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Influence of Propagation Media Type and Rooting Promoters on Rooting and Shoot Growth of Yellow Pitaya (*Hylocereus Megalanthus*) Cuttings

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A pot experiment conducted at net house in Horticulture department roof, Faculty of Agriculture, Zagazig University, Egypt, during the two consecutive summer seasons of 2024 and 2025. The aim of this experiment was to examine two of the key factors likely to influence rooting ability and shooting growth i.e.; rooting media type (sand, sand: clay or sand: clay: peat moss, at equal volumes), rooting promoters (control, indole butyric acid, chitosan and hydrolyses chickpea protein) and their combinations on *Hylocereus megalanthus* stem cuttings. Root fresh and dry weights/cutting (g), aerial root number, root length (cm), number of pneumatic roots, number of branches/cutting, maximum branch length (cm), stem diameter and thickness (cm) and total plant fresh weight (g) were recorded. Results pointed out that the highest values of the above mentioned traits were obtained by culturing stem in sand + clay (1: 1, *V/V*) mixture medium, in most cases. The maximum values of most of the above traits were detected when cuttings were treated with rooting substances promoters with significant difference with control treatment. In general, among various combination treatments, treating stem cuttings with IBA at 3000 ppm as well as chitosan at 8 ml/l before planting cuttings in sand: clay (1:1, v/v) appeared to be the best promising combination treatment in this connection.

Keywords: *Hylocereus megalanthus*, rooting, growth, medium, promoters

INTRODUCTION:

Pitaya (*Hylocereus megalanthus*), also known as dragon fruit, belongs to the genus Hylocereus of the Cactaceae family of the Caryophyllales order and has gained popularity recently for its appealing look, flavor, and nutritional value (**Caetano *et al*., 2014**). The climbing vine known as pitaya, or dragon fruit, initially became well-liked as an ornamental plant before turning into a fruit crop (**Bozkurt *et al*., 2022**). Dragon fruit contains vitamins, organic acids, betaines, glucose, soluble dietary fiber, minerals and phyto albumins (**Bozkurt *et al*., 2020**). Also, it can be utilized as ornamental flower, vegetable, medication, and health product in addition to being utilized as a fruit (**Kari *et al*., 2010**). In addition to being delicious, the fruit can be processed into wine, vinegar, ice cream, jam, juice, and pastry. Its unusual appearance makes its plant appealing (**Kasim *et al*., 2019**). It is becoming a super fruit all over the world because of its high nutritious content and antioxidant qualities. It is a climbing cactus vine that is perennial and semi-epyphytic, and it belongs to the Cactaceae family (**Drew and Azimi, 2002**). The family of cacti is very tolerant to changing conditions. The plants can withstand cold, heat, drought, and poor soil (**Esquivel *et al*., 2007**). The plants can withstand extreme conditions because of their modified stem for water storage, reduced or absent leaves, nighttime opening of the tissues for carbon dioxide uptake (the CAM process) and waxy surfaces (**Fan *et al*., 2013**).

Because stored pitaya seeds have a very low viability rate, stem cuttings are used as planting material (**Dhruve *et al*., 2018**). Auxin is necessary for the commencement of adventitious roots on stems, as has been frequently shown. In fact, it has been demonstrated that the first initial cell divisions are dependent on either endogenous or administered auxin. The most used method for rooting in commercial operations is IBA (**Hartmann *et al*., 2011**). Many studies determined the influence of IBA on rooting ability of some dragon fruit varieties cuttings (**Lalit Dhruve *et al*., 2018; Meena *et al*., 2023; Singh *et al*., 2025**). Chitosan shares structural similarities with cellulose, which is made up of a lengthy chain of interconnected glucose molecules. A slightly altered form of glucose serves as the building block of chitosan and is either involved in the construction of the cell wall or in the deacetylation of chitin oligosaccharides after endochitinases have acted on cell walls during autolysis (**Wojdyła, 2001**). Moreover, chitosan enhanced rooting of the dragon fruit cuttings, gave the highest number of shoots, maximum stem diameter and stem length (**Zahid *et al*., 2014**). Furthermore, the higher sugar as well as protein contents in the rooting zone is usually related with the highest rooting formation (**Husen and Pal, 2007**). Under greenhouse as well as open field circumstances, a number of experimental studies showed that protein hydrolysates have the ability to increase plant root and shoot biomass including papaya and passion fruit (**Colla *et al*., 2015**).

A good rooting media is one of the most crucial requirements for cuttings to root successfully. Because of its physical characteristics and the way the medium is managed, the rooting media may influence the diversity in the cuttings' capacity to root (MacDonald, 1986; Caldwell *et al.*, 1988). Season, cutting type, species, propagation method, cost and medium component availability all influence the choice of propagation media (**Hartmann *et al.*, 2011**). Moreover, many studies displayed superior performance of mixture medium in rooting ability and growth of dragon fruit cuttings i.e.; **Sudarjat *et al.*, 2018** (soil+ sand+ compost in ratio1:1:1/v:v:v)), **Chahal, 2020** (Soil + Sand + FYM in ratio 1: 1: 1) and **Ingole *et al.*, 2024** (Soil: Red Soil: Vermicompost in ratio 2:1:1).

Therefore, the purpose of this study was to examine the effects of rooting media type and rooting promoters, as well as their combinations, on the rooting capability and growth of *Hylocereus megalanthus* cuttings. These two factors are expected to have a significant impact on these processes. Improving nursery propagation and commercial multiplication of this significant fruit plant is the primary goal of this study.

MATERIALS AND METHODS:

A pot experiment conducted at net house in Horticulture department roof, Faculty of Agriculture, Zagazig University, Egypt, during the two consecutive summer seasons of 2024 and 2025. Dragon fruit cultivation requires a temperature range of 25 to 32 °C, which was maintained during the experiment in the net house. Cuttings were soaked in 3000 ppm indole-3-butyric acid (IBA) solution, 8 ml/l chitosan solution, 3 ml/l chickpea-protein hydrolysates and control (distillate water) for 10 mints before culture. Then the treated cuttings were planted in pots 25 cm diameter with filled with sand, sand: clay (1: 1, *V/V*) and sand: clay: peat moss (1: 1: 1, *V/V/V*). Each experimental unit contained 12 pots. *Hylocereus megalanthus* cuttings (20 cm long) were obtained from two years old plants grown at Mustafa Abo-Eisa Nursery, Belbas District, Sharkia Governorate, Egypt. Stem cuttings were cultured at 15th April in the two consecutive seasons.

Experimental design:

The experiment had sixteen treatments and three replicates for each treatment in a split plot design. The main plots were set up with medium type treatments, whereas the sub-plots were set up with rooting promoter treatments.

On stem cuttings that were successful, all agricultural procedures were performed, including fertilization (NPK and fulvic acid as foliar spray every 15 days from planting date, watering and, when necessary, disease and insect management.

IBA, protein hydrolysates and chitosan sources:

United Agriculture Development Company (UAD) provided the water-soluble salt known as Indole-3-Butyric Acid Potassium Salt ($C_{12}H_{12}NO_2K$ 98%). Chickpea-protein hydrolysates were obtained from the Chemical Department, Faculty of Agriculture, Zagazig University, Egypt. Modern Agricide Company (New Cairo, Cairo, Egypt) provided the chitosan solution (96.40%).

Data recorded:

At the end of experiment (after 180 days from planting day), maximum branch length (cm), branches number per cutting, stem diameter (cm), stem thickness (cm) and total fresh and dry weight of plant as growth traits were listed. In addition, root length (cm), fresh and dry weights per plant and pneumatic root number as rooting ability traits were recorded.

Statistical Analysis:

The arranged data were statistically analyzed as pointed out to **Gomez and Gomez (1984)** and the means were compared utilizing statistix software version 9 (**Analytical software, 2008**).

RESULTS AND DISCUSSION:

Growth traits:

Effect of rooting medium type:

Results listed in Tables 1, 2, 3, 4, 5 and 6 reveal that planted dragon fruit cv. Yellow cuttings in a mixture medium of Sand + Clay (1: 1, *V/V*) gave the highest values of maximum branch length (45.28 and 41.29 cm), number of branches (4.29 and 3.83), stem diameter (9.88 and 9.27 cm), stem thickness (2.82 and 2.66 cm) total plant fresh weight (189.15 and 194.15 g) and (19.95 and 22.92g) in both seasons compared to the other media under study. Because of their strong aeration and drainage, this mixture medium appears to be suitable pots or beds for *Hylocereus megalanthus* cuttings. A suitable medium would give the plant enough support, act as a reservoir for water and nutrients, allow oxygen to diffuse to the roots, and allow gaseous exchange between the atmosphere and the roots (**Argo, 1998**). Moreover, for successful dragon fruit cutting propagation, the red soil: soil: vermicompost ratio of 2:1:1 demonstrated superior performance as measured by root growth parameters, including survival percentage, root length, number of roots per cutting, root volume, length of longest root, root diameter, average length of root and fresh and dry weights of root among various treatments (**Ingole *et al.*, 2024**).

Effect of rooting promoters:

All rooting promoters under study recorded the lowest values of the maximum branch length compared to control in both seasons (Table 1). The highest branches number per cutting (3.33 and 3.11 as well as 3.00 and 3.28) was achieved with IBA as well as chitosan in 1st and 2nd seasons, respectively (Table 2). Treated dragon fruit cuttings with 3000 ppm IBA as well as control gave the maximum values of stem diameter (8.90 and 10.38 cm) and stem thickness (2.58 and 3.01 cm) in both seasons, respectively (Tables 3 and 4). Utilizing IBA as rooting promoters significantly recorded the heaviest total fresh and dry weight of dragon fruit plants compared to the other promoters under study (Tables 4 and 5). Auxin is a crucial plant hormone that encourages the production of lateral roots, which is reflected in the growth of shoots (**Fukaki *et al.*, 2007**). Likewise, Rooting and internode count were increased when grapevine cuttings were dipped in chitosan solution (**Górnik**). Also, **Dhruve *et al.* (2018**) reported that utilizing 6000 ppm IBA for dragon fruit (*Hylocereus undatus*) cuttings gave shooting parameters like the longest shoot length, number of new shoots per cutting and shoot fresh and dry weight.

Table 1. Effect of propagation media type (A), rooting promoters (B) and their interactions (A×B) on maximum branch length (cm) of yellow pitaya (*Hylocereus megalanthus*) during first and second seasons

Propagation media type (A)	Rooting promoters (B)				Mean (A)
	Control	IBA	Chitosan	Protein	
	First season				
Sand	2.07	9.25	9.40	0.00	**5.18**
Sand + Clay	65.00	56.85	10.00	49.25	**45.28**
Sand + Clay + Peat moss	34.37	30.67	52.30	21.00	**34.52**
Mean (B)	**33.81**	**32.26**	**23.42**	**23.81**	
L.S.D. at 5 %	**For (A)= 1.64**		**For (B)= 1.43**		**For (A×B)= 2.67**
	Second season				
Sand	9.53	4.47	7.63	0.00	**5.41**
Sand + Clay	56.17	38.83	46.00	24.15	**41.29**
Sand + Clay + Peat moss	36.15	27.67	33.27	22.07	**29.79**
Mean (B)	**33.95**	**23.66**	**28.97**	**15.41**	
L.S.D. at 5 %	**For (A)= 0.77**		**For (B)= 0.56**		**For (A×B)= 1.13**

Table 2. Effect of propagation media type (A), rooting promoters (B) and their interactions (A×B) on number of branches per plant of yellow pitaya (*Hylocereus megalanthus*) during first and second seasons

Propagation media type (A)	Rooting promoters (B)				Mean (A)
	Control	IBA	Chitosan	Protein	
	First season				
Sand	0.67	1.50	1.00	0.00	**0.79**
Sand + Clay	5.67	4.50	3.00	4.00	**4.29**
Sand + Clay + Peat moss	3.33	4.00	5.33	3.00	**3.92**
Mean (B)	**3.22**	**3.33**	**3.11**	**2.33**	
L.S.D. at 5 %	**For (A)= 0.72**		**For (B)= 0.38**		**For (A×B)= 0.90**

	Second season				
Sand	1.33	0.67	3.28	0.00	**0.83**
Sand + Clay	3.33	4.00	3.33	2.50	**3.83**
Sand + Clay + Peat moss	3.50	4.33	3.00	2.33	**3.29**
Mean (B)	**2.72**	**3.00**	**3.28**	**1.61**	
L.S.D. at 5 %	**For (A)= 0.59**		**For (B)= 0.42**		**For (A×B)= 0.72**

Table 3. Effect of propagation media type (A), rooting promoters (B) and their interactions (A×B) on stem diameter (cm) of yellow pitaya (*Hylocereus megalanthus*) during first and second seasons

Propagation media type (A)	**Rooting promoters (B)**				**Mean (A)**
	Control	**IBA**	**Chitosan**	**Protein**	
	First season				
Sand	0.00	8.28	6.28	0.00	**3.64**
Sand + Clay	11.38	10.15	8.33	9.67	**9.88**
Sand + Clay + Peat moss	7.75	8.56	7.75	8.33	**8.27**
Mean (B)	**6.38**	**8.90**	**7.68**	**6.00**	
L.S.D. at 5 %	**For (A)= 0.40**		**For (B)= 0.24**		**For (A×B)= 0.53**
	Second season				
Sand	8.97	4.57	4.96	0.00	**4.63**
Sand + Clay	11.08	9.22	9.58	7.20	**9.27**
Sand + Clay + Peat moss	11.10	10.11	9.35	8.28	**9.71**
Mean (B)	**10.38**	**7.97**	**7.96**	**5.16**	
L.S.D. at 5 %	**For (A)= 0.22**		**For (B)= 0.12**		**For (A×B)= 0.29**

Table 4. Effect of propagation media type (A), rooting promoters (B) and their interactions (A×B) on stem thickness (cm) of yellow pitaya (*Hylocereus megalanthus*) during first and second seasons

Propagation media type (A)	**Rooting promoters (B)**				**Mean (A)**
	Control	**IBA**	**Chitosan**	**Protein**	
	First season				
Sand	0.00	2.53	1.87	0.00	**1.10**
Sand + Clay	3.43	2.73	2.19	2.92	**2.82**
Sand + Clay + Peat moss	2.33	2.48	2.29	2.41	**2.38**
Mean (B)	**1.92**	**2.58**	**2.12**	**1.78**	
L.S.D. at 5 %	**For (A)= 0.33**		**For (B)= 0.16**		**For (A×B)= 0.40**
	Second season				
Sand	2.50	1.35	1.24	0.00	**1.27**
Sand + Clay	3.13	2.16	3.00	2.36	**2.66**
Sand + Clay + Peat moss	3.40	2.91	3.40	2.57	**2.94**
Mean (B)	**3.01**	**2.14**	**2.37**	**1.64**	
L.S.D. at 5 %	**For (A)= 0.36**		**For (B)= 0.37**		**For (A×B)= 0.66**

Table 5. Effect of propagation media type (A), rooting promoters (B) and their interactions (A×B) on plant fresh weight/ plant (g) of yellow pitaya (*Hylocereus megalanthus*) during first and second seasons

Propagation media type (A)	**Rooting promoters (B)**				**Mean (A)**
	Control	**IBA**	**Chitosan**	**Protein**	
	First season				
Sand	78.20	79.60	54.50	88.80	**75.27**
Sand + Clay	122.20	323.00	174.50	136.90	**189.15**
Sand + Clay + Peat moss	179.70	86.80	156.50	122.50	**136.38**
Mean (B)	**126.70**	**163.13**	**128.50**	**116.07**	
L.S.D. at 5 %	**For (A)= 1.32**		**For (B)= 0.92**		**For (A×B)= 1.90**

	Second season				
Sand	83.20	84.50	59.50	93.80	**80.28**
Sand + Clay	127.20	328.00	179.50	141.90	**194.15**
Sand + Clay + Peat moss	184.70	91.80	191.50	127.50	**148.87**
Mean (B)	**131.70**	**168.13**	**143.50**	**121.07**	
L.S.D. at 5 %	**For (A)= 0.85**		**For (B)= 0.75**		**For (A×B)= 1.39**

Table 6. Effect of propagation media type (A), rooting promoters (B) and their interactions (A×B) on plant dry weight/ plant (g) of yellow pitaya (*Hylocereus megalanthus*) during first and second seasons

Propagation media type (A)	**Rooting promoters (B)**				**Mean (A)**
	Control	**IBA**	**Chitosan**	**Protein**	
	First season				
Sand	9.09	7.70	4.60	6.42	**6.95**
Sand + Clay	10.57	41.14	17.47	10.60	**19.95**
Sand + Clay + Peat moss	12.16	19.83	11.14	8.59	**12.93**
Mean (B)	**10.61**	**22.89**	**11.07**	**8.54**	
L.S.D. at 5 %	**For (A) = 0.01**		**For (B)= 0.08**		**For (A×B)= 0.12**
	Second season				
Sand	5.28	7.83	4.98	9.77	**6.97**
Sand + Clay	12.27	43.29	21.72	14.38	**22.92**
Sand + Clay + Peat moss	7.77	20.77	13.30	10.94	**13.20**
Mean (B)	**8.44**	**23.96**	**12.33**	**11.70**	
L.S.D. at 5 %	**For (A)= 0.08**		**For (B)= 0.06**		**For (A×B)= 0.14**

Effect of combination between rooting medium type and rooting promoters:

As shown in Table 1 it is clear that the highest values of maximum branch length (65.00 and 56.17 cm) were noticed with the combination treatment between sand: clay mixture medium and control in both seasons with significant difference with the other combination treatments under study. The combination treatment between sand and protein hydrolysates did not produce and increase in branches length without any branches in both season (Tables 1 and 2). The treatment of sand: clay combined with control and IBA as well as sand: clay: peat moss combined with chitosan in the first season gave the highest values in number of branches per cutting. Whenever, sand: clay or sand: clay: peat moss combined with IBA recorded the highest values in this connection in the second season without significant difference between them (Table 2). In most cases, without or IBA application for dragon fruit cuttings cultured in sand: clay or sand: clay: peat moss media the best values of stem diameter and thickness were noticed (Tables 3 and 4). Treated dragon fruit cuttings with 3000 ppm IBA combined with sand: clay medium gave the maximum values of total plant fresh weight (323.00 and 328.00 g) and total plant dry weight (41.14 and 43.29 g) in both seasons, respectively (Tables 5 and 6).

Furthermore, among various treatments, Soil + Sand + FYM + IBA (1000 ppm) treatment significantly gave the maximum plant height, average of secondary and primary roots diameter, average length of longest root, total root length, dry and fresh weight of roots, dry and fresh weight of shoot and number of shoots per cutting of dragon fruit cuttings (**Chahal, 2020**).

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Rooting traits:

Effect of rooting medium type:

The heaviest root fresh weight (33.99 and 21.18 g) and dry weight (13.66 and 9.11 g) values were recorded in sand: clay medium in both seasons compared to the other rooting medium type under study (Table 6 and 7). The longest roots as well as number of pneumatic roots of dragon fruit cuttings were observed with sand alone or a mixture of sand: clay compared to the other medium under study in both seasons (Table 8, 9 and 10). Instead of resulting from indirect or previous physiological changes, variations in performance among different rooting media can be ascribed to the substrate's direct impact on the cutting's basal part (**Khayyat *et al.,* 2007**). Sand was added to clay to improve the mixture's drainage and aeration, which further benefited the medium. **Ingole *et al.* (2024)** on dragon fruit (*Hylocereus polyrhizus*) cuttings and **Anagha *et al.* (2025)** on dragon fruit (*Hylocereus undatus*) cuttings reported similar results.

Effect of rooting promoters:

Utilizing IBA and control in the 1st season as well as IBA in the second one significantly increased fresh and dry weights of roots per cutting (Tables 7 and 8) compared to the other promoters under study. In both season exposed dragon fruit cuttings to chitosan and protein in the first season and protein in the second one gave the highest values in root length compared to the other promoters under study in both seasons (Table 9). Utilizing IBA in the 1st season and control in the second one significantly increased number of pneumatic roots (Tables 10).

Table 7. Effect of propagation media type (A), rooting promoters (B) and their interactions (A×B) on roots fresh weight/ plant (g) of yellow pitaya (*Hylocereus megalanthus*) during first and second seasons

Propagation media type (A)	Rooting promoters (B)				Mean (A)
	Control	IBA	Chitosan	Protein	
	First season				
Sand	10.96	24.35	16.59	15.48	**16.85**
Sand + Clay	51.38	42.52	12.95	29.09	**33.99**
Sand + Clay + Peat moss	6.99	25.63	28.30	18.84	**19.94**
Mean (B)	**23.11**	**30.83**	**19.28**	**21.14**	
L.S.D. at 5 %	**For (A)= 0.10**		**For (B)= 0.15**		**For (A×B)= 0.24**
	Second season				
Sand	18.38	16.70	10.02	14.84	**14.99**
Sand + Clay	27.46	18.06	29.08	10.11	**21.18**
Sand + Clay + Peat moss	14.19	18.98	14.95	9.38	**14.38**
Mean (B)	**20.01**	**17.91**	**18.02**	**11.44**	
L.S.D. at 5 %	**For (A)= 0.04**		**For (B)= 0.21**		**For (A×B)= 0.22**

Table 8. Effect of propagation media type (A), rooting promoters (B) and their interactions (A×B) on roots dry weight/ plant (g) of yellow pitaya (*Hylocereus megalanthus*) during first and second seasons

Propagation media type (A)	Rooting promoters (B)				Mean (A)
	Control	IBA	Chitosan	Protein	
	First season				
Sand	3.18	8.02	5.33	5.53	**5.51**
Sand + Clay	20.93	17.98	5.90	9.84	**13.66**
Sand + Clay + Peat moss	2.74	8.06	10.13	7.02	**6.99**
Mean (B)	**8.95**	**11.35**	**7.12**	**7.46**	

L.S.D. at 5 %	**For (A) = 0.23**		**For (B)= 0.16**	**For (A×B)= 0.33**	
	Second season				
Sand	4.64	6.62	4.14	4.32	**4.93**
Sand + Clay	9.49	7.43	10.55	8.98	**9.11**
Sand + Clay + Peat moss	5.08	6.76	5.28	3.09	**5.05**
Mean (B)	**6.40**	**6.94**	**6.66**	**5.46**	
L.S.D. at 5 %	**For (A)= 0.08**		**For (B)= 0.11**	**For (A×B)= 0.18**	

Table 9. Effect of propagation media type (A), rooting promoters (B) and their interactions (A×B) on root length (cm) of yellow pitaya (*Hylocereus megalanthus*) during first and second seasons

Propagation media type (A)	**Rooting promoters (B)**				**Mean (A)**
	Control	**IBA**	**Chitosan**	**Protein**	
	First season				
Sand	36.50	32.75	44.33	42.50	**39.02**
Sand + Clay	45.67	21.00	38.00	61.00	**41.42**
Sand + Clay + Peat moss	21.67	36.50	21.67	39.50	**33.75**
Mean (B)	**34.61**	**30.08**	**39.89**	**47.67**	
L.S.D. at 5 %	**For (A)= 1.33**		**For (B)= 1.09**	**For (A×B)= 2.09**	
	Second season				
Sand	31.50	42.50	43.33	48.00	**41.33**
Sand + Clay	29.67	27.17	37.25	19.50	**28.40**
Sand + Clay + Peat moss	44.50	26.33	33.50	21.33	**31.42**
Mean (B)	**35.22**	**32.00**	**38.03**	**29.61**	
L.S.D. at 5 %	**For (A)= 1.90**		**For (B)= 0.52**	**For (A×B)= 2.04**	

Table 10. Effect of propagation media type (A), rooting promoters (B) and their interactions (A×B) on number of pneumatic roots of yellow pitaya (*Hylocereus megalanthus*) during first and second seasons

Propagation media type (A)	**Rooting promoters (B)**				**Mean (A)**
	Control	**IBA**	**Chitosan**	**Protein**	
	First season				
Sand	155.00	535.50	158.33	241.00	**272.46**
Sand + Clay	526.67	368.00	94.00	371.50	**340.04**
Sand + Clay + Peat moss	89.67	187.67	247.67	271.67	**199.17**
Mean (B)	**257.11**	**363.72**	**166.67**	**294.72**	
L.S.D. at 5 %	**For (A)= 2.91**		**For (B)= 1.63**	**For (A×B)= 3.76**	
	Second season				
Sand	376.67	315.33	174.00	180.50	**261.63**
Sand + Clay	299.67	164.00	222.50	31.50	**179.42**
Sand + Clay + Peat moss	203.50	173.67	86.00	131.00	**148.54**
Mean (B)	**293.28**	**217.67**	**160.83**	**114.33**	
L.S.D. at 5 %	**For (A)= 0.19**		**For (B)= 1.45**	**For (A×B)= 2.19**	

Applying IBA to stem cutting increases the likelihood of success, and in subtropical climates, 3500 ppm IBA is the most effective concentration for stem cutting dragon fruit in terms of the quantity, diameter, and length of roots and newly emerging shoots of dragon fruit cuttings (**Meena *et al.*, 2023**).

Effect of combination between rooting medium type and rooting promoters:

The combination between different rooting media and promoters indicate that, in most cases the fresh and dry weights of roots per cutting reached to the highest values as cuttings bases dipped in distillate water and chitosan cultured in the mixture of clay + sand (Tables 5 and 6). The longest roots were noticed with sand or sand: clay combined with protein hydrolysates in 1st and 2nd seasons, respectively (Table 7). Sand: clay or sand combined with control recorded the highest values of number of pneumatic roots compared to the other combination treatments under study (Table 8). The same results were found on *Duranta erecta* tip cuttings by **Shiri *et al.* (2019)** and on *Ficus benjamina* cuttings by **Mohammed *et al.* (2020)**.

Conclusion:

The data clearly show that, out of all the studied rooting media, sand: clay was the most effective. The ability of dragon fruit to cut roots was also enhanced by the use of IBA and chitosan rooting boosters. In order to grow this *Hylocereus megalanthus* plant via cuttings, the current study advises treating the cuttings with either chitosan at 8 ml/l or IBA at 3000 ppm before cultivating them in a sand and clay combination (1:1, *V/V*).

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