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# THE ECONOMIC EFFICIENCY OF THE TECHNOLOGY OF INTENSIVE *IN VITRO* PROPAGATION OF CHERRY VARIETIES

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**ABSTRACT**

*This article shows that the relevance of the method of microclonal propagation and cultivation of plants under in vitro condition as a cost-effective technology for the production of planting materials that allows growing plants in sufficient quantities for scientific and production purposes has been substantiated.*

*By determining the efficiency of new generation growth stimulants, which were not previously used in intensive in vitro culture, and comparing them with the standard growth substances used in clonal micropropagation, an economic evaluation of the technology of cultivating cherry rootstocks in intensive in vitro conditions, developed in the laboratory "Biotechnology" of the scientific research institute of horticulture, viticulture and winemaking named after Academician Mahmud Mirzayev and its efficiency was carried out. The economic appraisal of the technology of reproduction of promising cherry rootstocks in intensive in vitro conditions includes the selection of the object for the introduction of innovations, the description of the technology, the calculation of costs and the determination of economic evaluation indicators.*

**KEY WORDS:** *innovation, cherry rootstocks, technology, cost, profit, coefficient of resource efficiency, coefficient of gross growth of innovations, coefficient of shooting, efficiency.*

## INTRODUCTION

Today, an average of 9 billion tons of cherries are grown annually in 65 countries around the world. In this regard, "Turkey 800,000 tons, USA - 448,000 tons, Russia – 273 tons, and Iran - 250,000 tons are the leaders, in recent years, Uzbekistan has entered the top five in terms of gross cherry production and export volume." The productivity of the cherry plant today is 254,000 t/ha, the creation of new dwarf varieties and rootstocks of cherry that allows to increase its productivity to a high level in most of the cherry-growing countries of the world, the development of the most effective agrotechnical measures for intensive cherry orchards issues remain relevant [1, 2, 3, 7].

In all the countries that are the leaders in the cultivation of cherry (*Cerasus avium*) in the world, orchards of the stone fruits are being established. Since cherry is a vigorous growing fruit plant, its intensive orchards contain only seedlings grown on low-vigorous rootstocks. Scientific research is being carried out on the reproduction only *in vitro* condition of low-vigorous rootstocks such as Gisela, Maxma-14, Colt which are used in intensive cherry orchards in the world. By choosing the optimal nutrient medium for these rootstocks, micrografting varieties to rootstocks, developing effective methods of adapting micrografted plants to external environmental conditions, it is possible to grow high-quality cherry seedlings and reduce their cost [8,9, 10, 11, 12].

Label et al (1989) mentioned the use of *in vitro* propagation technologies of wild cherry for commercial clonal propagation of cherry and the effects of exogenous plant hormones on cherry explants [5].

Also, Mihaljevic et al mentioned that surface sterilization of explants is the most important step when preparing explants from trees growing in the field in order to prevent fungal and bacterial damage in microclonal reproduction[6].

In addition, Sisco (2011) studied the technologies of *in vitro* propagation of Gisela-5 rootstock. Explants from shoot tips and leaf axil buds were used [4].

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Selected stem tips from wild cherry (*Prunus avium L.*) and F 12/1 and Charger grafts brought from British forests and listed in MS medium.

## RESEARCH METHODOLOGY

The economic evaluation of the technology of intensive *in vitro* propagation of promising cherry rootstocks includes the selection of the object for the introduction of innovations, the description of the technology, the calculation of costs and the determination of indicators of economic evaluation.

The methods used were based on a systematic approach and generally accepted and validated methods used in scientific research on fruit crops. The results of experimental studies were calculated to assess the economic efficiency of innovative technologies used in agriculture using the "Borland C + + Bulder 6" program and the "O`ITS" electronic program [13].

To determine the economic evaluation of innovative technology, a methodology was developed that includes economic indicators such as the coefficient of resource saving, the coefficient of gross growth of innovations and the level of innovativeness of technology [13, 14].

According to the results of the research, it was proved that the microclonal method of vegetative reproduction of cherries under *in vitro* condition is highly effective and economically feasible.

## ANALYSES AND RESULTS

Economic efficiency of micrografted varieties and low-vigorous Krimsky-5, Gisela-5, Gisela-6 and Colt rootstocks of cherry grown under *in vitro* condition was calculated in the years 2019-2022 in "Alisher Fayz-Muruvvat" farm in Tashkent district of Tashkent region, in fertile mulberry seedlings growing "in vitro" laboratory at the "Silk, seedling" cluster farm in Marhamat district of Andijan region, in the Samarkand research station and the Surkhandarya research station of the Research Institute of horticulture, viticulture and winemaking named after Academician M. Mirzayev.

According to the results of the research, the economic efficiency of cherry rootstocks was as follows: the rootstock yield of Krimsky-5 variety was 75,000 pieces per hectare, production costs were 89,141 thousand soums, the cost of production was 1,18 thousand soums, the realization price was 5 thousand soums, revenue was 375,000 thousand soums, profit was 285,859 soums, and profitability was 320,7% (Tables 1 and 2).

Thus, the production costs of growing cherry rootstocks in traditional conditions were 33750 thousand uzbek soums, while under *in vitro* conditions were 89141 thousand uzbek soums, the cost of cherry rootstocks per 1.0 ha of land was 450 uzbek soums, in vitro conditions 1180 uzbek soums, and the cost difference was 738,5 uzbek soums. Economic efficiency in terms of technology amounted to 244,609 thousand uzbek soums.

**Table 1**

**Calculation of production costs for the cultivation of cherry rootstocks in traditional and *in vitro* conditions on one hectare of land,Thousand uzbek soum**

| No | Indicators | (Traditional) **Standart** | ***In vitro*** |
|---|---|---|---|
| 1 | Rootstock yield | 70000 | 70000 |
| 2 | Production costs | 33750 | 89141 |
| 3 | Cost of product | 0,45 | 1,18 |
| 4 | Realization price | 1 | 5 |
| 5 | Income | 75000 | 375000 |
| 6 | Benefit | 41250 | 285859 |
| 7 | Profitability | 122,2 | 320,7 |

The resource-efficient coefficient in the cultivation of cherry rootstocks under *in vitro* condition was 2.64. The coefficient of gross growth of innovation was 0.85. The rootstocks shooting coefficient was 60% in the (traditional) standard method and 95% in the *in vitro* method. Due to the use of this technology, the resources were spent twice as much as compared to the traditional method, and according to the obtained result a profitability rate was 320,7 percent due to the high level of rootstocks shooting and sales price.

The resource saving coefficient ($К_р$) is characterized by the ratio of the total costs of the adopted technologies to the total costs of traditional technologies.

$$К_р = \frac{ИЧХ_{ўз}}{ИЧХ_а}$$

$К_р$ –The resource saving coefficient

$ИЧХ_{ўз}$ – production costs of the technology in use
$ИЧХ_{а}$ – production costs of traditional technology.
The gross growth coefficient of innovation is characterized by the ratio of the gross profit of the adopted technologies ($ЯФ_{ўз}$) to the gross profit of the growth of technologies ($\Delta ЯФ$).

**Table 2**
**Economic efficiency of in Vitro Growing of Cherry Rootstocks, 2019-2022**

| Cherry Rootstocks | Indicators | | | | | | |
|---|---|---|---|---|---|---|---|
| | Rootstock Yield, Pcs | Production Costs, Thousand Soums | Price Of The Product, Soums | Realization Price, Thousand Soums | Gross Income, Thousand Soums | Net Profit | Profitability, % |
| Option 1 MS-control | | | | | | | |
| Krimskiy-5 | 70 | 89141 | 1273,4 | 5000 | 350000 | 260859 | 292,6 |
| Gisela-5 | 70 | 89141 | 1273,4 | 5000 | 350000 | 260859 | 292,6 |
| Gisela-6 | 63 | 89141 | 1414,9 | 5000 | 315000 | 225859 | 253,4 |
| Colt | 68 | 89141 | 1310,9 | 5000 | 340000 | 250859 | 281,4 |
| Option 2 DKW | | | | | | | |
| Krimskiy-5 | 75 | 89141 | 1188,5 | 5000 | 375000 | 285859 | 320,7 |
| Gisela-5 | 65 | 89141 | 1371,4 | 5000 | 325000 | 235859 | 264,6 |
| Gisela-6 | 65 | 89141 | 1371,4 | 5000 | 325000 | 235859 | 264,6 |
| Colt | 72 | 89141 | 1238,1 | 5000 | 360000 | 270859 | 303,9 |
| Option 3 MS-improved | | | | | | | |
| Krimskiy-5 | 75 | 89141 | 1188,5 | 5000 | 375000 | 285859 | 320,7 |
| Gisela-5 | 72 | 89141 | 1238,1 | 5000 | 360000 | 270859 | 303,9 |
| Gisela-6 | 68 | 89141 | 1310,9 | 5000 | 340000 | 250859 | 281,4 |
| Colt | 72 | 89141 | 1238,1 | 5000 | 360000 | 270859 | 303,9 |
| Option 4 WPM | | | | | | | |
| Krimskiy-5 | 72 | 89141 | 1238,1 | 5000 | 360000 | 270859 | 303,9 |
| Gisela-5 | 65 | 89141 | 1371,4 | 5000 | 325000 | 235859 | 264,6 |
| Gisela-6 | 62 | 89141 | 1437,8 | 5000 | 310000 | 220859 | 247,8 |
| Colt | 68 | 89141 | 1310,9 | 5000 | 340000 | 250859 | 281,4 |

$$И_{к} = \frac{\Delta ЯФ}{ЯФ_{ўз}}$$

Resource saving means the state of achieving the increase (or not decrease) of the results obtained in the process of using resources in terms of quantity and quality, in the conditions of relative stability of the amount of resource consumption. In this case, the main function of resource saving is the question of saving resource consumption, that is, saving resources by using less resources in the production of products (rendering services) or by using new innovative technologies in the use of resources.

When the production costs for the cultivation of cherry rootstocks in traditional and *in vitro* conditions were calculated, the labor cost was 24,000 thous.soums, the cost of seedlings was 5780 soums, the cost of water was 1200 thous.soums, and the fuel costs were 1425 thousand soums, and the total costs were 44,325,000 soums (see Table 3).

**Table 3**
**Calculation of production costs for cultivation of cherry varieties under traditional and *in vitro* conditions, 2019-2022. Thousand soum**

| | Indicators | Technologies | |
|---|---|---|---|
| | | Standard (Traditional) | *In vitro* |
| 1 | Salary (labor costs) | 36000 | 18000 |
| 2 | Costs for seedling | 5700 | - |
| 3 | Laboratory costs | - | 4054,5 |
| 4 | Greenhouse costs | - | 4191 |
| 5 | Electricity costs | - | 2655 |
| 6 | Natural gas costs | - | 300 |
| 7 | Water costs | 1200 | 450 |
| 8 | Fuel costs | 1425 | - |
| | **Total costs** | 44325 | 29651,4 |

When calculating production costs for growing cherry rootstocks under *in vitro* condition, salary costs were 18,000 thous.soums, laboratory costs 4054,50 thous.soums, greenhouse costs were 4191 thousand soums, electricity costs were 2655 thousand soums, and natural gas costs 300 thous.soums, water costs were 450 thousand soums and total costs were estimated to be 29651.4 thousand soums.

On the basis of resource-saving measures, it is necessary to organize the achievement of a timely and qualitative result through the least resource consumption per unit of processing facilities.

According to the results of the table, production costs for growing cherry seedlings in traditional and *in vitro* conditions on one hectare of land are given. Labor costs for workers were determined based on certain requirements (traditionally) for the cultivation of cherry varieties in the standard way, 36,000 thousand soms, and labor costs for *in vitro* conditions amounted to 18,000 thousand soms. 5,700,000 soums were spent on growing cherry seedlings (traditionally) in a standard way.

**Table 4**
**Indicators of economic efficiency of growing cherry seedlings (10 ha) in 2019-2022.**
**Thousand soums**

| No | **Indicators** | **Traditional (st)** | ***In vitro*** |
|---|---|---|---|
| 1 | Seedling | 5550 | 5550 |
| 2 | Production costs | 44325 | 29651,4 |
| 3 | Product cost | 8,0 | 5,3 |
| 4 | Realization price | 25 | 30 |
| 5 | Income | 138750 | 166500 |
| 6 | Benefit | 94425 | 136848,6 |
| 7 | Profitability | 213,0 | 461,5 |

The production costs of growing cherry seedlings were 44,325 thousand soums in the (traditional) standard method, and 29,651,4 thousand soums by *in vitro* method.

The cost of a cherry variety on 10 hectares of land in the (traditional) standard way was 8.0 thousand soums, while under *in vitro* conditions 5.3 thousand soums, the yield was 213.0% in standard method (see table 4).

Thus, it is necessary to organize the basis of resource saving measures to achieve timely and quality results through the least resource consumption at the expense of the unit of the processing facility.

Due to the use of this technology, resources are used less than the traditional ones, and the obtained result is a doubling of the profitability level due to the high level of shooting of rootstocks and the selling price of the micrografted cherry seedlings. 461.5% profitability was achieved in the cultivation of cherry seedlings under *in vitro* condition.

## CONCLUSIONS AND SUGGESTIONS

When a seedling is grown in the (traditional) standard way, it will be ready in 2.5 years. 70 thousand pieces seedlings will be spent on 1 ha land. However, due to weather conditions, agrotechnical measures and viability of seedlings, the yield of seedlings will be 60% of the total number.

While using *in vitro* method, a rootstock is grown in 6 months, and after grafting it the seedling is ready in 1 year. 73.5 thousand pieces are spent on 1 ha land.

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