Optimization of GA_3 Concentrations and Growing Conditions on the Survival and Economic Performance of Softwood Grafts in Tamarind (*Tamarindus indica* L.) Cv. No. 263

Vaishnavi S.Chavan[1], Anshul S. Lohakare[2*], Shital D. Pawar[3] and Prajakta P. Neharkar[4]

[1]*M.Sc (Hort) Scholar, Department of Horticulture, VNMKV, Parbhani.*
[2]*Assistant Professor, College of Horticulture, VNMKV, Parbhani.*
[3]*M.Sc (Hort) Scholar, Department of Horticulture, VNMKV, Parbhani.*
[4]*M.Sc (Hort) Scholar, Department of Horticulture, VNMKV, Parbhani.*

Abstract

An experiment conducted to assess the effects of different GA_3 concentrations and growing conditions on the survival and economics of tamarind softwood grafts. The treatment (T_2) GA_3 100 ppm + green shadenet house found superior in terms of maximum survival percentage (79.47%) at 120 DAG. The satisfactory outcome in respect to the higher grafts success in tamarind Cv. No. 263 with gross returns (Rs.3814), net income (Rs.2446) and maximum B:C ratio (2.78) was also recorded in the same treatment.

Keywords: Economics, GA_3, graft survival, growing condition, tamarind

Introduction

Tamarind (*Tamarindus indica* L.) belongs to the family Leguminosae, subfamily Caesalpiniaceae is native to tropical Africa. Tamarind tree grows wild, though cultivated to limited extent. Tamarind can be propagated by several vegetative methods, including stem cuttings, budding, inarching, air layering, softwood grafting, and veneer grafting. In India softwood grafting method is being employed on commercial scale for production of planting material in tamarind. These tamarind grafts perform well initially, but over the time, the mortality rate increases and development becomes extremely slow, as is the case with softwood grafting in open conditions. To overcome this bottleneck in tamarind grafting, application of GA_3 at different concentrations and optimized growing conditions are necessary for better growth and survival. The GA_3 involves in synthesis of amylase and other hydrolytic enzymes during the sprouting process. It is considered the principal factor activating gluconeogenic enzymes in the early phases of grafting. Favourable weather conditions are essential for the success of tamarind grafts because they may cause early vascular tissue contact and cambium layer formation, which trigger early sprouting. The optimal temperature for tamarind graft growth ranges from 28°C to 34°C, with green shade net houses proving most effective. Hence, it is advantageous to use a shadenet house to enhance propagation efficiency and to increase survival rates. A critical review of existing literature indicates significant potential for utilizing GA_3 and varying growing environments to further improve the growth and success rates of softwood grafts in tamarind. In light of this, the present investigation was designed with the objective of evaluating the effects of different GA_3 concentrations and growing conditions on the survival rate and economic performance of softwood grafts in tamarind Cv. No. 263.

Materials and methods

The present investigation entitled "Optimization of GA_3 concentrations and growing conditions on the survival and economic performance of softwood grafts in tamarind (*Tamarindus indica* L.) Cv. No. 263" was carried out at Central Nursery, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani during the year 2024-2025. The experiment was laid out in randomized block design with ten treatments replicated thrice.

Table 1: Treatment details

Treatments	Treatment details
T_1	GA_3 @ 100 ppm + Open condition
T_2	GA_3 @ 100 ppm + Green shadenet house
T_3	GA_3 @ 100 ppm + White shadenet house
T_4	GA_3 @ 125 ppm + Open condition
T_5	GA_3 @ 125 ppm + Green shadenet house
T_6	GA_3 @ 125 ppm + White shadenet house
T_7	GA_3 @ 150 ppm + Open condition
T_8	GA_3 @ 150 ppm + Green shadenet house
T_9	GA_3 @ 150 ppm + White shadenet house
T_{10}	Control

The bud sticks were collected during morning hours and kept in wet gunny bags to conserve moisture. The bud sticks were selected suitable to the thickness of rootstocks. The top of the stem was split longitudinally to about 4-5 cm in length forming a V shape. The lower end of the scion was cut into gently sloping wedge of about 3 to 4 cm by removing the bark and wood from both the opposite sides. The wedge shaped scion stick was inserted into the V shaped split of the rootstock and secured firmly with 200-gauge thickness green transparent polythene strip. The local rootstock was collected for tamarind grafting. The grafts were treated with foliar application of GA_3 at different concentration at 30 and 60 DAG and with soil drenching of Biomix 4% immediately after grafting. The grafts were then maintained under different growing conditions such as open condition, green shadenet house and white shadenet house for assessing growth and success of tamarind grafts.

Results and Discussion:

The perusal of the data presented in Table 2 and 3 regarding survival and economics of tamarind grafts as influenced by different concentrations of GA_3 and growing conditions recorded significant differences.

Survival percent of grafts

The data pertaining to survival percentage of graft revealed that treatment (T_2) GA_3 100 ppm + green shadenet house had maximum survival percent of grafts (79.47%) among rest of the treatments under study while the minimum survival percent (51.67%) was recorded in (T_{10}) control. The highest percentage of survival may be attributed due to the foliar applications of GA_3, which increases final graft survival primarily by accelerating and strengthening graft union formation. The GA_3 at 100 ppm concentration optimally enhanced vascular reconnection at the graft union by balancing auxin and GA_3 crosstalk, whereas higher dose (125 and150 ppm) disrupted hormonal equilibrium, causing poor callus formation and resource diversion to shoots at the expense of root development.

This is in conformity with the findings of Pawar *et al.* (2018) [10] and Dhorajiya *et al*. (2022) [4] .The above results might be due to favourable microclimatic conditions. such as moderate temperature and relative humidity inside for a longer period, which prevented desiccation of the scion and promoting stronger graft union that helped for better survival of the grafts. The mentioned result is in accordance with Raghavendra *et al*. (2011) [12], Chander *et al*. (2016) [2], Manga *et al*. (2017) [8] , Nanditha *et al*. (2017) [9] , Laxmi *et al*. (2018) [6] , Mahesh *et al*. (2018) [7] , Anil *et al.* (2022) [1] and Dewangan *et al.* (2023) [3].

Table 2: Effect of GA_3 concentrations and growing conditions on final survival percent of grafts in tamarind at 120 DAG

Treatment No.	Final survival % of graft
T_1	61.67
T_2	79.47
T_3	70.00
T_4	57.67
T_5	71.67
T_6	73.33
T_7	58.33
T_8	75.57
T_9	67.35
T_{10}	51.67
SE $\pm$	2.03
CD @ 5%	6.02

***Each value is average of three determination**

Economic parameters

The economics and B:C ratio of grafts were evaluated. The data show that treatment T_2 (GA_3 100 ppm + green shadenet house) provided the highest gross returns (Rs. 3814) and net returns (Rs. 2446), whereas the lowest gross (Rs. 2480) and net returns (Rs. 1234) were noted in treatment T_{10} (control).This may be attributed to the grafts receiving an optimal concentration of GA_3 and being maintained under favorable microclimatic conditions in the green shadenet house, which improved survivability and ultimately resulted in the highest net returns for this treatment. These results are in accordance with findings by Ghuge *et al*. (2023) [5] and Priyanka *et al*. (2023) [11] in tamarind, who reported similar effects of GA_3 and environmental conditions on graft success. Furthermore, this investigation revealed that the B:C ratio was significantly influenced by both GA_3 concentration and growing conditions. The highest B:C ratio (2.78) was recorded in Treatment T_2 (GA_3 100 ppm + green shadenet house), while the lowest (1.97) was observed in the T_{10} (Control).

Table 3: Effect of GA_3 concentrations and growing conditions on economics and B:C ratio of tamarind graft at 120 DAG

Treatments	Survival percent (%)	Selling Price (Rs/graft)	Cost of production for 60 grafts (Rs)	Treatment cost for 60 grafts (Rs)	Total cost for 60 grafts Production (Rs)	Gross return (Rs)	Net Return (Rs)	B:C ratio
T_1	61.67	80	1246	118	1364	2960	1596	2.17
T_2	79.47	80	1246	122	1368	3814	2446	2.78
T_3	70.00	80	1246	126	1372	3360	1988	2.44
T_4	57.67	80	1246	128	1374	2768	1394	2.01
T_5	71.67	80	1246	132	1378	3440	2062	2.49
T_6	73.33	80	1246	136	1382	3519	2128	2.54
T_7	58.33	80	1246	143	1389	2799	1410	2.02
T_8	75.57	80	1246	147	1393	3627	2234	2.60
T_9	67.35	80	1246	151	1397	3232	1835	2.31
T_{10}	51.67	80	1246	00	1246	2480	1234	1.97

Conclusion:

The foliar application of gibberellic acid (GA_3) at 100 ppm at 30 and 60 days after grafting (DAG), with grafts maintained under green shadenet house conditions, demonstrated significant superiority over all other treatments. This combination resulted in enhanced survivability and better economic returns for softwood grafts in tamarind Cv.No.263. These results highlight that optimizing GA_3 concentration, along with providing a favourable microclimate such as green shadenet house; can greatly enhance grafting outcomes and profitability.

REFERENCES:

[1] *Anil, Paikra, M.S., Deshmukh, U.B., Singh J., Nishad D., Paikra, P. and Kumar, D. Studies on softwood grafting of tamarind (Tamarindus indica L.) under different growing condition. The Pharma Innovation Journal. 11(7), (2022), 1627-1631.*

[2] *Chander, S., Kumar, S., Kavino, M. and Bora, L. Effect of seasonal variation on softwood grafting under different environmental conditions in jamun (Syzygium cumini L. Skeels.). Research on Crops. 17(3), (2016), 524-528.*

[3] *Dewangan, S., Ramteke, V., Sharma, G. L., Chandrakar, T., Singh, D. P., Netam, R. S. and Panigrahi, H. K. Grafting month and environmental condition influences on the success of softwood grafting in Cashew under Bastar region of Chhattisgarh. Emergent Life Sciences Research. 9(2), (2023), 83-92.*

[4] *Dhorajiya, N. P., Butani, A.M., Chaudhari, T. and Chitroda, R.L. Effect of pre-soaking treatments and various environmental conditions on germination and growth of custard apple (Annona squamosa L.) var. Sindhan. The Pharma Innovation Journal. 11(8), (2022), 450-454.*

[5] *Ghuge, N. B., Lohakare, A.S. and Barkule, S. R. Standardization of GA_3 and biomix concentrations for growth and success of softwood grafts in sapota Cv. Kalipatti under polyhouse conditions. The Pharma Innovation Journal.12(12), (2023),3340-3342.*

[6] *Laxmi, B., Tank, R.V., Chawla, S.L. and Kitty, R. Response of chemicals and colour shade nets on growth of epicotyl grafting of mango (Mangifera indica L.) CV. Kesar. International Journal of Chemical Studies.6(6), (2018), 2876-2880.*

[7] *Mahesh, S., Hipparagi, K., Goudappanavar, B., Thirupathaiah, G. and Naik, R. Influence of Different Mango Varieties and Time of Grafting on Graft Survivability (%) in Both Polyhouse and Shade Net Under Northrn Dry Zone of Karnataka. International journal of Pure & Applied Bioscience. 5(5), (2018), 1445-1451.*

[8] *Manga, B., Jholgiker, P., Swamy, G. S. K., Prabhuling, G. and Sandhyarani, N.. Studies on the effect of propagation environment for softwood grafting in guava (Psidium guajava L.) cv. Sardar. International Journal of Current Microbiology and Applied Sciences. 6(6), (2017), 2779-2783.*

[9] *Nanditha, G. C., Patil, D. R., Klapati, H., Ambresh, Patil, S.N., Venkateshalu & Kanthesh, G. Study the survivability of grafts in different varieties of guava (Psidium guajava L.) by softwood grafting under different growing conditions. Internatinal Journal Current Microbiology Applied Science. 6(12),(2017),3017-3022.*

[10] *Pawar, T. A., Patil, S. G. & Deshpande, D. P. Studies on effect of chemicals on growth of rootstock for softwood grafting in custard apple (Annona squamosa L.). M.Sc. (Hort.). Thesis submitted to Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani. (2018).*

[11] *Priyanka, T. N., Hiremath, J. S., Nataraja, K. H., Pushpa, T. N., Nandhimath, S. & Masuthi, D. A. Softwood Grafting in Tamarind (Tamarindus indica L.). Asian Journal of Agricultural and Horticultural Research. 10(4), (2023),227-235.*

[12] *Raghavendra, V. N., Angadi, S. G., Mokashi, A. N., Allolli, T. B., Venugopal, C. K. & Mummigatti, U. V. Studies on Softwood Grafting in Wood Apple (Feronia limonio L.). Acta Horticulturae. 890, (2011), 165-174.*