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Effect of growth stimulants on growth and survivability of avocado (*Persea americana* Mill.) grafts under hill zone of Karnataka

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Abstract
The study was carried out during the year 2021-22 under normal poly house condition at department of fruit science, College of Horticulture, Mudigere, on Effect of Growth Stimulants on Growth and Survivability of Avocado (*Persea americana* Mill.) Grafts under Hill Zone of Karnataka. Experiment was laid out in Completely Randomized Design with seven treatments, replicated thrice. In this experiment, avocado grafts were sprayed with GA_3, Biovita and Vipul at different concentrations. GA_3@ 200 ppm recorded maximum graft height (43.72 cm), sprout length (12.73 cm), number of sprouts (7.48), number of leaves (19.68), graft percentage (86.17), graft survival percentage (82.74) and graft vigour index II (3259.59 cm). Grafts sprayed with Biovita @ 4 ml per litre recorded maximum sprout diameter (2.68 mm). Grafts sprayed with Vipul @ 5 ml per litre recorded maximum graft vigour index I (793.37 cm).

Keywords: Graft success percentage, graft vigour index

Introduction
Avocado botanically known as *Persea americana* Mill. belongs to the family Lauraceae (Samson, 1980) [9]. It is native to Central and South America (Rice *et al*., 1987) [8]. In India, it is mainly grown as a backyard tree and is found in small pockets on hill slopes of Tamil Nadu, Kerala, Coorg and in selected regions of Karnataka and Maharashtra (Bose *et al.*, 1990) [1].
In Recent days, avocados are commercially propagated through softwood grafting. The softwood grafting will give more than 90 percent success, (Tripathi *et al*., 2014) [7]. Application of foliar spray of growth stimulants is known to improve the graft success and survival percentage and minimize the mortality rate.
Foliar application of GA_3 have been reported to increase plasticity of the cell wall followed by the hydrolysis of starch to sugars which lowers the water potential of cell resulting in the entry of water into the cell causing cell elongation. (Sargent, 1965) [10].
Biovita is based on seaweed *i.e., Ascophyllum nodosum*, the finest marine plant available for agricultural use. SWEs are non-fertilizer complex compounds that stimulate plant growth at low concentrations consisting macro and micro elements and several groups of plant stimulants such as cytokinins, auxins, vitamins, amino and organic acids and auxin-like compounds (Spinelli *et al.*, 2009) [11].
Vipul is a trade name of triacontanol, natural plant growth regulator found in plant cuticular waxes and bee wax. It is an endogenous hormone which is active at very low concentration on the cell membranes. Triacontanol is reported to improve growth, photosynthesis, transpiration, stomatal conductance, uptake of water and nutrients and other metabolic activities in different crops (Krishnan and Kumari, 2008) [4].

Materials and Methods
The experiment was carried out in a low polyhouse oriented in North South direction, College of Horticulture, Mudigere, Karnataka. Mudigere is situated in hilly region (Zone-9 and Region V) of Western Ghats of Karnataka State at 13^0 25' N latitude and 75^0 57' E longitude at an altitude of 980 m above mean sea level.
Fully matured avocado fruits were collected from Central Horticultural Experimental Station (CHES), Chettalli, Kodagu district during month of first week of September 2021.
Seeds were sown on the day of extraction and vigorously growing two month old rootstocks of

uniform size were selected for grafting. Single clone tree was selected for scion material which is located in farmer's field near Mavinamara village. Split the softwood of stock vertically in the form of cleft to a length of 4-5 cm downward with a sharp knife. The wedge-shaped scion thus prepared was inserted in to the 'V' shaped slit of the stock and tying with polythene strip tightly. Then the grafts were covered with small polythene cap to avoid desiccation.

Solutions of GA_3, Biovita and Vipul at different concentration were prepared and spray was done at monthly intervals and observations were recorded at monthly intervals after grafting.

Results and Discussion

The findings were considerably interpreted and listed in Table 1 based on the observations recorded in the present research.

Effect of growth stimulants on growth and survivability of avocado grafts

Graft height and sprout length

Maximum graft height and sprout length (43.72 and 12.73 cm) were recorded in treatment GA_3 @ 200 ppm, minimum values (39.71 and 9.64 cm) were found in control. It may be due to direct effect of GA_3 on stem elongation by inducing cell wall loosening, by increasing cell wall extensibility, stimulating the wall synthesis, reducing the rigidity of cell wall and by increasing cell division leading to more growth and also indirect effect on stem elongation was by increasing the synthesis of IAA, Leopold and Kriedemann (1983) [5].

Sprout diameter

Maximum sprout diameter was observed in treatment Bio vita @ 4ml/l (2.68 mm). Minimum sprout diameter was observed in control (1.85).

It may be due to the effect of seaweed extracts which contains plant hormone-like substances such as auxins, cytokinins and gibberellins and macro and microelements beside growth-promoting substances such as organic and amino acids and vitamins, which play major role in promoting cell division and elongation. thus, stimulated and increased efficiency the plant carbonation processes and improved plant vegetative growth in general (Osman *et al*., 2010) [6].

Number of sprouts and leaves

Maximum number of sprouts and leaves were recorded in treatment GA_3 @ 200 ppm (7.48 and 19.68). minimum were recorded in control (5.73 and 16.63). Foliar application of GA_3 have been reported to increase production of number of leaves due to increased plasticity of the cell wall followed by the hydrolysis of starch to sugars which lowers the water potential of cell resulting in the entry of water into the cell causing cell elongation. This might have attributed to increase the photosynthetic activity, accelerated translocation and efficiency of utilizing photosynthetic products resulting in cell elongation and rapid cell division in growing portion, (Sargent, 1965) [10].

Graft percentage and graft survival percentage

Maximum graft percentage and graft survival percentage were recorded in treatment GA_3 @ 200 ppm (86.17 and 82.74) respectively, minimum were recorded in control (62.95 and 63.49). It can be cleared that more efficient absorption of various nutrient elements and production of growth hormones and uptake of nutrients lead to higher graft survival percentage. The above finding was in conformity with Devechandra (2006) [3] in jamun.

Graft vigour index I and Graft vigour index II

Maximum graft vigour index I and graft vigour index II were noticed in treatment GA_3 @ 200 ppm (699.67 and 3259.59 cm), minimum were found in control (400.67 and 2031.82 cm). This might be due to maximum graft height and maximum percentage of graft and also enhanced vegetative parameters like length of sprout, number of sprouts and number of leaves which may indirectly influence the graft vigour index. The above results were in conformity with Dalal *et al.* (2002) [2] in rangpur lime.

Table 1: Effect of growth stimulants on growth and survivability of avocado grafts

Treatments	Graft height (cm)	Sprout length (cm)	Sprout diameter (mm)	Number of sprouts	Number of leaves	Graft percentage	Graft survival percentage	Graft vigour index I (cm)	Graft vigour index II (cm)
	120 DAG					90 DAG	180 DAG	90 DAG	
T_1- Control- water spray	39.71	9.64	1.85	5.73	16.63	62.95	63.49	400.67	2031.82
T_2- GA_3 @ 100 ppm	42.52	11.86	2.37	7.16	18.84	80.00	75.00	597.61	3055.5
T_3- GA_3 @ 200 ppm	43.72	12.73	2.55	7.48	19.68	86.17	82.74	699.67	3259.59
T_4- Bio vita-2 ml/l	40.22	10.42	2.48	6.25	17.64	68.77	68.06	418.81	2449.59
T_5- Bio vita- 4 ml/l	41.79	11.57	2.68	7.35	19.45	76.22	77.31	664.27	2663.93
T_6- Vipul- 2.5 ml/l	40.60	10.64	2.26	6.42	17.42	72.89	71.03	515.86	2273.54
T_7- Vipul- 5 ml/l	42.27	12.46	2.63	6.85	18.27	82.83	81.55	793.37	2813.51
S.Em±	0.34	0.16	0.03	0.07	0.21	1.05	3.90	6.02	9.28
CD @ 5%	1.04	0.49	0.11	0.24	0.65	3.20	11.84	18.27	28.14

Plate 1: Effect of growth stimulants on graft growth at 120 DAG a. Control b. GA_3 @ 200 ppm

Conclusion
Maximum graft percentage and graft survival percentage were observed in the grafts sprayed with GA_3 @ 200 ppm.

Future Scope
Effect of combination of different growth stimulants on graft growth and survivability can be studied

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Conflict of interest
The authors have declared that no conflict of interest exists.

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