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IMPACT OF DIFFERENT GROWING MEDIA AND PLANT GROWTH REGULATORS ON CAULOGENESIS OF DRAGON FRUIT (*SELENICEREUS UNDATUS* HAW. D.R. HUNT) CUTTINGS

Ravi Gupta and Rubee Lata*
Department of Horticulture, School of Agricultural Sciences and Technology, Babasaheb Bhimrao Ambedkar University (A Central University), Vidya Vihar, Raebareli Road, Lucknow (U.P.) - 226025
*Corresponding author's email: rubyhort@gmail.com
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ABSTRACT

An experiment entitled "Impact of different growing media and plant growth regulators on caulogenesis of dragon fruit [*Selenicereus undatus* (Haw.) D.R. Hunt] cuttings" was conducted at Horticulture Research Farm of Department of Horticulture, School of Agricultural Sciences and Technology, Babasaheb Bhimrao Ambedkar University, Lucknow (U.P.). Dragon fruit cuttings were treated with different growing media and plant growth regulators in Factorial Completely Randomized Design and were replicated thrice with 18 treatment combinations and two factors. The data revealed that the cuttings grown in media M_2 - Soil: Sand: Cocopeat: Vermicompost (1:1:1:1) performed significantly better than media M_1 - Soil: Sand: Cocopeat: FYM (1:1:1:1). Among the application of different plant growth regulators, IBA @ 6000 ppm recorded minimum number of days taken to sprout initiation (36.18 days), maximum number of sprouts per cutting (1.92, 2.79 and 4.12 at 45, 90 and 135 DAP, respectively), maximum length of shoot (9.09 cm, 13.09 cm and 21.89 cm at 45, 90 and 135 DAP, respectively), maximum shoot circumference (18.78 cm), maximum shoot fresh weight (123.59 g), maximum shoot dry weight (12.31 g), maximum number of spines/areole (5.21), shortest distance between areole (2.43 cm), highest arch height (0.78cm) and maximum survival percentage (98.26 %). Thus, the study revealed that the application of IBA @ 6000 ppm and media M_2- Soil: Sand: Cocopeat: Vermicompost (1:1:1:1) had significant impact on improving shooting of dragon fruit cuttings.
***Keywords* :** Dragon fruit, Plant growth regulators, growing media and cactus

Introduction

Dragon fruit [*Selenicereus undatus* (Haw.) D.R. Hunt] is an edible, fast growing, perennial epiphytic vine like cacti belongs to family Cactaceae. Dragon fruit is known by many names in different countries, "Thang loy" in Vietnam, "Pitajava" in Venezuela, "Tuna", "Nopal" and "Pitajaya" in Spain Junco, "Tasajo" in Mexico. It is also known as Pitaya, Strawberry pear and Night blooming cereus (Martin *et al.*, 1987). Dragon fruit is originated from tropical and subtropical forest/desert regions of Mexico and Central South America (Mirzahi and Nerdand , 1996). It is a new exotic fruit in India and lucrative profitable fruit due to its attractive colour (Adnan *et al.*, 2011), pleasant taste (Castellar *et al.*, 2006), high content of nutrients (Tze *et al.*, 2012), senescence-retarding (Lim *et al.*, 2012; Zhuang *et al.*, 2012), medicinal and cancer-preventing effects (Yusof *et al.*, 2012). hidden fruit on the earth with super nutritive and medicinal It is known as a characteristics. The fresh fruit has a moisture content of 82.5-83.0%, protein 0.16-0.23%, fat content of 0.21-0.61% and fiber content of 0.7-0.9%. content of Data shows that hundred grams of fresh fruit pulp contains calcium (6.3-8.8 mg), and vitamin C (8-9 mg) in per phosphorous (30.2-36.1 mg), iron (0.5-0.61 mg) type 100g of edible portion (Morton, 1987). It is thought to reduce blood sugars in 2 diabetes. It is also beneficial for carbohydrate metabolism, strengthening bones, heart tissues, healthy blood and tissue formation, strengthening immune system, respiratory tract infection and even as a mild laxative due to substantial fiber content. Dragon fruit is believed to able to lower cholesterol concentration, to balance blood sugar concentration, to strengthen kidney function and bone, increasing the sharpness of the eyes as well as cosmetic ingredients (Suryono, 2006). of The most common and economical method propagation of dragon fruit is through cutting, as dragon fruit is propagated vegetatively. is Propagation of dragon fruit can also be done by use of seeds, this method very simple, but the seedlings are not true to type where propagated through seeds because of the cross pollination and fertilization (Andrade *et al.*, 2005). Hence, the present experiment was carried out to study the impact of growing media and plant growth regulators on caulogenesis of stem cuttings in dragon fruit.

Materials and Methods

An experiment was carried out during the year 2024-25 at Horticulture Research Farm, Department of Horticulture, School of Agricultural Sciences and Technology, Babasaheb Bhimrao Ambedkar University (A Central University), Vidya Vihar, Raebareli Road, Lucknow (U.P.). The experiment was laid out in Factorial Completely Randomized Design and were replicated thrice with 18 treatment combinations of two factors, where, first factor was growing media [M_1 – Soil: Sand: Cocopeat: FYM (1:1:1:1) and M_2 - Soil: Sand: Cocopeat: Vermicompost (1:1:1:1)] and the second factor was plant growth regulators (IBA, NAA and IBA) at different concentrations. The details of the various treatment combination are : T_1- Media$_1$ (Soil: Sand: Cocopeat: FYM) + IBA @ 2000 PPM , T_2 - Media$_1$ + IBA @ 3000 PPM , T_3- Media$_1$ + NAA @ 150 ppm, T_4- Media$_1$ + NAA @ 250 ppm, T_5- Media$_1$ + IBA @ 2000 ppm + NAA @ 150 ppm, T_6- Media$_1$ + IBA @ 2000 ppm + NAA @ 250 ppm , T_7- Media$_1$ + IBA @ 3000 ppm + NAA @ 150 ppm, T_8- Media$_1$ + IBA @ 3000 ppm + NAA @ 250 ppm, T_9- Media$_1$, T_{10} - Media$_2$ (Soil: Sand: Cocopeat: Vermicompost) + IBA @ 2000 PPM, T_{11}- Media$_2$ + IBA @ 3000 PPM, T_{12}- Media$_2$ + NAA @ 150 ppm, T_{13}- Media$_2$ + NAA @ 250 ppm, T_{14}- Media$_2$ + IBA @ 2000 ppm + NAA @ 150 ppm, T_{15}- Media$_2$ + IBA @ 2000 ppm + NAA @ 250 ppm, T_{16}- Media$_2$ + IBA @ 3000 ppm + NAA @ 150 ppm, T_{17}- Media$_2$ + IBA @ 3000 ppm + NAA @ 250 ppm, T_{18}- Media$_2$.

The observations on various shoot growth parameters viz., number of days taken for sprout initiation, average number of sprouts per cutting, shoot length (cm), shoot circumference (cm), fresh weight of shoot (g), dry weight of shoot (g), number of spines per areole, distance between areoles (cm), arch height (cm), and survival percentage (%) were recorded at 135 days after planting (DAP). For data collection, sprouted cuttings were carefully examined and parameters were recorded manually using standard tools. The number of days taken for sprout initiation was recorded through regular visual observation from the date of planting. The number of sprouts per cutting was counted manually. Shoot length and arch height were measured using a graduated scale from the base to the tip of the main shoot. Shoot circumference was measured at the mid-point of the shoot using a measuring tape. Fresh weight was recorded immediately after harvesting using a precision electronic balance and expressed in grams. Dry weight was determined by oven-drying the shoots at 65±2°C until a constant weight was achieved. The number of spines per areole and distance between areoles were recorded using a hand lens and scale, respectively. Survival percentage was calculated based on the number of live cuttings at 135 DAP. All recorded data were subjected to statistical analysis by using the standard method suggested by Panse and Sukhatme (1985) for Factorial Completely Randomized Design.

Results

The dragon fruit cuttings grown in both the growing medias which were under study with the influence of different concentrations of plant growth regulators showed that the application of plant growth regulators was more effective than control for all the growth parameters under study as shown in table (1). IBA @ 6000 ppm concentration gave significantly better results in cuttings grown in both of the medias followed by IBA @ 4000 ppm and IBA @ 6000 ppm + NAA 150 ppm whereas the least performance was observed in control treatment. The data showed that the number of days taken to sprout initiation was found to be significant among the treatment combinations. The cuttings grown in M_2 (soil + sand + cocopeat + vermicompost) media and treated with IBA @ 6000 ppm recorded minimum days to sprout (38.25 days), while it was maximum (49.65 days) in the cuttings grown in M_1 (soil + sand + cocopeat + FYM) media with control treatment. Dragon fruit cuttings grown in M_2 (soil + sand + cocopeat + vermicompost) media and treated with IBA @ 6000 ppm performed significantly superior in shooting parameters viz., number of sprouts per cutting (1.92, 2.79 and 4.12 at 45, 90 and 135 DAP respectively) (table 2), length of shoot (9.09 cm, 13.09 cm and 21.89 cm at 45, 90 and 135 DAP respectively) (table 3), shoot circumference (18.78 cm) (table 1), shoot fresh weight and shoot dry weight (123.59 g and 12.31 g) (table 1), number of spines/areole (5.21) (table 4), distance between areole (2.43 cm) (table 4), arch height (0.78cm) (table 4) and survival percentage (98.26 %) (table 4). However, the above parameters were found to be poor in the cuttings grown in M_1 (soil + sand + cocopeat + FYM) media with control treatment.

Discussion

Cuttings grown in M_2 (soil + sand + cocopeat + vermicompost) with IBA @ 6000 ppm sprouted earliest (36.18 days), due to vermicompost's high nitrogen and IBA's enhancement of carbohydrate utilization (Chaplin and Westwood, 1980; Chandramouli, 2001). IBA@ 6000 ppm increased sprout numbers non-significantly, linked to dormant bud activation and rooting (Upadhyay and Badyal, 2007; Rahad *et al.*, 2016). M_2 with IBA @ 6000 ppm produced longer shoots, driven by nutrient-rich vermicompost and polysaccharide hydrolysis (Seran and Thiresh, 2015; Dhruve *et al.*, 2018). The same treatment yielded the thickest stems (18.78 cm), tied to vigorous roots and soil health (Thangjam *et al.*, 2019; Porghorban *et al.*, 2014). Highest fresh (123.59 g) and dry weights (12.31 g) were recorded in M_2 with IBA at 6000 ppm, reflecting enhanced nutrient uptake and photosynthesis (Seran and Thiresh, 2015; Dhruve *et al.*, 2018). Spines/areole was recorded highest (5.21) in M_2 with IBA@ 6000 ppm, due to cell division and nutrient assimilation (Sharma *et al.*, 2017; Rahad *et al.*, 2016). Shortest areole distance (2.43 cm) and highest arch height (0.78 cm) were observed in M_2 with IBA @ 6000 ppm, indicating compact growth and auxin-driven expansion (Kumar *et al.*, 2018; Nahar *et al.*, 2020; Singh and Patel, 2018). Survival was highest (98.26%) in M_2 with IBA @ 6000 ppm, due to improved rooting and soil properties (Patel *et al.*, 2017; Kumar *et al.*, 2018). M_2 with application of IBA @ 6000 ppm consistently outperformed M_1 and control treatments across all the parameters.

Table 1: Impact of different PGR and media on number of days taken to sprout initiation, shoot circumference (cm), shoot fresh weight (g) and shoot dry weight (g).

Plant Growth Regulator Concentrations (P)	Number of days taken to sprout initiation			Shoot circumference (cm)			Fresh weight of shoot (gm)			Dry weight of shoot (gm)		
	Media (M)		Mean	Media (M)		Mean	Media (M)		Mean	Media (M)		Mean
	M1	M2		M1	M2		M1	M2		M1	M2	
P_1 (IBA @ 4000 PPM)	40.42	38.25	39.33	16.69	18.46	17.58	109.21	116.65	112.93	11.61	11.88	11.75
P_2 (IBA @ 6000 PPM)	38.03	36.18	37.11	17.72	18.78	18.25	115.13	123.59	119.36	11.84	12.31	12.07
P_3 (NAA @ 150 PPM)	44.23	43.20	43.71	15.40	16.95	16.17	95.18	97.63	96.41	9.17	9.92	9.55
P_4 (NAA @ 250 PPM)	45.39	44.35	44.87	15.28	16.60	15.94	92.09	95.00	93.54	8.74	9.05	8.90
P_5 (IBA @ 4000 PPM + NAA 150 PPM)	42.77	41.51	42.14	15.76	17.59	16.68	100.82	104.54	102.68	10.28	10.95	10.62
P_6 (IBA @ 4000 PPM + NAA 250 PPM)	43.65	42.64	43.14	15.62	17.31	16.47	98.41	100.10	99.26	9.86	10.42	10.14
P_7 (IBA @ 6000 PPM + NAA 150 PPM)	41.33	39.11	40.22	16.18	18.10	17.14	106.11	111.91	109.01	10.91	11.64	11.28
P_8 (IBA @ 6000 PPM + NAA 250 PPM)	42.16	40.69	41.43	15.94	17.87	16.90	103.29	107.57	105.43	10.76	11.17	10.97
P_9 (Control)	49.65	47.70	48.67	12.81	14.31	13.56	69.07	77.03	73.05	3.76	4.55	4.16
MEAN	43.07	41.51		15.71	17.33		98.81	103.78		9.66	10.21	
	M	P	M x P	M	P	M x P	M	P	M x P	M	P	M x P
SE(m) ±	0.047	0.100	0.142	0.009	0.019	0.026	0.311	0.659	0.933	0.008	0.016	0.023
CD at 5%	0.136	0.289	0.409	0.025	0.054	0.076	0.895	1.899	2.686	0.022	0.046	0.065

Where, M_1 – Soil: Sand: Cocopeat: FYM and M_2 - Soil: Sand: Cocopeat: Vermicompost

Table 2: Impact of different PGR and media on number of sprouts per cutting in dragon fruit.

Plant Growth Regulator Concentrations (P)	45 DAP			90 DAP			135 DAP		
	Media (M)		Mean	Media (M)		Mean	Media (M)		Mean
	M1	M2		M1	M2		M1	M2	
P_1 (IBA @ 4000 PPM)	1.76	1.84	1.80	2.64	2.69	2.67	3.87	3.92	3.90
P_2 (IBA @ 6000 PPM)	1.89	1.92	1.90	2.69	2.79	2.74	4.02	4.12	4.07
P_3 (NAA @ 150 PPM)	1.47	1.49	1.48	2.31	2.38	2.35	3.50	3.52	3.51
P_4 (NAA @ 250 PPM)	1.37	1.42	1.40	2.24	2.34	2.29	3.40	3.46	3.43
P_5 (IBA @ 4000 PPM + NAA 150 PPM)	1.56	1.59	1.57	2.48	2.51	2.49	3.67	3.70	3.68
P_6 (IBA @ 4000 PPM + NAA 250 PPM)	1.49	1.54	1.51	2.39	2.44	2.41	3.52	3.54	3.53
P_7 (IBA @ 6000 PPM + NAA 150 PPM)	1.69	1.75	1.72	2.59	2.66	2.63	3.78	3.80	3.79
P_8 (IBA @ 6000 PPM + NAA 250 PPM)	1.61	1.67	1.64	2.49	2.54	2.52	3.68	3.73	3.71
P_9 (Control)	0.85	0.97	0.91	1.75	1.89	1.82	2.94	3.16	3.05
MEAN	1.52	1.58		2.40	2.47		3.60	3.66	
	M	P	M x P	M	P	M x P	M	P	M x P
SE(m) ±	0.004	0.009	0.013	0.004	0.009	0.013	0.004	0.009	0.013
CD at 5%	0.012	0.026	0.037	0.012	0.026	0.037	0.012	0.026	0.37

Where, M_1 – Soil: Sand: Cocopeat: FYM and M_2 - Soil: Sand: Cocopeat: Vermicompost

Table 3: Impact of different PGR and media on length of shoot per cutting in dragon fruit.

Plant Growth Regulator Concentrations (P)	45 DAP			90 DAP			135 DAP		
	Media (M)		Mean	Media (M)		Mean	Media (M)		Mean
	M1	M2		M1	M2		M1	M2	
P_1 (IBA @ 4000 PPM)	1.76	1.84	1.80	2.64	2.69	2.67	3.87	3.92	3.90
P_2 (IBA @ 6000 PPM)	1.89	1.92	1.90	2.69	2.79	2.74	4.02	4.12	4.07
P_3 (NAA @ 150 PPM)	1.47	1.49	1.48	2.31	2.38	2.35	3.50	3.52	3.51
P_4 (NAA @ 250 PPM)	1.37	1.42	1.40	2.24	2.34	2.29	3.40	3.46	3.43
P_5 (IBA @ 4000 PPM + NAA 150 PPM)	1.56	1.59	1.57	2.48	2.51	2.49	3.67	3.70	3.68
P_6 (IBA @ 4000 PPM + NAA 250 PPM)	1.49	1.54	1.51	2.39	2.44	2.41	3.52	3.54	3.53
P_7 (IBA @ 6000 PPM + NAA 150 PPM)	1.69	1.75	1.72	2.59	2.66	2.63	3.78	3.8	3.79
P_8 (IBA @ 6000 PPM + NAA 250 PPM)	1.61	1.67	1.64	2.49	2.54	2.52	3.68	3.73	3.71
P_9 (Control)	0.85	0.97	0.91	1.75	1.89	1.82	2.94	3.16	3.05
MEAN	1.52	1.58		2.40	2.47		3.60	3.66	
	M	**P**	**M x P**	**M**	**P**	**M x P**	**M**	**P**	**M x P**
SE(m) ±	0.004	0.009	0.013	0.004	0.009	0.013	0.004	0.009	0.013
CD at 5%	0.012	0.026	0.037	0.012	0.026	0.037	0.012	0.026	0.37

Where, M_1 – Soil: Sand: Cocopeat: FYM and M_2 - Soil: Sand: Cocopeat: Vermicompost

Table 4: Impact of different PGR and media on number of spines/areole, distance between areoles (cm), arch height (cm) and survival percentage (%).

Plant Growth Regulator Concentrations (P)	Number of spines/areole			Distance between areoles (cm)			Arch height (cm)			Survival percentage (%)		
	Media (M)		Mean	Media (M)		Mean	Media (M)		Mean	Media (M)		Mean
	M1	M2		M1	M2		M1	M2		M1	M2	
P_1 (IBA @ 4000 PPM)	4.56	4.94	4.75	3.26	3.08	3.17	0.62	0.72	0.67	92.96	96.02	94.49
P_2 (IBA @ 6000 PPM)	4.99	5.21	5.10	2.97	2.43	2.70	0.67	0.78	0.72	95.77	98.26	97.02
P_3 (NAA @ 150 PPM)	3.96	4.29	4.13	4.17	3.79	3.98	0.49	0.57	0.53	83.83	85.24	84.54
P_4 (NAA @ 250 PPM)	3.88	4.20	4.04	4.35	3.96	4.15	0.46	0.54	0.50	80.31	83.66	81.99
P_5 (IBA @ 4000 PPM + NAA 150 PPM)	4.13	4.53	4.33	3.86	3.58	3.72	0.54	0.63	0.59	86.07	88.91	87.49
P_6 (IBA @ 4000 PPM + NAA 250 PPM)	4.06	4.42	4.24	4.06	3.67	3.87	0.51	0.60	0.56	84.96	87.19	86.07
P_7 (IBA @ 6000 PPM + NAA 150 PPM)	4.34	4.77	4.55	3.57	3.24	3.41	0.59	0.68	0.64	91.15	93.89	92.52
P_8 (IBA @ 6000 PPM + NAA 250 PPM)	4.27	4.67	4.47	3.67	3.45	3.56	0.56	0.65	0.61	88.23	91.27	89.75
P_9 (Control)	3.53	3.68	3.61	4.74	4.51	4.63	0.33	0.39	0.36	74.08	76.14	75.11
MEAN	4.19	4.52		3.85	3.52		0.53	0.62		86.37	88.95	
	M	**P**	**M x P**	**M**	**P**	**M x P**	**M**	**P**	**M x P**	**M**	**P**	**M x P**
SE(m) ±	0.006	0.012	0.017	0.004	0.009	0.013	0.002	0.004	0.006	0.084	0.178	0.252
CD at 5%	0.016	0.035	0.049	0.012	0.026	0.036	0.005	0.012	0.016	0.242	0.512	0.725

Conclusion

The findings of the present study, clearly revealed that the cuttings of dragon fruit grown in media containing, soil + sand + cocopeat + vermicompost performed well in all aspect of root and shoot growth.

Among nine PGR treatments, IBA @ 6000 ppm gave better results with respect to root and shoot growth attributes followed by the treatment, IBA @ 4000 ppm.

Interaction of media and PGR treatments, were also found significant for many of the attributes. The combination of M_2 (soil + sand + cocopeat + vermicompost) with IBA @ 6000 ppm found to be significantly superior for many of root and shoot characters.

Based on the findings of the present study, it may be concluded that the vegetative method of propagation through stem cutting in dragon fruit is very reliable and can be recommended for the commercial production of planting materials of dragon fruit.

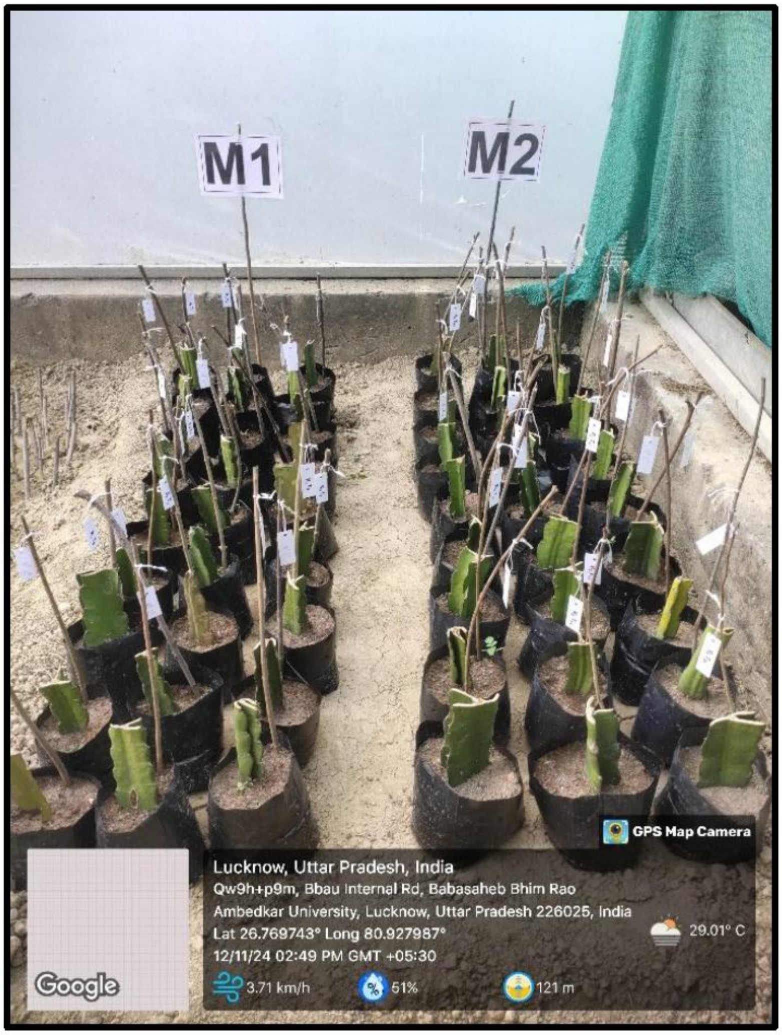

Plate 1: A general view of experimental field

Plate 2: Dragon fruit cuttings and polybags with growing media

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