Journal of Tropical Agriculture 63(4): 288-291, 2025
ISSN 0971-636X (Print), ISSN 0973-5399 (Online)
DOI No.: 10.63599/JTA.2025.1553

Short Communication

Modified softwood grafting method: A novel approach for enhancing graft success in sapota

Archana P.V.[1] and Meera Manjusha A.V.[2]*

[1]*Department of Horticulture, College of Agriculture, Padannakkad 671 314, Kerala, India*
[2]*KVK, Kannur 670 142, Kerala, India*

Received on 03 March 2025; received in revised form 28 July 2025, accepted 07 August 2025.

Abstract

The study is aimed to identify the best practices for improving the success rate of softwood grafting in sapota varieties under different environmental conditions and precuring treatments. The experiment conducted at the College of Agriculture, Padannakkad included 27 treatment combinations, replicated twice. The experiment considered three environmental conditions (open field - C_1, polyhouse - C_2, and polytunnel conditions followed by shaded environment - C_3), three cultivars (Cricket Ball - V_1, Pala - V_2, and Oval - V_3), and three scion precuring treatments (defoliation 10 days prior to grafting - S_1, defoliation and grafting on the same day - S_2, and grafting without defoliation - S_3). The findings revealed that grafting the Cricket Ball variety without defoliation under polytunnel conditions ($C_3V_1S_3$) resulted in the highest grafting success. Among the varieties, Cricket Ball performed the best, while polytunnel conditions (C_3) produced superior growth compared to open-field and polyhouse environments. Additionally, defoliation 10 days before grafting (S_1) achieved the highest graft success rate among the scion precuring treatments.

Key words: Defoliation, sapota, scion precuring, softwood grafting

Introduction

In sapota cultivation, various propagation methods exhibit different success rates. Propagation through seeds takes longer time for establishment and results in greater heterogeneity, making vegetative propagation a more suitable alternative. Vegetative propagation in sapota can be achieved through techniques such as budding, air layering, side grafting, veneer grafting, approach grafting, and softwood grafting. Among these, approach grafting has been widely practiced for many years. However, this method is expensive, time-consuming, and labor-intensive, making it insufficient to meet the high demand for planting materials.

Recently, softwood grafting has gained popularity among farmers and the horticulture sector due to its numerous advantages. It is a simple, cost-effective method that enables rapid multiplication of plants with a significant success rate. Khirni (*Manilkara hexandra*) is commonly used as a rootstock for grafting sapota. The success, survival, and subsequent growth of the scion, as well as the development of a successful graft, depend on several factors, including the timing of the grafting operation, the choice of varieties, grafting methods, rootstock-scion compatibility, the age of both scion and rootstock, and environmental conditions (Hartmann et al., 1997).

Despite the high demand for sapota cultivation, the limited availability of quality planting material has restricted its cultivation area compared to other major fruit crops. Therefore, there is a pressing need to produce healthy, high-quality planting material of various cultivars through rapid multiplication techniques throughout the year to meet this demand. The success rate of grafting varies across environmental conditions and cultivars. Precuring treatment has been shown to improve graft success in sapota (Pampanna and Sulikeri, 2000) and contributes to a higher success rate and better overall graft growth (Tanuja and Thippesha, 2016). However, it requires additional time and effort during grafting. Environmental conditions also significantly impact the performance of sapota softwood grafts on invigorated khirni rootstock (Ashutosh et al., 2020).

To address these challenges, a trial on the modified aspects of softwood grafting in sapota was conducted to optimize grafting success and ensure a steady supply of quality planting material.

Materials and methods

The experiment aimed to identify the best practices for improving the grafting success rate in softwood grafting of sapota cultivars. The study was conducted from November

* Author for Correspondences: Phone :9895514994 ; Email: meera.manjusha@kau.in; ORCID ID : 0000-0002-5293-4265

2020 to June 2021 (offseason period) at the College of Agriculture, Padannakkad, which experiences a humid climate and falls under the tropical humid region. The location belongs to the NARP Northern Zone of Kerala and the AZ 109th climatic zone of India.

A Completely Randomized Design (CRD) with a factorial concept was used by incorporating three factors. The experiment comprised 27 treatment combinations, with 15 grafts per replication and two replications. Factor1- environmental conditions in which C_1 - Softwood grafting under open condition, C_2 - Softwood grafting under polyhouse conditions and C_3 - Softwood grafting under polytunnel conditions followed by shaded environment (after 1 month) were considered Factor 2 was cultivars in which V_1 - Cricket Ball, V_2 - Pala, V_3 - Oval are evaluated. Factor 3 is scion precuring in which S_1 - Defoliation 10 days prior to grafting, S_2 - Defoliation followed by grafting on the same day and S_3 - Without defoliation was included. This study was done by applying various environmental conditions and scion precuring in different sapota cultivars.Selected scions from the mother plants of Oval, Pala, and Cricket Ball cultivars underwent defoliation as part of the precuring treatments. The process involved three approaches: defoliation 10 days before grafting, defoliation on the same day of grafting, and grafting without defoliation. After grafting, the grafts were placed under different environmental conditions like open field, polyhouse, and polytunnel followed by shaded environment. Periodically observations such as number of leaves per grafts, length of scion shoot (cm), leaf area (cm^2), height of graft (cm), girth of stem graft (cm), length of leaves(cm), breadth of leaves (cm), number of successful grafts are recorded at 30,60, 90, 120 ,150 and 180DAG. Success percentage (%) was noticed at 90 DAG and survival percentage (%), fresh weight (g) and dry weight (g) were recorded at 180DAG. Observations were made by taking mean value of successful grafts with uniform growth in each treatment of replication.

Results and discussion

Results from the experiment are presented and showed under different headlines.

Individual effect

Environmental conditions

The individual effect of environmental conditions on graft success up to the final growth stage revealed that grafting under polytunnel conditions (C_3) yielded the best results compared to open (C_1) and polyhouse (C_2) conditions. Observations recorded under C_3 included scion length (19.28 cm), stem girth (2.70 cm), number of successful grafts(7.00), success percentage (48.14 %), survival percentage (46.66 %) (Fig.1), leaf area (26.01cm^2), stem girth (2.70cm) leaf length (9.15 cm), leaf breadth (3.85cm), number of leaves (14.79), fresh weight (22.11g), dry weight (10.01g), and graft height (33.47 cm) during various growth intervals. The superior graft success under polytunnel conditions was attributed to a higher relative humidity percentage and minimal fluctuations between the mean maximum and minimum temperatures, which created an optimal environment for enhanced cell activity. These findings align with the research of Sulikeri et al. (1997) and Kalabandi et al. (2014).

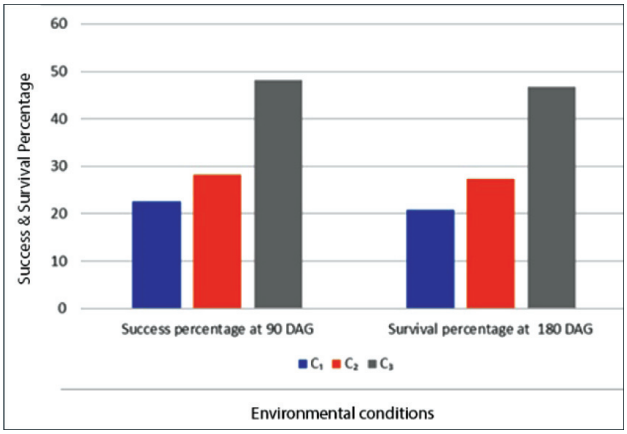

Figure 1. Effect of environmental conditions on success % & survival %

Cultivars

The data indicated that, during the growth stages of grafts, the individual effect of cultivars on grafting success showed that V_1 - Cricket Ball exhibited superior growth parameters. These included greater scion length (at 60, 90, 150, and 180 days after grafting), larger leaf area (at 30, 60, and 90 days after grafting), longer leaf length (at 30, 60, and 90 days after grafting), a higher number of successful grafts (5.22), a greater success percentage (35.92%), and a higher survival percentage (34.81%).

Similar findings were reported by Ghosh et al. (2010), where the Cricket Ball cultivar demonstrated the highest graft success rate (65–85%) under the conditions of Paschim Midnapore, West Bengal.The varying responses of sapota cultivars to softwood grafting have been previously documented by Kulwal et al. (1988) and Shirol et al. (2005), who reported significant differences in the success rate of softwood grafting among different cultivars.

Scion precuring

The individual effect of scion precuring treatments on graft success throughout the growth period revealed that

defoliation 10 days prior to grafting (S_1) resulted in significantly higher values for various growth parameters. These included the number of leaves (3.65), scion length (18.44cm), leaf area (22.31cm^2), graft height (32.76cm), stem girth (2.59 cm), leaf length (8.34 cm), leaf breadth (3.65cm), fresh weight (17.73 g), dry weight (7.99g), success percentage (42.59 %), and survival percentage (40.37 %). Similar findings were reported by Tanuja and Thippesha (2016).

The significant increase in the number of leaves with scions defoliated 10 days before grafting may be attributed to early bud break and an extended growth period, leading to a higher leaf count per plant. Additionally, grafts using scions that underwent defoliation 10 days before grafting produced the largest leaf length and breadth, while the smallest leaves were observed in scions grafted without prior defoliation. The positive impact of scion precuring on leaf size was also demonstrated in studies by Maiti and Biswas (1986) and Sarada et al. (1997).

Interaction effects

Environmental conditions and cultivars

The interaction effect of environmental conditions and cultivars during graft growth stages indicated that C_3V_3 (Polytunnel +Oval) exhibited superior growth parameters, including the highest number of leaves (15.30) and the largest leaf area at 90, 150, and 180 days after grafting (DAG). Additionally, it recorded the longest leaf length (9.41cm) at 90, 150, and 180 DAG, as well as the greatest leaf breadth at 90, 120, and 150 DAG. Meanwhile, C_3V_1 (Polytunnel + Cricket Ball) showed the highest values for graft height (34.06 cm, except at 30 DAG), number of successful grafts (8.00), success percentage(54.44%), survival percentage (53.33%), and dry weight (10.30g) of grafts. Furthermore, C_3V_2 (Polytunnel + Pala) recorded the highest fresh weight (22.87g).

The enhanced growth and success rates under polytunnel conditions can be attributed to the favorable climatic factors, which provided optimal humidity, temperature stability, and reduced environmental stress. Additionally, the presence of dormant and swollen terminal buds in different sapota cultivars likely facilitated early sprouting and vigorous graft growth.

Environmental conditions and scion precuring

In the case of the interaction effect between environmental conditions and scion precuring treatments during the growth stages of the grafts, C_3S_3 (Polytunnel + Without Defoliation) proved to be the most effective for all growth parameters like length of scion (20.92cm), number of successful grafts (11.66), success percentage (77.77%), survival percentage (77.77%), leaf area (33.72cm), girth of stem (2.98 cm), length of leaf (10.95 cm), breadth of leaf (4.21cm), number of leaves (17.78) and height of graft (34.71cm). These superior results were observed from 30 DAG to 180 DAG. The success of C_3S_3 can be attributed to the formation and accumulation of more food materials in the grafts, along with increased hormonal activity under polytunnel conditions. These factors likely promoted faster cell division and improved growth of existing cells, leading to enhanced overall graft performance.

Cultivars and scion precuring

Considering the interaction effect between cultivars and scion precuring treatments during the growth period, V_2S_1 (Pala + 10 days prior defoliation) exhibited the highest values for survival percentage (43.33%), fresh weight (19.50g), and number of leaves (9.36) from 30 DAG to 120 DAG. This superior performance can be attributed to the initiation of strong cambial activity following defoliation, which likely stimulated better graft growth. According to Hartmann et al. (1997), defoliation promotes cambial activity, enhancing the overall success of grafting by improving nutrient flow and callus formation.

Environmental conditions, cultivars and scion precuring

The data on the combined interaction effect of environmental conditions, cultivars, and scion precuring treatments through to the final graft growth stage revealed that $C_3V_1S_3$ (Polytunnel + Cricket Ball +Without Defoliation) was the most effective treatment combination for all growth parameters. *viz.* length of scion (21.36cm), girth of stem (3.05cm), number of successful grafts (14.00) (Fig.3), success percentage (93.33%) (Fig.2), survival percentage (93.33%) (Fig.2), leaf area (35.42 cm^2), length of leaf except 30 DAG (11.22 cm), breadth of leaf except 60 DAG (4.32 cm) and height of graft (35.75 cm).

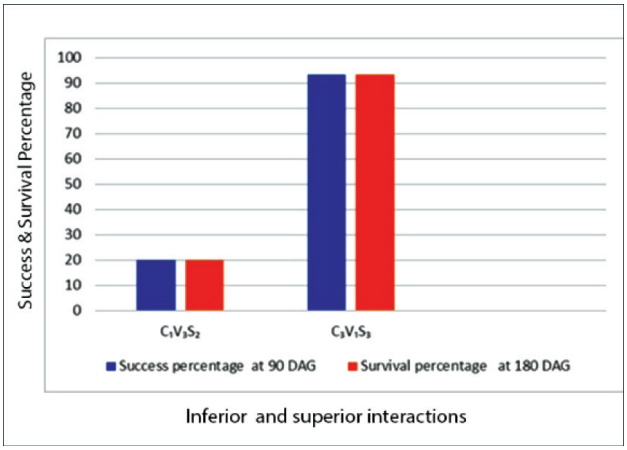

Figure 2. Effect of inferior and superior interactions (3 factor) on success % and survival %

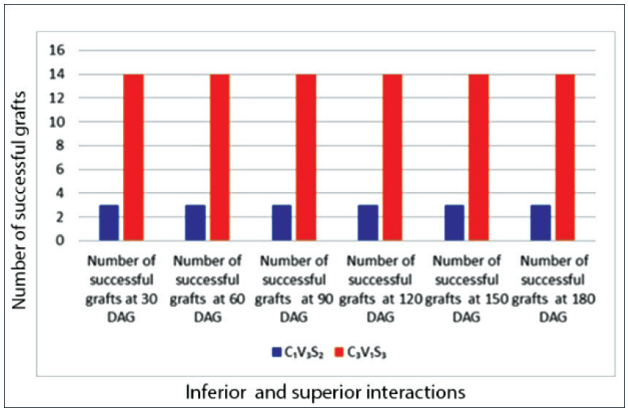

Figure 3. Effect of inferior and superior interactions (3 factor) on number of successful grafts

The grafts without defoliation showed increased photosynthetic activity and a longer growing period, contributing to better graft success and growth. Under polytunnel conditions, the rate of transpiration was higher, which kept the guard cells in a turgid state and facilitated the opening of stomata. This enhanced the formation and accumulation of carbohydrates and proteins, allowing for quicker physiological processes and rapid growth between the rootstock and scion. These findings are consistent with Baghel et al. (2000), who noted similar benefits of controlled environmental conditions for graft development.

Conclusion

The results of the present study revealed that grafting the Cricket Ball variety of sapota without defoliation of the scion under polytunnel conditions ($C_3V_1S_3$) proved to be the most effective treatment, resulting in the highest graft success. The varietal effect on graft success indicated that the Cricket Ball variety performed the best. Grafts grown under C_3 - polytunnel conditions showed superior growth parameters compared to those grown under open field and polyhouse conditions. Among the different scion precuring treatments, defoliation 10 days prior to grafting (S_1) resulted in the highest percentage of graft success. Based on these findings, the modified softwood grafting technique is recommended as an ideal approach for commercial-scale application in sapota propagation.

References

Ashutosh, S.G., Patil, S.R., and Diwakar, B. 2020. Effect of different environmental conditions on performance of sapota softwood grafts worked on invigorated Khirni rootstock on length of scion shoot, number of leaves per graft and leaf area. *J. Pharmacognosy Phytochemistry*. 9(2): 2340-2347.

Baghel, B.S., Hema N., and Nema, B.K. 2000. Response of mango (*Mangifera indica* L.) grafts to coloured polyhouse/light. *South Indian Hortic*. 50(1-3): 1-6.

Ghosh, S.N., Bera, B., and Banik, B.C. 2010. Effect of cultivars and season on grafting success in sapota under Paschim Midnapur conditions of West Bengal. *J. Hortic. Sci.* 5(2): 138-139.doi:10.24154/jhs.v5i2.463h

Hartmann, H.T., Kester, D.E., Davis, F.T., and Geneve, R.L.1997. *Plant Propagation, Principles and Practices.* (6th Ed.). Prentice Hall of India Ltd.:411p

Kalalbandi, B.M., Ziauddin, S., and Shinde, B.N. 2014. Effect of time of soft wood grafting on the success of sapota grafts in 50% shadenet under Marathwada conditions. *Agric. Sci. Digest* 4(2).doi:10.5958/09760547.2014.00037.8

Kulwal, J., Yayde, G.S., and Deshmukh, P.P. 1988. A simple method of grafting in sapota. Shetkari1:26-29.doi:10.7748/ns.2.29.18.s53

Maiti, S. C. and Biswas, P. 1986. Effect of scion variety and type of scion shoot on success of epicotyl grafting of mango. *Punjab Hort. J.* 20(3): 152-155.

Pampanna, Y. and Sulikeri, G.S. 2000. Effect of season on the success and growth of softwood grafts in sapota on invigorated rayan root-stock. *Karnataka J. Agric. Sci*. 13(3): 779-782

Sarada, C., Rao, V.P., Sakar, R., and Rao, S.N. 1997. Studies on softwood grafting in Cashew. *South Indian Hort*. 39(3): 119-123.

Shirol, A.M., Kanamadi, V.C., and Thammaiah, N. 2005. Response of different sapota cultivars to softwood wedge grafting. *Karnataka J. Hort*. 1: 41-43.

Sulkeri, G.S., Patil, V.S., Madalageri, M.B., and Mokashi, A.N. 1997. Standardization of softwood grafting technique in Sapota. *Directorate of Research Univ. Agric. Sci. Dharward* 283p.

Tanuja, P. and Thippesha, D. 2016. Effect of curing of scion on success rate of softwood grafting in Sapota. *Advances* 2004-2008.