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Effect of Organic Manures and IBA on Shoot Growth and Survival Percentage of Dragon Fruit (*Hylocereus polyrhizus)* Cuttings

Vishal Malik[1]*, Annjoe V. Joseph[2], Shilpa Rana[1] and Kanwar Singh[1]

Department of Horticulture, Naini Agricultural Institute,
Sam Higginbottom University of Agriculture, Technology and Sciences,
Prayagraj 211007, U.P., India

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ABSTRACT

An experiment was conducted to know the effect of organic manures and IBA on shoot growth and survival percentage of dragon fruit (*Hylocereus polyrhizus*) cuttings under shade net condition of the Department of Horticulture, Naini Agriculture Institute, Sam Higginbottom University of Agriculture Technology and Science, Prayagraj-211007 U.P., India during August to November 2022. The experiment was laid out by following a Completely Randomized Design with 10 treatments replicated thrice. Treatment consisted of different organic manures and different levels of IBA (4500, 6500 and 8500). The organic manures and IBA have a significant effect on the shoot growth and survival percentage of dragon fruit cuttings. On the basis of these results and those of other studies, we postulate that the treatment T_6(Soil + Sand + Vermicompost) + IBA (8500 ppm) took the minimum days for first sprouting per cutting (17.87) and the maximum number of sprouts per cutting (DAP) per cutting (1.48, 1.84, and 3.10 at 30, 60, and 90 DAP), average length of shoot (cm) (DAP) per cutting (4.47, 13.40, and 25.65 cm at 30, 60, and 90 DAP), average diameter of shoot (mm) (DAP) per cutting (13.40, 26.03, and 40.28 mm at 30, 60, and90 DAP), length of longest shoot (cm) (DAP) per cutting (6.35, 14.65, and 27.53 cm at 30, 60, and 90 DAP), diameter of longest shoot (mm) (DAP) per cutting (14.73, 27.36, and 41.61 mm at 30, 60, and 90 DAP), sprouting percentage per cutting (29.60, 36.80, and 62.07 % at 30, 60, and 90 DAP). The treatments T_3, T_6, and T_9 have the highest survival percentage per cutting (100.00 at 90 DAP).

Key words: *Organic manures, IBA, Shoot growth and Dragon fruit cuttings.*

Introduction

Dragon fruit (*Hylocereus* sp.) is diploid (2n=22) and belongs to the genus *Hylocereus*, family Cactaceae and subfamily Cactoideae. It is one of the newly introduced exotic fruit crop in India. The origin is tropical and subtropical forest regions of Mexico and Central South America Mirzahi and Nerd, (1996). It is commonly called as Pitaya, Strawberry pear, Night blooming cereus, Queen of night, Honorable queen, *Cereus triangularis*, Jesus in the cradle and Belle of the night Martin *et al.* (1987). It has received worldwide recognition, as an ornamental plant and as a fruit crop. The plants can tolerate cool or warm climate with average annual rainfall requirement of 500 to 1500 mm. Dragon fruit crop is cultivated with easy agronomic practices, low maintenance cost and requires minimal aftercare due to less attack of pests and diseases Ali *et al.* (2022). It has received worldwide recognition as an ornamen-

([1*]Research Scholar, [2]Assistant Professor)

tal as well as a fruit crop. Major dragon fruit growing countries are Vietnam, Columbia, Mexico, Costa Rica and Nicaragua and to a lesser degree, cultivation occurs in Australia and Israel. The vegetative propagation in Dragon fruit is of utmost desirable in order to propagate true-to-type plants. Hence, vegetative methods of propagation *viz.*, stem cuttings is done which is inexpensive, rapid, simple and does not require the particular techniques as in case of other methods. The reports on an investigation on the propagation of Dragon fruit from cuttings and use of growth regulators for better root growth are scanty. Therefore, the study was undertaken on the propagation of Dragon fruit using different growth regulators for rapid multiplication Siddiqua *et al.* (2018). Dragon fruit is considered a promising crop to be grown commercially in dry regions Vaillant *et al.* (2005). The easiest, cheapest and most convenient method of propagating dragon fruit is by stem cutting. Dragon fruit plants can be propagated through seed propagation, vegetative propagation and grafting. Currently, the three conventional methods such as seed propagation and vegetative means through stem cuttings and grafting could not meet the current market demand Gunasena *et al.* (2006). Vegetative propagation methods such as stem cutting and grafting can be used to overcome the shortcomings of seed propagation.

Materials and Methods

This study was conducted in the shade net condition of the Department of Horticulture, Naini Agriculture Institute, Sam Higginbottom University of Agriculture Technology and Science, Prayagraj, U.P., India during August to November 2022 and this set in a Complete Randomized Design with three replicates for each treatment. A total of 10 different treatments were formed i.e. T_0(Control) Soil + Sand) (1:1), T_1 (Soil + Sand + FYM) + IBA (4500 ppm),T3 (Soil + Sand + FYM) + IBA (8500 ppm), T4 (Soil + Sand + Vermicompost) + IBA (4500 ppm), T5 (Soil + Sand + Vermicompost) + IBA (6500 ppm), T6 (Soil + Sand + Vermicompost) + IBA (8500 ppm), T7 (Soil + Sand + Poultry manure) + IBA (4500 ppm), T8 (Soil + Sand + Poultry manure) + IBA (6500 ppm), and T9 (Soil + Sand + Poultry manure) + IBA (8500 ppm). Cuttings of 15 cm in length were taken from shoots with 4-5 one year old nodes. The cuttings basal end had a slant cut to expose the most absorbent area possible for efficient roots and were shade dried for one day before planting. The basal part (about 1 inch) of the cuttings was treated with plant growth regulators by quick dip method for 5 seconds, and later they were allowed to dry for 15 minutes under shade and planted in polybags containing the rooting media i.e, soil, sand, and organic manures in a ratio (1:1:1). After soaking the cuttings, they were placed into a soil mixture and kept in a net house. Water was sprayed over the cuttings daily. The collected data were analyzed using Statistical Analyzing System (SAS). The treatment means were compared using excel at 5% significant level.

Results and Discussion

Days for first sprouting

The data on shoot parameters showed significant differences among different treatments the cuttings treated with T_6 (Soil + Sand + Vermicompost) + IBA (8500 ppm) taken the minimum number of days for sprouting (17.87) and the maximum number of days taken was observed in T_0 control (42.03). This might be due to the fact that auxins are known to induce stimulus for the regeneration of roots by promotion of hydrolysis, mobilization and utilization of nutritional reserves. Similar findings were reported by Swetha *et al.* (2005) in lavender. Rooting media like soil + sand + vermicompost may also be provided good congenial conditions for early sprouting in cuttings.

Number of sprouts per cutting

When it came to the number of sprouts per cutting (DAP) per cutting, the organic manures and IBA treatments outperformed the control. The highest number of sprouts per cutting (DAP) per cutting (1.48, 1.84 and 3.10 at 30, 60 and 90 days after planting) was observed with T_6(Soil + Sand + Vermicompost) + IBA (8500 ppm) and the minimum was the lowest number of sprouts per cutting (DAP) was recorded in T_0 control (1.07, 1.35 and 1.60 at 30, 60 and 90 DAP) treatment. This might be due to the presence of endogenous auxins in cuttings might have brought early breakage of bud dormancy and caused early bud sprouting. A similar investigation was noticed by Singh (2017) in pomegranate. This might be due to higher organic matter content in vermicompost, which is related to the build-up of high concentrations of nutrients especially nitrogen and phosphorus in the cells and also the good mois-

ture capacity of the medium. This result was in close agreement with the evaluation of Panchal *et al*. (2014) in Sapota.

Average length of shoot (cm)

In terms of the Average length of shoot (cm) (DAP) per cutting, the organic manures and IBA treatments outperformed the control. The highest Average length of shoot (cm) (DAP) per cutting(4.47, 13.40 and 25.65 cm at 30, 60 and 90 days after planting) was noticed with T_6(Soil + Sand + Vermicompost) + IBA (8500 ppm) and the minimum average shoot length (cm) (DAP) was recorded inT_0 control (2.39, 6.16 and 12.07 cm at 30, 60 and 90 DAP) treatment. This may be attributed to better media combinations, higher nutrient and water retention capacities, good aeration, porosity and drainage than other growing media mixtures, which helped in forming a better root system and hence, better shoot development. A similar study was conducted by Sudarjat *et al.* (2018) in dragon fruit cuttings and concluded that the mixture of soil + vermicompost and soil + sand + vermicompost recorded the longest shoot length compared to other media.

Average diameter of shoot (mm)

Among the various treatments, organic manures and IBA had a more favourable impact on average shoot diameter (mm) (DAP) per cutting than the control. The highest Average diameter of shoot (mm) (DAP) per cutting (13.40, 26.03 and 40.28 mm at 30, 60 and 90 DAP) was noticed with T_6(Soil + Sand + Vermicompost) + IBA (8500 ppm) and minimum Average diameter of shoot (mm)(DAP) was recorded in T_0 control (8.27, 16.42 and 26.74 mm at 30, 60 and 90 DAP) treatment. This may be due to maximum number of roots with helps in nutrition and water absorption. Chandramouli (2001) stated that earliness in sprouting, and an increase in the number of sprouts, shoots and sprout length might be due to better utilization of stored carbohydrates, nitrogen and other factors with the aid of growth regulators. A similar result was reported by Singh (2013) in *Citrus limon*.

Length of longest shoot (cm)

Among the different treatments, the highest Length of the longest shoot (cm) (DAP) per cutting (6.35, 14.65 and 27.53 cm at 30, 60 and 90 days after planting) was noticed with T_6 (Soil + Sand +

Table 1. *Effect of organic manures and IBA on days taken for sprouting, number of sprouts per cutting, average length of shoot, and average diameter of shoot of Dragon Fruit (Hylocereus polyrhizus) cuttings.*

Treatment	Treatment combinations	Days taken for sprouting	Number of sprouts per cutting			Average length of shoot (cm)			Average diameter of shoot (mm)		
			30 (DAP)	60 (DAP)	90 (DAP)	30 (DAP)	60 (DAP)	90 (DAP)	30 (DAP)	60 (DAP)	90 (DAP)
T_0 (Control)	(Soil + Sand) (1:1)	42.03	1.07	1.35	1.60	2.39	6.16	12.07	8.27	16.42	26.74
T_1	(Soil + Sand + FYM) + IBA (4500 ppm)	35.91	1.10	1.48	1.85	3.23	8.37	17.62	11.40	20.31	32.83
T_2	(Soil + Sand + FYM) + IBA (6500 ppm)	34.74	1.15	1.50	1.87	3.34	8.79	18.61	11.76	24.28	37.53
T_3	(Soil + Sand + FYM) + IBA (8500 ppm)	31.85	1.20	1.51	1.89	3.55	9.21	19.46	11.84	25.09	38.72
T_4	(Soil + Sand + Vermicompost) + IBA (4500 ppm)	22.78	1.39	1.75	2.80	4.28	12.43	23.58	12.33	25.85	39.56
T_5	(Soil + Sand + Vermicompost) + IBA (6500 ppm)	20.71	1.44	1.77	3.05	4.41	13.07	24.70	12.43	25.95	39.83
T_6	(Soil + Sand + Vermicompost) + IBA (8500 ppm)	17.87	1.48	1.84	3.10	4.47	13.40	25.65	13.40	26.03	40.28
T_7	(Soil + Sand + Poultry manure) + IBA(4500 ppm)	30.40	1.22	1.54	2.18	3.74	11.89	22.14	11.99	24.24	38.76
T_8	(Soil + Sand + Poultry manure) + IBA(6500 ppm)	28.57	1.25	1.60	2.22	4.10	12.24	22.90	12.10	25.73	37.66
T_9	(Soil + Sand + Poultry manure) + IBA (8500 ppm)	26.19	1.33	1.69	2.30	4.17	12.85	24.31	12.22	25.44	38.43
	F-Test	S	S	S	S	S	S	S	S	S	S
	C.D. at 5 %	1.658	0.048	0.084	0.121	0.112	0.165	1.002	0.552	1.132	1.302
	S.Ed. (+)	0.558	0.023	0.040	0.057	0.053	0.078	0.477	0.263	0.539	0.620
	S.Em	0.789	0.016	0.028	0.041	0.038	0.055	0.337	0.186	0.381	0.438

Table 2. Effect of organic manures and IBA on Length of longest shoot, Diameter of longest shoot, and Sprouting percentage, Survival percentage of Dragon Fruit (*Hylocereus polyrhizus*) cuttings.

Treatment	Treatment combinations	Length of longest shoot (cm) (DAP)			Diameter of longest shoot (mm) (DAP)			Sprouting percentage			Survival percentage
		30 (DAP)	60 (DAP)	90 (DAP)	30 (DAP)	60 (DAP)	90 (DAP)	30 (DAP)	60 (DAP)	90 (DAP)	90 (DAP)
T_0 (Control)	(Soil + Sand) (1:1)	3.28	7.08	13.04	9.33	17.64	27.87	21.47	27.07	32.00	73.33
T_1	(Soil + Sand + FYM) + IBA (4500 ppm)	4.37	9.13	18.76	12.44	21.35	33.87	22.00	29.60	36.93	86.67
T_2	(Soil + Sand + FYM) + IBA (6500 ppm)	4.52	9.57	19.79	12.84	25.36	38.61	23.07	30.07	37.47	93.33
T_3	(Soil + Sand + FYM) + IBA (8500 ppm)	4.75	10.01	20.66	12.93	26.18	39.81	24.00	30.20	37.73	100.00
T_4	(Soil + Sand + Vermicompost) + IBA (4500 ppm)	5.93	13.53	25.23	13.56	27.08	40.79	27.80	35.00	56.07	86.67
T_5	(Soil + Sand + Vermicompost) + IBA (6500 ppm)	6.16	14.23	26.45	13.71	27.23	41.11	28.87	35.47	61.00	93.33
T_6	(Soil + Sand + Vermicompost) + IBA (8500 ppm)	6.35	14.65	27.53	14.73	27.36	41.61	29.60	36.80	62.07	100.00
T_7	(Soil + Sand + Poultry manure) + IBA(4500 ppm)	5.02	12.74	23.42	13.09	25.34	39.86	24.33	30.73	43.60	93.33
T_8	(Soil + Sand + Poultry manure) + IBA(6500 ppm)	5.48	13.16	24.28	13.25	26.88	38.81	25.00	31.93	44.40	86.67
T_9	(Soil + Sand + Poultry manure) + IBA (8500 ppm)	3.66	14.05	25.94	13.52	26.35	39.70	26.67	33.87	46.00	100.00
	F-Test	S	S	S	S	S	S	S	S	S	S
	C.D. at 5 %	0.115	0.667	0.815	0.543	1.198	1.319	0.966	1.674	2.415	14.566
	S.Ed. (±)	0.055	0.317	0.388	0.259	0.570	0.628	0.460	0.797	1.149	6.933
	S.Em	0.039	0.255	0.274	0.183	0.403	0.444	0.325	0.563	0.813	73.33

Vermicompost) + IBA (8500 ppm) and minimum lowest Length of the longest shoot (cm) (DAP) was recorded in T_0 control (3.28, 7.08 and 13.04 cm at 30, 60 and 90 DAP) treatment. Siddiqui and Hussain (2007) reported maximum shoot length with IBA 4000 ppm in *Ficus hawaii*. They pointed out that the increase in shoot length is related to better rooting performance. The cutting streated with IBA @4000 ppm gave more rooting, facilitating enhanced nutrient uptake and ultimately increasing the shoot length.

Diameter of longest shoot (mm)

Regarding the Diameter of longest shoot (mm) (DAP) per cutting, the organic manures and IBA treatments surpassed the control. The highest Diameter of longest shoot (mm) (DAP) per cutting (14.73, 27.36 and 41.61 mm at 30, 60 and 90 days after planting) was noticed with T_6 (Soil + Sand + Vermicompost) + IBA (8500 ppm) and minimum Diameter of longest shoot (mm) (DAP) was recorded in T_0 control (9.33, 17.64 and 27.87 mm at 30, 60 and 90 DAP) treatment. Alam *et al.* (2007) reported maximum shoot diameter with the treatment IBA 4000 ppm. Further, they stated that the increase in shoot diameter in kiwi fruit cuttings might be due to more number of leaves and vigorous root system as a consequence of better carbohydrate production and assimiliation. The results are in conformity with Seran and Thiresh (2015) in Dragon fruit.

Sprouting percentage

When comparing the effects of the various treatments on the percentage of sprouted cuttings, the organic manures and IBA outperformed the control. The highest Sprouting percentage per cutting (29.60, 36.80 and 62.07 % at 30, 60 and 90 days after planting) was noticed with T_6(Soil + Sand + Vermicompost) + IBA (8500 ppm) and the lowest Sprouting percentage was recorded in T_0control (21.47, 27.07 and 32.00 % at 30, 60 and 90 days after planting) treatment. This might be due to the fact that auxins are known to induce stimulus for the regeneration of roots by promotion of hydrolysis, mobilization and utilization of nutritional reserves in the region of root and shoot formation Nanda, (1975). Similar results are report ed by Swetha (2005) in Lavender.

Survival percentage

Significant differences were observed between

treatments for survival percentage of dragon fruit cuttings recorded after 90 days of planting. The highest Survival percentage per cutting (100.00 at 90 days after planting) was noticed with T_6 (Soil + Sand + Vermicompost) + IBA (8500 ppm), T_9 (Soil + Sand + Poultry manure) + IBA (8500 ppm) and T_3 (Soil + Sand + FYM) + IBA (8500 ppm) followed by T_7 (Soil + Sand + Poultry manure) + IBA(4500 ppm), T_5 (Soil + Sand + Vermicompost) + IBA (6500 ppm) and T_2 (Soil + Sand + FYM) + IBA (6500 ppm) while the lowest Survival percentage was recorded in control (60.00) treatment. The probable reasons for higher survivability in these media combinations could be due to the fact that vermicompost provided favourable physical conditions and triggering biochemical activities Wazir *et al.* (2003). These results are in close relation with Rashmita *et al.* (2016) in Pear (*Pyrus pyrifolia* L.).

Conclusion

On the basis of results obtained in the present experiment, it can be concluded that among the 10 treatments, T_6 (Soil + Sand + Vermicompost) + IBA (8500 ppm) showed comparatively good results with respect to shoot growth parameters and survival of dragon fruit cuttings. The application of vermicompost into the soil improves the shoot growth of the cuttings. Based on the findings of the current investigation, it is recommended that the vegetative method of propagation by using vermicompost and IBA@8500 ppm through stem cuttings in Dragon Fruit is reliable for commercial plant production as it is a quick and economical method of vegetative propagation.

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