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Integrated Effect of Vermicompost and Chemical Fertilizers on the Yield & Yield Contributing Characteristics of Brinjal (*Solanum melongena* L.)

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Authors' contributions

This work was carried out in collaboration among all authors. Author SAJ designed the study, performed statistical analysis, wrote protocol and made first draft of the manuscript. Authors MAH, MMH, MKJA and KN managed the analyses of the study. Authors SC, KN and MHR managed the literature searches. All authors read and approved the final manuscript.

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ABSTRACT

Field experiment was conducted at the BINA Sub-Station, Ishurdi to investigate the integrated effect of vermicompost and chemical fertilizers on the yield and yield contributing characters of brinjal. Seven treatments were used in the experiment. The treatments used in the experiments were T_1: Control; T_2: Recommended fertilizer (RF); T_3: 75% RF + 3 tha^{-1} Vermicompost (VC); T_4: 75% RF + 5 tha^{-1} VC; T_5: 50% RF + 3 tha^{-1} VC; T_6: 50% RF + 5 tha^{-1} VC; T_7: 5 tha^{-1} VC. The

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experiment was conducted in a Randomized Complete Block Design with three replications. The treatment T_4 (75% RF + 5 tha^{-1}) gave maximum yield (7.8 tha^{-1}) of brinjal followed by the treatment T_6 (6.88 tha^{-1}). But the treatments T_3 and T_5 gave identical yields of brinjal. Therefore, fertilizer doses of $N_{101.25}$, P_{27}, $K_{52.5}$, $S_{3.75}$, $Zn_{0.75}$ $kgha^{-1}$ with VC @ 5 tha^{-1} for Ishurdi could be adopted in the cultivation of brinjal for getting maximum yields.

Keywords: Vermicompost; fertilizer doses; brinjal; yield.

1. INTRODUCTION

Brinjal is one of the most important vegetables in Bangladesh. It has all kinds of nutritional values. It is a combination of vitamin A, C, E, and Iron. It is also a powerful antioxidant. Having a lot of iron, it helps to eliminate anemia. Vitamin A provides nutrition to the eyes and works against all eye diseases. Brinjal also contains a lot of calcium and magnesium which is very beneficial for teeth and bones, a lot of dietary fiber which helps in digestion of food and helps in relieving constipation. Brinjal is good for those who have high levels of bad cholesterol in their blood. However, for those who have arthritis, or asthma and allergies, there are some restrictions on purple [1]. Brinjal is cultivated in 34,973 hectares of land in Bangladesh producing 5,30,610 metric tons of fresh brinjal [2].

Excess use of chemical fertilizers declines soil organic matter (SOM) content & which leads to decrease in the quality of agricultural soil [3,4]. The judicial use of chemical fertilizers hardens the soil, declines soil fertility, pollutes air, water, and soil, and decreases important nutrients of soil and minerals, thereby causing negative impacts to environment. [1]. The avoidance of excess chemical fertilizers and the use of organic fertilizers such as vermicompost, biofertilizers, green manure and biopesticides can be a sustainable approach to crop productivity [5].

The judicious application of organic and inorganic sources of nutrients might be helpful to obtain a good economic return with good soil health for the crop [6]. Vermicompost increases the surface area and provides strong absorbability and retention of nutrients as well and retains more nutrients for a longer period of time [7]. Vermicompost application can enhance both quality and quantity of plants [8]. Vermicompost provides many valuable additional substances in the soil that are not found in chemical fertilizers [9,10]. vermicompost can be utilized as plant growth media and soil conditioners and also promotes soil microbial biodiversity by inoculating the soil with a wide array of beneficial microbes [11]. The effects of vermicompost + NPK are more efficient for egg plant and maintenance of soil fertility and also it is economically suitable [12].

Now, it is a well-known fact that organic fertilizers provide the necessary conditions for the crop plant's healthy growth and may even improve the uptake of nutrients, raise assimilation capacity, and stimulate hormonal activity [13]. Vermicompost is advantageous because it improves soil aeration, porosity, and water retention. Vermicomposting appears to have effects on plant growth that aren't directly related to its physical or chemical characteristics [14]. The application of vermicompost enhances soil health and crop productivity due to improved nutrient uptake, the presence of humic substances, phytohormones, and enhanced microbial activities in VC [15].

However, the increased plant growth is linked to the growth media's improved physical and chemical structure. It is asserted that micro flora connected to vermicomposting, which trigger hormone-like activity on the creation of metabolites, may be responsible for growth promotion [16]. Earthworms are employed in the vermicomposting process to turn organic waste into vermicompost, which can be used as fertilizer for crop growth [17]. *Solanum melongena* L., or eggplant, is a great source of minerals like calcium, magnesium, potassium, and iron. The yield relies on a number of variables. Among these elements, integrated usage of chemical fertilizers and vermicompost can significantly contribute to raise the production of brinjal.

2. MATERIALS AND METHODS

The experiment was conducted at the BINA substation, Ishurdi, Pabna to investigate the integrated effect of vermicompost with chemical fertilizers on the yield and yield contributing characters of brinjal. Seven treatment combinations were used in the experiment. The treatments were used as T_1: Control;

Table 1. Fertilizer rates used in experiment

Treatments	Fertilizer rate (kgha^{-1})					VC (tha^{-1})
	N	P	K	S	Zn	
T_1: Control	0	0	0	0	0	-
T_2: Recommended fertilizer	135	36	70	5	1	-
T_3: 75% CF+ 3 tha^{-1} VC	101.25	27	52.5	3.75	0.75	3
T_4: 75% CF+ 5 tha^{-1} VC	101.25	27	52.5	3.75	0.75	5
T_5: 50% CF + 3 tha^{-1} VC	67.5	18	35	2.5	0.5	3
T_6: 50%CF + 5 tha^{-1} VC	67.5	18	35	2.5	0.5	5
T_7: 5 tha^{-1} VC	-	-	-	-	-	5

T_2: Recommended fertilizer (RF); T_3: 75% RF+3 tha^{-1} Vermicompost (VC); T_4: 75% RF+ 5 tha^{-1} VC; T_5: 50% RF + 3 tha^{-1} VC; T_6: 50% RF + 5 tha^{-1} VC; T_7: 5 tha^{-1} VC.

The experiment was carried out in a RCBD design with three replications. Local brinjal cultivar named Deshal Shamla was used in the experiment. The unit plot size was 3m×2m. The whole amount of vermicompost, TSP, MOP, gypsum, zinc sulphate and boron were broadcast at the time of final land preparation and urea was top dressed in three equal split at 10, 25 and 45 days after transplanting (Table 1). Fertilizers were applied on the basis of soil test and the rates of fertilizer have been given in the Table 1. The seedlings of brinjal were transplanted in the experimental field on 11 December 2021. Weeding, irrigation and other intercultural operation were done as and when necessary. Brinjal was harvested on three installment as 1st, 2nd and 3rd between 2 March to 13 April 2022. Yield and yield contributing characters were recorded.

3. RESULTS AND DISCUSSION

Yield and yield contributing characteristics of brinjal were significantly influenced with the different treatments (Table 3) at BINA Sub-Station Ishurdi. Maximum plot yield of brinjal (7.8 tha^{-1}) was obtained in the treatment T_4 (75% CF+ 5 tha^{-1} Vermicompost). The fresh yield of brinjal was recorded in the treatment T_1 where no fertilizer was applied and that was 5.28 tha^{-1}. Yield contributing characters of brinjal were also significantly influenced with the combined use of chemical fertilizers and vermicompost application. Organic fertilizer has a positive role on soil properties and agricultural productivity [16].

The vermicompost was discovered to have a high humic acid concentration, which aids in root development by improving the root system's efficiency and so accelerating plant growth. This was accomplished by increasing the cell membrane's permeability and so promoting nutrient intake. Humic acid also played a significant function in the development of the soil's microbial features, which led to a high output of organic fertilizers and improved soil quality. The bacteria in the vermicompost may produce a variety of plant growth regulators, such as auxin, cytokinins, gibberellins, etc., as well as many metabolites that the plants can use [18].

The treatments T_4 gave the highest results regarding yield contributing characters of brinjal such as plant height (cm), no. of branches, no. of fruits and weight of fruits per 3 plants in both locations (Table 2). The results revealed that 75% CF + 5 tha^{-1} vermicompost enhanced more crop growth which influenced the fresh as well as edible yield of brinjal in field condition. G. Manimegala and G. Gunasekaran (2020) [12] found that 50% NPK + 50% VC showed enhanced growth and yield of brinjal than the plants treated with only vermicompost or NPK. However, considering of maximum yield, the treatments T_4 could be recommended for more production of brinjal. According to numerous studies, using vermicompost improved crop growth, yield, and yield components by providing the ideal nutrition conditions [19-21].

Table 2. Nutrient contents in vermicompost

Items	Percent
Organic C	15.2%
N	1.42%
P	1.45%
K	1.52%
S	0.35%

Table 3. Effects of different treatments on yield and yield-contributing characteristics of brinjal

Treatments	Plot Yield (Kg/6m^2)	Plant height of 3 plants (cm)	No. of branches/ 3 plants	No. of fruits/3 plants	Weight of fruits/3 plants (g)	Yield (tha^{-1})
T_1: Control	3.17	95.11d	2.22d	1.89e	146.11c	5.28e
T_2: Recommended fertilizer	3.37	101.67c	2.44d	2.44de	220.89c	5.62cde
T_3: 75% CF+ 3 tha^{-1} (VC)	3.76	112.89c	4.11c	4.56bc	354.67bc	6.27bc
T_4: 75% CF+ 5 tha^{-1} (VC)	4.68	118.67a	6.00a	6.55a	794.89a	7.8a
T_5: 50% CF + 3 tha^{-1} (VC)	3.75	109.00c	4.34bc	3.78cd	388.00bc	6.25bcd
T_6: 50%CF + 5 tha^{-1} VC	4.13	121.78a	5.22ab	5.56ab	549.89ab	6.88b
T_7: 5 tha^{-1} VC)	3.26	103.78c	3.11d	3.11cde	270.67bc	5.43de
CV (%)	4.57	1.54	8.70	15.11	26.97	4.57

CV= Co-efficient of variation

4. CONCLUSION

The study demonstrates that fertilizer doses of $N_{101.25}$, P_{27}, $K_{52.5}$, $S_{3.75}$, $Zn_{0.75}$ kgha^{-1} with VC @ 5 tha^{-1} for Ishurdi could be adopted in the cultivation of brinjal for getting maximum yields. Vermicompost enhanced more crop growth which influenced the fresh as well as edible yield of brinjal in field condition.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Pahalvi HN, Rafiya L, Rashid S, Nisar B, Kamili AN. Chemical fertilizers and their impact on soil health. Microbiota and Biofertilizers: Ecofriendly Tools for Reclamation of Degraded Soil Environs. 2021;2:1-20.
2. BBS. Year book of agricultural statistics of Bangladesh-2019. Bangladesh bureau of statistics, Statistics and Informatics Division (SID), Ministry of Planning, Government of the People's Republic of Bangladesh, Dhaka; 2020.
3. Alam MN, Jahan MS, Ali MK, Islam MS, Khandaker SMAT. Effect of vermicompost and NPK fertilizers on growth yield components of red Amaranth. Aus. J. Basic Appl. Sci. 2007;1 (4):706-716.
4. Uddin MJ. Productivity and profitability of local cultivar of brinjal and chilli in Chattogram District: Productivity and profitability of local cultivar of brinjal. Farm Economy. 2022;17:103-115.
5. Assefa S, Tadesse S. The Principal Role of Organic Fertilizer on Soil Properties and Agricultural Productivity -A Review. Agri Res & Tech. 2019;22(2): 556192.
6. Moraditochaee, M., Bozorgi, H. R., & Halajisani N. Effects of vermicompost application and nitrogen fertilizer rates on fruit yield and several attributes of eggplant (*Solanum melongena* L.) in Iran. World Applied Sciences Journal. 2011;15(2):174-178.
7. Wani KA, Rao RJ. Effect of vermicompost on growth of brinjal plant (*Solanum melongena*) under field Conditions. Journal on New Biological Reports. 2012;1(1):25-28.
8. Gutiérrez-Miceli FA, Santiago-Borraz J, Molina JAM, Nafate CC, Abud-Archila M, Llaven MAO, Dendooven L. Vermicompost as a soil supplement to improve growth, yield and fruit quality of tomato (*Lycopersicum esculentum*) Bioresource Technology. 2007;98(15): 2781-2786.
9. Kale RD, Mallesh BC, Kubra B, Bagyaraj DJ. Influence of vermicompost application on the available macronutrients and selected microbial populations in a paddy field. Soil Biology and Biochemistry. 1992; 24(12):1317-1320.
10. Bisht N, Chauhan PS. Excessive and disproportionate use of chemicals cause soil contamination and nutritional stress.

Soil contamination-threats and sustainable solutions. 2020;1-10.
11. Adrian PB, Priya OV, Chip A. Nitrogen dynamics of vermicompost use in sustainable agriculture. Journal of Soil Science and Environmental Management. 2016;7(11):173-183.
12. Manimegala G, Gunasekaran G. Effect of Vermicompost and NPK Fertilizer on Growth and Yield Components of Egg Plant (*Solanum melongena* L.). Int. J. Sci. & Tec. Res. 2020;9:1391-1391.
13. Grappelli A, Tomati U, Galli E, Vergari B. Earthworm casting in plant propagation. HortScience. 1985;20(5):874-876.
14. Dash MC, UC P. Wormcast production and nitrogen contribution to soil by a tropical earthworm population from a grassland site in Orissa, India; 1979.
15. Rehman SU, De Castro F, Aprile A, Benedetti M, Fanizzi FP. Vermicompost: Enhancing plant growth and combating abiotic and biotic stress. Agronomy. 2023; 13(4):1134.
16. Atiyeh RM, Lee S, Edwards CA, Arancon NQ, Metzger JD. The influence of humic acids derived from earthworm-processed organic wastes on plant growth. Bioresource Technology. 2002;84 (1):7-14.
17. Domínguez J. State-of-the-Art and New Perspectives on Vermicomposting Research: 18 Years of Progress. In Vermicomposting for Sustainable Food Systems in Africa. Singapore: Springer Nature Singapore; 2023:27-44.
18. Gholami, H., Fard, F. R., Saharkhiz, M. J., & Ghani, A. (2018). Yield and physicochemical properties of inulin obtained from Iranian chicory roots under vermicompost and humic acid treatments. Industrial Crops and Products, 123, 610-616.
19. Moraditochaee M, Bozorgi HR, Halajisani N. Effects of vermicompost application and nitrogen fertilizer rates on fruit yield and several attributes of eggplant (*Solanum melongena* L.) in Iran. World Applied Sciences Journal. 2011;15(2):174-178.
20. Vijaya D, Padmadevi SN, Vasandha S, Meerabhai RS, Chellapandi P. Effect of vermicomposted coirpith on the growth of *Andrographis paniculata*. Journal of Organic Systems. 2008;3(2):51-56.
21. Hernández A, Castillo H, Ojeda D, Arras A, López J, Sánchez E. Effect of vermicompost and compost on lettuce production. Chilean journal of agricultural research. 2010;70(4):583-589.

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