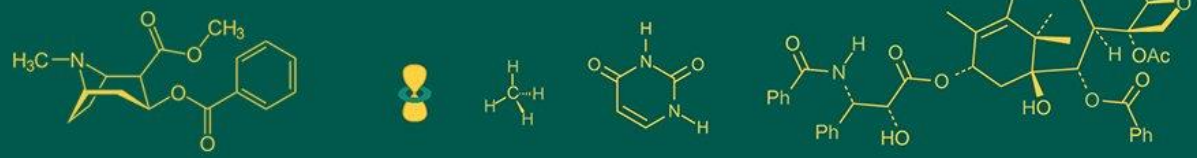
International Journal of Advanced Biochemistry Research



ISSN Print: 2617-4693
ISSN Online: 2617-4707
IJABR 2024; 8(1): 668-670
www.biochemjournal.com
Received: 10-11-2023
Accepted: 19-12-2023

Nutan B Ghuge
M.Sc. Scholar, Department of Horticulture, VNMKV, Parbhani, Maharashtra, India

Anshul S Lohakare
Assistant Professor, College of Horticulture, VNMKV, Parbhani, Maharashtra, India

Santosh R Barkule
Officer Incharge, Central Nursery Scheme, VNMKV, Parbhani, Maharashtra, India

Corresponding Author:
Anshul S Lohakare
Assistant Professor, College of Horticulture, VNMKV, Parbhani, Maharashtra, India

Standardization of GA_3 and biomix concentrations for survival and economics of softwood grafts in sapota Cv. Kalipatti under polyhouse conditions

Nutan B Ghuge, Anshul S Lohakare and Santosh R Barkule

DOI: https://doi.org/10.33545/26174693.2024.v8.i1i.474

Abstract
An experiment was conducted to standardize the optimum concentrations of GA_3 and Biomix for survival and economics of sapota softwood grafts. The treatment (T_6) GA_3 125 ppm + Biomix 4% found superior in terms of maximum survival percentage (90.67%) at 150 DAG. The satisfactory outcome in respect to the higher grafts success in sapota cv. Kalipatti with gross returns (Rs.1948.5), net income (Rs.1457) and maximum B:C ratio (2.96) was also recorded in the same treatment.

Keywords: Biomix, GA_3, graft success, Kalipatti, polyhouse, Sapota

Introduction
Sapota (*Manilkara achras* (Mill) Forsberg is one of the prominent fruits belongs to the family sapotaceae, subfamily Sapotoidae is native to tropical America. The quality of planting material available in India has greatly improved by softwood grafting. The ideal temperature range for cellular activity is typically between 12°C and 35°C. Polyhouse conditions were also found favorable for higher growth of grafts. As a result, employing polyhouses to increase propagation efficiency and produce off-season planting material is beneficial. In fact, sapota grafts are successful in the early stages, but the death rate rises with time and becomes very slow growth is noted in softwood grafting under open condition.
Additionally, it is noted that in softwood grafting, strong sprouting occurs early on, but later, development becomes problematic and the grafts are unable to survive. To overcome this bottleneck in sapota grafting the GA_3 and Biomix applications are necessary. The GA_3 involves in synthesis of amylase and other hydrolytic enzymes during the sprouting process. GA_3 appears to be the primary component triggering the gluconeogenic enzyme's activity early in the grafting procedure. To fix atmospheric nitrogen in the soil and make it available to plants, Biomix is a unique and well-balanced blend of 14 specific species of microbes. It also solubilizes soil-based minerals, such as iron, magnesium and residual phosphorus, to increase their availability to plants. It involves in increasing survival percentage of grafts and thereby overall income of the grafts. In view of the above and after critical review it was felt necessary to find out the optimum concentrations of GA_3 and Biomix in softwood grafts of sapota under polyhouse condition for obtaining higher survival percent and profit of the prepared grafts. Hence, the present investigation was undertaken with an object to standardize the optimum concentrations of GA_3 and biomix for maximum survival and economics of softwood grafts in sapota Cv. Kalipatti.

Materials and Methods
The present investigation was carried out at Central Nursery, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani during the year 2022- 2023. The experiment was laid out in randomized block design with ten treatments replicated thrice. 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 activated bud sticks with matching slant cuts of 2"2.5" length on either side was placed into the cut to form a wedge. The cut end of the scion is shaped to a wedge of 4-5 cm long by chopping the bark and wood from two opposite sides.

The Khirni rootstock was collected for sapota grafting and the foliar application of GA_3 and soil drenching of Biomix at three distinct stages *i.e.,* immediately after grafting, 30 DAG and 60 DAG was done. Immediately after grafting capping of grafts was done for next 20 days with plastic bags of having 25 cm length, 7.5 cm breadth and 200 guage thickness and grafts were kept under poly house for assessing survival and economics of sapota grafts.

Result and discussion

The perusal of the data presented in Table 1 and 2 regarding survival and economics of sapota grafts as influenced by different concentrations of GA_3 and Biomix applications recorded significant differences.

The data pertaining to days required for survival revealed that treatment (T_6) GA_3 125 ppm + Biomix 4% had maximum survival percent of grafts (90.67%) among rest of the treatments under study while the minimum survival percent (60.66%) was recorded in (T_{10}) control. The highest percentage of survival may be attributed due to the foliar applications of GA_3, which promotes faster root and shoot development, strengthening grafts resistance to root infections and standing shock. The results are in accordance with the findings of Palepad *et al.* (2017) [5], Pawar *et al.* (2018) [6], Yadav *et al.* (2012) [10], Rawat and Pandey (2019) [8], Boricha *et al.* (2020) [1] and Lalitha *et al.* (2020) [3]. The above results might be due to drenching of optimum quantity of Biomix as it is involved in accelerating root-associated organism's activities for biological nitrogen fixation, solubilization of insoluble phosphates, increase mobilization of plant nutrients and better nutrient uptake in plant. Increased levels of potassium, phosphate and nitrogen in inoculated plants at various phases of Biomix treatment led to improved plant development and a notable rise in plant growth (Salisburry and Ross, 1985) [9].

Treatment (T_6) GA_3 125 ppm + Biomix 4% gave highest gross returns (Rs.1948), net returns (Rs.1457) while lowest gross returns (Rs.1161) and net return (Rs.708) was noted in treatment (T_{10}) control. This could be because the graft received the proper concentration of GA_3 and Biomix; the success rate of this treatment was higher than that of other treatments under study, additionally the grafts were kept under polyhouse and capping were done to the grafts which may have provided congenial climatic condition for improved survival and ultimately, highest net returns obtained in this treatment. The results are in accordance with the findings of Ratan *et al*. 1987 [7]; Lingaiah *et al*. 2002 [4] and Lal *et al.* 2007 [2]. This investigation revealed that the B:C ratio was also significantly impacted by the use of optimum quantity of GA_3 and Biomix. The highest B:C ratio (2.96) was estimated in treatment (T_6) GA_3 125 ppm + Biomix 4%, and lowest (1.56) in treatment (T_{10}) control.

Table 1: Effect of GA_3 and Biomix concentrations on final survival percent of grafts in sapota

Treatment No.	Treatment details	Final survival percent of grafts (%) at 150 DAG
T_1	GA_3 100 ppm + Biomix 2%	80.00
T_2	GA_3 100 ppm + Biomix 3%	72.00
T_3	GA_3 100 ppm + Biomix 4%	70.00
T_4	GA_3 125 ppm + Biomix 2%	73.33
T_5	GA_3 125 ppm + Biomix 3%	76.67
T_6	GA_3 125 ppm + Biomix 4%	90.67
T_7	GA_3 150 ppm + Biomix 2%	66.00
T_8	GA_3 150 ppm + Biomix 3%	70.67
T_9	GA_3 150 ppm+ Biomix 4%	84.66
T_{10}	Control	60.66
SE(m) ±		3.31
CD @ 5%		9.85

Table 2: Effect of GA_3 and Biomix concentrations on economics and B:C ratio of sapota grafts at 150 DAG

Treatments	Success percent (%)	Selling price (Rs/graft)	Cost of production for 30 grafts (Rs)	Treatment cost for 30 grafts (Rs)	Total cost for 30 grafts production (Rs)	Gross return (Rs)	Net return (Rs)	B:C ratio
T_1	70.00	70	453	29	482	1470	988	2.04
T_2	62.00	70	453	31	484	1302	818	1.69
T_3	72.67	70	453	33	486	1526	1040	2.13
T_4	60.00	70	453	34	487	1260	773	1.58
T_5	76.67	70	453	36	489	1610	1121	2.29
T_6	92.83	70	453	38	491	1948.8	1457	2.96
T_7	64.67	70	453	41.5	494.5	1358	863.5	1.75
T_8	63.33	70	453	43.5	496.5	1323	826.5	1.66
T_9	82.67	70	453	45.5	498.5	1909.6	1411.1	2.83
T_{10}	55.33	70	453	00	453	1161	708	1.56

Conclusion

It can be concluded that the foliar application of GA_3 125 ppm and soil drenching of Biomix 4% at three distinct stages i.e., immediately after grafting, 30 DAG and 60 DAG was found significantly superior over rest of the treatments, under poly house condition with the capping of polythene bags for twenty days of grafting to get better survival and economics of softwood grafts in Sapota Cv. Kalipati.

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