Improving the technology of growing uterine plantations of grapes with load modes in the conditions of the Chechen Republic

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Abstract. Reducing the load provides an increase in the yield of marketable cuttings from 8.0 thousand pieces/ha in control to 33.3-71.0 tousand pieces/ha. It has been established that a decrease in the load of the mother bush contributes to a significant improvement in the ratio of the size of conductive tissues to the diameter of the cutting from 70.4% in the control to 71.2-74.3%, which is an important indicator for further propagation of grapes. The regularity of the decrease in the load of mother plants with an increase in the quality indicators of the cutting was revealed, namely the content of NPK from 7.8% to 8.1-8.7%, carbohydrates from 17.6% to 22.45-23.28%, of which starch from 5.0% to 9-9.3%, disaccharides from 6.17% to 6.20-6.45%, monosaccharides from 6.43% to 7.22-7.33%. The increased content of nutrients in the cuttings, with their further use as vegetative seedlings, contributed to an increase in the rates of survival, growth and development of seedlings on the plantation. A significant increase in the yield of seedlings from 40.1% in the control to 46.1-53.9% was noted with a decrease in the load of bushes with shoots.

1 Introduction

Currently, viticulture in Russia is actively supported by the state policy in expanding the areas of vine plantations [1]. The revival of the industry is due to a number of problems. At present, the availability of their own planting material is extremely low, in connection with which the farms are forced to purchase imported material, which is mainly purchased from Serbia (3.4 million units), Italy (2.3 million units), France (0 .9 million pieces). In 2020, imports of seedlings amounted to 8.84 million pieces for a total cost of $9.8 million [2]. The problems of planting material production in Russia are primarily associated with the low yield of grafted and own-rooted seedlings from the garden [3-5]. The grafted grape culture has a number of advantages, the main of which is the phylloxera resistance of the rootstock variety. However, the reproduction of newly bred varieties is significantly slowed down in time due to the harvesting of the cuttings of the graft variety as a by-product from fruit-bearing vineyards [6-8]. In such a system, farms use cuttings harvested from

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underdeveloped or fattening shoots for self-root propagation [9-11]. Due to the increase in the duration of the harvesting of the cutting, it often dries up before being stored for storage, which subsequently significantly inhibits the processes of callus formation, the development of the root system and the one-year-old shoot, when propagated in a native root culture, without providing a strong accretion of the grafting components, in connection with which, seedling yield is extremely low. All of the above significantly reduces the quality of the resulting planting material, its yield, delaying the already slow process of reproduction of the desired varieties and their clones [12-14].

Depending on the region of viticulture culture, the load of mother plants varies significantly. So, in the conditions of the Rostov region, to achieve the maximum production of commercial cuttings of grapes of technical and wine varieties is the load of 15 shoots per bush, and for canteens 20 shoots per bush. In the conditions of the Orenburg region, the optimal load of the Aleshenkin variety is 10-12 shoots per bush [3; 15-16]. A number of authors noted the need for a comprehensive study of the influence of the load of the mother vine bush in each region of its cultivation in order to obtain only cuttings.

At present, such studies have not been conducted in the conditions of the Chechen Republic, which makes our research relevant and promising. The country's policy aimed at reviving the viticulture industry and providing its own high quality planting material confirms the demand for experience.

2 Materials and methods

The purpose of the research is to experimentally determine the reaction of mother plantations to the modes of bushes with loads, anatomical, physiological changes in the vine, the quality and quantity of the cutting material obtained from the hard-to-root universal grape variety Violet ranniy.

Experiments were laid in 2014-2016 according to the experimental scheme: option 1 - 26 shoots per bush (control - without removing inflorescences); option 2 - 18 shoots per bush; option 3 - 12 shoots per bush; option 4 - 6 shoots per bush; option 5 - 4 shoots per bush. The experiments were carried out in triplicate (30 bushes each) on young grape seed beds with a feeding area of 3 x 1.5 m, observations and records were carried out according to generally accepted methods in viticulture.

Experimental variants were separated from each other by two protective rows. After planting the vegetative seedlings on the plantation, the shoots were pruned leaving two eyes, with the growth of which a regular fragment was carried out, leaving the load according to the experimental options starting from the third year of life. When standardizing experimental variants with a reduced load, additional removal of inflorescences, underdeveloped shoots and stepchildren was carried out, with minting in August. The resulting stalk was used to propagate the variety and study the amount of accumulated nutrients, callus formation, survival rate, growth force during the growing season and the final yield of seedlings according to the methods generally accepted in the practice of grape nursery.

The studies were carried out in the conditions of the Shelkovsky region of the Chechen Republic. Climatic conditions are characterized by short and little snowy winters, with frequent thaws and strong winds, the snow depth is not more than 10 cm. The amount of precipitation and temperature in the winter period were within the average annual values. From March to September, the air temperature was observed above the long-term average values by an average of 22%, reaching 38.7 ºC, with an average air humidity of 38%.

The soil of the experimental site is sandy, well permeable. The analysis of the soils showed that it was on the experimental plot that the supply of nutrients was low, with the

following content: humus from 0.60 to 0.65%; gross N content from 0.03 to 0.4%; P - 9.9-15.5 mg / kg; K - 124-147 mg / kg; Mn - 25-26.2 kg / kg; B - 0.01-0.14 mg / kg; the total carbonate content was 2.2-2.3%, and the pH of the soil ranged from 8.7 to 8.9%. The deficiency of nutrients was compensated by applying fertilizer Green Go 8 + 16 + 24 CaO containing water-soluble: K_2O (24%), P_2O_5 (16%), CaO (10%), B (0.05%); total and nitrate N (8% each); trace elements: Fe (0.15%), Mn (0.1%), B and Zn (0.05% each), Cu and Mo (0.008% each).

3 Results and Discussion

The load with shoots significantly affected the quantity of the resulting cuttings and its quality, which is clearly reflected in table 1. At the highest load with shoots (26 pcs/bush), the harvested cuttings were characterized by uneven shoots, the presence of a large number of thin shoots, of which the marketable yield was 8.0 thousand pieces/ha. With a decrease in the load by shoots, an increase in the yield of commercial cuttings is observed up to 33.3 thousand pieces/ha in option 5, up to 71.0 thousand pieces/ha in option 3, which is significantly more than the control option by 25.3 to 45.3 thousand pcs/ha, respectively.

When propagating hard-to-root grape varieties, an important indicator of the suitability of a cutting for propagation is the number of conductive tissues that perform the conductive, storage and mechanical functions of the conductive bundle and regeneration processes. It has been established that a decrease in the load has a positive effect on the increase in the conductive tissues of the cutting from 70.4% in the control to 71.2-74.3% in the experimental variants. The largest percentage of conductive tissues was noted at a load of 12 shoots, with a decrease in which the indicator decreases.

Table 1. Influence of load by shoots on the yield and quality of cuttings

Index	Experience Variant				
	1 (k)	2	3	4	5
Output of marketable cuttings from 1 ha, thousand pieces	8	53.3	71.0	49.9	33.3
+/- to control	-	45.3	63.0	41.9	25.3
Phloem+xylem ratio to diameter, %	70.4	71.2	74.3	72.8	72.2
+/- to control	-	0.8	3.9	2.4	1.8
Core to diameter ratio, %	29.6	28.8	25.7	27.2	27.8
+/- to control	-	-0.8	-3.9	-2.4	-1.8

The content of moisture, macronutrients and carbohydrates changed depending on the load of shoots of grape plants, which is clearly shown in table 2. The moisture content of the experimental options was lower than the control by -1.3 ... -2.8%, in general, varying from 48.5 to 51.4%. The content of NPK was the lowest in the control (7.8%), and the experimental variants exceeded the control by 0.3-0.9%.

The total carbohydrate content of the control variant was 17.60%, and with a decrease in load, the indicator increased by 4.85-5.68%. When analyzing the increase in the total amount of carbohydrates, it is worth noting that the largest increase was noted in the content of starch, in the form of which nutrients are stored. The minimum amount of starch in the cutting was 9.0% in option 5, and the largest was 9.5% in option 3, which is 1.9 times more than the control on average. The increase in starch content in experimental variants can be explained not only by a decrease in the load of shoots, due to which the distribution of nutrients, which occurred more evenly, but also due to the removal of inflorescences, due to which there was no consumption of nutrients for crop formation.

Table 2. The state of the cuttings of the Violet early grape variety depending on the load mode, %

Index	Experience Variant				
	1 (k)	2	3	4	5
Content in the cutting: moisture	51.4	51.5	48.6	48.5	50.1
+/- to control	-	+0.1	-2.8	-2.9	-1.3
NPK	7.8	8.4	8.7	8.3	8.1
+/- to control	-	+0.6	+0.9	+0.5	+0.3
Total Carbs	17.60	22.76	23.28	22.94	22.45
of which: monosaccharides	6.43	7.26	7.33	7.27	7.22
+/- to control	-	+0.83	+0.90	+0.84	+0.79
disaccharides	6.17	6.20	6.45	6.37	6.23
+/- to control	-	+0.03	+0.28	+0.20	+0.06
starch	5.00	9.30	9.50	9.30	9.00
+/- to control	-	+4.30	+4.50	+4.30	+4.00

The increased content of carbohydrates and NPK had a positive effect on the processes of cutting rooting, its survival rate on the plantation, the yield of seedlings and the quantitative indicators of one-year growth, which is clearly shown in figure 1. Thus, during the rooting period, the least callus formation was noted in the control 62.4%, experimental variants by 5.3-15.0% more. The survival rate of the cuttings on the plantation varied slightly and was quite high from 94.8% in the control to 98.4% in option 3. However, the yield of seedlings more accurately reflects the effect of the accumulated amount of nutrients in the cuttings with a decrease in the load of the mother bush with shoots.

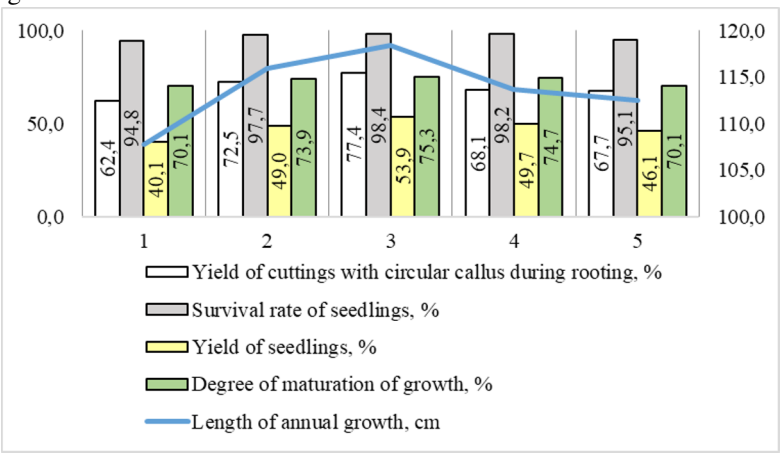

Fig. 1. Influence of load by shoots on the development parameters of vegetative seedlings from cuttings of experimental variants

The output of seedlings of the control variant was 40.1%, and in the experimental variants it was 6.0-13.8% more. The highest yield of planting material, its survival on the plantation and the final yield of seedlings were noted in variant 3, with a load of mother liquors with 13 shoots per bush, respectively, in terms of 72.5; 98.4 and 53.9%. It should be noted that it was in this variant that the amount of accumulated nutrients and macroelements was the largest.

The indicators of one-year growth of grape seedlings varied significantly, which is also reflected in figure 1 and further in the text description. Thus, the length of one-year growth varied from 107.8 cm in control, to 118.4 cm in option 3, with a degree of maturation from

70.1% in options 1 and 5, to 75.3% in option 3. variant was 26.6-27.9 cm^2, which is more than the control variant with an area of 25.7 cm^2.

The development of the aerial part of the seedling is closely related to the development of the root system, which is confirmed by the results of our research. Variants 1 and 2 differed the least: the length of one-year growth (107.8-112.5 cm), maturation (70.1%) and leaf surface area (25.7-26.6 cm^2), with the smallest number of roots (10-10.3 pieces). With a more developed aerial part of the seedling, a better development of the root system was observed, with the number of roots from 11.6 in option 4 to 13.2 in option 3.

4 Conclusion

Based on the results of the studies, it can be concluded that reducing the load of mother plantings of early Violet grapevine plantings with shoots is a highly effective and expedient method. Improving the system for obtaining high-quality grafting material for propagation, increasing the yield of high-quality planting material should be closely related to minimizing cutting loss, working time and money, which can be achieved by searching for the optimal load of mother plants.

According to the results of the research, it was found that a decrease in the load of 4-18 shoots per bush, when removing inflorescences, provides an increase in the number of commercial cuttings obtained up to 33.3-71.0 thousand pcs/ha, which is significantly higher than the indicator of the control variant equal to 8.0 thousand. pcs/ha at a load of 26 shoots per bush. With a decrease in the load of shoots, a significant increase in the quality indicators of the cuttings was observed, namely, the content of NPK from 7.8% to 8.1-8.7%, carbohydrates from 17.6% to 22.45-23.28%, of which starch with 5.0% to 9-9.3%, disaccharides from 6.17% to 6.20-6.45%, monosaccharides from 6.43% to 7.22-7.33%. The increased content of nutrients in the cuttings, with their further use as vegetative seedlings, contributed to an increase in the rates of survival, growth and development of seedlings on the plantation. A significant increase in the yield of seedlings from 40.1% in the control to 46.1-53.9% was noted with a decrease in the load of bushes with shoots. It has been established that with a decrease in the load of the mother bush, an increase in the ratio of the size of conductive tissues to the diameter to 71.2-74.3% is noted, which is an important indicator for further reproduction of grapes.

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