modern orchards, which will attain the remarkable performances similar to the countries with a developed fruit culture. The results obtained at Voinesti, recommend the extension in culture of the apple tree high density system, due to the high economical efficiency and also due to the fact that it permits the rapid adoption of the assortments and technologies according to the market requirements and the steadily growing general technical level.

Key words: apple tree high density system, genetic disease resistant breeds.
Cuvinte cheie: sistem de mar de inalta densitate, rezistenta la boli genetice

1. Introduction

As everywhere in the agricultural and tree growing production, the most suitable solutions for increasing the economic outputs per surface unit are searched for, by the adoption of new systems of modern culture, which shall assure quantitative and qualitative superior productions.

The modern apple tree culture, with rapid fruit growing start and short exploitation duration, represents a modality of periodical replacement of the assortments, thus being encouraged the introduction of modern techniques and ideas in obtaining productions adapted to the requirements of the European quality standards.

On European level, they generalized the use of the midget graft bearers like M9, of weak strength, with trees sustaining and irrigation system, covering the orchards with anti-hail nets. In the high density tree growing exploitations in France, Italy, Germany, Spain, Switzerland, etc., with densities of 2500 - 3000 trees/Ha, they obtain remarkable performances, concreted by productions of 40 - 60 t/Ha.

The researches undertaken at the Voinesti by the establishment in the year 2007 of a high density apple tree plantation with a diseases resistant assortment will represent a model for the extension to the private farms of our county's consecrated tree growing zones, with possibilities to recuperate rapidly the investments.

2. Material and methods

The researches were organized at the at the in the spring of the year 2007, aiming to the promotion of a high density apple tree system, based on disease resistant cultivars, and the adoption of specific technological solutions, leading to an early fruit growing start and to the permanent fruits growing on young wood.

The genetic disease resistant apple tree assortment proposed for the experimentation: Redix, Iris, Real, Remar, Inedit, Luca, Rebra, Entreprise, Saturn, Golden Lasa, Goldrush, Ariwa, were grafted on M9.

The trees were planted at a distance of 4x1 m (2500 trees/Ha), crown form Slender Sprindle.

The apple tree assortment, used at setting up the orchard, had in the view the trees growing potential, the fruit bearing precocity, the productions level, the fruits quality in the years 2 - 4 after planting, the resistance against diseases and other culture aspects, which represent factors to be taken into account at the promotion in culture of the high density apple tree orchards.

The soil of the experimental lot was fallow on the interval and clean of weeds in the trees row, being brown eumezobazic weakly pseudogleizat, with a clayish texture, with a weak pH (5.7 – 5.9). The humus content is medium at the surface (2.0 – 2.9%), medium supplied with nitrogen and weakly supplied with phosphorus and potassium.

The climatic conditions were favorable for the growth and the fruit bearing of the trees, characterized by a medium annual temperature greater with 0.6^0 C, than the zone' normal (8.8^0 C), with an annual rainfalls sum of 693 mm.

For the pests control, 6 - 8 treatments, only with insecticides, were applied. The other works were performed according to the technology specific for the high density apple tree orchards.

3. Results and discussions

In Romania, after the year 1990, by applying the Land Fund Law, a part of the intensive apple tree orchards came back to the private owners. Presently these orchards are aged, (they have an age of over 40 years), the trees have a low production potential, an inferior fruits quality, between limits that cannot be surpassed, regardless of the level of the applied technologies.

The apple producers will be obliged in the next years to replace the old plantations with modern culture systems, with rapid fruit bearing start, with cultivars asked for by the consumers, those of high productivity, with superior quality fruits, competitive both on the internal market and for export.

The high density apple tree system offers more facilities regarding the assortment exchange (due to the shorter exploitation period of these orchards), an increased output in performing the works (performed all from the soil) - and also quantitative and qualitative superior productions.

The promotion of the apple tree high density tree system, with foreseen disease resistant cultivars, grafted on weak strength rootstock (M9), leads to the identification of new tree growing technologies, which have a positive impact in short time on the productivity increase in the newly set up plantations, with immediate profitability in the agricultural – food chain: production, storage, sorting – packing, marketing. In the same time the realization of apple lots with reduced pesticide residue content is aimed at, these being more and more needed in the consumers' diet.

The realizations on European level, regarding the apple tree culture, have attained presently remarkable performances in the great cultivating countries, both regarding the assortment and the culture technology.

By promoting the apple tree high density system in our country's traditional tree growing zones, the aim is the rapid replacement of the existing declining plantations with performant plantations, which bear fruits in the second and in the third year after planting and which reach the maximum potential in the years 5 - 6 after planting, with the obligation to clear the trees aged 15 - 16 years, in view of the assortment exchange according to the fruit market requirements.

The results obtained at the Voineşti Station in the period 2007 – 2010 are promising and mandatory to be followed up for the promotion in culture of the most precocious and productive cultivars, suitable to the high density apple tree system.

The tree growth strength at the studied genetic disease resistant apple tree cultivars is expressed under the quantitative aspect by the vegetative growth volume, accumulated annually by the trunk dimensions, the tree crown height and dimension, these being determined by the cultivars strength, but also by the soil fertility, the unchanged factor being the rootstock.

The growth vigour in the tree fourth age year, when the growing potential outlines itself rather well, shows us that between the genetic disease resistant apple tree cultivars appear differences regarding the trunk thickness growth, the crown height and the diameter (*Table 1*).

In the trees planting year (2007), the trunk dimensions register values comprised between 7.79 mm and 10.90 mm, conferring the planting material uniformity, with insignificant differences between the cultivars.

In the year 4 after planting, the genetic disease resistant apple tree cultivars, grafted on the rootstock M.9, differentiate themselves:

- High vigour, with a trunk diameter of over 40 mm: Luca (41.68.mm), Golden Lasa (41.97 mm), Enterprise (43.43 mm);
- medium vigour, with a trunk diameter comprised between 35 and 40 mm: Iris (35.31 mm), Inedit (35.85 mm), Redix (36.60 mm), Rebra (38.16 mm) and Remar (38.25 mm);
- Low vigour, with a trunk diameter of less than 35 mm: Ariwa (33.34 mm), Real (32.40 mm), Saturn (37.09 mm), Goldrush (29.63 mm).

The annual vigour increase respects somehow the apple tree cultivars classification after the trunk diameter, registering values comprised between 6.84 mm at the apple tree cultivar Goldrush and 11.68 mm at the apple tree cultivar Enteprise.

The tree height in the year 4 after planting was comprised between 210 and 270 cm, with a fruit bearing fence width of 120 – 180 cm, determining a crown volume comprised between 4,800 and 9,675 cubic m/Ha

The productions obtained in the year 3 after planting, demonstrate the special performances of the apple tree high density system, which can be extended into the traditional tree growing zones, with the most productive cultivars having fruits with a quality conforming to the market requirements.

From the apple tree variety cultivated in the apple tree high density system, the Iris cultivar, grafted on the rootstock M9 has the tendency to bear fruits yet in the year 2 after planting.

From the year 3 after planting, the 12 genetic disease resistant apple tree cultivars, grafted on the rootstock M9, realized satisfactory productions, having in view that at planting we used planting material from the field II of nursery, rods without anticipated offshoots, as support of the fruit bearing buds yet from the planting year.

From the data presented in table 2, results that form the studied apple tree assortment, the most precocious and productive Romanian cultivars: Real (7.5 t/Ha), Inedit (6.5 t/Ha), Iris (6.3 t/Ha), Remar (3.8 t/Ha).

From the foreign cultivars stand out with productions in the year 3 after planting: Saturn (5.8 t/Ha), Ariwa (5.5 t/Ha), Golden Lasa (5.5 t/Ha), Goldrush (5.0 t/Ha).

In the year 4 after planting, the productions registered at the genetic disease resistant apple tree cultivars, cultivated in the high density system, were comprised between 10.7 t/Ha at the cultivar Rebra and 21.9 t/Ha at the cultivar Ariwa.

From the Romanian cultivars which produced over 18 t/Ha stand out: Inedit (18.5 t/Ha), Real (18.8 t/Ha), Remar (19.8 t/Ha), Iris (20.4 t/Ha), and from the foreign ones: Golden Lasa (19.4 t/Ha), Goldrush (20.8 t/Ha), Saturn (21.6 t/Ha) and Ariwa (21.9 t/Ha).

The fruits weight (g) was variable, comprised between 160 g at the Goldrush cultivar and 190 g at the Rebra and Remar cultivars. The trees being young, they realized fruits surpassing 170 g, with a calibre corresponding to the marketing standards. At the majority of the cultivars, the fruits had diameters of over 70 mm. The cultivars Goldrush and Inedit present themselves with smaller fruits.

In the experimentation period, the studied apple tree cultivars presented a very good resistance against apple scab (*Venturia inaequalis*) and a reduced attack degree to mildew (*Podosphaera leucotricha*) under the conditions of using only insecticides at performing the phyto-sanitary treatments. In the year 3 after planting (the first fruit bearing year), at the last treatment a contact product was used, in order to prevent the *Gleosporium* attack.

The introduction and the generalization of the apple tree high density system, with disease resistant cultivars, into the traditional tree growing zones, creates the premises for obtaining apple lots with reduced pesticide residues, beneficial to the consumers.

By promoting genetic disease resistant apple tree cultivars, the number of treatments is substantially reduced in the orchards, simultaneously with reducing the production costs (*Table 3*)

From the data presented in the *table 3*, results that between the 2 assortments cultivated are pointed out significant differences regarding the total number of treatments at warning, necessary during the vegetation period, the pesticides quantities, the fuel consumption and the afferent costs.

Thus, in the orchard with sensitive cultivars, the medium number of performed treatments was 15, whereas in the orchard with resistant cultivars it was 7. The savings realized in the orchard with resistant cultivars by eliminating the fungicides in a proportion of 90% - and by reducing those with the insecticides and acaricides by 81%, represent 66%, as compared with the sensitive cultivars, which means that in the orchards with disease resistant cultivars 50% lesser spraying is applied - and its value is 2 times lower than in the orchards with a classical sensitive assortment. The fuel consumption is reduced by 53%.

Besides the registered beneficial economical effects, we must also add the pollution reduction, the more rapid regeneration of the populations of natural predators and parasites and the maintaining of the fruits quality standard.

The results obtained at the Voinesti, recommend the extension in culture of the apple tree high density system, due to the high economical efficiency and also due to the fact that it permits the rapid adaptation of the assortments and of the technologies in accordance with the consumption requirements and with the general, continuously growing, technical level.

4. Conclusions

The vigour in the trees age year 4, represented by the trunk dimensions, registers values comprised between 29.63 mm at the Goldrush cultivar and 43.43 mm at the Enteprise cultivar, having the greatest strength. The crown volume was comprised between 4800 and 9675 cubic m/ha.

At the promotion in culture of the apple tree high density system, it is mandatory to use weak strength rootstock (M9) and the sustaining and dropping or micro jet irrigation system.

From the studied genetic disease resistant apple tree cultivars assortment, the most precocious and productive cultivars, suitable for the promotion in the high density system are: Real, Inedit, Iris, Remar among the Romanian cultivars and Saturn, Ariwa, Golden Lasa, Goldrush among the foreign cultivars, which have realized quantitative superior productions in the years 3 - 4 after planting and fruits with a quality corresponding to the market requirements.

The savings realized in the orchard with disease resistant apple tree cultivars, by eliminating the fungicides and by reducing the insecticides and the acaricides, was of 62% - meaning that in the orchards with disease resistant cultivars, with 50% lesser spraying is applied – and the its value is 2 times lower, as compared to the orchards with a classical sensitive assortment.

The high density apple tree system, in which genetic disease resistant cultivars are provided for, grafted on a low vigour rootstock (M9), with the density of 2,500 trees/Ha (the distance 4x1m) - are recommended for the extension in our country's traditional tree growing zones, due to the high

economical efficiency, to the periodical and rapid replacement modality of the assortments and to obtaining of apple lots with reduced pesticide residues, beneficial to the consumers.

5. References

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Tables and figures

Table 1. The growth potential of some genetic disease resistant apple tree varieties, cultivated in the high density system (2,500 trees/Ha)

Nr.	Variety / rootstock	Trunk dimensions (mm)			Tree dimensions in the year 4 (cm)		Crown volume (cm/Ha)
		Ø at planting (2007)	Year 4 (cm) Ø in the year 4 (2010)	Annual growth increase	Height	Fossiliferous fence width	
1	Ariwa / M9	9.15	33.34	8.06	220	160	6,800
2	Golden Lasa / M9	10.10	41.97	10.62	245	125	6,094
3	Goldrush / M9	9.11	29.63	6.84	210	120	4,800
4	Enteprise / M9	8.59	43.43	11.61	265	180	9,675
5	Inedit / M9	10.90	35.85	8.32	230	120	5,400
6	Iris / M9	8.96	35.31	8.78	240	150	7,125
7	Luca / M9	9.13	41.68	10.85	270	165	9,075
8	Real / M9	8.80	32.40	7.87	255	145	7,431
9	Rebra / M9	8.97	38.16	9.73	270	145	7,975
10	Redix / M9	8.79	36.60	9.27	260	135	7,100
11	Remar / M9	7.79	38.25	10.15	270	140	7,700
12	Saturn / M9	9.11	31.09	7.33	220	140	5,950

Table 2. The fruit production realized in the years 3 and 4 after planting, at the genetic disease resistant apple tree varieties, cultivated in the high density system (2,500 trees/Ha)

Nr.	Variety / rootstock	The production obtained in the year (t/Ha):		Medium fruits weight -g -	Consumption period
		3 2009	4 2010		
1	Ariwa / M9	5.5	21.9	170	Winter
2	Golden Lasa / M9	5.5	19.4	178	Winter
3	Goldrush / M9	5.0	20.8	160	Winter
4	Enteprise / M9	1.3	12.5	185	Winter
5	Inedit / M9	6.5	18.5	160	Winter
6	Iris / M9	6.3	20.4	165	Autumn
7	Luca / M9	2.8	16.4	180	Winter
8	Real / M9	7.5	18.8	185	Summer
9	Rebra / M9	3.0	10.7	190	Winter
10	Redix / M9	2.8	16.6	185	Winter
11	Remar / M9	3.8	19.8	190	Autumn
12	Saturn / M9	5.8	21.6	180	Autumn

Table 3. The economical efficiency elements of the disease resistant varieties, as compared with those of the orchards with sensitive assortment (2008-2010)

Specification	Sensitive apple tree varieties	Resistant apple tree varieties	Economical effects (%)
Applied treatments	15	7	53
Consumption of insecto-fungicides (kg/l), of which:	122	54	56
- fungicides (kg/l)	63	6	90
- insecticides-acaricides (kg/l)	59	48	81
Costs, of which:	6,484	2,454	62
- with phyto-sanitary products	4,706	1,614	66
- with the manpower	674	336	50
- with mechanical works	1,104	504	54
Fuel consumption - litres	90	42	53
- value (lei)	450	210	53