AGRISCIENCE AND TECHNOLOGY
Armenian National Agrarian University
ԱԳՐՈԳԻՏՈՒԹՅՈՒՆ ԵՎ ՏԵԽՆՈԼՈԳԻԱ АГРОНАУКА И ТЕХНОЛОГИЯ
International Scientific Journal
ISSN 2579-2822

UDC 634.8:631.527 doi: 10.52276/25792822-2024.2-121

Rooting, Growth, and Maturation of Grape Cuttings Under Different Growth Regulators

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ARTICLE INFO

Keywords:
cutting,
grape,
growth regulator,
rooting,
Variety

ABSTRACT

With the development of viticulture in recent years, vineyard areas have increased and the demand for orchards with local varieties has grown. Propagation by cuttings is the most common method of grape propagation. The influence of growth regulators (zircon, heteroauxin, and kornevin) on the rooting, growth, and ripening of hardwood cuttings of grape varieties Voskehat, Garan Dmak, and Tozot was studied. The study shows that the use of growth regulators positively affects the growth and development of cuttings, strengthens roots, increases rooting, and promotes the growth and development of surface organs Among the regulators used, the best results were shown by growth stimulants heteroauxin and zircon. These stimulants can be used to ensure the high survival rates of less common varieties.

Introduction

With the development of viticulture in recent years, vineyard areas have increased and the demand for orchards with local varieties has grown. Propagation by cuttings is the most common method of grape propagation. Obtaining high-quality planting material requires rooting cuttings with a high percentage. Many factors affect rooting, such as polarity, quality, substances contained in the cutting, and growth regulator. Cuttings are propagated using auxins and artificial growth regulators (Ayvazyan, 2003; Grigoryan, 2001; Praveen Kumar Ausari, et al., 2023). There are currently many new-generation stimulants being investigated, including krezacin, zircon, and larixin (Maistrenko and Kologribaya, 2009; www.nest-m.ru).

Zircon is a natural Growth-Promoting Substance, that is nonhormonal, derived from the purple echinacea plant, and is harmless to plants. Its active ingredient, called hydroxycinnamic acid, is responsible for root growth and plant immunity enhancement (www.nest-m.ru). Kornevin and heteroauxin are also growth promoters, the active substance of Kornevin is indolyl butyric acid, and the basis of heteroauxin is indolyl acetic acid, which used to promote the rooting of cuttings. The treatment of grape cuttings with various growth regulators encourages both

the formation of a large number of roots and their continued growth in the soil (Turetskaya, 1949; Chailakhyan and Sarkisova, 1980; Grigoryan, et al., 2022). The study aims to investigate the effect of different rooting stimulants on native grape varieties that are less common.

Materials and methods

During 2022-2023, the experiments were conducted at Voskehat Viticulture Scientific Center's Nalbandian experimental station. Zircon, kornevin, and heteroauxin regulators were studied on the rooting of cuttings of Voskehat, Garan Dmak, and Tozot varieties. Technically, these cultivars mature late. For the experiments, 5-eye cuttings (30 cutting for each, with 3 repetitions) of Voskehat, Garan Dmak, and Tozot of local varieties were used. The experiments were conducted as follows: 1. The test water 2. Zircon 0.01 %, 3. krezacin 0.08 %, 4. Heteroauxin 0.02% growth regulators. Growth regulators were applied to the cuttings before clipping. The cuttings were immersed in the growth-regulating solution for 24 hours. Rooting was done with an electric root growth regulator. The duration of the incubation was 14-15 days. Rootstock growth, shoot growth, and root system development were studied at the vegetation's end. It determined the average length of shoots, woody roots, the number of rootlets and semi-main roots, and the root diameter (Lazarevsky, 1963; Rozhkov, et al., 2008). Statistical analysis was performed using the analysis of variance method (Mamajanyan, 2018).

Results and discussions

During the experiment, cutting adhesion, root number, root length, main root number, and root diameter were measured (Table 1). The data in the table show that the tested regulators had a regulating effect on the adhesion of the cuttings. The number of formed roots increased, but different varieties responded differently to the impact of the tested regulators. The heteroauxin regulator gave the highest adhesion results (90 %) for the Voskehat and Tozot varieties, and zircon gave the highest adhesion results (87.5 %) for the Garan Dmak variety. In the Voskehat variety, heteroauxin and zircon regulators showed effective results based on the number of formed and main roots. For the heteroauxin regulator, the measured indicators were 30 pieces, 5 pieces with 4.2 mm diameter, and for the zircon stimulator, 32 pieces, and 6 pieces with 5.3 mm diameter respectively.

Table 1. The effect of regulators on root adhesion, shoot growth, and development*

Growth regulators	Adhesion of cuttings, %	The number of formed roots, pieces	Root length, cm	Main roots	Diameter of main roots, mm
Voskehat					
Control	67	19	15.7	3.7	3.1
Heteroauxin	90	30	11.6	5	4.2
Kornevin	84.6	18.3	15.6	3.3	4.1
Zircon	79	32	14.7	6	5.3
Sx%=4.4 %, $LSD_{0.5}$=11.9 %					
Garan Dmak					
Control	52.9	19.3	15.1	3	3.1
Heteroauxin	62.2	21.3	12.3	5	4.5
Kornevin	68.4	24	10.3	3.7	3.5
Zircon	87.5	19.3	12.4	3.3	4.9
Sx%=8.8 %, $LSD_{0.5}$=17 %					
Tozot					
Control	42	14	9.5	4	3.8
Heteroauxin	90	22	8.8	5	4.3
Kornevin	88	19	10.9	4	2.8
Zircon	71	11	7	3	4.0
Sx%=6.5 %, $LSD_{0.5}$=16.3 %					

* Composed by the authors.

Table 2. Effects of Growth Regulator on shoot growth and maturation*

Growth-Promoting Substances	Number of shoots	Length of the shoots, cm	maturation of shoots, %
Voskehat			
Control	1.6	62.5	63
Zircon	2	66.4	66.8
Kornevin	2	51.2	63
Heteroauxin	2	53.3	68.3
Sx%=4.4 %, $LSD_{0.5}$=8.8 cm			
Garan Dmak			
Control	2	47.4	68.1
Zircon	2.6	49.2	81
Kornevin	2	41.2	68.3
Heteroauxin	2	40.2	75.3
Sx%=7.5%, $LSD_{0.5}$=10.5 cm			
Tozot			
Control	2	20	62.5
Zircon	2	20	65
Kornevin	2	30	60
Heteroauxin	2	45	67
Sx %=6.8 %, $LSD_{0.5}$=6.8 cm			

* Composed by the authors.

A different effect of the regulators was also observed on shoot and root length, and their maturation as shown in (Table 2). The Voskehat variety, by comparison with the control, showed the best result, with a shoot length of 66.4 cm and maturation of 66.8 %. Compared to zircon, in the case of heteroauxin regulator, shoots were shorter, but the percentage of maturation was higher (68.3 %). Garan Dmak variety treated with zircon also recorded an average shoot length of 49.2 cm and 81 % woodiness. Heteroauxin regulator resulted in a short shoot length, but a high percentage of maturation (75.3 %). The heteroauxin has shown effective results in the Tozot variety. The shoot length was 67 cm, and the maturation was 67 %. In the case of Zircon, the shoot length was 20 cm, but the maturation was high (65 %).

Conclusion

Considering the results of the study, we can conclude that the use of growth regulators for rooting cuttings is beneficial because it leads to a large number of roots being formed, increases cuttings adhesion, and contributes to normal shoot growth and lignification. Among the applied regulators, heteroauxin and zircon showed the best results. These can be used to ensure high adhesion of less common varieties.

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Declarations of interest

The authors declare no conflict of interest concerning the research, authorship, and/or publication of this article.

Accepted on 31.01.2024
Reviewed on 01.04.2024