Spring long stalk grafting as a promising resource-saving way of obtaining branched sweet cherry seedlings

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Abstract. The formation of costs in the cultivation of fruit crops have their own characteristics. Before establishing perennial plantings, it is necessary to grow planting material. The high cost of planting material is due to the rather sophisticated technology of growing it. Nowadays, seedlings grafted on low rootstock and have 3 or more branches are chosen to lay modern intensive gardens, thus accelerating the formation of crown in the garden and the entry of trees into the the fruiting period for 1-2 years, as well as by its growth strength and reduction of harvest costs. For cultivation of sweet cherries planting material, summer budding and winter grafting are used, but in these methods seedlings are poorly branched or well branched, but with sharp angles of lateral branches offset. Spring grafting with long stalks can become a promising and resource-saving way of obtaining branched sweet cherry seedlings. This method does not require the use of a grafting complex, provides minimal costs for grafting care, there is also no need for special methods of seedlings branchings strengthening.

1 Introduction

Currently there is a shortage of sweet cherry seedlings suitable for modern intensive gardens [8]. Sweet cherries are most often grafted on seedling rootstocks. Trees on these rootstocks are growthy or very growthy, which increases the cost of harvesting and they enter fruitage phase late [7].

The laying of modern intensive sweet cherry gardens requires a quality planting material directly affecting further productivity of plantings [3]. The main indicators of the quality of planting material are the well developed root system and the overground seedling part, which includes a certain number (3-6) of lateral branching with wide angles of branch union, which allows to accelerate the formation of crown in the garden and the entry to fruiting [5].

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On their own, sweet cherry seedlings tend to branch poorly or do not branch at all. One of the main reasons for the lack of crown in plants is the weak biological ability of most varieties to branch.

The main method of obtaining sweet cherry seedlings is summer budding, but this technology gives unbranched or poorly branched annual seedlings [2].

It is proved that the planting of intensive gardens is better carried out by branched seedlings [4]. But growing seedlings is quite a costly process that requires performing a large set of care operations and further cultivation in order to obtain standard branched seedlings.

To get branched sweet cherry seedlings, winter grafting is used. This technology provides for the presence of a grafting complex and chambers for further grafting stratification [6]. This method allows to obtain branched seedlings, but with sharp angles of side branches union.

To reduce the consumption of resources in the cultivation of branched sweet cherries seedlings, a promising way was developed — spring grafting with long stalks. This method does not require the use of a grafting complex, provides minimal costs for care of rootstocks and graftings, there is also no need to apply special methods and techniques for seedlings branching strengthening [2].

In foreign countries, this practice of obtaining branched sweet cherry seedlings is not applied, but the “knip-baum” technology of obtaining two-year-old seedlings with annual crown is used instead [9].

2 Materials and Methods

Research was carried out in 2016-2018 in the fruit crop nursery of the Academy of Bioresources and Nature Management of FSAEI of HE “CFU named after V. I. Vernadsky” using field experiment method in 4-time repetition on varieties Krupnoplodnaya, Melitopol’skaya chernaya, Talisman and Zodiak. The rootstock is the seedlings of mahaleb cherry, planted according to the scheme 90x20 cm. The method of growing seedlings by spring grafting with long stalks in the second field of the nursery was studied. The standard technology for growing annual seedlings using budding served as control.

Also research was carried out in the conditions of production on the basis of fruit nursery “Yugagropitomnik” LLC in Bakhchisaray district of the Republic of Crimea in 2018-2019. The experiment consisted of 3 options: 1. Budding (control); 2. Spring grafting with long stalks; 3. Winter grafting. Placement of plots by the method of randomized repetitions in 4 times repetition. The rootstock is a clone VSL—2. The varieties are Melitopol’skaya chernaya, Kordia and Regina. Planting scheme - 120x20 cm.

Seedling rootstock budding was introduced in the root neck and clone rootstock budding - at 20 cm height in mid-August. Spring grafting was carried out in the 2nd decade of March with long 80 cm stalks using the way of whip-and-tongue grafting. Immediately after grafting a metal-plastic support was installed and the graftings were tied to it. Winter grafting was performed in the second decade of December, 2018 with three-eye stalk followed by stratification and planting in 1 field in the third decade of December.

Biometric records and sorting were conducted in accordance with GOST R 53135-2008 [1]. The results of the accounts were processed by the method of dispersion analysis with “Agrostat” program.

3 Results and Discussion

Survival ability of graftings in all studied varieties was at a high level over 3 years on average. Version using spring grafting with long stalks compared to control had higher

rates and amounted to: Melitopol'skaya chernaya variety - 93.6%, Krupnoplodnaya variety - 96.0%, Zodiak variety — 84.1%, and Talisman variety — 87.0%, which is 10.5 — 22.4% more than in control (Table 1).

Table 1. Survival ability of graftings and parameters of the overground part of sweet cherry seedlings grafted on seedling rootstock, average for 2016-2018.

Option	Survival ability of graftings, %	Seedling height, cm	Number of side branches on branched seedlings, pcs.	Seedling bole diameter, mm
Melitopol'skaya chernaya				
1. Budding (c)	80.7	138	2.7	16.8
2. Spring grafting with long stalks	93.6	160	4.5	21.4
Krupnoplodnaya				
1. Budding (c)	73.6	158	1.6	17.2
2. Spring grafting with long stalks	96.0	162	4.4	20.3
Zodiak				
1. Budding (c)	71.3	152	1.8	16.9
2. Spring grafting with long stalks	84.1	171	4.7	23.4
Talisman				
1. Budding (c)	76.5	128	0.2	15.6
2. Spring grafting with long stalks	87.0	149	3.4	18.7
NSR ₀₅		13.1	0.75	3.0

The high survival ability rates of spring grafting with long stalks are due to the fact that it is not exposed to adverse effects during overwintering, as buds in the control version.

Analysis of seedlings biometric indicators showed that the second variant in all varieties, except Krupnoplodnaya, exceeds control by 19-22 cm in height of seedlings. The strongest branching of seedlings was also observed in the variant using spring grafting with long stalks. The average number of lateral branching per seedling in varieties was 3.4-4.7 pieces, which surpasses control by 1.6-17 times.

The bole diameter in the second variant also exceeds control for all studied varieties. On average for three years in variants with long stalks spring grafting it was 18.7-23.4 mm, which is 18.8 -38.5% more than in control.

Among the obtained planting material, seedlings with 1-2 branches were allocated, having 3 or more branches in the crown and unbranched (Table 2). Nowadays, well-branched sweet cherry seedlings with three or more side branches are preferred for the laying of intensive type gardens, allowing to speed up crown formation in the garden and the entry of trees into the fructification phase.

Table 2. Output of branched cherry seedlings grafted on seedling rootstock, in % of the number of obtained planting material, on average for 2016-2018.

Option	1-2 branches	More than 3 branches	Unbranched
Melitopol'skaya chernaya			
1. Budding (c)	27.8	51.8	20.4
2. Spring grafting with long stalks	15.9	84.1	0
Krupnoplodnaya			

1. Budding (c)	24.2	23.9	51.9
2. Spring grafting with long stalks	10.7	89.3	0
Zodiak			
1. Budding (c)	27.1	39.5	33.4
2. Spring grafting with long stalks	21.4	76.2	2.4
Talisman			
1. Budding (c)	9.3	3.4	87.3
2. Spring grafting with long stalks	32.9	67.1	0

On the output of branched seedlings with 3 or more branches in the crown, on average for three years the variety Krupnoplodnaya in a variant using spring grafting with long stalks: it is 89.3%, which is more control by 3.7 times. A little less — 84.1% in the same variant—has the Melitopol'skaya chernaya variety, exceeding the control by 1.6 times and Zodiak variedly - 76.2%, which is 1.9 times higher than the control. The weakly branching variety Talisman had only 3.4% of well-branched seedlings in control, and the variant using spring grafting with long stalks - 67.1%, 19.7 times more.

It should be noted that in the cultivation of branched sweet cherry seedlings using spring grafting with long stalks, seedlings with wide angles of side branches union were obtained, which simplifies further crown formation of trees in the garden.

In 2018-2019, research was carried out on the cultivation of branched sweet cherry seedlings on the clone rootstock of VSL-2 (Table 3).

Table 3. Survival ability of graftings and parameters of the overground portion of sweet cherry seedlings grafted on clone rootstock VSL-2, 2019

Option	Survival ability of graftings, %	Seedling height, cm	Number of side branches on branched seedlings, pcs.	Seedling bole diameter, mm
Regina				
1. Budding (c)	93.1	144	2.0	14.3
2. Spring grafting with long stalks	96.6	168	2.6	18.6
3. Winter grafting	74.9	160	2.4	16.3
Kordia				
1. Budding (c)	96.6	162	1.7	14.7
2. Spring grafting with long stalks	98.3	183	4.7	20.7
3. Winter grafting	76.6	160	2.7	12.2
Melitopol'skaya chernaya				
1. Budding (c)	91.4	148	1.3	14.9
2. Spring grafting with long stalks	93.3	178	2.4	16.8
3. Winter grafting	63.2	169	2.3	14.6
NSR ₀₅		9.6	0.21	1.10

The highest percentage of survival ability in all varieties was in the version using spring grafting with long stalks: Regina variety — 96.6%, Kordia — 98.3%, Melitopol'skaya chernaya 93.3%, which exceeded control by 1.7 -3.6%. Winter grafting had the lowest survival ability rate on all varieties. Thus, in Regina grade the survival ability rate of winter grafting was 74.9%, Kordia variety — 76.6%, Melitopol'skaya chernaya — 63.2%, which is 18.2 -28.2% less than in control. The low survival ability rate of winter grafting is associated with still weak root system of rootstock and unstable spring weather.

In all varieties, the height of seedlings in variants of spring grafting with stalks exceeded control by 21-30 cm.

The greatest bole diameter was observed in seedlings in variants with spring grafting with long stalks — 20.7 mm at the Kordia variety, slightly smaller than the same variant on Regina — 18.6 mm and Melitopol'skaya chernaya 16.8 mm, which exceeds the control by 1.2 to 1.4 times.

The branching of seedlings was most intense in variants with spring grafting with long stalks. The average number of lateral branching was in Regina variety - 2.6 pcs per branched seedling, Kordia variety — 4.7 pcs, Melitopol'skaya chernaya — 2.4 pcs, which exceeds control by 1.7-2.7 times.

The number of lateral branches on branched seedlings in variants using winter grafting was 2.3-2.7 pcs, higher than in control by 1.4 times, and close to that of spring grafting with long stalks. Only in the Kordia variety the option with winter grafting was inferior in the number of lateral branches to spring grafting with long stalk (2.7 and 4.7 pcs per seedling respectively).

Among the obtained planting material, distinguishing of seedlings with 3 or more branches in the crown was also allocated (Table 4).

Table 4. Output of branched sweet cherry seedlings grafted on clone rootstock VSL—2, in % of the number of planting material received, 2019

Option	1-2 branch es	More than 3 branches	Unbranched
Regina			
1. Budding (c)	24.1	10.4	65.5
2. Spring grafting with long stalks	48.8	41.9	9.3
3. Winter grafting	28.8	35.6	35.6
Kordia			
1. Budding (c)	18.2	3.6	78.2
2. Spring grafting with long stalks	38.9	51.9	9.2
3. Winter grafting	20.8	62.5	16.7
Melitopol'skaya chernaya			
1. Budding (c)	20.0	11.1	68.9
2. Spring grafting with long stalks	54.5	38.2	7.3
3. Winter grafting	38.1	38.1	23.8

At the exit of branched seedlings with 3 or more branches in the crown, all studied varieties are distinguished with the use of spring grafting with long stalks (38.2 -51.9%) and winter grafting (35.6-65.2 %), while exceeding control by 3.4-14 times and 3.3-17 times respectively. But it should be noted that seedlings derived from winter grafting form a sharp angle of branch union, making it difficult to form a crown in the garden. And spring grafting with long stalks allows to obtain seedlings with wide angles of branch union, which can have a positive impact on crown formation, further growth and fruiting of trees in the garden.

4 Conclusion

Budding of sweet cherries on seedling and clone rootstock of Krupnoplodnaya, Zodiak, Talisman, Regina, Kordia and Melitopol'skaya chernaya varieties does not allow for a good enough yield of branched seedlings.

Winter grafting with three-eye stalk allows to obtain branched sweet cherry seedlings, but with sharp angles of branch union. Also, this technology requires mandatory availability of a grafting complex with a camera for further grafts stratification.

The most resource-saving and efficient way of growing branched sweet cherry seedlings with wide angles of lateral branch union, ensuring high survival ability in field conditions, is spring grafting with long stalks. This method does not require the use of a grafting complex, provides minimal costs for graftings care, there is no need for special methods of seedlings' branching stimulation.

The disadvantage of spring grafting with long stalks is the increased graft consumption and the limited duration of grafting - 20-25 days.

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