

**THE GROWTH AND DEVELOPEMENT OF APPLE TREES ON DIFERENT
ROOTSTOCKS IN THE FRUIT NURSERY**

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ABSTRACT

Investigations were conducted during the period of 2008-2009 years in Fruit Nursery of Company „Codru-ST” Ltd., which is located in the centre of Moldova. As objects of the investigation served three apple varieties: Gala Must, Golden Reinders and Idared, witch were bench-grafted on five rootstocks such as: M 9, 62-396, M 26, M 7 and MM 106. Planting distance was 90x35 cm.

It was established, that in the first and second fields of the fruit nursery, the main indicators of apple tree growth manifest significant increases depending on the increase of rootstocks' vigor of growth used in the process of grafting and the evidence obtained corresponds to the current standards.

INTRODUCTION

One of the main apple crop increased, including the Republic of Moldova, is the establishment and efficacious exploitation of intensive and superintensive orchards, used the grafted trees by small and medium vigor rootstocks led by well-structured system of crown, which can ensure the early economical fructification once two-three year after planting in the orchards (Babuc and Rapcea, 2002, Pesteanu, et al. 2010).

From the experience of the countries with a developed fruit growing – Italy, Holland, Poland, etc., the superintensive apple trees are established with crowned apple trees produced during the period of two years (Gudumac, et al. 2007, Peşteanu, 2007, Petre, et al. 2006).

The crowned apple trees in the fruit nursery, being planted in the orchard, have an early fruit production and increase more rapidly the fruit production in comparison with the planted trees without crown (Bielicki and Czynczyk 1994, Mika, et al.2003, Sadowski, et al. 2005).

Of recent research (Gudumac, et al. 2007, Pesteanu, et al. 2010), on crown

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structure in second field of the nursery (of apple trees grafted by M 9 rootstock) was elaborated a mixed method which consists in the formation of base of crown by four normal (grown from last year buds), well-developed longer than 60 cm branches, and to the shoot axis extension two-three early branches obtained of early buds.

It is very important number, distribution uniformity and length of the shoots on the central axis basitonic strict compliance with the principle, which are large determined by biological features of varieties (Ghena, et al. 2004).

Taking into the consideration that the determinative factor of having an early fruit production in the orchard constitute the type and quality of the planting material, the investigations had the aim to determine the development of apple trees, grafted on different types of rootstock for the apple tree plantations (Babuc, et al. 2009, Petre, et al. 2006).

For these requirements it is necessary to develop and practice the formation methods of the crown, suitable with features of variety-rootstock associations, beginning in the fruit nursery, the formation of trees crown base.

MATERIAL AND METHODS

The research was carried out during 2008-2009 in the fruit nursery of company „Codru-ST” Ltd., which is located in the central area of Moldova, research items were used for apple varieties: Gala Must, Golden Reinders and Idared bench-grafted on M 9, 62-396, M 26, M 7 and MM 106 rootstocks.

The bench-grafting was performed in March, using the perfected copulation method with detached branch. Grafting site was tied with porous polyethylene tape designed specifically for graft and graft was paraffined. The obtained graftings were stratified by placing them upright in containers, so that the basal layers (20-25 cm) to be placed in a layer of wet sand. The stratification temperature in the refrigerator was +2...+4°C. To produce grafted trees were used well-developed layers of 10 mm diameter and graft branches with higher biological values.

The first field of tree nursery was established in the second half of April, with bench grafts. Distance of planting grafted plants was 90x35 cm. The aerial part was palisated on a stick of bamboo.

In the second field of nursery, early spring annual stems have been shortened to a height of 75-80 cm above the grafting site. During the vegetation was carried trunk release, being left only 4-5 shoots to form the crown base. To obtain sylleptic shoots on the central axle, when they reached the length of 15-20 cm, it was made the remove of apical leaves without hurting the point of growth. This operation is repeated every 5-7 days for 5-6 times. To stimulate the strong development of shoots are made more frequent irrigation and fertilization based on macro-and micronutrients.

The usual black soil, the content of humus is 2,6%, that is maintained as cultivated field, irrigation is made by sprinkling keeping the soil wet at 75-80% from the capacity of field.

The number of repetition in each variant is 4. The number of trees in each repetition is 20. The researches were made in field and laboratory conditions according to the required methods for doing experiments with fruit growing plants. The main results obtained were statistically processed.

RESULTS AND DISCUSSIONS

On the basis of the results obtained it was demonstrated that the type of the rootstock has an influence on apple tree's growth in the fruit nursery.

The degree of striking the bench graftings in the first field of the fruit nursery during the period of investigation (fig. 1), for all the rootstocks taken into the study, is between the limits of 95,6-99,2 %.

In 2008 the highest degree of striking was registered by the Gala Must variety that was grafted on MM 106 rootstock, being of 99,1%, and the lowest striking degree – by the Idared variety, being grafted on M 9 rootstock (95,6 %).

In 2009, the appropriateness exposed previously remains. The varieties Gala Must and Golden Reinders, have the identical the degree of striking, reducing most only on M9 rootstock. The variety Idared, in 2009, the degree of striking is higher as in 2008, but lower than the varieties Gala Must and Golden Reinders.

Having a more detailed study of this indicator, it may be observed that a lower value was registered at the investigated varieties which were grafted on rootstocks M 9 and M 26. This is due to the fact that this rootstock have already formed a smaller quantity of roots in comparisson with the rootstocks 62-396, M 7 and MM 106, that to their hereditary characters form a bigger quantity of roots (Adăscăliței, et al., 2004, Babuc, et al. 2009, Ghena, et al. 2004).

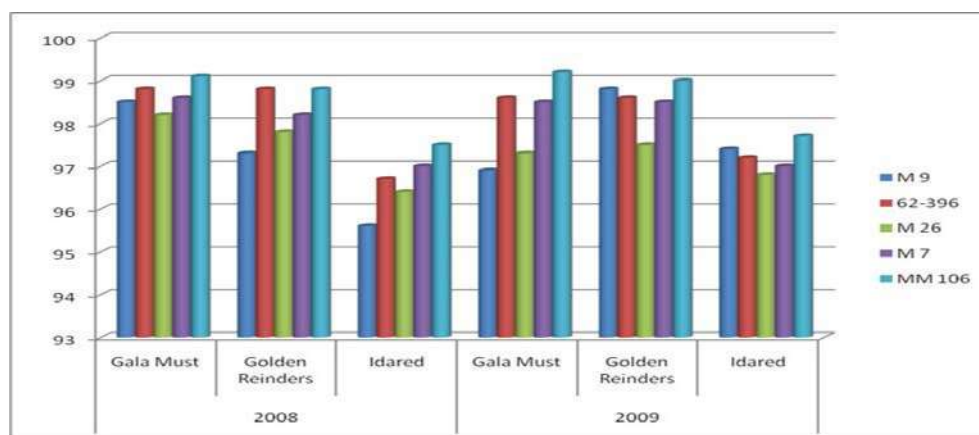


Fig. 1. The degree of striking bench graftings planted in the first field of the fruit nursery, %.

At the end of the first period of vegetation in the first field of the fruit nursery it was established that the height of trees (tab. 1) for all the varieties and types of rootstocks the investigations were corresponding with the limits of 111-135 cm in 2008 year and 109-125 cm in 2009.

Table 1

Growth main indicators of apple trees in the first field of the fruit nursery depending on the rootstocks type

Rootstock	Variety					
	Gala Must		Golden Reinders		Idared	
	graft height, <i>cm</i>	graft diameter, * <i>mm</i>	graft height, <i>cm</i>	graft diameter, * <i>mm</i>	graft height, <i>cm</i>	graft diameter, * <i>mm</i>
2008 year						
M 9	124	8,9	113	8,3	111	8,6
62-396	126	9,0	120	8,5	115	8,7
M 26	128	9,6	123	8,9	117	8,9
M 7	131	10,0	124	8,9	118	9,0
MM 106	135	10,2	129	9,4	124	10,0
<i>Dl</i> _{0,05}	1,98	-	3,03	-	2,86	-
2009 year						
M 9	114	9,4	111	8,9	109	8,7
62-396	116	9,8	112	9,4	114	8,8
M 26	117	9,8	117	9,5	114	9,2
M 7	120	10,0	117	9,6	115	9,5
MM 106	125	10,1	120	10,0	116	9,7
<i>Dl</i> _{0,05}	2,75	-	2,40	-	3,01	-

*- at 10 cm above the graft's place

The highest values of graft height were recorded in both years by Gala Must variety grafted on MM 106 rootstock, which has a medium force of growth and is 125-135 cm. The Golden Reinders variety, grafted on the same rootstock, registered intermediary values of this index, being 120-129 cm. At the Idared variety, the highest value of this index was recorded at the same event, being 116-124 cm. With decreasing growth vigor of rootstocks studied, there is a decrease in the value of this index and is 109-111 cm at the Idared variety grafted on the rootstock M 9, and 111-113 cm at the Golden Reinders variety, 114-124 cm at the Gala Must variety grafted on the same rootstock.

The graft diameter at 10 cm above the graft's place in the years 2008-2009, which is affected by increasing the vigor of the rootstocks and varieties investigated was within the limits of 8,3 mm and 10,2 mm. As the graft's height, the diameter increases at the same time with the increase of vigour of growth of the investigated rootstocks.

The leaf surface (fig. 2) grows at the same time with the increase of growth vigor of rootstock from 0,20-0,27 m²/tree to 0,26-0,35 m²/tree.

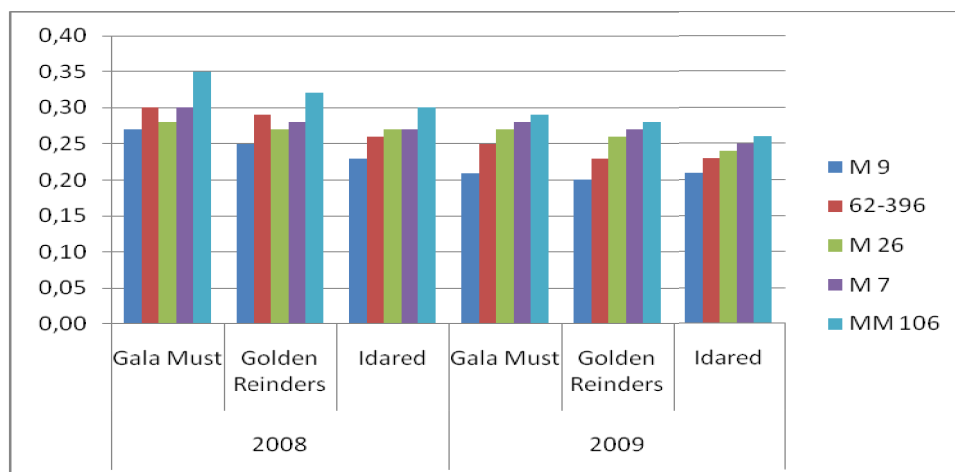


Fig. 2. Leaf surface of apple trees in the first field of the fruit nursery depending on rootstock type, m²/tree.

At the end of the second period of vegetation in the first field of the fruit nursery it was established that the height of the fruit trees (tab. 2) grows consequently with the vigour of the investigated rootstocks to the limit of 190,25-194,75 cm or with 3-13 %.

The trunk diameter above with 10 cm from the graft's place as an integral indicator, in 2009 had higher values at the grafted trees on rootstock M 7 (16,3-17,0 mm) and respectively the grafted trees on the rootstock M 9, the lowest diameter was of 15,0-15,5 mm due to the fact that this rootstock give the lowest vigour of growth to the fruit trees.

The number of normal leaves formed at the base of the crown at the varieties taken into the study in the second field of the fruit nursery is between the limits of 3,5-4,5 pcs/tree.

The average length depends on the biological peculiarities of the varieties and rootstocks taken into the study and, also their number, so as in the second field of the fruit nursery the values of this indicator is between the limits of 67,24-92,88 cm.

The longest length of normal shoots was registered at all the investigated varieties, grafted on rootstock M 7. The average length of normal shoots was registered at the apple trees grafted on the rootstocks MM 106, M 26 and 62-396.

The number of sylleptic shoots formed from early buds on the extension shoot of the axle, at the varieties taken into the study, depends greatly on the variety's capacity to emit sylleptic shoots, and the vigor of growth of the rootstock researched.

The most pronounced hereditary capacity to form sylleptic shoots on the central axle was registered at the Gala Must variety – 3,50-7,50 pcs/tree with an average length of 23,00-33,39cm, followed by the Golden Reinders variety with 3,50-6,25 pcs/tree with a length of 26,5-43,88 cm and, respectively, by Idared variety with the lowest hereditary capacity to emit sylleptic shoots that had formed 1,75-5,25 pcs/tree with their average length of 31,49-37,96 cm.

If to compare the above mentioned indicators according to the vigour rootstock type, it may be observed that the rootstocks M 7 and MM 106 have formed the greatest number of sylleptic shoots in comparison with the rootstocks M 9 and 62-396 with a low vigour of growth.

Table 2

Growth main indicators of apple trees in the second field of the fruit nursery depending on rootstock type, 2009

Rootstock	Tree height, <i>cm</i>	Trunk diameter,* <i>mm</i>	Crown dimensions			
			normal branches		sylleptic shoots	
			number, <i>pcs/tree</i>	average length, <i>cm</i>	number, <i>pcs/tree</i>	average length, <i>cm</i>
Gala Must variety						
M 9	170,00	15,00	4,50	80,00	3,50	23,00
62-396	176,50	16,33	4,50	73,13	4,00	30,75
M 26	191,25	15,65	4,25	78,78	4,75	33,39
M 7	186,25	16,33	4,25	86,50	7,25	28,00
MM 106	193,75	16,25	4,50	82,94	7,50	31,98
<i>LSD</i> _{0,05}	4,32	-	-	2,72	-	3,76
Golden Reinders variety						
M 9	184,50	15,33	4,00	75,63	3,50	35,75
62-396	185,00	17,00	3,50	72,85	3,50	34,50
M 26	191,50	16,50	4,00	81,88	3,75	43,88
M 7	185,00	17,00	4,00	92,88	6,25	26,85
MM 106	194,75	16,13	4,25	74,25	6,00	44,47
<i>LSD</i> _{0,05}	7,71	-	-	6,74	-	2,79
Idared variety						
M 9	186,25	15,50	4,00	67,24	4,25	34,38
62-396	182,50	15,68	3,75	72,50	1,75	37,16
M 26	190,00	16,33	4,00	80,30	3,00	32,50
M 7	192,00	16,30	4,00	83,44	4,00	37,96
MM 106	190,25	16,25	4,00	75,94	5,25	31,49
<i>LSD</i> _{0,05}	4,77	-	-	5,09	-	1,68

*- at 10 cm above the graft's place

The leaf surface of apple trees in the second field of the fruit nursery (fig. 3) is majored concomitantly with the increase of rootstock vigor of growth, from 0,71-0,82 m²/tree in the case when the varieties taken into the study were grafted on M 9 to 0,89 m²/tree at the trees of Idared variety grafted on rootstock M 26, 0,95 m²/tree at the variety Golden Reinders and 1,00 m²/tree at the Gala Must variety, both grafted on rootstock MM 106, or with 18-30%.

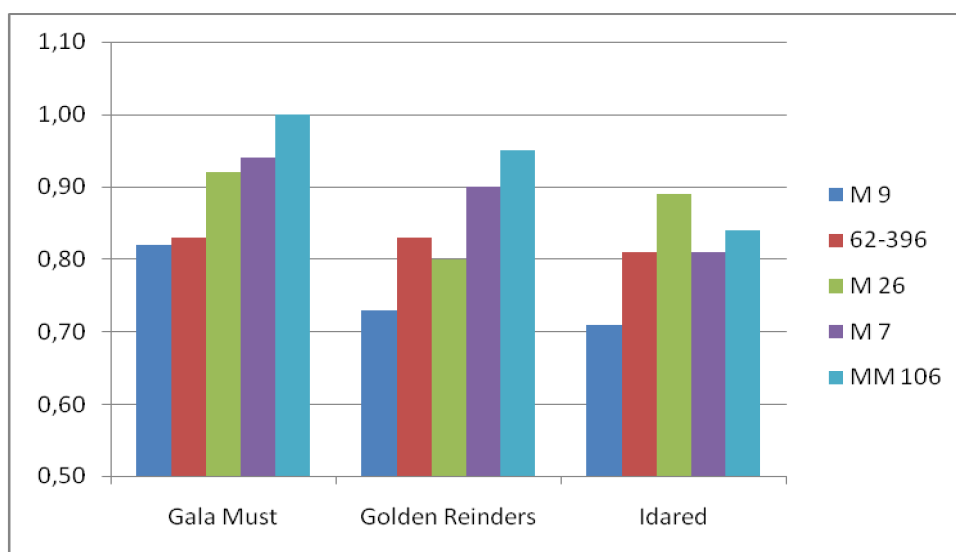


Fig. 3. Leaf surface of apple trees in the second field of the fruit nursery depending on rootstock type, m²/tree, 2009.

On the basis of the researches made and according to present standards of the Republic of Moldova (SM 155:2003), it was found that the apple trees obtained on different variety-rootstock combinations in the second field of the fruit nursery correspond to first category quality.

CONCLUSIONS

1. The degree of striking and starting to grow of the bench-graftings is very high, being between the limits of 95,6-99,2%.
2. The principal indicators of apple tree growth in the first and second fields of the fruit nursery demonstrate significant increases depending on the increase of rootstocks vigor of growth that were used in the process of grafting;
3. The parameters of apple trees in the second field of the fruit nursery had registered values that correspond to 1st category of quality according to the present standards on: height, trunk diameter, number of branches, as well as their average length;
4. The biological peculiarities of the types of investigated rootstocks influence apple trees growth and development in the nursery. It is recommended to use for the apple tree superintensive system grafted apple trees on rootstocks M 9, 62-396 and M 26, and for the intensive system – more suitable are considered to be the rootstocks M 7 and MM 106;
5. Superior values of the main indicators of apple tree's vigor of growth in the first and second field of the fruit nursery were registered according to the varieties under the investigation, at the varieties Gala Must and Golden Reinders – varieties of perspective, being followed by Idared – a homologated variety in the Republic of Moldova.

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