The Bioscan
AN INTERNATIONAL QUARTERLY JOURNAL OF LIFE SCIENCES
20(4): 1756-1760, 2025 www.thebioscan.com

Effect of Biofertilizers on Benefit & Cost Ratio of Dragon fruit

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DOI: 10.63001/tbs.2025.v20.i04.pp1756-1760

Received on:
18-10-2025
Accepted on:
23-11-2025
Published on:
27-12-2025

ABSTRACT

The present investigation entitled **"Studies on natural farming in Dragon Fruit [*Hylocereus costaricensis* (Web.) Britton and Rose]"** was carried out during the year 2023-24 and 2024-25 at Main Experiment Station, Department of Fruit Science, College of Horticulture and Forestry, ANDUAT, Kumarganj, Ayodhya, Uttar Pradesh, India. The treatments comprised of the spraying of different biofertilizers (FYM, Vermicompost, Panchgavya, Amritpani and Jeevamrit) to study benefit and cost ratio of dragon fruit. The experiment was conducted in randomized block design (RBD) with Seven treatments and three replications. The experiment consisted of seven treatments treatments (T1- Control, T2- FYM + Panchgavya, T3- FYM + Amritpani, T4- FYM + Jeevaamrit, T5- Vermicompost + Panchgavya, T6- Vermicompost + Amritpani and T7- Vermicompost + Jeevaamrit) were used for this study. The highest benefit and cost ratio found in treatment T5- Vermicompost + Panchgavya and lowest observed in T1.

Introduction

The dragon fruit (*Hylocereus costaricensis* (Web.) Britton and Rose) is a perennial climbing cactus belonging to the family Cactaceae (2n=22). The scientific name of dragon fruit is derived from the Greek word 'hyle' (meaning woody) and Latin word 'cereus' (meaning waxen). This fruit has emerged as a significant economic commodity on a global scale, due to its exceptional nutritional value (Rifat *et al.*, 2019).

Dragon fruit is originated in tropical sub- tropical region of Mexico, Central America and Northern South America (Kakade *et al.*, 2020). Globally, dragon fruit is produced in Vietnam, China, Indonesia Thailand, Malaysia, Israel, Sri Lanka, Mexico, Central America, Europe, South East Asia, United States and Australia over an area of 1,12,264 ha with the production of 21,00,777 MT (Kakade *et al.*, 2020). Three major countries *viz.*, Vietnam, China and Indonesia contribute more than 93% of dragon fruit production of world. The share of Vietnam alone is more than half (51.1%) of the world production over an area of 55, 419 ha with average productivity of 22–35 MT/ha. China is the biggest consumer and importer while Vietnam is the biggest exporter of the fresh dragon fruit (mostly white flesh).

Dragon fruit was introduced to India during the late 1990s (Chen & Paull, 2019). Thereafter, area under its cultivation was gradually increased from 4 to 400 ha in different states during 2005–2017. Initially

cultivation of dragon fruit was started in Karnataka, Maharashtra, Gujarat, Kerala, Tamil Nadu, Orissa, West Bengal, Andhra Pradesh, Telangana and Andaman & Nicobar Islands. Nowadays, its cultivation has extended to Rajasthan, Punjab, Haryana, Madhya Pradesh, Uttar Pradesh and North Eastern States. India's dragon fruit production increased drastically to more than 12,000 MT over an area of 3,000–4,000 ha in 2020. Productivity of dragon fruit India is reported to be 8.0-10.5 (MT/ha) (Wakchaure & Reddy, 2023). Gujarat, Karnataka and Maharashtra are the leading producers contributing about 70% of India's dragon fruit production.

India is nowhere in the list of global exporters of dragon fruit. However, considering present expansion of dragon fruit cultivation, India has great scope in a near future for large scale export to meet global market demand particularly market at North America, Europe, Asia–Pacific, South America, and the Middle East and Africa *etc*. Hence, India has to promote dragon fruit farming in the form of large clusters in barren/dry land areas. One of the obstacles to increasing the profitable commercial cultivation of Dragon fruit is the lack of information about its nutritional management (Sharma *et al.*, 2021).

The fresh dragon fruit contains the water (80-88g), ascorbic acid (4-25mg), ash (0.4-0.7g), calcium (6-10mg), calories (35-50), carbohydrates (9-14g), carotene (vitamin 'a') traces, fat (0.1-0.6g), fiber (0.3-0.9g), iron (0.3-0.7mg), niacin (0.2-0.45mg), phosphorus (16-36mg), protein (0.15-0.23g), thiamine (vitamin b1) traces, riboflavin (Vitamin B2) traces these all nutrients are found fruit per $100g^{-1}$ of fruit (Hussain *et al.*, 2021).

Organic farming is considered eco-friendly and it is also Imbalanced use of chemicals and second-generation problems of green revolution in agriculture has weakened the ecological base in addition to degradation of soil, water resources food quality, crop productivity and farm profitability especially in cereal based intensive cropping systems in the country in general and especially North India. Organic manures and biofertilizers as source of nutrients, many organic formulations like *Panchgavya* and biodynamic preparation are being advocated and practiced for increasing the yield and quality of food. *Panchagavya* is a fermented product made from five ingredients obtained from cow, such as milk, urine, dung, curd and clarified butter (Amalraj *et al.*, 2013).

Jeevamrutham is an organic fertilizer and a great replacement of chemical fertilizers. It is a very good source of biomass, natural carbon, nitrogen, phosphorous, calcium and other nutrients which are essential for plant growth and development. The microorganisms which are present in the soil are responsible for increasing the fertility of the soil and the productivity of the crops. In order to increase the microorganisms in the soil Jeevamrutham is used. Jeevamrit enhances microbial activity in soil and helps in improvement of soil fertility. Organic farming of dragon fruit will remain sustainable if efforts are made to increase the Total Economic Value (TEV) contained therein, so that land conversion is not carried out for other development purposes. Therefore, further research is needed to increase the social benefits of organic dragon fruit farming. (Ningsih *et al.* 2020).

Organically produced dragon fruit would be residue free, poisonous chemical

free healthy crop, an ideal fruit crop for a health-conscious person. Very scant information is available until now about the fully organic cultivation of dragon fruit, keeping this view, the present experiment was undertaken to examine the effect of FYM, Vermicompost, Panchgavya, Amritpani and Jeevamrit on the flowering and fruiting of Dragon fruit.

Materials and methods

The present experiment entitled "Effect of FYM, Vermicompost, Panchgavya, Amritpani and Jeevamrit on the flowering and fruiting of Dragon fruit" was conducted at the Main Experimental Station, Department of Horticulture, and lab work in PG Lab, Department of Fruit Science, College of Horticulture & Forestry, Acharya Narendra Deva University of Agriculture & Technology, Kumarganj. Ayodhya (U.P.) during year 2023-24 and 2024-25. Seven treatments (T_1- Control, T_2- FYM + Panchgavya, T_3- FYM + Amritpani, T_4- FYM + Jeevaamrit, T_5- Vermicompost + Panchgavya, T_6- Vermicompost + Amritpani and T_7- Vermicompost + Jeevaamrit) are used with three replications in randomized block design in 2023-24 and 2024-25. All the organic manure are in two split parts at different stage in soil, 1st application in last week of December and 2nd application in last week of March.

Gross return (Rs./ha)

Gross returns include the fruit yields per hectare multiplied by local market rate for Dragon fruit.

Net return (Rs./ha)

Net returns were calculated by deducting cost of cultivation from gross returns by using the following formula.

Net Return = Gross return – cost of cultivation

Cost: Benefit ratio

In order to find out benefit cost ratio, gross return of individual treatment per hectare was divided, by their respective cost of cultivation per hectare including fixed and treatment cost by using the following formula.

$$\text{Cost: Benefit ratio} = \frac{\text{Gross return (Rs./ ha.)}}{\text{Cost of Cultivation (Rs./ha.)}}$$

Result and discussion

In T5 treatment in 2023-24 the cost of cultivation is 681565.86 Rs/ha., yield 14598.54kg/ha. and net return 1654200.60 Rs/ha., 2024-25 the cost of cultivation is 681565.86Rs/ha., yield 14154.14 kg/ha. and net return 1866179.40 Rs/ha. is highest among seven treatment and lowest benefit cost ratio found in T1, 2023-24 cost of cultivation 571156.80Rs/ha., yield 3992.94 kg/ha and net return 136772.40 Rs/ha. In 2024-25 cost of cultivation 571156.80Rs/ha., yield 3999.60 kg/ha. and net return 148771.20 Rs/ha.

Treatment	1st Year				2nd Year			
	Cost of cultivation (Rs/ha.)	Gross return (Rs/ha.)	Net return (Rs/ha.)	Cost benefit ratio	Cost of cultivation (Rs/ha.)	Gross return (Rs/ha.)	Net return (Rs/ha.)	Cost benefit ratio
T_1-Control	571,156.80	707,929.20	136,772.40	0.09	571,156.80	719,928.00	148,771.20	0.26
T_2-FYM + Panchgavya	622,285.80	1,471,852.80	849,567.00	1.37	622,285.80	1,483,851.60	861,565.80	1.38
T_3-FYM + Amritpani	622,285.80	1,198,102.40	575,816.60	0.93	622,285.80	1,463,853.60	841,567.80	1.35
T_4-FYM + Jeevaamrit	622,285.80	1,930,473.60	1,308,187.80	2.1	622,285.80	2,115,788.40	1,493,502.60	2.4
T_5-Vermicompost + Panchgavya	681,565.80	2,335,766.40	1,654,200.60	2.43	681,565.80	2,547,745.20	1,866,179.40	2.74
T_6-Vermicompost + Amritpani	681,565.80	2,204,224.00	1,522,658.20	2.23	681,565.80	2,455,754.40	1,774,188.60	2.6
T_7-Vermicompost + Jeevaamrit	681,565.80	2,097,568.00	1,416,002.20	2.08	681,565.80	2,427,757.20	1,746,191.40	2.56

Conclusion

The present study demonstrated that use of organic inputs significantly enhanced the yield and yield-attributing traits of dragon fruit. Among the treatments, T5 (Vermicompost + Panchgavya) was found to be the most effective in flowering and fruiting traits and highest benefit and cost ratio of dragon fruit. In contrast, the control treatment (T1) consistently recorded the lowest values across all recorded parameters, benefit cost ratio of Dragon fruit. These findings suggest that the application of vermicompost along with Panchgavya can be a sustainable and efficient strategy for improving dragon fruit productivity under organic and low-input farming systems especially in eastern plains.

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