Effect of bio-fertilizers on shoot growth of dragon fruit cuttings [*Hylocereus undatus* L. (Haworth Britton & Rose)]

Abstract

The present investigation was carried out on the effect of bio-fertilizers on Shoot growth of dragon fruit cutting (*Hylocereusundatus*L.) during the year 2022-23 at the Horticulture Research Farm, Department of Horticulture, Babasaheb Bhimrao AmbedkarUniversity (A Central University), Vidya Vihar Rae Bareli Road, Lucknow U.P. (India). The experiment was laid out in a randomizedblockdesign(RBD)with 09 treatments combination forshootgrowthparameterofdragonfruitcuttingswithonefactorandthreereplicationsunderopenfieldcondition.Treatment combination has showed the significant difference. Among the different treatment combination used media containing ofsand + soil and FYM enriched with bio-fertilizers combination of Azotobacter + PSB (Phosphate Solubilizing Bacteria) has recordedminimumdays taken to shoot initiation and maximum Shootlength.

Keywords:bio-fertilizers,Shootgrowth,dragon fruit cuttings,growthparameters.

Introduction:

Dragon fruit (*Hylocereus undatus)*(Haworth Britton & Rose) is a cactus, belonging to family cactaceae. Recently, dragon fruitintroducedassuperfruitinIndia,isconsideredtobeapromisingandremunerativefruitcrop.Itisalongdayplantwithbeautifulnight-bloomingflowersthatisnicknamed“NobleWoman”or“QueenoftheNight”.Thefruitisalsoknownasstrawberry,pear,dragonfruit,pitahaya, night blooming cereus, Belle of the Night, Cinderella plant, and Jesus in the Cradle. The fruit is named Pitaya because of thebracts or scales on the fruit skin hence, the name pitaya means ‘‘the scaly fruit’’. The fruit has a very attractive colour and mellowmouth-melting pulp with a black colour edible seed embedded in the pulp along with tremendous nutritive properties which attractgrowers from different parts of India to cultivate this fruit crop which is native to tropical and subtropical forest regions of Mexico andcentral 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 bemade into various valuable processed products. The fruit possesses medicinal properties. It is known to prevent colon cancer anddiabetes, neutralizes toxic substances such as heavy metals, reduce cholesterol and high blood pressure. It is also reported to controlhigh sugar levels. It is rich in vitamin C, phosphorous and calcium which help to develop strong bones, teeth and skin. The fruit isconsidereda‘healthfruit’.Betalainshaveagreatpotentialincolouringabroadarrayoffood.Inthisview,betacyaninsfromredcoloureddragonfruit aremostpromising,notonlyascolouringagentsbutalsoinpossessingantiradicalpotential.Itisconsideredasa fruitcropforfuture.Hence,widelyfavoured(GunasenaandPushpakumara,2005andGunasena*etal*.,2005).Dragonfruitwasintroducedin1990for its commercial cultivation in South Asian tropical countries. At present, significant production and expansion of fruit are occurringin 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 (Barbeu,1990,WuandChen,1997*)*.Theplantspropagatedthroughstemcuttingsstartsfloweringwithin12to18monthsafterplanting.Growingme dia is the important factor for the plants that give anchorage to the plants and provide essential nutrients required by the plants. Thegrowing media enriched with bio-fertilizers possess the advantages like more availability of nutrients in the available forms throughnatural process like nitrogen fixing, phosphorus solubilizing and stimulate plant growth through the synthesis of growth promotingsubstances. They build up soil microflora and there by maintains soil health. So, the present investigation was carried out to study theeffectof bio-fertilizers and theirinteraction onShoot growth of dragon fruit cuttings.

Material andMethods:

The present investigation was carried out at the Horticulture Research Farm, Department of Horticulture, Babasaheb BhimraoAmbedkarUniversity(ACentralUniversity),VidyaViharRaeBareliRoad,LucknowU.P.(India)duringtheyear2022-23tostudytheeffect of bio-fertilizers on Shoot growth of dragon fruit (*Hylocereus undatus*L.) cuttings under open field conditions. Thepresentinvestigation was laid out in randomized block design (RBD) with 09 treatments combination replicated thrice and number of cuttingsin each replication are two. Thus, there were total 54 plants. Shooted cuttings of three year old plant were collected from progressivefarmer Shri Ram Sharan Verma at Rasoolpur , Sultanpur. The Shooting media prepared by mixing of sand, soil and FYM with 2:1:1 ratio. The various treatment combination of bio-fertilizerswereasfollows:[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%)andT9-Azotobacter(2%)+PSB(2%)]respectively.Theobservationonnumber of daystakenfor sprouting,sprouting percentage, numberofsproutpercutting,sproutlength, shoot length,shootdiameter, number of spines/aerole, shoot freshweight andshoot dryweightrecordedat30,60and90DAP.Thedatarecordedfromthepresentstudiesweresubjected to analysis byusingstandard method suggested byPanseand Sukhatme(1967).

ResultandDiscussion:

Number of days taken for sprouting:

Data collected on days taken to sprout initiation as influenced by bio-fertilizers and their combination. Bio-fertilizer combination contained Azotobacter (2ml) + PSB (1ml) (T8) showed significantly less (27.95 days) time for sprout initiation and it is followed by Azotobacter (2ml) + PSB (2ml) 28.15 days, whereas control (T1) has taken comparatively more (46.24 days) time for sprout initiation. This may be due to increase level of plant growth regulators in the cutting. Therefore, the physiological processes involved in rooting and sprouting of cuttings were completed earlier as a result of the increased amount of auxins (PGR's). Additionally, according to Slankis (1973), bio-fertilizer raised the concentration of plant growth regulators in the plants. Bio-fertilizers has ability to fix or increase the nitrogen content and is vital for cellular processes, growth, electron transport, and photosynthetic rate. It is also a vital source of proteins needed for metabolic processes that occur during growth and development (Chaplin and Westwood, 1980). Similar results were reported by Awasthi *et al.* (2008) in guava and Minz (2021) in dragon fruit cuttings.

Percent sprouting:

The data pertaining to sprouting percentage as influenced by different concentration of bio-fertilizers with different combination at the different stages of growth are presented in table 1. The maximum percentage of sprouting at 30 AND 60 DAP was recorded in cuttings treated with (18) Azotobacter (2ml) + PSB (1ml) (33.33 and 49.88%). While the control (T_1) recorded the minimum percentage of sprouting (11.44 and 18.22%). The ability to produce more sprouts is due to the use of bio-fertilizers, which assisted in the creation of beneficial hormones and growth factors, which in turn increased cell division, cell multiplication, and increased assimilation and accumulation of food resources. Similar results were observed in apple by Raman (2012) and Abdullahi *et al.* (2012) shea tree. This finding was supported by Kaur (2017) in Mango.

Number of sprouts per cutting:

At 30, 60 and 90 DAP significant differences were observed on the parameter number ef sprouts per cutting among different combination of bio-fertilizers. Among different bio- fertilizers used highest (0.75, 1.53 and 2.05 at 30, 60 and 90 DAP respectively) number of sprouts per cutting was recorded in Azotobacter (2ml) + PSB (1ml) (T8) combination. The minimum response was observed (0.32, 1.12 and 1.43 at 30, 60 and 90 DAP respectively) in the control (T1). The ability to produce more sprouts is due to the use of bio-fertilizers, which assisted in the creation of beneficial hormones and growth factors, which in turn increased cell division, cell multiplication, and increased assimilation and accumulation of food resources. Similar results were observed in apple by Raman (2012) and Abdullahi *et al.* (2012) shea tree. This finding was supported by Kaur (2017) in Mango.

Shoot diameter (mm) and Length of sprout (cm):

The data pertaining to the diameter of shoot as influenced by bio-fertilizers and their combinations. The mixture applied with Azotobacter (2ml) + PSB (1ml) (T8) recorded the largest shoot diameter (2.45, 3.15, and 4.12 mm at 30, 60 and 90 DAP, respectively), and it is followed by Azotobacter (T9) (2.13, 2.99 and 3.99 cm at 30, 60 and 90 DAP respectively) and the largest length of sprouts per stem cutting recorded (2.45, 7.01 and 14.75 cm 30, 60 and 90 DAP respectively), and it is followed by (2.39, 6.36 and 14.25 cm at 30, 60 and 90 DAP). The un-inoculated seedlings (control) had the smallest shoot diameter (1.05, 1.44, 1.52 mm at 30, 60 and 90 DAP, respectively) and the minimum length of sprouts per stem cutting was recorded (1.06, 1.38 and 2.82 cm at 30, 60 and 90 DAP, respectively). The increased shoot diameter was due to the uptake of NPK by the plants which was improved by the bio-fertilizers used. Similarly, increased length of sprouting due to the increase availability of NPK and other nutrient uptake. 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. The beneficial nutrients provided by the bio-fertilizers, caused the diameter of the seedlings to increase. Both Ganeshnauth*et al.* (2018) study on pepper plants.

Fresh weight of shoot (g):

The data on the shoot fresh weight of dragon fruit cuttings as influenced by different concentration of bio-fertilizers with different combination are furnished in table 1. The treatments differed significantly at 30, 60 and 90 days after planting. The highest shoot fresh weight was seen in dragon fruit cutings treated with (18) Azotobacter (2ml) + PSB (1ml) (14.97, 24.69 and 51.34 g respectively), Lowest fresh weight was seen in (T1) control (9.51, 18.46 and 24.28 g respectively). The observation on days taken to sprout initiation, number of grouts per cutting and shoot 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 Sukhatme (1967).

Dry weight of shoot (g):

The stem cuttings of dragon fruit showed significant differences among the treatments and the control for shoot dry weight. The untreated cuttings showed least shoot dry weight at all stages of its growth. This may be because of slow sprout initiation, minimum leaf area and a smaller number of leaves.

The differences among the treatments may be due to bio-fertilizers which activate shoot growth, resulting in elongation of stems and leaves through cell division accounting for higher dy weight of shoot. The results are in line with the findings of Devi*et al.* (2019) in Lemon. Among the treatments, application of (T8) Azotobacter (2ml) + PSB (1ml) showed higher shoot dry matter. This could be due to earliness in sprouting, increase in number of leaves and leaf area and higher shoot fresh weight. Similar results are in conformity with

Devi*et al.* (2019) in Lemon cuttings.

Table1:Effectofbio-fertilizersonShootgrowthofdragonfruit(*Hylocereusundatus* L.)cuutings:																						
Sr. No.	**Treatment**	**Number of days taken for sprouting**	**sprouting percentage**		**numberofsproutpercutting**			**sprout and shoot length (cm)**			**Diameter of shoot /cutting,**			**number of spines/aerole**			**shoot freshweight**			**shoot dryweight**		
		30 DAP	30DAP	60DAP	30DAP	60DAP	90DAP	30DAP	60DAP	90DAP	30DAP	60DAP	90DAP	30DAP	60DAP	90DAP	30DAP	60DAP	90DAP	30DAP	60DAP	90DAP
T1	Control	16.24	11.44	18.22	0.32	1.12	1.43	1.06	1.38	2.82	1.05	1.44	1.52	3.23	3.64	3.79	9.51	18.46	24.28	1.85	3.77	6.85
T2	Azotobacter(1%)	14.45	16.45	28.12	0.45	1.15	1.55	1.42	3.45	7.85	1.25	2.15	2.99	3.42	3.98	4.25	12.85	20.15	31.45	3.15	5.45	9.15
T3	PSB (1%)	13.25	15.25	27.16	0.42	1.14	1.53	1.39	3.25	8.15	1.56	2.25	3.15	3.37	3.87	4.23	11.75	19.85	30.38	2.95	5.25	9.05
T4	Azotobacter(2%)	13.12	19.33	35.18	0.56	1.25	1.65	1.55	4.55	9.12	2.05	2.89	3.14	3.45	4.01	4.46	12.95	21.25	35.44	3.25	5.85	9.25
T5	PSB(2%)	11.25	21.27	36.25	0.58	1.28	1.72	1.65	3.75	8.76	1.69	1.78	2.85	3.56	4.12	4.65	13.25	22.15	37.63	3.45	6.12	9.45
T6	Azotobacter(1%)+ PSB (1%)	12.36	25.47	34.56	0.61	1.35	1.76	1.75	5.75	9.32	2.00	2.26	3.25	3.65	3.99	4.76	14.15	21.85	41.26	3.75	6.45	9.75
T7	Azotobacter(1%)+ PSB (2%)	9.46	29.38	39.44	0.65	1.51	1.85	1.95	5.25	12.33	2.21	3.01	3.85	3.78	4.24	4.82	14.35	23.65	46.74	3.96	6.88	10.01
T8	Azotobacter(2%)+ PSB (1%)	7.95	33.33	49.88	0.75	1.53	2.05	2.45	7.01	14.75	2.45	3.15	4.12	3.99	4.56	5.02	14.97	24.69	51.34	4.12	7.48	10.64
T9	Azotobacter(2%)+ PSB (2%)	8.15	31.68	48.68	0.72	1.48	1.99	2.39	6.36	14.25	2.13	2.99	3.99	3.88	4.45	4.99	14.75	24.25	50.16	4.01	7.36	10.25
S.Em(±)		0.132	0.325	0.535	0.008	0.027	0.042	0.023	0.062	0.182	0.03	0.04	0.06	0.036	0.047	0.067	0.183	0.296	0.559	0.077	0.087	0.173
C.D.at5%		0.399	0.984	1.618	0.025	0.081	0.128	0.070	0.187	0.550	0.10	0.12	0.19	0.110	0.141	0.202	0.552	0.896	1.691	0.233	0.262	0.522

Conclusion:

It may be concluded that among the different treatments of bio-fertilizers either single or in combination have great potential toaccelerate shooting in stem cuttings of dragon fruit. Among all the treatment, Azotobacter (2%) + PSB (1%) gave better results withrespect to shooting parameters followed by the treatment, Azotobacter (2%) + PSB (2%). Based on the findings of current investigation,itisrecommendedthatvegetativemethodofpropagationthroughstemcuttingsindragonfruittreatedwithbio-fertilizersisreliablefor commercial production ofplantingmaterials and it isquick and economicalalso.

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