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MANURING AND IRRIGATION EFFECT ON GROWTH, FLOWERING, AND FRUITING OF DRAGON FRUIT (*HYLOCEREUS UNDATUS* HAW) IN BANGLADESH

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ABSTRACT: Two experiments were carried out at the BAU Germplasm Centre (GPC) of Bangladesh Agricultural University, Mymen singh, Bangladesh during the period from September to December to find the effect of different types and doses of organic manures and irrigation on the growth, flowering, and fruiting of Dragon fruit. The first experiment consisted of two doses of each manures viz. paragon compost viz. 0.5 kg/plant, 1.0 kg/plant, cow dung viz. 5.0 kg/plant, 10.0 kg/plant and compost viz. 10.0 kg/plant, 20.0 kg/plant. The experiment was laid out in RCBD with five replications. Results revealed that, the highest height of the plants (222.52 cm) was observed at the dose 1.0 kg/plant of paragon compost and minimum (162.67 cm) in control treatment (at 90 DAM). In case of paragon compost, the dose 1.0 kg/plant gave the highest yield (0.572 t/ha); in case of cow dung treatment it was 0.376 t ha^{-1} and in case of compost, the dose 20.0 kg/plant gave the highest yield (0.286 t/ha). Among the all treatments, paragon compost @1.0 kg/plant gave the highest yield (0.572 t/ha). In the second experiment, among the irrigation interval the highest height of the plants (163.90 cm) was observed at 4 days interval of irrigation and minimum (100.89 cm) at control irrigation. The maximum yield was observed at 4 days interval (0.353 t ha^{-1}) and minimum yield was observed at control irrigation (0.145 t ha^{-1}).

Keywords: Manuring, irrigation, growth, flowering, fruiting, dragon fruit.

INTRODUCTION

The dragon fruit (*Hylocereus undatus* Haw.) is native to Central America. English common names included night-blooming careus, strawberry pears, queen of the night and Honolulu Queen, Latin American names pitaya and pitahaya (Martin *et al*., 1987). Nerd *et al*. (2004) stated that *Hylocereus undatus* is a vine cactus from Central America that has been established as a new fruit crop (pitaya) in many tropical and subtropical countries. Pitahaya fruit or commonly known as the Dragon fruit is among the most nutritious and wonderful exotic fruits in Bangladesh. Nobel (2002) stated that *Hylocereus undatus* is widely distributed naturally and is currently cultivated in 19 countries for fruit. It produces fruit of 1 kg or more and has a light melon-like taste. The color of the skin of fruit is a beautiful bright red, with translucent white or red flesh. It is favorite to many people, particularly people of Asian origin. It features a mouth-watering light sweet taste, an intense shape and color, not forgetting its outstanding flowers. In addition to being tasty and refreshing, this beautiful fruit is a source of water and other vital minerals with varied nutritional ingredients. Several studies showed that dragon fruits are a good Source of minerals, glucose, fructose, dietary fiber, and vitamins (Berbeu, 1990; Wu and Chen, 1997). It requires a tropical climate, especially when growing for commercial purposes to have successful and fruitful plantation. It is believed that the fruit was introduced to Vietnam by the French and today the average yield per hectare is 20-25 tonnes in Vietnam. There are some exotic fruits in Bangladesh. Among them Strawberry, Avocado, Passion fruit, Longan, Mangosteen, Soursop, Rambutan, Persimmon, Durian etc. are the common. Among the exotic fruits there are many possibilities of cultivation of Dragon fruits. Researchers are thinking that it would be possible to cultivate dragon fruits commercially

in Bangladesh. Dragon fruit requires a warm climate thus prospers well in semi-arid areas (Feng-Ru and Chum-Rubey, 1997a; 1997b). Planting the fruit has very high prospects since it's industrially used in juices, making wine and flavorings, not forgetting its medicinal value which a lot of people have grown to trust. Replacing chemical fertilizers by application of organic manure reduced the factors responsible for environmental pollution and also minimizes organic waste. Organic manure supply considerable amount of nutrients necessary for growth and development of plant. Organic manure reduces soil erosion and supply more than one nutrient at a time. It is well known that organic manure and irrigation improve the soil properties through improved physiochemical and biological condition of the soil (Pushpakumar *et al.*, 2005). No research about organic manuring and irrigation has yet been reported on Dragon Fruit in Bangladesh. Therefore, the present experiment was carried out to ascertain the yield of fruits per unit area of land, to select the balance dose of organic manure, and to identify the suitable interval of irrigation for better production of Dragon fruit.

MATERIALS AND METHODS

The experiment was conducted at the BAU Germplasm Centre of Bangladesh Agricultural University, Mymen singh, Bangladesh during the period from September to December. The experimental area was situated in the subtropical zone, characterized by heavy rainfall during Kharif season (April to September) and scanty in Rabi season (October to March). Rabi season is characterized by plenty of sunshine. Information regarding average monthly maximum and minimum temperature, rainfall and relative humidity, soil temperature as recorded by the Weather Yard, Department of Irrigation and Water Management, Bangladesh Agricultural University, Mymen singh, Bangladesh during the period of study. The soil of the experimental area is sandy loam type and belongs to the Old Brahmaputra Flood Plain Alluvial Tract (UNDP, 1988). The experimental site was a medium high land and the pH of the soil was 6.7. The experiment was done in Dragon fruit plants. The plants were established by cuttings and planted in August in previous year of experiment. The experiment was designed to study the effect of different types of organic manure and irrigation on growth, flowering and fruiting of dragon fruit. The first experiment consisted of three organic manures viz. Paragon super compost, cow dung, and Compost. The experiment was laid out in randomized complete block design (RCBD) with five replications. The first experiment consisted of different doses of paragon compost at 0.5 kg/plant and 1.0 kg/plant; cow dung at 5.0 kg/plant and 10.0 kg/plant and compost at 10.0 kg/plant and 20.0 kg/plant. The second experiment consisted of different interval of irrigation, viz. 2, 4, 6, 8 days interval. Data were recorded on different plant characters like plant height, number of flowers per plant, fruit length, breadth of fruit, number of fruits per plant, individual fruit weight, total soluble solid, and yield. Collected data were statistically analyzed for evaluation of the effect on different treatments. (Gomez and Gomez, 1984)

RESULTS AND DISCUSSION

Effects of Manuring

Manuring exhibited significant influence on almost all the characteristics studied except thickness of skin (Table 1). Among the organic manures treatments the highest plant height (222.52 cm) was obtained from the dose of 1.0 kg/plant of paragon compost at 90 DAM. Between the doses of cow dung, the higher plant height (194.39 cm) was obtained from the dose of 10.0kg/plant at 90 DAM. On the other hand between compost treatments, the dose 20.0 kg/plant showed the better result (201.24 cm) and the lowest plant height was recorded from the control treatment (162.66 cm). The highest number of flowers per plant was found at the dose of 1.0 kg/plant (3.0/plant) followed by 0.5 kg/plant of paragon super compost. In the cow dung treatments, higher number of flowers per plant was found at the dose of 10.0 kg/plant (1.80/plant). Again highest flowers were found at the dose 20 kg/plant (1.80/plant) in the compost treatments. In the control treatment gave the lowest number of flowers (1.40). The highest fruit length (9.89 cm) was obtained from the dose of 1.0 kg/plant of paragon compost and the lowest fruit length (7.15 cm) was obtained

from the control treatment. The highest fruit breadth (8.98 cm) was obtained from the dose of 1.0 kg/plant of paragon compost and the lowest fruit length (6.30 cm) was obtained from the control treatment. There was a significant effect of different organic manures on total soluble solid .The highest total soluble solid (26.72) was recorded at the dose of 1.0 kg/plant of paragon compost and the lowest total soluble solid (21.94) was obtained from the control treatment. The number of flowers per plant differs on the application of different organic matters. In case of paragon treatments the highest number of fruits set per plant (2.60) was recorded at the dose 1.0 kg/plant. In the cow dung treatments 1.80 fruits/plant were found at the dose 10.0 kg/plant. In the compost treatments, maximum fruit set per plant was 1.40 in the both dose. From the experiment it was observed that number of fruits set per plant was highest in the paragon compost (1.0 kg/plant) and the lowest was recorded from the control.

Table 1. Effects of organic manuring on. Plant height, no. of flowers/plant, fruit length, fruit breadth TSS, No. of fruits/plant individual fruit weight, thickness of pulp, thickness of skin and yield of dragon fruit.

	Doses (kg/tree)	Plant height (cm) at 90 DAI	No. of flowers/plant	Fruit length (cm)	Fruit breadth (cm)	TSS	No. of fruits/plant	Individual fruit weight (g)	Thickness of pulp (cm)	Thickness of skin (cm)	Yield (t/ha)
Control	0	162.67	1.40	7.15	6.30	21.94	1.00	257.67	6.072	0.242	0.185
Paragon compost	0.5	211.06	2.20	8.49	7.62	25.78	1.80	282.94	7.276	0.240	0.366
	1	222.52	3.00	9.89	8.98	26.72	2.60	305.32	8.714	0.244	0.572
Cowdung	5	185.71	1.60	9.39	8.49	22.81	1.60	288.31	8.268	0.258	0.332
	10	194.39	1.80	9.58	8.18	22.48	1.80	290.15	7.822	0.238	0.376
Compost	10	195.29	1.60	8.73	7.83	25.08	1.40	272.77	7.550	0.240	0.275
	20	201.24	1.80	9.10	8.26	24.46	1.40	284.53	7.966	0.254	0.286
LSD at 1%		4.77	0.893	1.016	1.175	2.563	0.767	13.88	1.156	0.056	0.07
LSD at 5%		6.46	0.659	0.750	0.867	1.891	0.566	10.24	0.853	0.041	0.058
Level of significance		**	**	**	**	**	**	**	**	NS	**

** Significant at 1% level of probability, DAM = Days after manuring, NS= Not Significant

There was significant influence of application of different organic manure on the weight of individual fruit. In case of paragon compost highest fruit weight was (305.32 g) was found at 1.0 kg/plant. In case of cow dung treatments the highest fruit weight was (290.15 g) at 10.0 kg/plant. Among the treatments, the highest fruit weight was (305.32 g) in case of paragon compost at 1.0 kg/plant and the lowest (257.67 g) was recorded from the control. In case of paragon compost highest thickness of pulp (8.71 cm) was at 1.0 kg/plant. In case of cow dung treatments the highest thickness of Pulp was (8.26 cm) at 5.0 kg/plant. Among the treatments, the highest thickness of Pulp (8.71 cm) was observed in case of paragon compost at 1.0 kg/plant and the lowest (6.72 cm) from the control. There was no significant influence of application of different organic manures on the thickness of skin. However in case of paragon compost the highest thickness of skin (0.244 cm) was found at 1.0 kg/plant. In case of cow dung treatments, the highest thickness of skin was (0.258 cm) was recorded at 5.0 kg/plant. Among the treatments, highest thickness of skin was (0.258 cm) in case of cow dung at 5.0 kg/plant and the lowest (0.238 cm) were in case of cow dung at 10.0 kg/plant. The most desirable important parameter of a plant is yield. Application of different doses of three organic manures (Paragon compost, cow dung, and compost) was found statistically significant on the yield (t ha^{-1}) of dragon fruit. The highest yield (0.572 t ha^{-1}) was obtained from paragon compost treatment with the dose of 1.0 kg/plant. Between the cow dung treatments it was 0.376tha^{-1}. Between the compost treatments it was 0.286 t/ha. The lowest yield (0.185 t/ha) was given by the control treatment. So from the comparison it was revealed that paragon compost @ 1.0 kg/plant was the best to give the highest yield.

Effects of irrigation

Irrigation exhibited significant influence on almost all the characteristics studied except thickness of pulp and thickness of skin (Table 2). The plant height was recorded at different growth stages after irrigation (i.e. at 30, 60 and 90 days). The plant height varied significantly due to application of irrigation at different

intervals. During the period of plant growth the highest plant height was observed (163.90 cm) in 4 days interval at 90 days followed by 6 days interval at 90 days (151.04 cm), the lowest growth was recorded in control irrigation (100.89 cm). Application of irrigation showed significant effect on the number of flowers per plant at different intervals. In case of number of flowers per plant the maximum number of flowers/plant (1.80) was found in day's interval and the minimum number of flowers/plant (0.80) was found in the control irrigation. There was a significant effect of irrigation on fruit length. The longest fruit length (9.39 cm) was obtained from the treatment of 4 days interval and the lowest fruit length (7.04 cm) was recorded from the control treatment.

Table 2: Effect of irrigation on plant height, no. of flowers/plant, fruit length, fruit breadth and TSS, no. of fruits/plant, individual fruit weight , thickness of pulp, thickness of skin and yield of dragon fruit.

	Doses (Days interval)	Plant height (cm) at 90 DAI	No. of flowers/ plant	Fruit length (cm)	Fruit breadth (cm)	TSS	No. of fruits/ plant	Individual fruit weight (g)	Thickness of pulp (cm)	Thickness of skin (cm)	Yield (t/ha)
Control	no irrigation	117.73	0.80	7.04	6.90	22.05	0.80	251.77	6.578	0.236	0.145
Irrigation interval	2	148.83	1.20	8.09	7.18	24.49	1.00	265.25	6.950	0.234	0.191
	4	163.90	1.80	9.39	7.86	25.99	1.80	278.98	7.418	0.242	0.353
	6	151.04	1.00	8.83	7.86	22.75	1.00	272.76	7.626	0.262	0.196
	8	131.47	1.40	8.66	8.02	22.88	1.00	272.53	7.788	0.230	0.201
LSD at 1%		6.931	0.691	1.064	0.674	2.041	0.795	18.95	1.935	0.058	0.101
LSD at 5%		9.549	0.502	0.773	0.489	1.482	0.577	13.750	1.404	0.042	0.073
Level of significance		**	**	**	**	**	**	**	NS	NS	**

** Significant at 1% level of probability, DAI = Days after irrigation, NS= Not significant

There was a significant effect of irrigation on the fruit breadth. The largest fruit breadth (8.02 cm) was obtained from the irrigation of 8 days interval and the lowest fruit breadth (6.90 cm) was found in the control treatment. The total soluble solid (TSS) was different in different treatments. There was a significant effect of irrigation intervals on total soluble solid. The highest total soluble solid (25.99) was obtained from the irrigation at 4 days interval and the lowest total soluble solid (22.05) was recorded in the control treatment (Table 3). Application of irrigation showed significant effect on the fruit weight per plant at different interval. In case of fruit weight the highest fruit weight (278.98 g) was found in irrigation at 4 days interval and the lowest fruit weight (251.77 g) was observed in control irrigation. There was significant influence of application of irrigation on the thickness of pulp. The highest thickness of pulp (7.78 cm) was at 8 days interval. Among the treatments, the lowest thickness of pulp (6.57 cm) was in case of control irrigation. There was no significant influence of application of irrigation on the thickness of skin. However the highest thickness of skin (0.262 cm) was at 6 days interval. Among the treatments, the lowest thickness of skin (0.230 cm) was at 8 days interval. The most desirable important parameter of a plant is yield. Application of irrigation at different intervals (control, 2, 4, 6 and 8 days) was found statistically significant on the yield (t ha^{-1}) of dragon fruit. The highest yield (0.353 t ha^{-1}) was obtained at 4 days interval of irrigation and the lowest yield (0.145 t ha^{-1}) was obtained at control irrigation. So from the comparison it reveals that at 4 days interval of irrigation is the best to give the highest yield.

CONCLUSION

The results obtained from this investigation exhibited a great influence of organic manures on plant height, flowering, and fruiting of dragon fruit an indication to apply paragon compost at the dose of 1.0 kg/plant to get higher yield (0.342t/ha) of dragon fruit (six months old) in Bangladesh. Also the result showed a great influence of supplementary irrigation on plant height and yield of dragon fruit an indication to apply irrigation at 4 days interval to get higher yield (0.100t/ha) of dragon fruit(six months old) in Bangladesh. However, further studies may be carried out to investigate the bearing habit with different doses of application in different ages of plant.

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