

A STUDY ON THE AGROBIOLOGICAL PARAMETERS IN ROOTING OF KRISTALEN WINE VINE VARIETY IN DIFFERENT VARIETY–ROOTSTOCK COMBINATIONS

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Abstract

The agrobiological parameters of Kristalen grapevine vine variety, grafted on two rootstocks, with different development and disposal of the root system – SO4 (*Berlandieri* × *Riparia*) and Chaselas 41B (*Chaselas* × *Berlandieri* 41B) were studied. The experiment was conducted during the period 2018–2021 at the Experimental grapevine rooting nursery of IASS “Obraztsov Chiflik” – Ruse, Bulgaria. The study was carried out in two variants, according to the rootstock, in four replications each, 50 grafted cuttings each replication. In the variant with Chaselas 41B rootstock, in terms of biometric parameters, lower values were recorded compared to the data about those grafted onto SO4. The vines of the variant with Chaselas 41B had a well-developed root system, with a very good root formation, regardless of the smaller number of the both types of roots – with diameter < 2 mm and > 2 mm, which did not negatively affect the quality of the vine planting material. The results showed a good affinity of Kristalen variety to SO4 rootstock, as the vines had a very well-developed root system, better growth and maturing of the cane. A significant role in the formation of the percentage of rooted first-class vines was played by the biological features of the rootstock, with the highest percentage of first-class vines obtained in the variant with Kristalen variety grafted onto SO4. The aim of the study was to determine the primary manifestation of the affinity between the components of grafting, the nature and degree of the modification variability caused by the two rootstocks.

Key words: vine planting material, root system, growth, ripening, biometric measurements

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Introduction. With the great diversity of rootstocks and varieties in viticulture, a problem arises due to the fact that some important agrobiological indicators modify positively under the influence of one rootstock, and the changes in other characteristics are in a negative direction, under the same rootstock. Numerous studies in the production of grafted and rooted vines show that not all cultivars (*Vitis vinifera* L.) take roots equally well in the vine rootstocks used. Not every rootstock accepts the grafted variety in the same way, as a result of which different yields of first-class vines are obtained, with different development of the aboveground part [1].

In grafting, an artificial symbiosis is created between the two components, in which the variety, with its individual genetic characteristics, combined with the rootstock and environmental factors, forms its biological and economic qualities [2–4]. More than 80% of all vineyards in the world are planted with vines grafted onto rootstocks. The vine rootstocks, widely used in practice are obtained by crossing two or more species belonging to the genus *Vitis*. The majority of rootstocks used in viticulture belong to the hybrids *V. riparia*, *V. berlandieri*, and *V. rupestris* [5,6].

The rootstocks have an important role in the adaptation of the vines to the environmental conditions, influencing the vegetative growth and development of the root system of the vines, as well as the physicochemical composition of the grapes. Therefore, the choice of the right rootstock is a suitable adaptation tool, used by grape growers in the changing climate [7,8].

The objective of the study was to determine the primary manifestation of the degree of affinity between grafting components in stratification, rooting, character and degree of modification variability induced by different rootstocks, and the most suitable rootstock for grafting of Kristalen grapevine vine variety to be recommended.

Material and methods. The experiment was conducted during the period 2018–2021 at the Experimental vine rooting nursery of IASS “Obraztsov Chiflik” – Ruse, in two variants, according to the rootstock, in four replications each variant, 50 grafted cuttings each replication.

Cuttings of Kristalen variety were used, grafted on two rootstocks with different disposal of the root system, causing different growth vigour – SO4 (*Berlandieri* × *Riparia* selection Oppenheim 4) and Chaselas 41B (*Chaselas* × *Berlandieri* 41B).

The paraffined and stratified cuttings were rooted in a bed-ribbon, with an exposed paraffined part and grown according to the technology adopted by IASS “Obraztsov Chiflik”, with drip irrigation and micro-jet irrigation in the first month after planting for rooting [9]. After rooting the cuttings, the vine rooting nursery was kept clear of weeds. The following agrobiological parameters were traced during the study: length of the mature cane (cm); mass of mature increment (g); internode diameter (cm); internode length (cm); average yield of first-class

rooted vines (%); average number of roots and roots with a thickness below and above 2 mm. The degree of maturing of the main shoot was monitored three times during rooting. The length and mass of the mature increment, the diameter of the second internode, the length of the internodes, the average number of roots, and the average yield of first-class rooted vines were reported after certification of the planting material. Measurements were performed on 8 vines from each replication.

The data were subjected to one-way analysis of variance (ANOVA), and differences among the mean values of yield and agrobiological traits of grafted vines of the Kristalen cultivar were evaluated using the Least Significant Difference (LSD) test, implemented with SPSS 19.0 [10].

Results and discussion. The results of the studied seven agrobiological traits, recorded in grafted vines of Kristalen variety, are presented in Fig. 1 and Table 1.

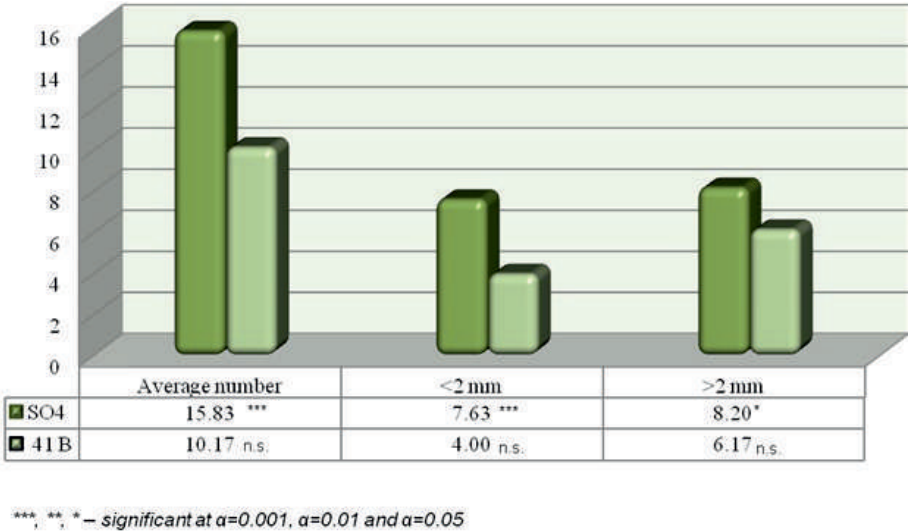


Fig. 1. Average number and thickness of roots (< 2 mm and > 2 mm) after removing the vines from the vine rooting nursery, 2018–2021

The development of the root system was the main quality parameter of grafted rooted vines which was determined by measuring the thickness of the stepped up roots below 2 mm and above 2 mm, which develop at the base of the rootstock. Roots < 2 mm thick are nutritious and supply the plant with water and minerals, while roots > 2 mm thick are skeletal and serve as a storehouse for reserve nutrients, anchoring the vine to the soil and providing stability to its aerial parts.

Figure 1 shows graphically the average number and thickness of roots (< 2 mm and > 2 mm) of vines of Kristalen variety, grafted onto SO4 and Chaselas 41B rootstocks.

T a b l e 1

Agrobiological parameters characterizing the growth of grafted rooted vines of Kristalen grapevine variety, on average for the period 2018–2021

Variants	Diameter of the second internode, cm	Length of the internodes, cm	Length of the mature increment, cm	Mass of the mature increment, g
SO4	0.54***	2.09***	17.69***	2.15***
Chaselas 41B	0.37	1.43	8.78	0.70
LSD $\alpha=0.5$	0.08	0.18	2.43	0.48
LSD $\alpha=0.1$	0.11	0.23	3.23	0.64
LSD $\alpha=0.01$	0.15	0.31	4.21	0.83

*** Significant at $\alpha = 0.001$

The study showed that root number and thickness varied with rootstock genotype, as SO4 was performing better than Chaselas 41B, in terms of the parameters studied.

The comparative analysis of the parameter average number of roots per vine was strongly influenced by the type of rootstock ($\alpha = 0.01$) and showed 35% increase in values when SO4 was used (15.83 pcs), compared to Chaselas 41B (10.17 pcs).

A greater number of roots with a thickness < 2 mm (7.63 pcs) and > 2 mm (8.20 pcs) were found in SO4 rootstock, which exceeded those reported for the variant with Chaselas 41B rootstock (4.00 and 6.17 pcs), by 47% and 24%, respectively. The reported higher values of those traits were statistically proven at level of significance $\alpha = 0.01$ for roots with a thickness < 2 mm and $\alpha = 0.5$ for roots with a thickness > 2 mm.

Those results were similar to the results reported by other studies. According to SOMKUWAR et al. [11] and KÖSE et al. [12], both rootstock and cultivar affected the number, type and size of the root system. They found that root anatomy, morphology, development and distribution differed in the different types of rootstocks.

For the production of grafted rooted vines, not only the underground part, but also the vegetative development of their above-ground part is important.

SO4 rootstock was found to have a positive effect on the vegetative development of grafted and rooted vines, as significant differences were observed in diameter (cm) and length (cm) of the second internode, length (cm) and mass (g) of the mature part of the shoots per vine ($\alpha = 0.01$). The variant with Chaselas 41B rootstock had a weaker vegetative development of the shoots (Table 1).

The greater length of the mature part of the increment, at the end of the growing season in Kristalen variety on SO4 rootstock, was mainly due to the characteristic more vigorous growth that this rootstock gives to the graft.

It is known that the stronger and better developed vines, when planted in a permanent place, start fruiting earlier and their yield is higher in the first years. For this reason, in the production of grafted rooted vines, the question about the vegetative development of their underground and above-ground part, along with the yield of first-class vines, is of great importance.

A determining parameter in the production of vine planting material is the percentage of first-class rooted vines. Biometric measurements of the vines related to mature increment and root system over the years of the study showed differences not only in those parameters but also in the percentage of standard grafted rooted vines in both variants. On average for the period, the highest percentage the first-class rooted vine features are established by grafting Kristalen white grapevine variety on SO4 rootstock (50.43%), which exceeded the variant with Chaselas 41B rootstock (30.31%) by 66%. The differences between the two variants were statistically proven at $\alpha = 0.01$ (Fig. 2).

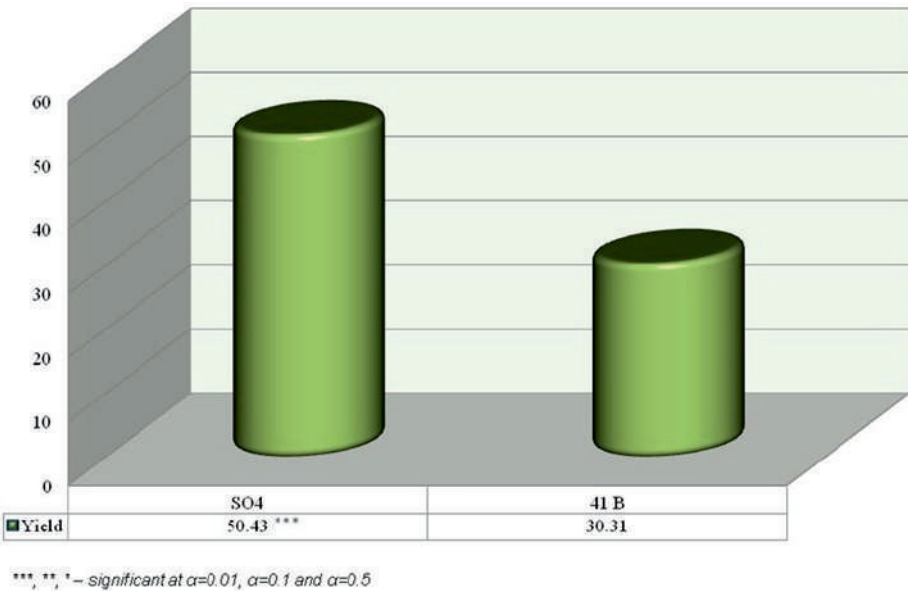


Fig. 2. Average yield of standard first-class rooted vines (in % of grafted cuttings), averaged over the period 2018–2021

WOOLDRIDGE et al. [13] and NADER et al. [14] found that yield depended on the interaction between the grafted variety, rootstock and soil type. According to LOVISOLO et al. [15] and ROMERO et al. [16], rootstock type influences water uptake, vigour and productivity of grafted and rooted vines. Studies by other authors reported no significant effect of rootstocks on grapevine yield, possibly due to the differences in experimental soil and climate conditions [17, 18].

Conclusions. The correct selection of rootstock is an important factor in the selection of varieties for the creation of new vine plantations. The study showed

that SO4 rootstock had a positive effect on the formation of the percentage of first-class rooted vines and gave better growth and maturing of the increment in the production of vine planting material of Kristalen variety, compared to vines, grafted onto Chaselas 41B rootstock.

The obtained higher percentage of rooted vines on SO4 rootstock, was due to the specificity of the grafted combinations.

The results showed a good affinity of Kristalen variety to SO4 rootstock, and the vines had a very well-developed root system. The smaller number of roots reported for Chaselas 41B rootstock did not negatively affect the quality of the vine planting material.

SO4 rootstock can be recommended as suitable for grafting of Kristalen variety.

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