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Effect of Different Nutrient Management Sources on the Vegetative Growth, Flowering and Sex Expression of the Bottle Gourd [*Lagenaria siceraria* L.] c. v. BBOG-3-1

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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Original Research Article

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ABSTRACT

A field research was carried out in the Department of Vegetable Science, Odisha University of Agricultural and Technology (OUAT), India, during the 2018 *kharif* season to investigate the impact of various sources of nutrient management on the vegetative growth and flowering of *Kharif* Season Bottle Gourd. The research project was set up in a randomized block design with replicated three times of twelve treatment. According to the results, the maximum vine length (529.33cm) was noted in treatment T_{10} (100% RDF + FYM @ 7.5 t ha^{-1} + Biofertilizer), maximum number of Primary branches (8.97), internodal length (15.83),minimum no. of node bearing 1st male flower (4.67), minimum no. of node bearing 1st female flower (7.67) was recorded in treatment T_{12} (50% RDF +

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FYM @7.5 t ha^{-1}+ Vermicompost @ 2.5 t ha^{-1}+ Biofertilizer) whereas minimum number of days until the 1st male flower (46.33 days),minimum days to the first female blossom (49.00days), minimum days to 1st Fruit set (50.67days) were found significant as vegetative, flowering parameters and Sex ratio (3.10) while the lowest response for these parameters was obtained with T_1 (control).

Keywords: Bottle gourd; growth; flowering; Sex ratio; vermicompost; FYM; NPK; Biofertilizer.

1. INTRODUCTION

In India, the growing population on land is always increasing; as a result, current vegetable productivity is not meeting people's demand. To improve this, it is required to raise vegetable production through the use of appropriate combinations of organic manures, inorganic-fertilizers, and bio-fertilizers that have the least impact on the ecological yield potential of the soil. There is a pressing demand for natural, low-cost, and ecologically friendly nutrient component sources that not only meet crop requirements but also sustain soil health. Under these circumstances, integrated soil fertility management systems that employ sensible mixtures of organic and chemical fertilizers appear to be a commercially and profitably viable option.

The use of inorganic nutrients has a significant direct impact on yield parameters as well as nutrient uptake. Inorganic fertilizers are expensive, and long-term usage of these chemical fertilizers causes soil damage, nutrient imbalances and ultimately poor fertilizer use efficiency. Also, small hold farmers lack access to chemical fertilizer due to high fertilizer prices, poor distribution, and other socio-economic issues. The use of organics in the soil as a source of nutrients is regarded as an eco-friendly scientific approach of crop development. Organic manures alone cannot supply all of the nutrients required for plant growth.

However, using an appropriate combination of organic and inorganic fertilizers not only increases crop productivity but also acts as a nutrient storage facility, as well as improving the physical state of the soil. Effective and cost-effective nutrient management begins with an understanding of the nutrient requirements of the crops being cultivated as well as the soil's nutrient status. Nutrient requirements may vary depending on management styles as well as type or variation, particularly with Bottle gourd.

Bottle gourd is scientifically known as *Lagenaria siceraria* (Mol.) and is a member of the Cucurbitaceae family [1]. Calabash, Doodhi, and Lauki are some of the other names for bottle gourd in India [2]. In India, bottle gourd is widely consumed as a vegetable. It is especially beneficial to vegetarians because it provides various essential nutrients for optimum health and well-being. Bottle gourd consumption has been linked to a number of beneficial properties and may be viewed as a great anti-infection defence, which has recently stimulated the interest of Indian consumers. Ayurvedic medicine uses bottle gourd to control blood sugar levels, high blood pressure, constipation, cooling effects, gastrointestinal issues, loss of weight, as well as other ailments because of its nutritional value, Bottle Gourd is a best diet ingredient in delicious curries, soups, jellies, liquids, drinks, desserts, and frozen foods. Fruit pulp is used as a therapeutic to certain diseases. The bitter fruits are poisonous and are used as a strong purgative. When mixed with honey, the bitter fruit ash of bottle gourd can be applied to the eyes to treat night blindness. In the form of a sugary brew, the leaves are used to treat jaundice. The hard skins of mature fruits are utilized in the production of musical instruments, containers, household items for storing liquid and food materials, and floats for fishing nets.

2. MATERIALS AND METHODS

During the *Kharif* Season, 2018, the Department of Vegetable Science, Odisha University of Agriculture and Technology (OUAT), (Bhubaneswar) India, undertook a study to determine the impact of various nutrient management on the vegetative growth and blooming of Bottle Gourd. The research was set up in a three replications of a randomised block design and twelve different treatment options, viz. T_1 [Control],T_2 [100% RDF (80:50:50Kg NPK ha^{-1}],T_3 [FYM @15tha^{-1}], T_4 [Vermicompost @5tha^{-1}], T_5 [50% RDF+FYM@7.5tha^{-1}+Biofertilizer], T_6[50% RDF+ Vermicompost@ 2.5tha^{-1} +Biofertilizer],T_7 [FYM @7.5tha^{-1}

^{1}+Biofertilizer],T_8 [50%RDF+Biofertilizer], T_9 [Vermicompost @ 2.5tha^{-1}+Biofertilizer], T_{10} [100% RDF +FYM @7.5 t ha^{-1}+ Biofertilizer], T_{11} [100% RDF+Vermicompost@2.5tha^{-1}+ Biofertilizer] and T_{12}[50% RDF + FYM @7.5 t ha^{-1}+ Vermicompost @ 2.5t ha^{-1}+ Biofertilizer] were assigned at random in each plot. Bottle gourd variety BBOG-3-1 has been released as a National Check name Utkal Sobha under agro-climatic situation of Odisha. Plants are cultivated 1.5m X 1.5m apart in each 16m^2 plot size. Five randomly selected plants from each treatment were studied for vegetative development, blooming features, and sex ratio. A basal dose of 80kg N, 50kg P_2O_5, and 50kg K_2O ha^{-1}, as well as FYM (15t ha^{-1}) and Vermicompost (5t ha^{-1}), were used in the treatment combinations. Data on vegetative development, flowering characteristics, and sex ratio were obtained. At each treatment, five plants were chosen at random. Prior to sowing, one-third of the nitrogen and the entire amount of P and K were supplied. The remaining nitrogen dose was applied in two separate doses, 30 days and 60 days after planting. With the additional help of a weeding hoe, the fertilizers and manures were thoroughly integrated into the soil according to the treatment. Data on various vegetative development, blooming characteristics, and sex expression were collected and statistically evaluated using the analysis of variance technique with Randomized Block Design [3]. The t-level test's of significance was set at 5% (P=0.05).

3. RESULTS AND DISCUSSION

3.1 Impact of Various Nutrient Sources on Bottle Gourd Crop Growth Characteristics

The mean results shown in table exhibited a significant difference in growth characters across different levels of nutrients source. Data analysis revealed a significant difference in vine length (529.33cm) among different levels of nutrient supply. The mean results in Table 1. demonstrated a significant variations in growth parameters across different source of nutrient. Maximum vine length (529.33cm) was measured with 100% RDF +FYM @ 7.5t ha^{-1} +BF (T_{10}) and was *statistically* comparable to T_{11}, T_{12}, T_2, T_6, T_5, T_3 and T_4. Treatment T_1 had the shortest vine length (150.11cm) (control). This might be due to favourable environment created by the integrated application of organic manures (FYM) along with RDF and biofertilizer. The increase in vine length could be attributed to increased availability of nitrogen compounds to the plant from organic and inorganic sources, which increases the plant's foliage and hence photosynthesis rate. It is also attributable to the presence of nitrogenous substances, which causes cell elongation. This study supported by Yadav et al and Patel et al [4,5] in bottle gourd.

Number of primary branches per plant was significantly affected by different source of nutrient. Maximum number of primary branches per vine (8.97) were found superior with the treatment 50%RDF+FYM@7.5t/ha+VC@2.5t/ha +Biofertilizer (T_{12}) over rest of the treatment while minimum no of primary branches per vine (3.06) was observed with treatment Control (T_1).

In terms of length of internodes, treatment T_{12} (50% RDF+FYM @ 7.5t ha^{-1} +VC @ 2.5t ha^{-1} +BF) recorded maximum (15.83cm) followed by T_2, T_5, T_6, T_{10}, T_{11} whereas minimum (9.12) was recorded in treatment T_1(Control). The phenomenon of increased growth parameter could be attributed to improved photosynthetic actions across a wide range of photosynthetic aspects. The increase in growth parameters might be attributed to improved plant stand and the direct contribution of biofertilizers to boosting soil fertility due to bacterial activity. The current findings are consistent with those of Tripathi et al and Rabari et al. [6,7] in bottle gourd.

3.2 Effect of Diverse Nutrient Sources on Bottle Gourd Flowering Features and Sex Ratio

The length of time required for the first blooming to appear is a critical factor in determining a quick and good yield. The results of the experiment showed that mixing various organic and inorganic manures had a significant influence on flowering parameters such as node number corresponding to the first female flower, node no. to first male flower, days when the first male bloom appears, days till the fruit set, and bottle gourd sex ratio. The data on flowering characteristics can be found in (Table 2 and Fig 1; Fig 2). Minimum number of days until the first male flower appears (46.33) in treatment T_{11} (100% RDF+VC @ 2.5 t ha^{-1}+BF), with equal number of days until the first female flower appears (49.00) in treatment T_{11}(100% RDF+VC

@ 2.5tha^{-1}+BF), resulting in minimum days to fruit set (50.67) and by the application of T_{12} (50% RDF+FYM @ 7.5 t ha^{-1}+VC @ 2.5 t ha^{-1}+BF) were recorded lowest sex ratio(3.10). Plants in the plots, on the other hand, did not receive any outside manure or fertiliser (T_1)

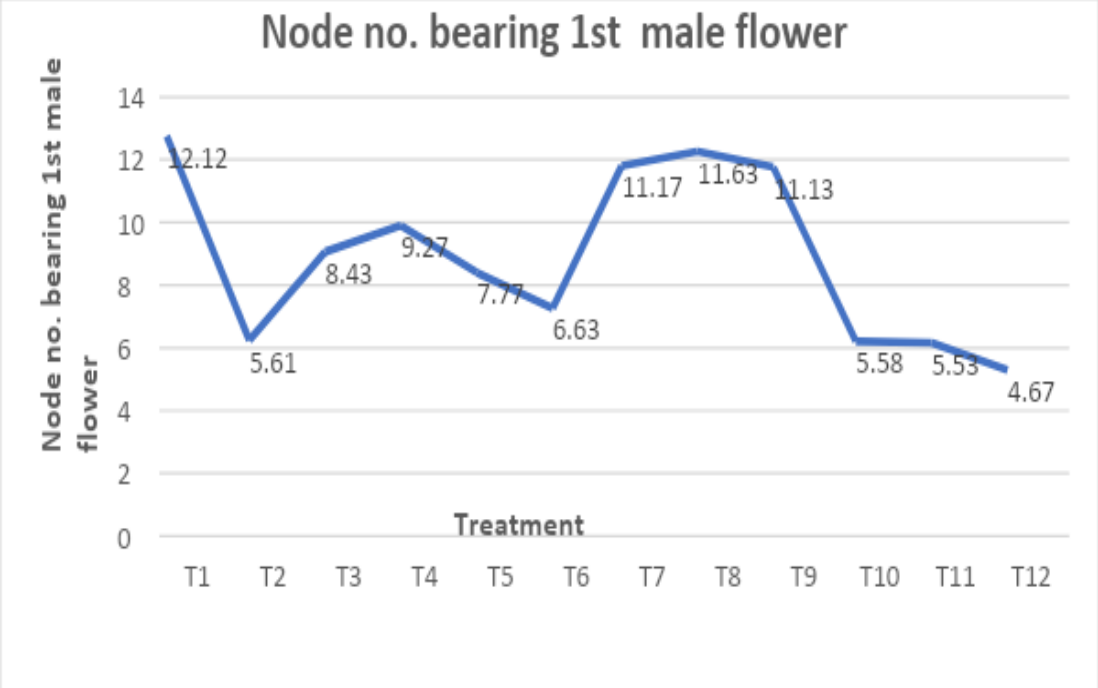

Fig. 1. Effect of integrated nutrient management of Node no. bearing 1st male flower

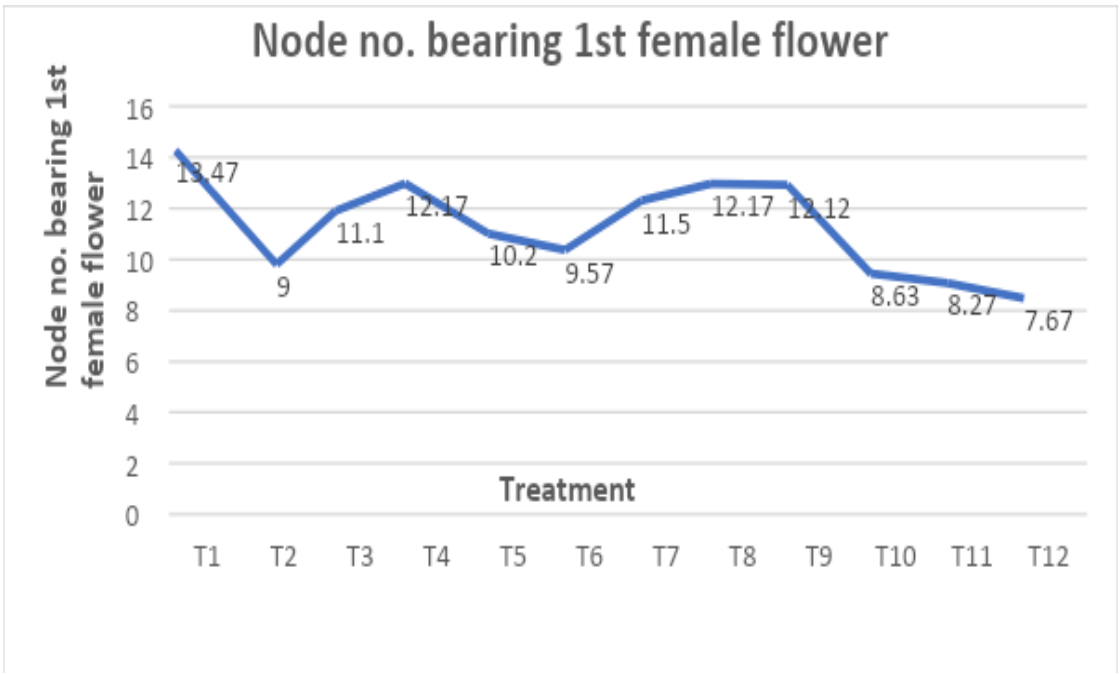

Fig. 2. Effect of integrated nutrient management of Node no. bearing 1st female flower

Table 1. Effect of different source of nutrient on vegetative parameters of Bottle gourd cv. BBOG-3-1

Treatment	Vine length (in cm) at the time of final harvest	Number of Primary Branches per Vine	Internodal length (cm)
T_1-Control	150.11	3.06	9.12
T_2-100%RDF(80:50:50KG NPK/ha)	489.62	6.43	14.54
T_3-FYM@15t/ha	463.67	5.00	12.73
T_4-VC@5t/ha	462.87	4.67	12.32
T_5-50%RDF+FYM@7.5t/ha+BF	472.92	5.10	13.97
T_6-50%RDF+VC@2.5t/ha+BF	475.46	5.24	14.47
T_7-FYM@7.5t/ha+BF	389.05	4.87	12.27
T_8-50%RDF+BF	340.43	4.07	11.67
T_9-VC@2.5t/ha +BF	416.67	4.67	12.32
T_{10}-100%RDF+FYM@7.5t/ha+BF	529.33	6.84	14.62
T_{11}-100%RDF+VC@2.5t/ha+BF	505.86	6.95	14.69
T_{12}-50%RDF+FYM@7.5t/ha+VC@2.5t/ha+BF	503.71	8.97	15.83
Mean	433.431	5.49	13.21
SE (m) ±	26.22	0.34	0.83
CD (5%)	76.89	0.98	2.45

**Biofertilizer (Azotobacter, Azospirillium and PSB@ 4kg ha^{-1})*

Table 2. Impact of integrated nutrient management on Flowering and sex expression Parameters of Bottle gourd cv. BBOG-3-1.

Treatment	Days to 1st Male Flower	Days to 1st Female Flower	Days to 1st Fruit Set	Sex Ratio (M:F)
T_1-Control	56.00	61.33	63.67	5.84
T_2-100%RDF (80:50:50KG NPK/ha)	48.00	51.00	53.33	3.58
T_3-FYM@15t/ha	49.00	52.33	55.00	4.01
T_4-VC@5t/ha	49.33	53.67	56.33	4.33
T_5-50%RDF+FYM@7.5t/ha+BF	48.33	52.33	54.67	3.79
T_6-50%RDF+VC@2.5t/ha+BF	48.33	52.00	54.33	3.65
T_7-FYM@7.5t/ha+BF	53.33	56.33	58.33	4.64
T_8-50%RDF+BF	54.67	57.67	59.67	4.89
T_9-VC@2.5t/ha +BF	49.33	53.33	56.00	4.35
T_{10}-100%RDF+FYM@7.5t/ha+BF	48.67	53.33	54.67	3.48
T_{11}-100%RDF+VC@2.5t/ha+BF	46.33	49.00	50.67	3.37
T_{12}-50%RDF+FYM@7.5t/ha+VC@2.5t/ha+BF	48.00	51.33	52.00	3.10
Mean	49.94	53.64	55.72	4.09
SE (m) ±	1.71	1.57	1.98	0.26
CD (5%)	5.02	4.62	5.80	0.77

**Biofertilizer (Azotobacter, Azospirillium and PSB@ 4kg ha^{-1})*

required the longest time to initiate both male and female flowers (60.69 days and 50.79 days, respectively), as well as the longest time to fruit set (63.67 days) and the highest sex ratio (5.84). The results could be explained by the fact that a balanced dose of NPK and FYM + Vermicompost + Biofertilizer was used. Increased growth with higher photosynthetic area for more production and translocation of photoassimilates which ultimately delayed the reproductive phase. Similar finding was reported by Pandey and Rajput [8]. The reduction in the number of days required for male and female flower initiation was induced by phosphorous's stimulating influence on growth hormones, which promote early blooming (Asrey and Singh [9]. The integration effect may be responsible for early flowering because vermicompost contains microbial populations,nitrogen-fixing organisms, phosphate solubilizing microbes, and growth regulators such as auxin, gibberlines, and zeatin, all of which influence and improve nitrogen utilisation more than chemical fertilizers, which influence early emergence. The current findings are consistent with those of Das et al. [10-12].

4. CONCLUSION

Various organic and inorganic nutrient management techniques have a significant impact on practically all bottle gourd cultivars BBOG-3-1 development and blooming characteristics The optimal INM treatment for bottle gourd production was found to be 50 percent RDF + FYM @7.5 t ha^{-1} + Vermicompost @ 2.5 t ha^{-1} + Biofertilizer. T_1 (Control) was the worst performance in terms of outcomes of the above characters. So, with yield sustainability, ecosystem balance, soil health enrichment, and human well-being in mind, It is proposed that vegetable farmers supplement with inorganic fertilisers or FYM, Vermicompost and Biofertilizers, either alone or in combination.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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