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EFFECT OF BIO-FERTILIZERS ON ROOT GROWTH OF DRAGON FRUIT CUTTINGS [*HYLOCEREUS UNDATUS* L. (HAWORTH) BRITTON & ROSE]

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ABSTRACT

The present investigation was carried out on the effect of bio-fertilizers on root growth of dragon fruit cutting (*Hylocereus undatus* L.) during the year 2022-23 at the Horticulture Research Farm, Department of Horticulture, Babasaheb Bhimrao Ambedkar University (A Central University), Vidya Vihar Rae Bareli Road, Lucknow U.P. (India). The experiment was laid out in a randomized block design (RBD) with 09 treatments combination for root growth parameter of dragon fruit cuttings with one factor and three replications under open field condition. Treatment combination has showed the significant difference. Among the different treatment combination used media containing of sand + soil and FYM enriched with bio-fertilizers combination of Azotobacter + PSB (Phosphate Solubilizing Bacteria) has recorded minimum days taken to root initiation and maximum root length.

***Keywords*:** Bio-fertilizers, root growth, dragon fruit cuttings, growth parameters.

Introduction

Dragon fruit (*Hylocereus undatus)* (Haworth Britton & Rose) is a cactus, belonging to family cactaceae. Recently, dragon fruit introduced as super fruit in India, is considered to be a promising and remunerative fruit crop. It is a long day plant with beautiful night- blooming flowers that is nicknamed “Noble Woman” or “Queen of the Night”. The fruit is also known as strawberry, pear, dragon fruit, pitahaya, night blooming cereus, Belle of the Night, Cinderella plant, and Jesus in the Cradle. The fruit is named Pitaya because of the bracts or scales on the fruit skin hence, the name pitaya means ‘‘the scaly fruit’’. The fruit has a very attractive colour and mellow mouth-melting pulp with a black colour edible seed embedded in the pulp along with tremendous nutritive properties which attract growers from different parts of India to cultivate this fruit crop which is native to tropical and subtropical forest regions of Mexico and central South America (Mizrahi *et al*., 1996). It is a nutritious fruit with a variety of uses. The fruit pulp can be eaten fresh and can be made into various valuable processed products. The fruit possesses medicinal properties. It is known to prevent colon cancer and diabetes, neutralizes toxic substances such as heavy metals, reduce cholesterol and high blood pressure. It is also reported to control high sugar levels. It is rich in vitamin C, phosphorous and calcium which help to develop strong bones, teeth and skin. The fruit is considered a ‘health fruit’. Betalains have a great potential in colouring a broad array of food. In this view, betacyanins from red coloured dragon fruit are most promising, not only as colouring agents but also in possessing antiradical potential. It is considered as a fruit crop for future. Hence, widely favoured (Gunasena and Pushpakumara, 2005 and Gunasena *et al*., 2005). Dragon fruit was introduced in 1990 for its commercial cultivation in South Asian tropical countries. At present, significant production and expansion of fruit are occurring in many countries *viz.*, Australia, Cambodia, China, Columbia, Ecuador, Guatemala, Hawaii, Indonesia, Israel, Japan, Laos, Malaysia,

Mexico, New Zealand, Nicaragua, Peru, Philippines, Spain, Sri Lanka, Taiwan, Thailand, South Western USA and Vietnam (Wu and Chen, 1997). The plants propagated through stem cuttings starts flowering within 12 to 18 months after planting. Growingmedia is the important factor for the plants that give anchorage to the plants and provide essential nutrients required by the plants. The growing media enriched with bio-fertilizers possess the advantages like more availability of nutrients in the available forms through natural process like nitrogen fixing, phosphorus solubilizing and stimulate plant growth through the synthesis of growth promoting substances. They build up soil microflora and there by maintains soil health. So, the present investigation was carried out to study the effect of bio-fertilizers and their interaction on root growth of dragon fruit 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 bio-fertilizers on root growth of dragon fruit (*Hylocereus undatus* L.) cuttings under open field conditions. The experiment field was situated at 26'55' North latitude and 80'59'longitude and the elevation was 123 meter above mean sea level (MSL). The present investigation was laid out in randomized block design (RBD) with 09 treatments combination replicated thrice and number of cuttings in each replication are two. Thus, there were total 54 plants. Rooted cuttings of three year old plant were collected from progressive farmer Shri Ram Sharan Verma at Rasoolpur in Sultanpur and planted directly in the field . The rooting media prepared by mixing of sand, soil and FYM with 2:1:1 ratio. The various treatment combination of bio- fertilizers were as follows: [T1- Control, T2- Azotobacter (1%), T3- PSB (1%), T4- Azotobacter (2%), T5- PSB (2%), T6- Azotobacter (1%) + PSB (1%), T7- Azotobacter (1%) + PSB(2%), T8- Azotobacter (2%) + PSB(1%) and T9- Azotobacter (2%) + PSB(2%)] respectively. The observation on days taken to root initiation, average number of roots per cutting, root length, fresh weight, dry weight and root diameter recorded at 30, 60 and 90 DAP. The data recorded from the present studies were subjected to analysis by using standard method suggested by Panse and Sukhatme (1967).

Result and Discussion

Length of the longest root (cm)

Significant difference between treatments with respect to length of longest root was observed. The maximum length of longest root (4.31 cm, 8.99 cm and 20.31 cm) was observed in Azotobacter (2%) + PSB (1%) and the minimum length of longest root was observed in control (2.14 cm, 5.18 cm, and 12.14 cm respectively) at 30, 60 and 90 days after planting. The cuttings treated with Azotobacter (2%) + PSB (1%) initiate the formation of longest roots per cuttings could be due to rapid hydrolysis of starch stored in thecuttings into physiologically active sugars, which provide energy through respiratory activity to the root primordia and helps in rapid elongation of the meristematic cells there by initiate the longest roots per cutting. Similar results were reported by P. Venkata Siva Prasad *et al*. (2022) in dragon fruit, Porghorban *et al*. (2014) in Olive,Rahad *et al*. (2016) in dragon fruit.

Average number of roots per rooted cutting (cm)

In the present study, application of different bio-fertilizers significantly influenced the maximum number of roots per cutting at30, 60 and 90 days after planting. Untreated cuttings showed minimum number of roots in all stages of growth. The induction of maximum number of roots in the treated cuttings may be due to cambial activity involved in root initiation was stimulated by growth regulators as seen in many species (Ullah *et al*. 2005).

It was observed that the cuttings treated with Azotobacter (2%) + PSB (1%) showed a greater number of roots per cutting (10.29, 13.25 and 39.69 respectively) at 30, 60 and 90 days after planting compared to control (3.15, 5.45, and 17.24 respectively). This might be due to the presence of the reserved food materials present in the cuttings. Initial internal sugar concentration and their metabolism are important during the early period of rooting process (Denaxa *et al*., 2001).

Root diameter (mm)

Diameter of the root varied significantly among different treatments with different bio-fertilizers. The highest mean diameter (0.44 mm, 0.78 mm, and 1.42 mm) was observed in the cuttings treated with Azotobacter (2%) + PSB (1%) and the lowest (0.11 mm, 0.25 mm and 0.85 mm) at 30, 60 and 90 days after planting respectively was observed in control. This result corroborates the findings of Bhalerao *et al*. (2009).

Fresh weight of the root (g)

Significant differences were observed between the treatments. The maximum fresh weight of roots was recorded with the cuttings treated with Azotobacter (2%) + PSB (1%). It could be attributed to the rapid hydrolysis of polysaccharides stored in the cuttings into physiologically active sugars by activation of hydrolytic enzymes. These sugars provide energy for the meristematic tissue through respiratory activity leads to initiate a greater number of adventitious roots as well as longest roots per cutting which helps in early establishment of cuttings and an increase in root fresh weight per cutting. The present findings are also in conformity with the results of Porghorban *et al*. (2014) in Olive, Rahad *et al*. (2016) in dragon fruit.

Dry weight of the root (g)

Significant differences were seen between the treated and untreated stem cuttings of dragon fruit. The bio-fertilizers increased root length and fresh weight of roots, resulting in increased dry weight of roots. This might be due to the fact that, bio-fertilizers stimulates the initiation of lateral and adventitious roots because of bio-fertilizers are increased nutrient availability in the rooting system. The maximum dry weight of the root was recorded in cuttings treated with Azotobacter (2%) + PSB (1%). Bio-fertilizers increase the number of roots resulting in higher accumulation of fresh and dry matter of roots. The results are in agreement with the earlier findings of Kaur *et al*. (2015) in Grape, Devi *et al*. (2009) in Lemon.

Table 1: Effect of bio-fertilizers on root growth of dragon fruit (*Hylocereus undatus* L.) cuutings:

Root growth attributing characters																
S. No.	**Treatment**	**Length of longest root (cm)**			**Average no. of roots per cuttings**			**Root diameter (mm)**			**Fresh weight (g)**			**Dry weight (g)**		
		30 DAP	**60 DAP**	**90 DAP**	**30 DAP**	**60 DAP**	**90 DAP**	**30 DAP**	**60 DAP**	**90 DAP**	**30 DAP**	**60 DAP**	**90 DAP**	**30 DAP**	**60 DAP**	**90 DAP**
T1	Control	2.14	5.18	12.14	3.15	5.45	17.24	0.11	0.25	0.85	0.13	0.99	1.42	0.05	0.15	0.33
T2	Azotobacter (1%)	2.45	7.12	15.76	5.45	8.25	19.36	0.25	0.65	1.15	0.21	1.55	1.54	0.09	0.21	0.37
T3	PSB (1%)	2.31	6.45	15.64	7.12	7.46	18.46	0.24	0.45	1.12	0.19	1.45	1.49	0.08	0.20	0.35
T4	Azotobacter (2%)	3.45	5.45	14.19	5.12	9.14	21.22	0.29	0.48	1.30	0.27	1.59	1.67	0.13	0.27	0.38
T5	PSB (2%)	3.34	6.25	16.52	6.15	11.36	26.74	0.28	0.56	1.28	0.29	1.63	1.82	0.15	0.31	0.42
T6	Azotobacter (1%) + PSB (1%)	3.58	5.31	16.75	7.25	10.05	29.14	0.37	0.49	1.33	0.28	1.75	1.93	0.19	0.35	0.46
T7	Azotobacter (1%) + PSB (2%)	3.25	8.15	19.16	8.95	12.78	36.28	0.41	0.71	1.38	0.40	1.79	1.99	0.23	0.38	0.51
T8	Azotobacter (2%) + PSB (1%)	4.31	8.99	20.31	10.29	13.25	39.69	0.44	0.78	1.42	0.42	1.83	2.18	0.26	0.43	0.57
T9	Azotobacter (2%) + PSB (2%)	4.24	8.25	19.68	9.56	11.99	37.64	0.42	0.75	1.39	0.39	1.81	2.14	0.24	0.41	0.54
S.Em (±)		0.063	0.096	0.252	0.207	0.118	0.235	0.004	0.010	0.02	0.004	0.010	0.028	0.004	0.005	0.006
C.D. at 5%		0.190	0.289	0.761	0.146	0.358	0.712	0.011	0.031	0.06	0.012	0.030	0.084	0.013	0.015	0.019

Conclusion

It may be concluded that among the different treatments of bio-fertilizers either single or in combination have great potential to accelerate rooting in stem cuttings of dragon fruit. Among all the treatment, Azotobacter (2%) + PSB (1%) gave better results with respect to rooting parameters followed by the treatment, Azotobacter (2%) + PSB (2%). Based on the findings of current investigation,it is recommended that vegetative method of propagation through stem cuttings in dragon fruit treated with bio-fertilizers is reliable forcommercial production of planting materials and it is quick and economical method of vegetative propagation.

Plate 1: Pictures of Research Trail

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