IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.57
Volume 4, Issue 1, July 2024

Impact of Technological Improvements on the Quality and Yield of Grafted Grape Seedlings

Sushama Pruthviraj Bhamare[1] and Dr. Pradeep Kumar[2]
Research Scholar, Department of Agriculture[1]
Assistant Professor, Department of Agriculture[2]
Sunrise University, Alwar, Rajasthan, India

Abstract*: The area of grape plants in the Russian Federation is now steadily increasing. One of the issues contributing to the industry's resurgence is the scarcity of high-quality planting material for grapes. Because imported clone types cannot adapt to the soil and climate of grape-growing areas in the Russian Federation, buying imported seedlings is not always a satisfactory solution for vineyards in terms of seedling satisfaction. The output of grape seedlings of regional table and technical varieties must thus be increased. The findings of a research on the growth time of grape seedlings and the substrate they are grown on are presented in this publication. The best substrate composition for grafted vegetative seedlings was determined to be a 1:1:1 mixture of sawdust, glauconite sand, and bentonite clay, with a 60-day growth period. The yield of first-class grafted seedlings produced using this growing technique was 51.2%. Grafted vegetative seedling culture, which is often recognized to take 40–45 days to produce, yields seedlings at a level of 35.4–39.6%, which is 11.6–15.8% less than the best form of the experiment.*

Keywords: Viticulture, Propagation, Grafting, Rootstocks, Cultivation, Irrigation, Mechanization

I. INTRODUCTION

In the current market, viticulture should be developed using highly effective, energy-efficient technical techniques to produce grape planting material [1].

The most significant and intriguing aspect of production is the growing of grafted vegetative seedlings. Grafted and root seedling grape plants are both in a vegetative stage and are meant to be planted on a plantation, which is a permanent location, without first being planted in a nursery garden. A lot of people employ these seedlings to speed up the growth of new, promising table and technical grape types [2, 3, 4].

One of the most significant areas of agriculture is viticulture. In the agriculture sector, this branch's continued growth in our nation is crucial [5]. But the scenario facing the grape-growing sector is challenging [6, 7]. The poor seedling yield is one of the causes. The use of unpromising and inefficient artificial substrates in the development of vegetative grape seedlings is one of the many detrimental aspects that contribute to this [8, 9].

The timing of grape plant growth on grafted planting material and the selection of ideal nutritional substrates are given particular consideration. Good aeration, enough water capacity for plant growth, and fertilizer delivery are the primary functions of the artificial substrate.

Since planting cuttings in an open nursery garden is now the primary technique of cultivating grape seedlings, many of the most fertile sites are utilized for nurseries each year [10, 11]. Since growing seedlings in a nursery garden involves high labor expenditures at the most taxing time of the field season, this approach cannot yet be deemed reasonable. However, even with advanced agricultural equipment, the output of seedlings from the nursery garden is low [12].

A novel technique for planting material that grows on artificial surfaces in greenhouses is being actively adopted in contemporary grape breeding. In several nations, protected ground areas have grown rapidly during the last 10 years. They now cover more than 190,000 hectares. The USA typically has particularly high rates of protected ground development [13, 14].

Numerous factors affect how well greenhouse farming technology works. When developing planting material in greenhouses that provide the best growth conditions for plants, special consideration should be given to the substrate selection [15].

The substrate, which is a highly productive medium where plants' root systems are found, is made up of a range of natural materials and their analogs. Industrial production uses a variety of substrates, including inorganic (mineral wool, sand, perlite, hydrogel, and others) and organic (sawdust, sod, sphagnum moss, and others) depending on the crop being produced and the growth technique [16].

The right technology selection for seedling growth should be the foundation of the complex of measures for creating highly productive grape plantings. This is because the technology has a direct impact on the productivity of grape plantations, the duration of fruiting, and the degree of seedling survival in permanent locations. Additionally, the cost of production and the quantitative and qualitative indicators of plants per unit area are the main determinants of the economic efficiency of grape seedling growth and cost reduction [17].

According to the aforementioned, it is now important to look for novel substrates, choose the right composition for them, and develop energy-saving techniques for growing plants on them.

II. MATERIALS AND METHODS

The experiment examined how planting times and substrates affected the production and quality of vegetating seedlings. Standard grafted seedlings (graft: Crystal variety, rootstock: Kober 5BB) were the subject of the study. Plots of the VNIIViV n.a. Ya.I. Potapenko's experimental field, which is situated on the steppe bottom plateau and has hummock-and-hollow topography, were used for the tests in 2016–2018. The following experiment alternatives were part of the experiment scheme:

Option - stratification 40-45 days, substrate: sawdust (control);

Option - stratification 45 days, substrate: sawdust + glauconite sand;

Option - stratification of 40-45 days, substrate: sawdust + glauconite sand + bentonite clay;

Option - stratification of 60 days, substrate: sawdust;

Option - stratification 60 days, substrate: sawdust + glauconite sand;

Option - stratification of 60 days, substrate: sawdust + glauconite sand + bentonite clay.

With 300 grafts in each option, the experiment is based on a three-fold repeat. In properly prepared plastic bags, the green seedlings were stratified. Generally acknowledged manufacturing standards were followed in the fabrication of the rootstock material and ingraftings. The table ingrafting technique was used to do the ingrafting; routine care work is required.

III. RESULTS AND DISCUSSION

When cultivated in a greenhouse, vigorous growth and ingraftings might yield a very well-chosen substrate. In our experiment, we looked at typical substrates like sawdust and glauconite as well as the addition of bentonite clay, which has a rich chemical makeup (Figure 1).

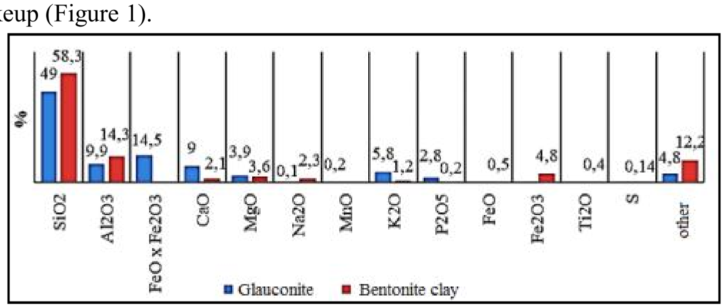


Fig. 1. Chemical composition of used substrates, %

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.57
Volume 4, Issue 1, July 2024

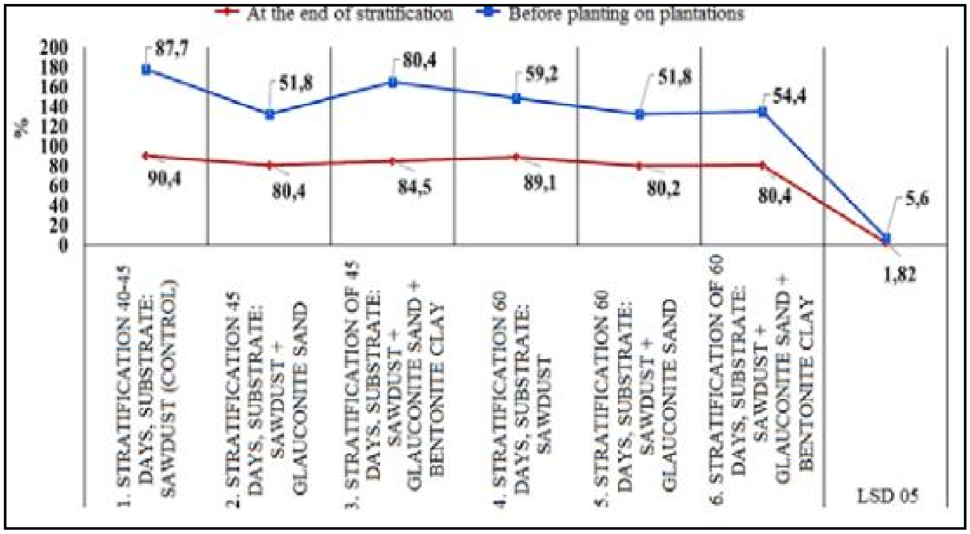


Fig. 2. Moisture content in callus cells of grafted seedlings Crystal × Kober 5 BB, average 2016- 2018, %

The length of stratification affects the callus cells' moisture content. Figure 2 shows that the quantity of moisture content in the callus at the conclusion of stratification is reduced by 1.3–10.2% when the stratification period is extended to 60 days. Prior to planting, the plantation's moisture content ranged from 51.8 to 87.7% during a 45-day stratification period. The moisture content varied significantly throughout the course of 60 days of stratification, ranging from 51.8 to 59.2% (Figure 2).

Grafted cuttings' growth into seedlings is closely linked to the establishment of the root system and leaf-bearing shoots, which can only flourish when given enough nutrients. The examination of Figure 3 makes this assertion very evident.

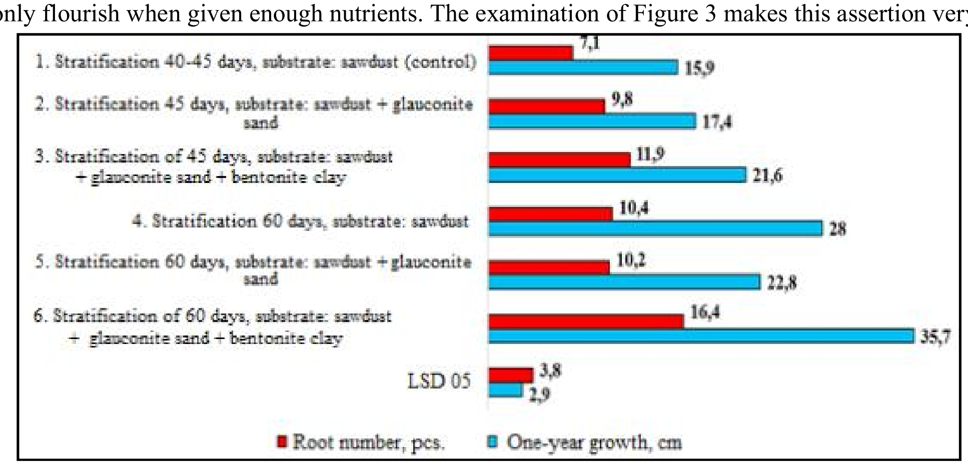


Fig. 3. Development of annual grafted seedlings of Crystal × Kober 5 BB on the plantation, average 2016-2018

The variations that added bentonite clay (with stratification of 45 and 60 days, respectively) showed the longest annual growth (21.6 and 35.7 cm) and the most developed root system (11.9 and 16.4 pieces of roots).

Therefore, it can be inferred from a combined analysis of Figures 2 and 3 that the growth of seedlings is unaffected by the moisture content of the callus tissues. Properly chosen substrates that satisfy the plant's nutritional requirements are more crucial for the complete growth of seedlings on the plantation.

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.57
Volume 4, Issue 1, July 2024

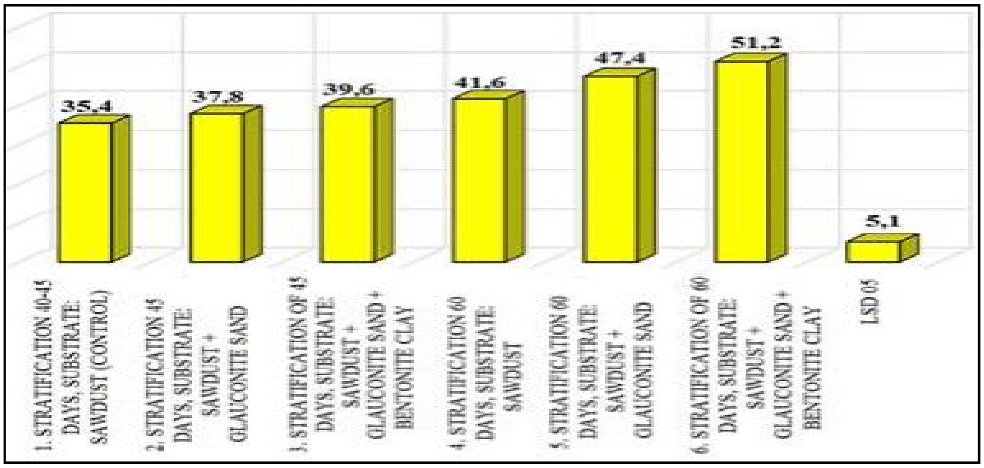
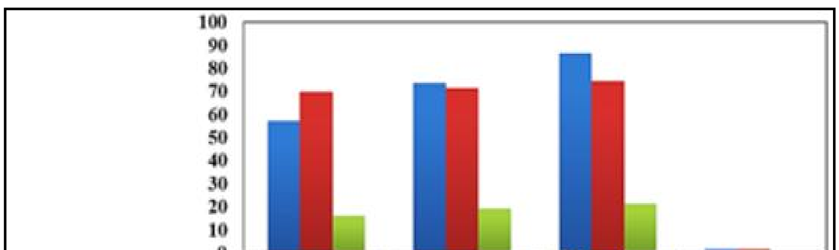


Fig. 4. Yield of grafted seedlings of Crystal × Kober 5 BB, average 2016-2018

When combined with a well chosen substrate, the length of stratification may provide a high output of seedlings that match GOST. After 45 days of stratification on sawdust, the control variation produced the lowest yield of seedlings, at 35.4%. The yield of seedlings rises to 37.8 and 39.6%, respectively, when glauconite sand and bentonite clay are added to the substrate. The formation of the root system became more robust after 60 days of stratification, yielding between 41.6 and 51.2%. With 60-day stratification on the substrate of sawdust + glauconite sand + bentonite clay, the maximum seedling yield was 51.2%, 15.8% more than the control variety. (Fig. 4).

In the second decade of May, vines were planted with vegetative seedlings in the holes that the digger had excavated. Variants 2 and 3 had the highest seedling survival rates on the plantation, which were -73.6% and 86.4%, respectively (Figure 5).



	1. Sawdust (control)	2. Sawdust + glauconite sand (1:1)	3. Sawdust + glauconite sand + bentonite clay (1:1:1)	LSD 05
Survival in a permanent place, %	57,2	73,6	86,4	1,37
Shoots ripening, %	69,9	71,2	74,5	1,53
Carbohydrate content in one-year shoots, %	16	19,1	21,3	0,34

Fig. 5. Influence of substrates on the development of annual grafted seedlings of the Crystal grape variety at the end of the growing season, average 2016-2018

Option 3 had the largest carbohydrate content and the finest vine maturity. The carbohydrate content is 21.3%, which is 5.3% greater than the control, and the vine maturity is 74.5%, which is 4.6% higher.

The highest shrub preservation during overwintering was likewise seen when a substrate consisting of sawdust, glauconite sand, and bentonite clay was used (Figure 6).

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
Impact Factor: 7.57
Volume 4, Issue 1, July 2024

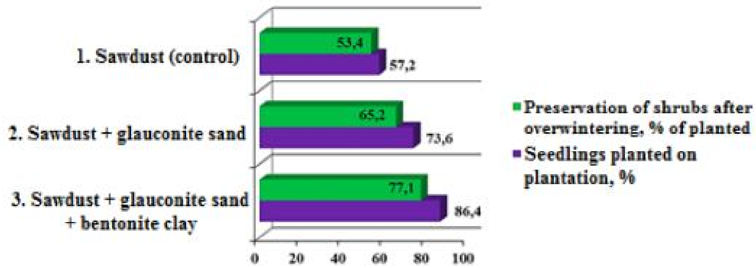


Fig. 6. Preservation of Crystal grape shrubs after overwintering, average 2016-2018

IV. CONCLUSION

It will be feasible to harvest a much greater quantity of superior seedlings from the greenhouse space if the suggested substrates are widely used. Heat and moisture are used to grow and develop plants in a controlled environment; a substrate with a suitable thermal regime encourages quick plant roots and growth and enables the greenhouse's space to be used again.

The best substrate composition for grafted vegetative seedlings was determined to be a 1:1:1 mixture of sawdust, glauconite sand, and bentonite clay, with a 60-day growth period. The yield of first-class grafted seedlings produced using this growing technique was 51.2%. Grafted vegetative seedling culture, which is often recognized to take 40–45 days to produce, yields seedlings at a level of 35.4–39.6%, which is 11.6–15.8% less than the best form of the experiment. Therefore, it is efficient to choose the right substrate and cultivate grafted vegetative seedlings in a viticulture nursery.

REFERENCES

[1]. L.B. Moreiro, BIO Web of Conferences, **9**, 01023 (2017)
[2]. S. Vršič, B. Pulko, L. Kocsis, Scientia Horticulturae, **181**, 168 (2015)
[3]. S. Sabbadini, L. Capriotti, C. Limera et al, BIO Web Conf., **12**, 01019 (2019)
[4]. B. Kamsu-Foguem, A. Flammang, G. Tchuenté-Foguem, Ecological Informatics, **30**, 72 (2015)
[5]. D. Santillán, A. Iglesias, I. La Jeunesse et al, Science of The Total Environment, **657**, 839 (2019)
[6]. J. Fritz, M. Athmann, G. Meissner et al, OENO One, **54(2)** (2020)
[7]. R.G.V. Bramley, J. Ouzman, M.C.T. Trought, OENO One, **54(4)** (2020)
[8]. E. Neethling, G. Barbeau, C. Coulon-Leroya et al, Agricultural and Forest Meteorology, **276-277**, 107618 (2019)
[9]. G. Gutiérrez-Gamboa, W. Zheng, F. Martínez de Toda, Food Research International, **139**, 109946 (2021)
[10]. L.Yu. Novikova, S.N. Travina, T.E. Zhigadl et al, Proceedings of Applied Botany, Genetics and Breeding, **4**, 391 (2015)
[11]. L.G. Santesteban, Food Chemistry, **279**, 58 (2019)
[12]. M.J.R. Silva, A.P.M. Paivaa, A.J. Pimentel et al, Scientia Horticulturae, **241,** 194 (2018)
[13]. S. Semitela, A. Pirra, F.G. Braga, Bioresource Technology, **289**, 121622 (2019)
[14]. Batukaev, M. Mukailov, M. Batukayev et al, International multidisciplinary scientific geoconference SGEM, **62**, 783 (2018)
[15]. Gautier, S.J. Cookson, L. Lagalle et al, OENO One, **54(1),** 1 (2019)
[16]. T. Verdenal, Á. Dienes-Nagy, J.E. Spangenberget et al, OENO One, **55(1)** (2021)
[17]. M. Alarcon,P. Marty, A.-C. Prévot, Journal of Rural Studies, **80**, 160 (2020)