The Pharma Innovation Journal 2019; 8(6): 726-728

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277- 7695
ISSN (P): 2349-8242
NAAS Rating: 5.03
TPI 2019; 8(6): 726-728

www.thepharmajournal.com
Received: 04-04-2019
Accepted: 06-05-2019

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Effect of organic, inorganic and bio-fertilizers on vegetative characters of dragon fruit (*Hylocereus undatus* L.) plant

RS Verma, Rubee Lata, RB Ram, SS Verma and Som Prakash

Abstract
The present investigation was conducted to find out the response of combined ‘‘effect of organic, inorganic and bio-fertilizers on vegetative characters of dragon fruit (*Hylocereus undatus* L.) plant’’. The results clearly revealed that growth and growth attributing characters were significantly influenced by integrated of organic, inorganic and bio-fertilizers. The maximum plant height (129.30 cm), number of branches per plant (7.61), number of thorns (58.41) and stem diameter (19.13 cm) were observed under the various treatments consisting of Water spray (T_1), FYM (T_2), 100% NPK (T_3), Azotobacter (T_4), PSB (T_5), FYM + 50% NPK (T_6),FYM + 75% NPK (T_7),FYM + 50% NPK + Azotobacter (T_8), FYM + 75%NPK +Azotobacter (T_9),FYM + 50%NPK + PSB (T_{10}), FYM + 75%NPK + PSB (T_{11}) , FYM + 50%NPK + Azotobacter + PSB (T_{12})andFYM + 75%NPK +Azotobacter +PSB (T_{13}) respectively. Hence, treatment combination (T_{13}) can be considered as best treatment for enhancing vegetative growth characters in dragon fruit under Lucknow conditions.

Keywords: Dragon fruit, FYM, NPK, bio-fertilizers and vegetative growth

1. Introduction
Dragon fruit (*Hylocereus undatus* L.) plant is a cactus, belonging to the family Cactaceae. Recently, dragon fruit introduced as super fruit in India, is considered to be a promising and remunerative fruit crop. Fruit has very attractive colour and mellow mouth melting pulp with black colour edible seed embeded in the pulp along with tremendous nutritive property which attract the growers from different part of India to cultivate this fruit crop which is originated in Mexico and Central and South America. (Britton and Rose, 1963; Morton, 1987 and Mizrahi *et al*., 1997) [2, 8, 9]. It is a long day plant with beautiful night blooming flower that is nicknamed as “Noble Woman” or “Queen of the Night”. The fruit is also known as strawberry, pear, dragon fruit, pithaya, night blooming cereus, Belle of the night, Conderella plant and Jesus in the Cradle. Fruit is named as pitaya because of the bracts or scales on the fruit skin and hence, the name of pitaya meaning ‘‘the scaly fruit’’. It has ornamental value due to the beauty of their large flowers (25 cm) that bloom at night; they are creamy white in colour. Dragon fruit production is gaining and it is receiving more recognition as a crop in India. 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, 2006 and Gunasena *et al*., 2006) [11]. Bio-fertilizers and organic supplements can play very significant role and are being used for improving crop growth and quality of products producing phytohormons, enhancing the uptake of plant nutrients thus help in sustainable crop production through maintenance of soil fertility and productivity. However, very little information is available until now with regards use of bio-fertilizers in dragon fruit plants for which the present study was initiated to find out the alternative source of chemical fertilization.

Materials and methods

The present study was conducted at Botanical Garden, Department of Horticulture, Babasaheb Bhimrao Ambedkar University (A Central University), Vidya Vihar, Rae Bareli Road, Lucknow during 2018-19 on dragon fruit plant. The experimental field was situated at $26^0$56'N latitudes and $80^0$52' E longitudes and the elevation was 111 m above msl. The soil of the experimental plot was sandy clay loam having the pH of 8.25. The experiment was laid out in Randomized Block Design (RBD) with 13treatments and replicated thrice. Thus, there were total 39 plants. Rooted cuttings of 12-week-old plants were collected from M/s Anil Krishi Farm, Raipur, Chhattisgarh during the 30th June, 2018 and planted directly in the field on 1st July, 2018.This experiment is first attempt to cultivate dragon fruit under Lucknow conditions. Well rotten FYM @ 15 Kg per pit and the recommended dose of fertilizers @ 200 g N, 250 g P_2O_5 and 100 g K_2O per plant were applied as per treatment schedule. Whole P_2O_5 along with half of K_2O was applied at the time of planting and rest half of K_2O was applied after 8 months of planting. Nitrogenous fertilizer was applied in three split doses i.e. 100 g at the time of planting, 50 g four months after planting and 50 g eight month after planting. The various treatments comprising of organic manure (FYM), inorganic fertilizers (NPK), bio-fertilizers (Azotobacter and PSB) were as follows:Water spray (T_1), FYM (T_2), 100% NPK (T_3), Azotobacter (T_4), PSB (T_5), FYM + 50% NPK (T_6), FYM + 75% NPK (T_7), FYM + 50% NPK + Azotobacter (T_8), FYM + 75% NPK + Azotobacter (T_9),FYM + 50% NPK + PSB (T_{10}), FYM + 75% NPK + PSB (T_{11}) , FYM + 50% NPK + Azotobacter + PSB (T_{12})andFYM + 75% NPK +Azotobacter + PSB (T_{13}) respectively. Observation on various growth and growth attributing characters were recorded as per standard procedures. The data were analyzed statistically as per Panse and Sukhatme (1985). To established the between various parameters associated with vegetative growth, the data were subjected to correlation analysis.

Table 1: Effect of organic, inorganic and bio-fertilizers on vegetative charactersof dragon fruit (*Hylocereus undatus*L.) plant

Growth and growth attributing characters					
S. No.	**Treatment**	**Plant height (cm)**	**No. of branches per plant**	**No. of thorns**	**Stem diameter (cm)**
T_1	(Control)	76.13	3.60	32.46	17.42
T_2	FYM	79.47	4.56	34.21	18.08
T_3	(100%) NPK	98.55	5.45	42.38	18.90
T_4	Azotobacter	84.34	4.64	34.39	18.24
T_5	PSB	77.89	3.87	32.94	17.76
T_6	FYM + (50%) NPK	94.23	5.20	38.47	18.83
T_7	FYM + (75%) NPK	102.56	5.48	43.49	18.93
T_8	FYM + (50%) NPK + Azotobacter	107.59	5.72	52.46	19.00
T_9	FYM + (75%) NPK +Azotobacter	114.26	5.98	52.94	19.03
T_{10}	FYM + (50%) NPK + PSB	89.58	4.82	35.10	18.52
T_{11}	FYM + (75%) NPK + PSB	92.32	5.06	38.10	18.76
T_{12}	FYM + (50%) NPK + Azotobacter +PSB	120.17	6.47	56.48	19.10
T_{13}	FYM +(75%) NPK+Azotobacter +PSB	129.30	7.61	58.41	19.13
SE m±		0.298	0.267	2.721	2.470
CD at 5%		2.018	0.621	1.895	7.172

Results and Discussion

The data presented in Table 1 clearly revealed that various growth and growth attributing characters were significantly influenced by different combinations of organic, inorganic and bio-fertilizers. Maximum vegetative growth in term of plant height (129.30 cm) were recorded in treatment with FYM + NPK (75%) +Azotobacter +PSB (T_{13}), whereas the minimum plant height (76.13 cm) was recorded in control (T_1). The increased vegetative growth in this treatment might also be attributed due to the increased biological nitrogen fixation, better organic nitrogen utilization, better development of root system and the possible synthesis of plant growth regulators like IAA, GA and cytokinins with the combined application of bio-fertilizers, organic manures and chemical fertilizers (Singh and Singh, 2009) [12]. Incorporation of bio-fertilizers with FYM and inorganic fertilizers should have led to better mobilization of bound nutrients and improvement in the physical condition of the soil facilitating deeper penetration of the roots and higher nutrient extraction from the soil. This in turn might have enabled the plant top put up better growth leading to greater plant height and girth (Trivedi *et al.*, 2014). Bhalerao *et al.* (2009) [4] also observed similar trend in plant height and girth in banana by using INM.

The maximum number of branches per plant (7.61) was noted with applications of FYM + NPK (75%) +Azotobacter +PSB (T_{13}) followed by (6.47) with applications of FYM + NPK (50%) +Azotobacter +PSB (T_{12}) in comparison to control (3.60) was recorded under control. (T_1). The present findings are in line with the results of Verma *et al.* (2015).

It is also evident from data given in Table-1 that the maximum number of thorns (58.41)was noted with applications of FYM + NPK (75%) +Azotobacter +PSB (T_{13}) followed by (56.48) with applications of FYM + NPK (50%) +Azotobacter +PSB (T_{12}) in comparison to control (32.46) was recorded under control. (T_1). These results are in agreement with the work done by Singh and Singh, (2009) [12].

The results clearly revealed that maximum stem diameter (19.13 cm) was noted with under the treatment of FYM + NPK (75%) +Azotobacter +PSB (T_{13}) followed by (19.10 cm) with under the treatment of FYM + NPK (50%) +Azotobacter +PSB (T_{12}) in comparison to control (17.42 cm) was under the treatment control. (T_1). This result corroborates the findings of (Trivedi *et al.*, 2014). Bhalerao *et al.* (2009) [4].

Conclusion

On the basis above findings it is be concluded that use of organic, inorganic resources and bio-fertilizers drastically enhance: the plant height, number of branches per plant, number of thorns and stem diameter of dragon fruit plants respectively.

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