



COMPARATIVE EVALUATION OF THE MORPHOBIOLOGICAL CHARACTERISTICS OF SEMI-DWARF ROOTSTOCKS IN THE PROPAGATION OF HARDWOOD CUTTINGS

Khayitboyev Bakhodir Toyirovich ¹

Akhmatbekova Mavluda Rustamkhodjaevna ²

¹ Researcher at the Tashkent Scientific Experimental Station of the Research institute of horticulture, viticulture and winemaking named after academician Mahmud Mirzayev;

² Student of the Faculty of Philology, Alfraganus University
<https://doi.org/10.5281/zenodo.18373489>

Abstract. This article analyzes the process of propagating various semi-dwarf rootstocks (Eureka 99, Myrobalan 29C, Druzhba, Kuban-86, Krymsk-5, Colt) using hardwood cuttings treated with specific growth regulators. Based on the research results, a comparative assessment was conducted regarding callus formation, rooting duration, vegetative growth parameters, and root volume.

Keywords: rootstock, cutting, callus, regeneration, root volume, Eureka 99, Myrobalan 29C.

Introduction. In global agricultural practice, ensuring the population with high-quality food products and increasing the export potential of fruit and vegetable production are considered among the priority tasks. In modern fruit growing, the main factor for increasing productivity and achieving economic efficiency is the establishment of intensive orchards. The foundation of intensive horticulture is dwarf and semi-dwarf rootstocks.

In particular, the production of semi-dwarf clonal rootstocks for stone fruit crops (peach, apricot, plum, cherry) is of great relevance. Unlike traditional seed-propagated rootstocks, vegetative (clonal) rootstocks fully preserve maternal characteristics, ensure uniform tree growth, and accelerate the onset of fruiting.

At the same time, there are certain difficulties in propagating some promising rootstocks by vegetative methods, especially by hardwood cuttings. The rooting process of cuttings is a complex physiological phenomenon that directly depends on environmental factors, the nutritional status of the cutting, and the amount of growth-regulating substances (auxins). Therefore, studying the regenerative capacity of rootstocks of different genetic origins under local climatic conditions, determining optimal planting periods, and developing effective rates of stimulants are of great scientific and practical importance.

The main objective of this study is to improve the technology of propagating hardwood cuttings of promising rootstocks such as “Evrika-99”, “Mirobalan 29S”, and “Krimskiy-5” under the soil and climatic conditions of our region, and to develop scientific foundations for obtaining high-quality planting material.

Literature Review. Issues related to vegetative propagation of clonal rootstocks of stone fruit crops have been widely studied by scientists worldwide, and significant scientific results have been achieved in this field.

First of all, the theoretical and practical bases of propagating rootstocks by cuttings have been thoroughly described by many researchers. In their fundamental works, they proved that endogenous and exogenous auxins (in particular, indole-3-butyric acid – IBA) play a decisive role in root formation in hardwood cuttings [1]. According to their findings, the carbohydrate reserves in the cutting and the auxin balance determine the rate of callus formation.

G.V. Yeremin, in his long-term studies, developed the selection and propagation technology of clonal rootstocks of the “Krimsk” and “Kuban” series for stone fruit crops. According to his research, hybrid rootstocks of the genus *Prunus* (for example, Krimskiy-5) are characterized by difficult rooting, and their propagation necessarily requires the use of synthetic auxins and control of substrate temperature [4].

C. Tsipouridis and T. Thomidis studied the effect of IBA concentration on the propagation of peach and plum rootstocks (in particular GF677 and Mirobalan) by cuttings. Their experiments showed that stimulants significantly increased the rooting percentage; however, excessively high doses led to excessive callus growth and deterioration of root quality [5].

Studies on the preparation and planting of hardwood cuttings in winter and early spring periods concluded that passing through a “cold storage” period and maintaining a warm soil temperature accelerate the rooting process [6]. This serves as an important scientific basis for selecting planting dates in our study.

The relationship between root architecture and tree size has also been investigated. Scientists have found that the size and degree of branching of the root system directly affect the productivity of the grafted cultivar and the dwarfing characteristics of the tree [7, 8]. This scientifically confirms the importance of the root volume indicator presented in our table.

Research Methodology. The experiments were carried out based on the methodological guide by M.T. Tarasenko, “New Technology for Plant Propagation by Green Cuttings” [3].

Research Results. The results obtained from the conducted experiments on growing hardwood cuttings of semi-dwarf rootstocks under optimal rates of growth-regulating substances and selected planting periods showed that, depending on the biological characteristics of the studied rootstocks, significant differences were observed in the dynamics of their development.



Figure 1. Propagation of hardwood cuttings of semi-dwarf rootstocks.

According to the duration of the initial developmental stages in cuttings, particularly callus formation and root initiation, the Mirobalan 29S rootstock showed the highest activity. In this rootstock, the callus formation process averaged 22.8 days, while root initiation occurred after 35.7 days. In contrast, regeneration processes in the Drujba (Do'stlik) and

Krimskiy-5 rootstocks proceeded relatively more slowly. Specifically, callus formation in these rootstocks lasted 28.2 and 27.9 days, respectively, and the duration of root initiation was 38.8–38.9 days, which was delayed by 3–5 days compared to Mirobalan 29S.

When analyzing the growth parameters of rootstock seedlings during the vegetation period (height and leaf area), strong growth vigor was observed in Mirobalan 29S and Evrika 99.

- Mirobalan 29S recorded the highest results, with an average height of 88.6 cm and 118.6 leaves per plant.
- Evrika 99 also showed close results (height 84.6 cm, number of leaves 113.3).
- The lowest values in the experiment were observed in the Kolt rootstock (number of leaves 78.9), which indicates that the ability of this rootstock to accumulate vegetative mass under the given conditions was weaker compared to the others.

Table 1. Morpho-biological characteristics of hardwood cuttings of semi-dwarf rootstocks when planted at the optimal rate of growth-regulating substances and the selected planting period.

Rootstock name	Duration of callus formation	Duration of root initiation	Rootstock height	Number of leaves	Root volume (cm ³)	Number of sprouted cuttings
Evrika 99	24,8	35,6	84,6	113,3	11,3	86,3
Miroblan 29S	22,8	35,7	88,6	118,6	12,4	84,6
Durujba	28,2	38,8	87,8	115,9	10,5	78,4
Kuban-86	27,9	36,4	83,6	108,3	9,3	73,8
Krimskiy-5	27,9	38,9	79,6	102,4	13,7	74,5
Kolt	26,8	36,2	82,4	78,9	8,7	72,7

A noteworthy aspect of the study is that the Krimskiy-5 rootstock, which had a relatively smaller aboveground part, demonstrated absolute superiority in terms of root system volume. Its root volume reached 13.7 cm³, which was significantly higher than that of Mirobalan 29S (12.4 cm³) and Evrika 99 (11.3 cm³). The lowest root volumes were recorded in the Kolt (8.7 cm³) and Kuban-86 (9.3 cm³) rootstocks.

Regarding the main indicator determining propagation efficiency — the percentage of sprouted cuttings — the Evrika 99 rootstock showed the highest result (86.3%). Mirobalan 29S ranked second with a high value of 84.6%. In the other rootstocks (Drujba, Kuban-86, Krimskiy-5, Kolt), the sprouting rate ranged from 72.7% to 78.4%, which, although representing acceptable results compared with the control variants, lagged behind the leading rootstocks by 8–14%.

Conclusions and Recommendations.

Among the studied rootstocks, Mirobalan 29S was identified as having the highest regenerative capacity. This rootstock outperformed the others by 3–5 days in terms of the shortest periods of callus formation (22.8 days) and root initiation (35.7 days), thereby enabling acceleration of the seedling production cycle. According to the main criterion of seedling production efficiency — the percentage of sprouted cuttings — the Evrika 99 (86.3%) and Mirobalan 29S (84.6%) rootstocks showed the best results. This indicates that these

rootstocks represent the most economically viable choice for large-scale industrial propagation.

An important novelty of the study is that the Krimskiy-5 rootstock, despite having a moderately developed aboveground part, formed the most vigorous root system (13.7 cm³). In this parameter, it even surpassed the leading Mirobalan 29S and Evrika 99 rootstocks, which indicates its high adaptive potential to drought-prone and unfavorable soil conditions.

In terms of shoot growth vigor, Mirobalan 29S (88.6 cm) and Evrika 99 were the leaders, whereas in the Kolt and Kuban-86 rootstocks the accumulation of vegetative mass and root volume proceeded relatively slowly. The Krimskiy-5 rootstock, although showing an average sprouting percentage, was distinguished by its ability to form a strong and well-developed root system.

References:

1. Astakhov, A.A. Study in the nursery of vegetatively propagated rootstocks for sour cherry and sweet cherry / The role of cultivars and new technologies in intensive horticulture: Proceedings of the International Scientific and Methodological Conference (Orel, July 28–31, 2003). – Orel: Publishing House of GNU VNIISPK, 2003. – pp. 18–19.
2. Pavlova, A.Yu. Improvement of propagation technology of promising cherry cultivars using synthetic growth regulators. // Abstract of the Candidate of Agricultural Sciences dissertation. – Moscow, 1999. – pp. 5–17.
3. Tarasenko, M.T. New Technology for Plant Propagation by Green Cuttings.
4. Yeremin, G.V. (2000). Clonal Rootstocks of Stone Fruit Crops. Rostov-on-Don: Rostizdat.
5. Tsipouridis, C., & Thomidis, T. (2004). Effect of different IBA concentrations on the rooting of 'GF677' peach × almond hybrid hardwood cuttings. *Acta Horticulturae*, 658, 263–266.
6. Howard, B.H. (1987). The effects of wounding and IBA concentration on the rooting of apple and plum hardwood cuttings. *Journal of Horticultural Science*, 62(4), 459–468.
7. Moreno, M.A. (2004). Breeding and selection of *Prunus* rootstocks at the Aula Dei Experimental Station, Zaragoza, Spain. *Acta Horticulturae*, 658, 519–528.
8. Tworcoski, T., & Miller, S. (2007). Rootstock effect on growth and yield of apple trees. *HortScience*, 42(6), 1362–1367.

