Effect of different growing media on shoot growth of dragon fruit cuttings [*Hylocereus undatus* L. (Haworth) Britton & Rose]

Abstract

The present investigation was carried out under open field conditions at Horticulture Research Farm, Babasaheb Bhimrao Ambedkar University, Lucknow,Uttar Pradesh, India, to determine the effect of different growing media on the shoot growth of dragon fruit cuttings (*Hylocereus undatus* L.) during the years 2022–23. The experiment was laid out in a randomized complete block design (RBD) with three replications. There were 8 treatments, viz., T1-Soil, T2-Sand, T3-Vermicompost, T_4-Coco Peat, T5-Farmyard Manure, T6-Soil+Sand+Farmyard Manure, T7-Soil+Sand+Vermicompost and T_8-Soil+Vermicompost+Coco Peat. Treatments have shown significant differences among the growth parameters in terms of number of days taken for sprouting, percent sprouting, number of sprouts per cutting, shoot diameter, length of sprout, number of spines/areoles, fresh weight of shoot, and dry weight of shoot. Among the treatment combinations, the least number of days taken for sprouting, maximum percent sprouting, maximum number of sprouts per cutting, maximum sprout and shoot length of stem cutting, maximum increase in diameter of shoot, maximum number of spines/areoles, maximum fresh weight of shoot, and maximum dry weight of shoot were found in treatment T7-Soil+ Sand+ Vermicompost, followed by T8-Soil+ Vermicompost+. Coco peat, while the minimum has been recorded in T_1-Soil.

Keywords: shoot growth, growing media, vermicompost, FYM, cocopeat.

Introduction:

Dragon fruit [*Hylocereus undatus* L. (Haworth) Britton & Rose] is a perennial climbing cactus. It is a tropical climbing vine fruit crop that is a member of the Cactaceae family. It first gained appeal as an attractive plant before becoming a fruit crop, and today it is grown all over the world. According to the skin and pulp colour, the 16 species that make up the genus Hylocereus can be divided into three distinct species: *Hylocereus costaricensis* (red skin and red pulp), *Hylocereus polyrhizus* (red skin and red pulp), *Hylocereus undatus* (red skin, white pulp), and *Hylocereus megalanthus* (yellow peel and white pulp) (Nerd *et al.* 2002). Additionally, it has a lot of vitamin C and other antioxidants that support the immune system. Among the antioxidants found in it are flavonoids, phenolic acid, and betacyanin.

According to Vaillant*et al.* (2005), dragon fruit is a potential crop that might be produced profitably in dry areas. The easiest, quickest, and most effective method of propagating dragon fruit is by stem cutting. Cross-pollination prevents seeds from being true to type even when the seed propagation process is fairly straightforward (Andrade et *al*. 2005). Stem cuttings are the best method for achieving dragon fruit reproduction. There are several different growth media in which stem cuttings can be grown. The media ought to be clean, homogeneous in texture and fineness, but loose and thoroughly aerated. It should be devoid of weed seeds, nematodes, pests, and disease. Good media has the ability to retain moisture but is also well-drained. It is essential to choose the right growing medium while propagating dragon fruit because it is essential to its growth and cultivation. The media composition (mixing sand with organic materials) can be an alternative growing medium for successful propagation if you want to get high-quality cuttings.

Material and Methods: The present investigation was carried out at the Horticulture Research Farm, Department of Horticulture, Babasaheb Bhimrao Ambedkar University (A Central University), Vidya Vihar Rae Bareli Road, Lucknow U.P. (India) during the year 2022-23 to study the effect of different growing media on shoot development of dragon fruit (*Hylocereus undatus* L.) cuttings under polyhouse. The experiment field was situated at 26'55' North latitude and 80'59Longitude, and the elevation was 123 meters above mean sea level (MSL). The present investigation was laid out in a randomized block design (RBD) with eight treatment combinations replicated three times, and the number of cuttings in each replication is two. Thus, there were a total of 48 plants. Shooted cuttings of three-year-old plants were collected from progressive farmer Shri Ram Sharan Verma at Rasoolpur in Sultanpur and planted directly in the field. The various treatment combinations of (T1-Soil, T2-Sand, T3-Vermicompost, T4-Coco Peat, T5-FYM, T6-Soil+Sand+FYM, T7-Soil+Sand+Vermicompost, T8-Soil + Vermicompost + Coco Peat) respectively. The observation on shoot growth parameters—minimum days taken to sprout initiation, number of sprouts per cutting, shoot length, shoot fresh weight, shoot dry weight, root to shoot ratio recorded at 30, 60, and 90 DAP. The data recorded from the present studies were subjected to analysis using the standard method suggested by Panse and Sukhatme (1967).

Results and Discussion:

Shoot parameters:

Number of days taken for sprouting: In the present investigation, the influence of different growing media and their combinations has greatly influenced the days taken for sprout initiation. Significant differences were seen between Auxin concentrations for days taken to first sprout. Similar results were also concluded by Awasthi *et al.* (2008) [4] in guava and Minz (2021) [11] in dragon fruit cuttings.

Sprouting Percentage: The maximum percentage of sprouting was recorded at 30 days in cuttings grown in (T7) soil + sand + vermicompost (33.33%), which was followed by (T8) soil + vermicompost + coco peat (31.68%). While the control (T1) recorded the minimum percentage of sprouting (11.44%). The maximum percentage of sprouting was recorded at 60 days in cuttings combination with (T7) Soil + Sand + Vermicompost (49.88%), which was at par with (T8) Soil + Vermicompost + Coco Peat (48.68%). While the control (T1) recorded the minimum percentage of sprouting (18.22%).

Number of sprouts per cutting: The data pertaining to the number of sprouts per cutting is influenced by different growing media with different combinations at the different stages of growth. Number of sprouts per cutting at 30 days after planting. The maximum number of sprouts per cutting (0.85) was recorded in the cuttings grown in (T_7) Soil+Sand+Vermicompost, which was at par with (T_6) (0.77) Soil+Sand+FYM. While minimum numbers of sprouts (0.44) were recorded in control (T_1). Number of sprouts per cutting at 60 days after planting: The maximum number of sprouts (1.59) was recorded in cuttings grown in (T7) soil + sand + vermicompost, which was on par with (T6) soil + sand + FYM (1.51).

While the minimum numbers of sprouts (1.15) were recorded in (T_1) control.Number of sprouts per cutting at 90 days after planting: The maximum number of sprouts (2.02) was recorded in cuttings grown in (T_7) Soil+Sand+Vermicompost, which were followed by (T6) Soil+Sand+FYM(1.96). While minimum numbers of sprouts (1.45) were recorded in control (T_1). This result was in close agreement with the evaluation of Panchal *et al.* (2014) [16] in Sapota. Similarly. Rashmita *et al.* (2016) [18] also recorded the maximum number of sprouts in treatment consisting of soil + vermicompost (1:1) in pear (*Prunus persica* L.) cuttings.

Sprout length and shoot length (cm): The data pertaining to length of sprout and shoot per cutting as influenced by different growing media with different combinations at the different stages of growth. Sprout length at 30 days after planting (cm): the maximum sprout length

was recorded in cuttings grown in (T7) soil + sand + vermicompost (2.10 cm), which was at par with (T8) soil + vermicompost + coco peat (2.05 cm). While the least was found in (T_1) control (1.08 cm).Shoot length at 60 days after planting (cm) the highest shoot length was recorded in cuttings grown in (T7) soil + sand + vermicompost (5.44 cm), which was followed by (T6) soil + sand + FYM (6.36 cm). While the minimum length of shoots (1.04 cm) was recorded in control (T1). Shoot length at 90 days after planting (cm) the maximum shoot length (8.76 cm) was recorded in cuttings combination with Soil+Sand+Vermicompost (T7), which was followed by (T_8) Soil + Vermicompost + Coco Peat (7.66 cm). While the minimum shoot length (2.97 cm) was recorded in control (T_1).

Diameter of shoot per cutting: Diameter of shoot At 30 days after planting (mm), **t**he maximum diameter of shoot (2.06 mm) was recorded in cuttings grown in (T7) soil + sand + vermicompost, which were on (T8) soil + vermicompost + coco peat (2.01 mm). While the minimum diameter of the shoot (1.07 mm) was recorded in control (T1). Diameter of shoot per cutting at 60 days after planting (mm) the maximum diameter of shoot (2.06 mm) was recorded in (T7) soil + sand + vermicompost, which was on par with (T8) soil + vermicompost + coco peat (2.01 mm). While the minimum diameter of the shoot (1.07 mm) was recorded in control (T_1). Diameter of shoot per cutting at 90 days after planting (mm): the maximum diameter of shoot (3.14 mm) was recorded in (T7) soil + sand + vermicompost, which was on par with (T8) soil + vermicompost + coco peat (2.98 mm). While the minimum diameter of the shoot (1.45 mm) was recorded in control (T_1). The results of Verma *et al.* (2019) in dragon fruit and Rana *et al.* (2020) research on sweet orange were in accordance with these findings.

Number of spines per areole: The data pertaining to the number of spines per areole as influenced by different growing media with different combinations at the different stages of growth. 1 Number of spines per areole cutting at 30 days after planting (mm) The maximum number of spines per areole (3.86) was recorded in cuttings grown in (T7) soil + sand + vermicompost, which was on par with (T8) soil + vermicompost + coco peat (3.79). While the minimum number of spines (3.25) was recorded in control (T_1). Number of spines per areole cutting at 60 days after planting (mm) the maximum number of spines per areole (4.04) was recorded in (T7) soil + sand + vermicompost, which was on par with (T8) soil + vermicompost + coco peat (3.92). While the minimum number of spines (3.77) was recorded in control (T_1). Number of spines per areole cuttings at 90 days after planting (mm): the

maximum number of spines per areole (4.21) was recorded (T7)Soil+Sand+Vermicompost, which was on par with (T_8)Soil + Vermicompost+Coco Peat (3.92). While the minimum number of spines (3.77) was recorded in control (T_1).

Shoot fresh weight (g): The data on the shoot fresh weight of Dragon fruit cuttings as influenced by different mixtures of different growing media with different combinations. The treatments differed significantly at 30, 60, and 90 days after planting. Shoot fresh weight of dragon fruit cuttings at 30 days after planting (g): the highest shoot fresh weight was seen in dragon fruit cuttings grown in (T7) soil, sand, and vermicompost (12.14 g), which was found at par with (T8) soil, vermicompost, and coco peat (11.15 g). The lowest fresh weight was seen in (T_1) control (9.11 g). Shoot fresh weight of dragon fruit cuttings at 60 days after planting (g): the highest shoot fresh weight was observed in dragon fruit cuttings grown in (T7) soil . + sand + vermicompost (22.85 g), and it was found at par with (T6) soil + sand + FYM (24.25 g). The least shoot fresh weight of Dragon fruit cuttings was observed in (T_1) control (19.59 g). Shoot fresh weight of dragon fruit cuttings at 90 days after planting (g) the highest shoot fresh weight was recorded in dragon fruit cuttings grown in (T7) soil + sand + vermicompost (48.55 g), which was at par with (T8) soil + vermicompost + coco peat (40.47 g). The least shoot fresh weight of Dragon fruit cuttings was recorded (T_1) in control (25.85 g). Similar results were in accordance with Dhakar *et al.* (2016) [7] in papaya and Yadav *et al*. (2012) [25] in acid lime.

Shoot dry weight (g): The data on the shoot dry weight of Dragon fruit cuttings as influenced by different mixtures of different growing media. The treatments differed significantly at 30, 60, and 90 days after planting. Shoot dry weight of Dragon fruit cuttings at 30 days after planting (g) Among the combination, the highest shoot dry weight was seen in dragon fruit cuttings grown in (T7) soil + sand + vermicompost (4.77 g), which was on par with (T8) soil + vermicompost + coco peat (4.25 g), and the least shoot dry weight of dragon fruit cuttings was found in (T_1) control (1.96 g). Shoot dry weight of dragon fruit cuttings at 60 days after planting (g): the highest shoot dry weight was seen in dragon fruit cuttings grown in (T7) soil + sand + vermicompost (6.78 g), which was at par with (T8) soil + vermicompost + coco peat (6.01 g). The minimum shoot dry weight of Dragon fruit cuttings was recorded in (T_1) control (3.45 g).Shoot dry weight of dragon fruit cuttings at 90 days after planting (g) the maximum shoot dry weight was recorded in dragon fruit cuttings grown

in (T7) soil + sand + vermicompost (9.85 g), which was at par with (T8) soil + vermicompost + coco peat (9.45 g). The minimum shoot dry weight of Dragon fruit cuttings was recorded (T_1) in control (6.79 g). Similar findings were also observed by Dhakar *et a*l. (2016) [7] in papaya seedlings, where media combined with soil + FYM+ sand + vermicompost (1:1:1:1) recorded significantly maximum dry weight. Similarly, Prajapati *et al*. (2017) [17] reported that media with soil + vermicompost (1:1) registered maximum dry weight of shoot in acid lime.

Table 1: Effect of different growing media on shoot growth of dragon fruit cuttings [*Hylocereus undatus* L. (Haworth) Britton & Rose]

Treatment	Experimental details	Number of days taken for sprouting			% Sprouting of shoot per stem cutting		Sprouting per stem cutting		Sprout and shoot length of stem cutting (cm)			Shoot diameter of stem cutting (mm)			Number of spines per areole (mm)			Fresh weight of shoot of stem cutting (g)			Dry weight of shoot of stem cutting (g)		
		30 DAP	30DAP	60DAP	30DAP	60DAP	90DAP	30DAP	60DAP	90 DAP	30DAP	60DAP	90 DAP	30DAP	60DAP	90 DAP	30DAP	60DAP	90 DAP	30DAP	60DAP	90 DAP	30DAP	60DAP	90 DAP
T1	**Soil**	15.33	11.01	16.99	0.44	1.15	1.45	1.08	1.04	2.97	1.07	1.07	1.45	3.25	3.77	3.77	9.11	19.59	25.85	1.96	3.45	6.79
T2	**Sand**	13.35	15.35	18.55	0.59	1.32	1.55	1.69	3.85	5.66	1.75	1.75	1.47	3.55	3.78	3.89	10.15	19.45	28.45	2.14	4.7	7.09
T3	**Vermicompost**	12.55	16.51	23.77	0.63	1.37	1.65	1.65	3.99	5.99	1.88	1.88	1.99	3.74	3.74	3.82	10.25	20.14	29.36	2.96	4.78	7.55
T4	**Coco Peat**	11.12	18.99	28.77	0.66	1.41	1.75	1.72	4.26	6.41	1.98	1.98	2.11	3.74	3.81	3.74	10.85	19.96	35.45	3.45	4.89	7.65
T5	**FYM**	10.11	17.54	28.05	0.71	1.44	1.81	1.88	4.77	6.81	1.99	1.99	2.45	3.75	3.52	3.92	10.45	20.45	38.45	3.88	5.45	8.15

T 6	**Soil+ Sand +FYM**	9.45	19.55	32.44	0.77	1.51	1.96	1.85	5.21	6.55	1.88	1.88	2.74	3.77	3.79	4.06	10.44	20.85	34.85	3.99	5.98	8.05
T 7	**Soil+ Sand + Vermi compost**	9.55	29.55	34.55	0.85	1.59	2.02	2.10	5.44	8.76	2.06	2.06	3.14	3.86	4.04	4.21	12.14	22.85	48.55	4.77	6.78	9.85
T 8	**Soil + Vermi compost+ Coco Peat**	8.55	23.55	32.55	0.67	1.15	1.73	2.05	2.11	7.66	2.01	2.01	2.98	3.79	3.92	4.15	11.15	19.59	40.47	4.25	6.01	9.45
C.D. at 5%		**0.494**	1.209	1.222	0.025	0.070	0.093	**0.078**	**0.201**	**0.319**	**0.087**	**0.103**	**0.119**	**0.153**	**0.173**	**0.152**	**0.500**	**0.950**	**1.799**	**0.163**	**0.284**	**0.325**
SE(m) ±		**0.161**	0.395	0.399	0.008	0.023	0.031	**0.025**	**0.066**	**0.104**	**0.028**	**0.034**	**0.039**	**0.050**	**0.056**	**0.050**	**0.163**	**0.310**	**0.587**	**0.053**	**0.093**	**0.106**

Conclusion:

1. In shoot parameters, number of sprouts per cutting, shoot length, shoot fresh and dry weight, and root to shoot ratio were influenced under the treatment T7-Soil + Sand + Vermicompost. However, the minimum days to sprout initiation were achieved under the treatment T7: Soil + Sand + Vermicompost.
2. In conclusion, it can be stated that vermicompost is suitable to be used as growing media for cuttings. It can be combined with soil and sand to improve the quality.
3. The application of vermicompost with soil and sand was found to be best and performed better among all the media combinations in terms of shoot growth parameters.

Reference:

Valliant, F., Imbert, E., and Belleca, F.L. (2005. Pitahaya (*Hylocereus spp*.): a new fruit crop, a market with a future. Edition Diffusion Presse Sciences, 61(4):237–250.

Nerd, A., Sitrit, Y., Kaushik, R.A., and Mizrahi, Y. 2002. High summer temperatures inhibit flowering in vine pitaya crops (*Hylocereus spp.). Scientia Horticulturae*, 9(6): 343-350.

Andrade, R.A. de, Oliveira, IV.De M., and Martins, A.B.G. 2005. Influence of condition and storage period in germination of red pitaya seeds. Revista Brasileira de Fruticultura, 27(1): 168-170.

Awasthi, P., Lal, S., and Singh, B. C. 2008. Influence of stooling time and IBA concentrations on growth attributes of stooled shoots in guava Pant Prabhat. Progressive Research, 3 (2): 154-156.

Minz, V. 2021. Effect of growing media and plant growth regulators on root and shoot growth of dragon fruit cuttings. M.Sc. (Horti.) Fruit Science thesis, Indira Gandhi KrishiVishwavidyalaya, Raipur, Chhattishgarh, Pp. 1-78.

Rashmita, R. 2015. Effect of different media on rooting and survival of Pear (Pyruspyrifolia L.) Cuttings cv. Pathamakh. M.Sc. (Ag.) Horticulture thesis, Birsa Agricultural University, Kanke, Ranchi, Jharkhand. Pp. 1-68.

Panchal, G.P., Parasana, J.S., Patel, S.R., and Patel, M.V. 2014. Effect of different growing media and levels of IBA on growth and development of khimi (Manilkarahexandra L.) seedlings cv. Local. Global Journal of Bio-Science Biotechnology, 3(4): 379-383.

.

Ranawana, S.R.W.M.C.J.K., and Eswara, J.P. 2009. Effect of type and size of stem cutting and propagation media for multiplication of pineapple (*Ananascomosus* L.). Tropical Agricultural Research, 20: 388-394.

Verma RS, Lata R, Ram RB, Verma SS, Prakash S. Effect of organic, inorganic, and biofertilizers on vegetative characters of dragon fruit (*Hylocereus undatus* L.) plant. The Pharma Innovation Journal. 2019; 8 (6): 726–728.

Rana H, Sharma K, Negi M. Effect of organic manure and biofertilizers on plant growth, yield, and quality of sweet orange (*Citrus sinensis* L.). International Journal of Current Microbiology and Applied Sciences. 2020;9 (4):2064-2070.

Mizrahi, Y., and A. Nerd. "New crops as a possible solution for the troubled Israeli export market." (1996): 37-45.

Dhakar, S.S., Kaushik, R.A., and Sarolia, D.K. 2016. Influence of growing media and containers on germination and seedling growth of papaya (*Cartca papaya* L.) cv. PusaNanha. Green Farming, 72): 451-454.

Dvin, S.R., Moghadam, E.G., and Kiani, M. 2011. Rooting response of hardwood Cuttings of MMI11 Apple clonal rootstock to Indole butyric acid and rooting media. Asian Journal of Applied Sciences, 4(4): 453-458.

Yadav, R.K., Jain, M.C., and Jhakar, R.P. 2012. Effect of media on growth and development of acid lime (*Citrus aurantifolia Swingle*) with or without Azotobacter. African Journal of Agriculture Research, 7(48): 6421-6426.

Prajapati, D. G., Satodiya, B. N., Desai, A. B., and Nagar, P. K. 2017. Influence of storage period and growing media on seed germination and growth of acid lime

seedlings (*Citrus aurantifolia swingle*) cv. Kagzi. Journal of Pharmacognosy and Phytochemistry, 6(4): 1641-1645.

Panse V G. and Sukhatame P V. 1967. Statistical Methods for Agriculture Workers, p. 381, edn. 2. Indian Council of Agricultural Research, New Delhi.