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Inderjeet Singh
Research Scholar, PG Department of Agriculture, GSSDGS Khalsa College, Patiala, Punjab, India

Satveer Kaur
Research Scholar, PG Department of Agriculture, GSSDGS Khalsa College, Patiala, Punjab, India

Harpreet Kaur
Assistant Professor, PG Department of Agriculture, GSSDGS Khalsa College, Patiala, Punjab, India

Corresponding Author:
Inderjeet Singh
Research Scholar, PG Department of Agriculture, GSSDGS Khalsa College, Patiala, Punjab, India

Effect of organic nutrient management practices on growth and yield of brinjal (*Solanum melongena* L.)

Inderjeet Singh, Satveer Kaur and Harpreet Kaur

Abstract
A present experiment "Effect of organic nutrient management practices on growth and yield of brinjal (*Solanum melongena* L.)." was conducted at Campus for Research and Advanced Studies, Dhablan, PG Department of Agriculture, G.S.S.D.G.S. Khalsa College, Patiala during the *rabi* season in 2021-2022. The experiment was laid out in Randomized Block Design (RBD) with eleven treatment and three replications. Results showed that T_5 RDN 100% + Panchagavya 5% + Jeevamrut 5% recorded significantly higher plant growth attributes (plant height (84.12 cm), plant spread (84.81 cm) and number of leaves plant^{-1} (107.12), Yield parametrs viz. number of fruits plant^{-1} (20.38), fruit yield (441.84 q ha^{-1}) and T_4 RDN 100% + Jeevamrut 5% gave significantly higher fruit weight (55.27 g) , fruit length (21.59 cm) and fruit diameter (5.82 cm) as compared to all other treatments. Different organic management practices significantly influenced the growth and yield of brinjal.

Keywords: Brinjal, vermicompost, poultry maure, Jeevamrut, Panchagavya

Introduction
Brinjal (known as eggplant in USA and aubergine in France and UK, *Solanum melongena* L., chromosome no. 2 n = 2 x = 24) is one of the few cultivated Solanaceous species originating in the Old World. It is known as brinjal in India where it was domesticated long ago and where the greatest diversity is found. Brinjal is a major vegetable crop in several countries like India, Japan, Indonesia, China, Bulgaria, Italy, France, USA and several African countries.

Brinjal is also known as poor man's vegetable, has occupied a prominence place in daily diet of all parts of society. It became more popular not only because of several luscious and beautiful dishes prepared from its fruits but also due to its cheapness and easy availability. Brinjal is most common and popular vegetable crop in India. (NHB, 2020) [13].

Vermicompost is widely adopted by farmers among various organic fertilizers such as FYM, compost and green manure and it is produced by the activity of earthworms. It contains all maco and micronutrients and beneficial microorganisms such as N-fixants, biologically active metabolites, growth promoting substances especially gibberellin, cytokinin's, auxins, group B vitamins and lipases, nitrogenises. (Bano *et al.*, 2007) [7].

Various types of liquid bio-enhancer, namely Panchagavya, Jeevamrut, Bijamrut and Vermiwash are made from plant and animal sources by using the cow dung, urine, ghee, cow milk, plant extracts and palm sugar, etc. These products are effective in stimulating the growth and productivity of the crops. Organic matter not only contributes to the nutrient content of the soil but also plays a crucial role in boosting soil fertility through the stimulation of soil flora and fauna, thereby facilitating the rapid growth of crops (Yadav and Mowade, 2004) [16].

During the early centuries in India, the prevalent farming method relied on organic farming techniques that made use of locally sourced organic manures. This traditional approach played a vital role in sustaining Indian agriculture over an extended period. But with the arrival of inorganic fertilizers in the cultivation of crops, their use has come to the level of causing a concern to the environment. In recent years the incorrect and excessive utilization of chemical fertilizers and chemicals has detrimental impacts on soil health and fertility, as well as detrimental effects on soil flora and fauna. The adverse outcomes resulting from this misuse have become evident over time, such as reduced crop productivity, heightened prevalence of insect pests and diseases, declining water tables and the pollution of air, water, and soil, all of which contribute to the destruction of beneficial soil flora and fauna. Organic manures have emerged as crucial elements within organic farming as they not only boost crop productivity but also contribute to the long-term maintenance of soil fertility and soil health. (Anonymous, 2021) [3].

Materials and Methods

The field experiment entitled "Effect of organic nutrient management practices on growth and yield of brinjal (*Solanum melongena* L.)" was carried out during the *Rabi* season in the year 2021-2022 at Campus for Research and Advanced Studies Dhablan, P.G. Department of Agriculture, G.S.S.D.G.S Khalsa College Patiala. The experimental site is situated at about 30-20° N latitude and 76-28° E longitude at an altitude of about 249 m above the mean sea level. It is located in south eastern direction in Punjab state and North West India. The experiment was conducted in Randomized Block Design which is replicated three times with application of different concentration of organic and liquid manures.PBH-4 is a hybrid of brinjal was a sown at a distance of 60 cm Row to Row and 40 cm Plant to Plant. Total 11 treatments were undertaken i.e, T_1 – Control, T_2 – RDN 100%, T_3 – RDN 100% + Panchagavya 5%, T_4 – RDN 100% + Jeevamrut 5% , T_5 – RDN 100%+Panchagavya 5% + Jeevamrut 5% , T_6 – RDN 75% + Panchagavya 5%, T_7 – RDN 75% + Jeevamrut 5% , T_8 – RDN 75% + Panchagavya 5% + Jeevamrut 5% , T_9 – RDN 50% + Panchagavya 5%, T_{10} – RDN 50% +Jeevamrut 5% , T_{11} – RDN 50%+Panchagavya 5% + Jeevamrut 5%. The observations were recorded during the course of experimentation on following characters- plant height (cm) , plant spread (cm), number of leaves plant^{-1}, Number of fruits plant^{-1} , Fruit length (cm), Fruit diameter (cm), Fruit weight (g) and Fruit yield q ha-1. Average of data from the sampled plant of each treatment was used for statistical analyses in order to draw valid conclusions.

Results and Discussion

Effect of organic nutrient management practices on growth parameters of brinjal

The maximum plant height (84.12 cm) was recorded in treatment T5 (RDN 100% + Panchagavya 5% + Jeevamrut 5%) which was at par with the treatment T4 RDN 100% + Jeevamrut 5% (83.74 cm) and minimum plant height (43.48 cm) was observed in treatment T_1 (Control). The manures such as vermicompost, FYM and poultry manure helps in improving the soil's condition by releasing several nutrients. The availability of more nitrogenous compounds with the application of organic and liquid manures together increases the photosynthesis rate which increase the vegetative growth of the plant. Hameedi *et al*. (2018) [8] observed a substantial increase in plant height following the application of vermicompost and jeevamrut on capsicum.

The maximum plant spread was recorded (70.81 cm) in the treatment T_5 (RDN 100% + Panchagavya 5% + Jeevamrut 5%) which was at par with the treatment T_4 (RDN 100% + Jeevamrut 5%) (70.23 cm) and treatment T_1 gave the lowest values for the plant spread (33.86 cm). Vermicompost increased the microbial activity of soil, increases availavility of oxygen, increase soil porosity and infiltration rate of water and improve the nutrient content and increase plant spread and growth of brinjal crop. Ahamd *et al.* (2017) [17] also showed that the treatment of poultry manure resulted in a considerable increase in plant spread of coriander.

The number of leaves plant^{-1} were significantly by various treatments of organic manure and in combination with liquid manure. The maximum number of leaves (107.12) was found from treatment T5 (RDN 100% + Panchagavya 5% + Jeevamrut 5%) which was at par the treatment T_4 (RDN 100% + Jeevamrut 5%) (106.23) and T_3 (RDN 100% + Panchagavya 5%) (106.03) and the minimum reading for the number of leaves (77.46) was recorded from the treatment T1 (Control). The vermicompost, jeevamrut and poultry manure has more capability to supply the nutrients for the proper growth and development of the plant that may enhance the photosynthetic activity of the plant and prepare sufficient food for the proper growth of plant. The better transportation of water, uptake and discharge of nutrients results in the higher vegetative growth and number of leaves as reported by Meena *et al.* (2017) [10].

Effect of organic nutrient management practices on yield parameters of brinjal

The maximum number of fruits plant^{-1} (20.38) was shown in the treatments T_5 (RDN 100% + Panchagavya 5% + Jeevamrut 5%) which was statistically at par with the treatment T_4 (RDN 100% + Jeevamrut 5%) (18.65) and T_3 (RDN 100% + Panchagavya 5%) (18.16). The lowest number of fruits plant^{-1} (8.52) was recorded from treatment T_1 (Control). Combination of organic manures and liquid manures influences the nutrient and water uptake from the soil increases the number of fruits and weight which is known for the more accumulation of food in the plant of brinjal. Similarly vermicompost, Panchagavya significantly increased the amount of fruits plant^{-1} in snake gourd (Mohan *et al*., 2016) [12]. Palekar and Vasanth Kumar (2006) [14] provide an example.

Treatment T_4 (RDN 100% + Jeevamrut 5%) shows the maximum fruit weight (55.27 g) which was significantly superior over all other treatments. This treatment was at par with T_3 (RDN 100% + Panchagavya 5%) (53.87 g). While the minimum fruit weight (40.80 g) was recorded from the treatment T1 (Control). Application of different concentration of organic manure and liquid manures exhibits a significant effect on the weight of fruit. Organic manures and liquid manures helps to maintain the soil moisture, improves the water holding capacity and nutrient availavility of soil also increase the soil porosity and soil productivity that ultimately enhances the vegetative and reproductive growth of the plant. Arumugam and Anburani (2008) [6] found that the use of FYM, vermicompost and panchagavya resulted in a noticeable variation in the weight of individual tomatoes.

Effect of organic nutrient management practices on yield parameters of brinjal:

The maximum number of fruits plant^{-1} (20.38) was shown in the treatments T_5 (RDN 100% + Panchagavya 5% + Jeevamrut 5%) which was statistically at par with the treatment T_4 (RDN 100% + Jeevamrut 5%) (18.65) and T_3 (RDN 100% + Panchagavya 5%) (18.16). The lowest number of fruits plant^{-1} (8.52) was recorded from treatment T_1 (Control). Combination of organic manures and liquid manures influences the nutrient and water uptake from the soil increases the number of fruits and weight which is known for the more accumulation of food in the plant of brinjal. Similarly vermicompost, Panchagavya significantly increased the amount of fruits plant^{-1} in snake gourd (Mohan *et al*., 2016) [12]. Palekar and Vasanth Kumar (2006) [14] provide an example.

Table 1: Growth of brinjal as influenced by different organic nutrient management practices

Treatments	Plant Height (cm)	Plant spread (cm)	No. of Leaves-1
T_1 – Control	43.48	33.86	77.46
T_2 – RDN 100%	80.11	65.43	101.27
T_3 – RDN 100% + Panchagavya 5%	83.39	69.75	106.03
T_4 – RDN 100% + Jeevamrut 5%	83.74	70.23	106.33
T_5 – RDN 100% + Panchagavya 5% + Jeevamrut 5%	84.12	70.81	107.12
T_6 – RDN 75% + Panchagavya 5%	79.17	64.25	99.86
T_7 – RDN 75% + Jeevamrut 5%	79.56	64.67	100.73
T_8 – RDN 75% + Panchagavya 5% + Jeevamrut 5%	80.21	65.82	101.78
T_9 – RDN 50% + Panchagavya 5%	73.68	58.51	94.21
T_{10} – RDN 50% +Jeevamrut 5%	74.24	59.13	94.83
T_{11} – RDN 50% + Panchagavya 5% + Jeevamrut 5%	74.88	59.45	95.05
S.E. (m)±	0.88	1.15	0.84
C.D. 5%	1.83	3.39	1.76

Treatment T_4 (RDN 100% + Jeevamrut 5%) shows the maximum fruit weight (55.27 g) which was significantly superior over all other treatments. This treatment was at par with T_3 (RDN 100% + Panchagavya 5%) (53.87 g). While the minimum fruit weight (40.80 g) was recorded from the treatment T1 (Control). Application of different concentration of organic manure and liquid manures exhibits a significant effect on the weight of fruit. Organic manures and liquid manures helps to maintain the soil moisture, improves the water holding capacity and nutrient availavility of soil also increase the soil porosity and soil productivity that ultimately enhances the vegetative and reproductive growth of the plant. Arumugam and Anburani (2008) [6] found that the use of FYM, vermicompost and panchagavya resulted in a noticeable variation in the weight of individual tomatoes.

The fruit length (cm) was maximum noted treatment T_4 (RDN 100% + Jeevamrut 5%) (21.59 cm) and minimum fruit length (15.58 cm) was recorded from the treatment T1 (Control). Organic manures play a crucial role in enhancing fruit length during the fruit development stage, primarily due to the presence of nitrogen and phosphorus. By enriching the soil fertility and enhancing the chemical, physical, and biological properties of the soil, organic manures facilitate cell elongation and contribute to improved crop productivity and soil porosity. As a result, the fruit length of brinjal experiences a substantial increase. With the application of farmyard manure, vermicompost, PSB, and Azospirilum, Mishra *et al*. (2018) [11] also showed a substantial improvement in the growth parameters (fruit length) of brinjal.

Table 2: Yield of brinjal as influenced by different organic nutrient management practices

Treatments	No. of fruits plant^{-1}	Fruit weight (g)	Fruit length (cm)	Fruit diameter (cm)	Fruit yield q ha^{-1}
T_1 – Control	8.52	40.75	15.58	3.73	144.95
T_2 – RDN 100%	17.57	46.43	18.65	4.62	366.36
T_3 – RDN 100% + Panchagavya 5%	18.16	49.25	19.64	4.86	407.79
T_4 – RDN 100% + Jeevamrut 5%	18.65	55.02	21.59	5.82	429.67
T_5 – RDN 100% + Panchagavya 5% + Jeevamrut 5%	20.38	52.04	20.63	5.7	441.84
T_6 – RDN 75% + Panchagavya 5%	16.29	48.2	19.58	4.82	334.06
T_7 – RDN 75% + Jeevamrut 5%	16.49	48	18.75	4.64	341.12
T_8 – RDN 75% + Panchagavya 5% + Jeevamrut 5%	17.72	49.92	19.68	5.6	368.55
T_9 – RDN 50% + Panchagavya 5%	14.53	44.92	17.74	4.5	256.06
T_{10} – RDN 50% +Jeevamrut 5%	14.77	45.85	18.44	4.55	270.64
T_{11} – RDN 50% + Panchagavya 5% + Jeevamrut 5%	15.37	46.42	18.53	4.6	282.56
S.E. (m)±	1.08	0.98	1.02	0.57	11.99
C.D. 5%	2.25	2.05	2.12	1.19	25.02

The improved fruit diameter was noted maximum in treatment T_4 (RDN 100% + Jeevamrut 5%) (5.82 cm) and minimum fruit diameter (3.73 cm) was recorded from the treatment T_1 (Control). The early release of nutrients from the manures at the time of fruit development stimulates to influence the microbial activity in the soil, improves soil fertility and soil porosity and maintain soil structure that improve crop productivity and increase yield-related statistics like fruit diameter (cm). Organic manures and liquid formulations were used and the results showed a larger fruit diameter.

The Maximum fruit yield (441.84 q ha^{-1}) was given by the treatment T_5 (RDN 100% + Panchagavya 5% + Jeevamrut 5%). This was at par with the treatment T_4 (RDN 100% + Jeevamrut 5%) (429.67 q ha^{-1}) and the minimum fruit yield (144.95 q ha^{-1}) was found from the treatment T_1 (Control).Application of different of organic manures and liquid manures significantly increases the yield of brinjal per quantel per hectare over all the other treatments. It has been observed that due to more vegetative growth of plant and higher rate of photosynthesis. This provide as more accumulation of food for the vegetative and reproductive growth of the plant. This leads to an higher produce of fruit yield q ha^{-1}. This may be as a result of more fruit plants and greater vegetative development. Findings from Kumar (2016) [9], Arancon *et al*. (2003) [4], Arancon *et al*. (2005) [5], Ramesh *et al*. (2015) [15] and Adhikari *et al*. (2016) [1] confirm these conclusions increases the yield of brinjal per quantel per hectare over all the other treatments.

Conclusion

It has been concluded that effect of different organic nutrient management practices results in higher growth and yield attributes . Results showed that T_5 RDN 100% + Panchagavya 5% + Jeevamrut 5% recorded significantly higher in plant growth attributes: plant height (84.12 cm), plant spread (84.81 cm) and number of leaves plant^{-1} (107.12), Yield parametrs : number of fruits plant^{-1} (20.38), fruit yield (441.84 q ha^{-1}) and T_4 RDN 100% + Jeevamrut 5% gave significantly higher fruit weight (55.27 g) , fruit length (21.59 cm) and fruit diameter (5.82 cm) as compared to all other treatments. Organic and liquid manures increased the availability of other nutrients which are essential for the plant growth. Organic and liquid manures improve the soil physical, chemical and biological properties, improve the nutrient content, increase soil porosity, infiltration rate of water and improve vegetative growth, more number of fruits, better availability of nutrients at vital growth period.

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