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Effect of different bio manure produced on the growth and yield of green gram

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Abstract
The field experiment was conducted at the field of SDMVMS College of Agricultural Biotechnology Aurangabad (MH), to determine the agronomical performance of green gram in the presence of different bio manure produced. Using biomanure derived from the anaerobic digestion of organic waste streams can provide several benefits in agricultural applications. Bio manure is a rich source of essential plant nutrients, such as nitrogen, phosphorus, and potassium, which can be readily absorbed by crops, thereby reducing the need for synthetic fertilizers. The experimental field's soil had a silt clay loam texture, was low in organic carbon and accessible nitrogen, and was medium in available phosphorus and potash, with a pH of 7.4. There were three replications of each treatment, which included three types of organic manures. There are 4 different treatments available (T_1 to T_4). The treatments included the application of various biomanures produced from sugarcane bagasse, waste potato, and wheat straw. The growth and yield parameters, such as plant height, number of branches, number of pods per plant, number of seeds per pod, seed weight, and 1000-seed weight, were recorded and analyzed to assess the effectiveness of the different bio-manure treatments. The treatment of 5 t/ha potato waste bio manure (T_2) resulted in positive plant growth and yield.

Keywords: Bio manure, green gram, anaerobic digestion, organic waste streams

Introduction
Green gram, also known as Vigna radiata, is an important pulse crop in India, one of the most important pulse crops, green gram (*Vigna radiata* L.), often known as mung bean, is an excellent source of high-quality protein (Patel *et al*., 2016; Mahalingam *et al*., 2018) [1, 2]. It's also used in salads, vegetables, and Indian recipes such as curry, sevpuri, panipuri, and Indian chat sprout salad. Green gram has been cultivated in India since ancient times and is native to the Indian subcontinent and Central Asia, where it has been grown for over a decade. India is the world's leading producer of green gram. It is cultivated across various states, including Odisha, Madhya Pradesh, Rajasthan, Maharashtra, Gujarat, and Bihar. The production of green gram has been affected by the rising costs of chemical fertilizers, prompting the need for alternative nutrient sources, such as biofertilizers and organic manures. Fertilizers alone cannot sustain land productivity in modern farming. The long-term and excessive use of chemical fertilizers has resulted in soil health deterioration and decreased productivity (Yadav and Lourd Raj, 2005) [3].
Bio manure contributes significantly to soil fertility and capacity through positive effects on soil physical, volatile, and biological properties, as well as plant nutrition. Efficient plant nutrition management practices must be identified to ensure improved and sustainable agricultural production while also conserving natural resources. The role of organic manures in sustainable agriculture is especially important in this context. Bio manure has a good value of the primary nutrients (N.P.K.) in it. In general, Nitrogen is responsible for increased yield and quality, and as Nitrogen rates increase, so does yield. The role of Phosphorus and Potassium in the plant is maintenance. Both are found in high concentration in areas of new growth and are responsible for keeping the system operating smoothly. The present study aims to evaluate the effect of different bio manures on the growth and yield of green gram to provide a comprehensive understanding of the most effective nutrient management strategies for this important pulse crop.

Materials and Methods

The study, entitled " Effect of Different bio manure produced on the growth and yield of green gram" field experiment was conducted at the field of SDMVMS College of Agricultural Biotechnology Aurangabad (MH), to determine the agronomical performance of green gram in the presence of Different bio manure produced. The N.P.K. contained in produced different Bio-manure is determined by the method described by John Kjeldahl (1883) [5]. The soil at the test site was a silt clay loam texture. Several soil samples from topsoil to a depth of 15 cm were randomly taken before sowing and the mixed samples prepared after mixing were analyzed in the soil testing laboratory SDMVMS College of Agriculture Aurangabad for mechanical and chemical composition.

In this investigation four treatments *viz*. T_1 (control), T_2 (Potato waste bio manure), T_3(sugarcane bagasse bio manure), and T_4 (wheat straw bio manure, were tested in randomized block design with three replications. Randomly five plants were selected to record observation *viz*. plant height, number of branches, number of pods per plant, number of seeds per pod, seed weight, and 1000-seed weight. Mung beans were carefully harvested when the harvest season was reached. Plant height (cm) and plant dry matter accumulation (g) were manually measured with four companion plants randomly selected from each replicating plot, seeds were separated and dried in the sun 3 days after harvest. The foliage production from each plot was measured and expressed in tone per hectare. Statistics were calculated and analyzed using Gomez and Gomez's 1984 [4] statistical approach.

Results and Discussions

Effect of different produced biomanures on growth attributes

Plant height

The highest plant height of 17.16 cm recorded at 15 days after sowing, 39.16 cm at 30 days after sowing, and 53.23 cm at 45 days after sowing were recorded in the treatment T_2 (potato waste bio manure.) which was the most effective treatment. The lowest plant height of 11.10 cm recorded at 15 days after sowing, 32.26 cm at 30 days after sowing, and 43.20 cm at 45 days after sowing were recorded in the treatment T_1 (control). Which was inferior to other treatments.

Plant dry weight

The highest plant dry weight of 2.97 grams recorded at 15 days after sowing, 4.92 grams at 30 days after sowing, and 7.94 grams at 45 days after sowing were recorded in the treatment T_2 (potato waste bio manure.) which was the most effective treatment. The lowest plant dry weight of 1.99 grams recorded at 15 days after sowing and 6.92 grams at 45 days after sowing were recorded in the treatment T_1 (control). The lowest plant dry weight of 4.29 grams at 30 days after sowing in the treatment T_4 was recorded.

Number of leaves per plant

In the treatment, T_2 (potato waste bio manure.) the higher number of leaves 11.66 recorded at 15 days after sowing, 16.00 at 30 days after sowing, and 20.66 at 45 days after sowing were recorded (potato waste bio manure.) the most effective treatment. The lowest number of leaves 7.33 recorded at 15 days after sowing, 12.33 at 30 days after sowing, and 15.33 at 45 days after sowing were recorded in the treatment T_1 (control). Which was inferior to other treatments.

Number of branches per plant

The treatment involving potato waste bio manure – 5 t/ha (T_2) recorded a maximum number of branches of 3.33 at 15 days after sowing, 5.66 at 30 days after sowing, and 8.33 at 45 days after sowing were recorded. Which was the most effective treatment The lowest number of branches recorded was 1.66 at 15 days after sowing, 4.00 at 30 days after sowing, and 5.66 at 45 days after sowing were recorded in the treatment T_1 (control). Which was inferior to other treatments.

The application of potato waste bio manure (T_2) at 5 t/ha significantly enhanced the growth and yield attributes of the plants compared to the control treatment (T_1), which had no bio manure. The improved growth characteristics, such as increased number of branches**,** plant height**,** dry weight**,** and number of leaves per plant**,** are consistent with findings from previous studies. For instance, Parvathi *et al*. (2016) [13] reported that organic amendments like compost and biomanure improve plant biomass and branching by providing essential nutrients and enhancing soil fertility. Additionally, Bünemann *et al.* (2018) [12] highlighted that organic fertilizers promote root and shoot growth through improved soil microbial activity and nutrient availability, which aligns with the results observed in this study.

Table 1: Effect of different produced bio manures on growth attributes.

Treatments	Plant height			Plant dry weight			Number of leaves per plant			Number of branches per plant		
	15 days	30 days	45 days	15 days	30 days	45 days	15 days	30 days	45 days	15 days	30 days	45 days
T_1	11.1O	32.26	43.20	1.99	4.31	6.92	7.33	12.33	15.33	1.66	4.00	5.66
T_2	17.16	39.16	53.23	2.97	4.92	7.94	11.66	16.00	20.66	3.33	5.66	8.33
T_3	15.06	36.23	48.30	2.55	4.54	7.31	9.00	13.33	18.00	2.66	4.66	7.33
T_4	12.33	33.36	45.93	2.72	4.29	7.16	8.66	12.66	17.33	2.33	4.33	6.66
S.Ed	0.16	0.23	0.21	0.05	0.02	0.03	0.34	0.31	0.37	0.28	0.30	0.25
CD (p= 0.05)	0.33	0.48	0.44	0.12	0.04	0.07	0.71	0.65	0.77	0.58	0.63	0.53

Effect of produced different bio manures on yield attributes

Number of pods per plant

The number of pods per plant The results show that the number of pods per plant was influenced significantly due to the application of different manures. The number of pods per plant ranged from 09 to 13. The maximum number of pods per plant (13.00) was observed under the application of waste potato bio manure (T_1) – 5 t/ha whereas the lower number of pods was recorded in the absolute control (T_1) with 9.33 and was significantly inferior to the rest of the treatments.

Number of seeds per pod

The highest number of seeds (8.33) was recorded in the application of potato waste bio manure – 5 t/ha (T_2). The lower seeds per pod were recorded in the absolute control (T_1) with 6.66 and were significantly inferior to the rest of the treatments.

1000 grain weight

The highest number of 1000 grain weight (32.23 gm) was registered in the application of potato waste bio manure – 5 t/ha (T_2). The lower 1000-grain weight was recorded in the absolute

control (T_1) with 31.53 gm and was significantly inferior over the rest of the treatments.

In terms of yield attributes, the number of pods per plant**,** seeds per pod**,** and 1000 grain weight were significantly higher in T_2, further demonstrating the positive influence of potato waste bio manure. This is supported by Akinmoladun *et al*. (2014) [11]**,** who noted that organic manures enhance crop productivity by improving nutrient availability and overall plant health. The superior yield in T_2 (1170 kg/ha) was substantially higher than the control (941 kg/ha), suggesting that the application of bio manure directly contributes to increased grain yield, as observed in similar studies by Sharma *et al*. (2017) [14]**,** where organic amendments were shown to improve crop yields by improving soil structure and nutrient retention.

Table 2: Effect of produced different bio manures on yield attributes.

Treatments	Pod per plant	Seeds per pod	1000 grain weight
T_1	9.33	6.66	31.53
T_2	13.00	8.33	32.23
T_3	12.33	7.33	31.84
T_4	11.66	7.66	31.61
S.Ed	0.29	0.27	0.05
CD (p= 0.05)	0.61	0.57	0.11

Table 3. Effect of produced different bio manures on yield attributes.

Treatments	Grain Yield (Kg ha^{-1})	Straw Yield (Kg ha^{-1})	Biological Yield (Kg ha^{-1})	Harvest Index
T_1	940.00	1261.00	2201.00	2.34
T_2	1173.66	1769.00	2942.66	2.50
T_3	1121.00	1608.66	2729.66	2.43
T_4	1091.66	1467.00	2558.66	2.34
S.Ed	1.03	0.80	1.41	0.0013
CD (p= 0.05)	2.14	1.67	2.94	0.0028

Grain yield

The highest grain weight (1173 kg/ha) was registered in the application of potato waste bio manure – 5 t/ha (T_2). And was significantly superior to the rest of the treatments. The lower grain weight was recorded in the absolute control (T_1) with 940 kg/ha and was significantly inferior to the rest of the treatments.

Straw Yield

The highest straw yield was recorded under the application of potato waste bio manure – 5 t/ha (T_2) by registering 1769 kg/ha. The least stover yield was recorded in the absolute control (T_1) with 1261 kg/ha and was significantly inferior to the rest of the treatments.

Biological yield

The result shows that biological yield per hectare was influenced significantly due to the application of different bio manure the potato waste bio manure – 5 t/ha (T_2) registered the highest biological yield i.e. 2942kg/ha. The least biological yield was recorded in the absolute control (T_1) with 2201 kg/ha and was significantly inferior to the rest of the treatments.

Harvest Index

The highest harvest index was noticed in the treatment with the application of potato waste bio manure – 5 t/ha (T_2) by registered 2.50. The last harvest index was recorded in the absolute control (T_1) at 2.34 and was significantly inferior to the rest of the treatments. This finding is corroborated by Tewari *et al*. (2019) [15], who found that organic amendments enhance the harvest index by improving plant nutrient uptake and growth efficiency.

Overall, these results underscore the effectiveness of potato waste bio manure in improving both vegetative growth and yield, aligning with established research on the benefits of organic fertilizers in crop production. The application of bio manure not only enhances plant growth but also contributes to higher productivity and efficient use of resources.

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