

# Influence of five rootstocks on growth and development of two apple varieties in the nursery

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**Abstract** Investigations were conducted in 2008-2009 in Nursery Fruit Company „Codru-ST” Ltd., which is located in the centre of Moldova. As objects of research were used two apple varieties (Idared and Golden Reinders) and were bench-grafted on five rootstocks (M 9, 62-396, M 26, M 7 and MM 106). Distance of planting was 90x35 cm. In the results of the researches made it was established that in the first and second fields of the fruit nursery the main indicators of apple tree growth manifest significant increases in function of increase of rootstocks' vigor of growth that were used in the process of grafting and the evidence obtained corresponds to the current standard of the Republic of Moldova.

## Key words

Apple Varieties, Variety-rootstock Combination, Rootstock, Planting material, Fruit Nursery

One of the basic factors to establish and efficiently exploit a modern orchard constitutes the planting material quality, including the variety-rootstock combination, rational density increase of plants per a unit of area reported to advanced technologies (2).

Nowadays, the modern technologies in EU are established with 2-year old apple trees with the crown base already formed from the nursery (5, 6, 8). The crowned apple trees in the nursery, being planted in the orchard, have an early crop production and increase more rapidly the fruit production in comparison with those trees planted without a crown (3, 4, 7).

The formation of the crown in the fruit nursery means to realize by pruning and other processes of a rational structure of the crown base adequate to biological peculiarities of the varieties, species, variety-rootstock combination, ecological and technological conditions with the aim to urgent apple trees fructification after planting them in the orchard (1).

## Material and Method

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: Idared (control) - homologated variety in Republic of Moldova and Golden Reinders – perspective variety, the bench-grafted rootstocks M 9, 62-396, M 26, M 7 and MM 106.

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 aim of the investigations is to determine the influence of five rootstocks on the degree on growth and development of apple trees obtained by bench grafting of fruit growing nursery.

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

In the results of the researches made it was established that in the first and second fields of the fruit nursery the main indicators of apple tree growth manifest significant increases in function of increase of rootstocks' vigor of growth that were used in the process of grafting.

It was established that the height of the graft to the end

of the period of vegetation in the first field of the fruit nursery (tab. 1) at all the varieties and variants taken into the study reached correspondingly 111-129 cm in 2008 and 109-120 cm in 2009. In the indicated limits, superior values were registered at the variety Golden Reinders, grafted on rootstock MM 106. The variety Idared, grafted on the same rootstock as Golden Reinders, registered also maximal values of 124 cm (2008) and 116 cm (2009).

Simultaneously with the diminution of the rootstock's vigor of growth used on at grafting, it was registered a gradual decrease of the graft's height to 111-109 cm at the variety Idared, grafted on rootstock M 9, and, respectively, 113-111 cm at the variety Golden Reinders, grafted on the same rootstock.

Table 1

**Growth main indicators of apple trees in the first field of the fruit nursery depending on the variety-rootstock combination**

| Rootstock                      | Graft height, cm |        | Graft diameter,* mm |      | Leaf surface, m <sup>2</sup> /tree |      |
|--------------------------------|------------------|--------|---------------------|------|------------------------------------|------|
|                                | 2008             | 2009   | 2008                | 2009 | 2008                               | 2009 |
| <b>Idared variety</b>          |                  |        |                     |      |                                    |      |
| <b>M 9</b>                     | 111              | 109    | 8,6                 | 8,7  | 0,23                               | 0,21 |
| <b>62-396</b>                  | 115              | 114    | 8,7                 | 8,8  | 0,26                               | 0,23 |
| <b>M 26</b>                    | 117              | 114    | 8,9                 | 9,2  | 0,27                               | 0,24 |
| <b>M 7</b>                     | 118              | 115    | 9,0                 | 9,5  | 0,27                               | 0,25 |
| <b>MM 106</b>                  | 124              | 116    | 10,0                | 9,7  | 0,30                               | 0,26 |
| <i>average on variety</i>      | 117,00           | 113,60 | 9,04                | 9,18 | 0,27                               | 0,24 |
| <i>LSD<sub>0,05</sub></i>      | 2,86             | 3,01   | -                   | -    | 0,04                               | 0,03 |
| <b>Golden Reinders variety</b> |                  |        |                     |      |                                    |      |
| <b>M 9</b>                     | 113              | 111    | 8,3                 | 8,9  | 0,25                               | 0,20 |
| <b>62-396</b>                  | 120              | 112    | 8,5                 | 9,4  | 0,29                               | 0,23 |
| <b>M 26</b>                    | 123              | 117    | 8,9                 | 9,5  | 0,27                               | 0,26 |
| <b>M 7</b>                     | 124              | 117    | 8,9                 | 9,6  | 0,28                               | 0,27 |
| <b>MM 106</b>                  | 129              | 120    | 9,4                 | 10,0 | 0,32                               | 0,28 |
| <i>average on variety</i>      | 121,80           | 115,40 | 8,80                | 9,48 | 0,28                               | 0,25 |
| <i>LSD<sub>0,05</sub></i>      | 3,03             | 2,40   | -                   | -    | 0,03                               | 0,03 |

\*- at 10 cm above the graft's place

The leaf surface grows at the same time with the increase of growth vigor of variety-rootstock combination from 0,20-0,25 m<sup>2</sup>/tree to 0,26-0,32 m<sup>2</sup>/tree.

In the second field, the height of apple trees at the end of the period of vegetation is not essentially influenced by the variety-rootstock combination, but by the number of sylleptic shoots formed on the extension shoot of the axis as a result of periodical remove of apical leaves from them and is between the limits of 182,50-194,75 cm.

The trunk diameter is an indicator that directly influences on establishment of trees' quality in the fruit nursery in the investigations made with different variety-rootstock combinations the mentioned index constituted 15,33-17,00 mm.

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 3,50-4,25 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 number of sylleptic shoots formed on the extension shoot of the axle at the varieties under the investigation depends greatly on the variety's capacity to emit sylleptic shoots, and the vigor of growth of the variety-rootstock combination researched, registering at the variety control (Idared) 1,75-5,25 pcs/tree, with an average length between 31,49 cm and 37,96 cm.

Table 2

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

| Rootstock                      | Tree height, cm | Trunk diameter,* mm | Crown dimensions |                    |                  |                    |
|--------------------------------|-----------------|---------------------|------------------|--------------------|------------------|--------------------|
|                                |                 |                     | normal branches  |                    | syllaptic shoots |                    |
|                                |                 |                     | number, pcs/tree | average length, cm | number, pcs/tree | average length, cm |
| <b>Idared variety</b>          |                 |                     |                  |                    |                  |                    |
| <b>M 9</b>                     | 186,25          | 15,50               | 4,00             | 67,24              | 4,25             | 34,38              |
| <b>62-396</b>                  | 182,50          | 15,68               | 3,75             | 72,50              | 1,75             | 37,16              |
| <b>M 26</b>                    | 190,00          | 16,33               | 4,00             | 80,30              | 3,00             | 32,50              |
| <b>M 7</b>                     | 192,00          | 16,30               | 4,00             | 83,44              | 4,00             | 37,96              |
| <b>MM 106</b>                  | 190,25          | 16,25               | 4,00             | 75,94              | 5,25             | 31,49              |
| <i>average on variety</i>      | 188,20          | 16,01               | 3,95             | 75,88              | 3,65             | 34,70              |
| <i>LSD<sub>0,05</sub></i>      | 4,77            | -                   | -                | 5,09               | -                | 1,68               |
| <b>Golden Reinders variety</b> |                 |                     |                  |                    |                  |                    |
| <b>M 9</b>                     | 184,50          | 15,33               | 4,00             | 75,63              | 3,50             | 35,75              |
| <b>62-396</b>                  | 185,00          | 17,00               | 3,50             | 72,85              | 3,50             | 34,50              |
| <b>M 26</b>                    | 191,50          | 16,50               | 4,00             | 81,88              | 3,75             | 43,88              |
| <b>M 7</b>                     | 185,00          | 17,00               | 4,00             | 92,88              | 6,25             | 26,85              |
| <b>MM 106</b>                  | 194,75          | 16,13               | 4,25             | 74,25              | 6,00             | 44,47              |
| <i>average on variety</i>      | 188,15          | 16,39               | 3,95             | 79,50              | 4,60             | 37,09              |
| <i>LSD<sub>0,05</sub></i>      | 7,71            | -                   | -                | 6,74               | -                | 2,79               |

\*- at 10 cm above the graft's place

The variety Golden Reinders, considered as a perspective variety for the Republic of Moldova, has formed a big number of sylleptic shoots (3,50-6,25 pcs/tree) with their average length of 26,00-44,47 cm. When is compared with the value of this index

at the rootstocks under the study, then it can be observed the greatest number of sylleptic shoots was being formed in case of rootstocks M 7 and MM 106, that manifest a greater vigor of growth in comparison with other investigated variants.

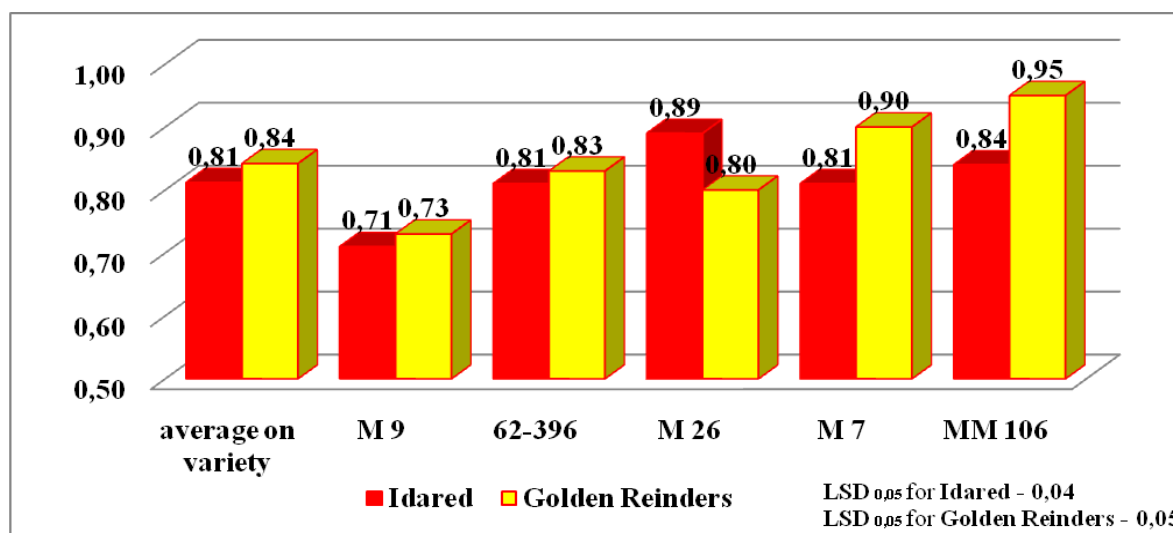


Fig. 1 – Leaf surface of apple trees in the second field of the fruit nursery depending on variety-rootstock combination, m<sup>2</sup>/tree, 2009.

Leaf surface of the apple trees in the second field of the fruit nursery increases as in the first field at the same time with the vigor of growth of the rootstock from 0,71-0,73 m<sup>2</sup>/tree in case when the investigated varieties were grafted on rootstock M 9 to 0,89 m<sup>2</sup>/tree in the combination Idared/M 26 and,

respectively, 0,95 m<sup>2</sup>/tree in the variant Golden Reinders/MM 106, or with 18-30%.

## Conclusions

1. The main indicators of apple tree growth in the first and second fields of the fruit nursery manifest significant increases in function of increase of rootstocks' vigor of growth that were used in the process of grafting;
2. To the end of the period of vegetation, in the first field of the nursery, the height of the graft constitutes 109-129 cm, the diameter of the graft at 10 cm above the grafting's place – 8,3-10,0 mm and, respectively, the leaf surface is 0,20-0,32 m<sup>2</sup>/tree;
3. In the second field of the fruit nursery the apple trees registered growth indicators that correspond to 1<sup>st</sup> category according to the present standard on: height of trees, trunk diameter and crown dimensions;
4. According to the varieties under the investigation, 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 at the varieties Golden Reinders – a variety of perspective, being followed by Idared – a homologated variety in the Republic of Moldova.
5. The dimensions of trees and the structure of the crown correspond to the SM-155 standard provisions (9) with a reference to the apple trees, crowned in the second field of the fruit nursery and can be successfully planted in the superintensive and intensive systems of culture. For the superintensive system of apple culture is recommended to use grafted apple trees on rootstocks M 9, 62-396 and M 26, and for the intensive system – more suitable are the rootstocks M 7 and MM 106.

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