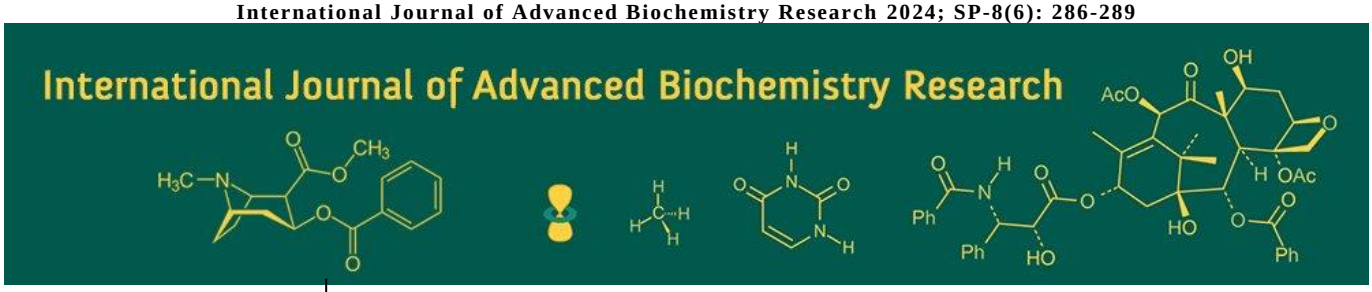

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To study the influence of integrated nutrient management (INM) on vegetative growth and flowering of summer season bottle gourd. [*Lagenaria siceraria* (*Molina*) Standl.]

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Abstract
A field experiment was conducted at Department of Horticulture, National Post Graduate College Barhalganj Gorakhpur (U. P.), India, during the summer season of 2022-23, to study the influence of Integrated Nutrient Management (INM) on vegetative growth and flowering of summer Season Bottle Gourd. The experiment was laid out in randomized block design with three replications consisted of nine treatment combinations which allocated randomly in each plot. The plants were planted at 1m X 1.5m spacing in each $6m^2$ plot size. The data were collected from five randomly selected plant of each treatment and subjected to statistical analysis. The results revealed that the treatment T_8 (Poultry Manure @ 2.5t/ha + half N.P.K through chemical fertilizer) significantly found best among the all treatments at all successive growth stages in term of maximum vine height (8.93m), Number of branches (6.65), length of lateral branches (4.04m) and leaf area/plant ($506.72cm^2$) as growth parameters whereas minimum days to 1st male flower (63.30days), days to 1st female flower (66.81days), node no. to 1st female flower (11.94) and more no. of male flower (76.54), maximum no. of female flower (30.06) and lowest percent deformed fruits (10.45%) were found significant as flowering parameters while lowest response for these parameters were recorded with T_0 (control) which received only recommended dose of NPK. These results are in support of earliness and higher yield of bottle gourd through INM practices.

Keywords: Bottle gourd, growth, flowering, vermicompost, poultry manure, neem cake and NPK

Introduction
Bottle gourd (*Lagenaria siceraria* (Molina) standl; 2n=22) is an important cucurbitaceous crop grown throughout the country. It is native in South Africa. Bottle gourd or white flowered gourd is commonly known as Lauki or Ghiya in India. It is one of the most important cucurbits cultivated in India. It is grown in summer season as well as in rainy season (Yadav *et al.*, 2010) [17]. Fruit in green and tender stages are used as vegetables, sweets, *raita* and pickles. The young fruits are usually used as vegetable dishes. The hard shells of mature fruits are used as containers, hats, decorative handy-crafts and flatus musical instruments. Numerous health benefits are reported in bottle gourd including its anti-cancerous, cardio protective (Fard *et al.*, 2008) [8], diuretic, aphrodisiac, general tonic, antidote to certain poisons and scorpion stings, alternative purgative and cooling effects (Badmanaban and Patel, 2010) [1]. It can also be used to cure pain, ulcers and fever and is used for pectoral cough, asthma and other bronchial disorders using prepared syrup from the tender fruits (Upaganlawar and Balaraman, 2010) [16]. Bottle gourds are known to lower cholesterol, triglyceride, low density lipoproteins, pain and inflammation (Ghule *et al*., 2006) [9], free radicals and oxidation (Deshpande *et al*., 2008 and Kubde *et al.*, 2010) [7, 10]. During the last two decades there has been a constant progress in the production of bottle gourd by farmers, particularly with the traditional method of cultivation. Integrated plant nutrient management (IPNM) is the best approach for obtaining potential crop yield with less expenditure. On the other hand, current intensive agriculture is harmful for the soil, environment and human health.

A judicious use of organic manures along with chemical fertilizers may be effective not only in sustaining crop productivity and soil health, but also in supplementing chemical fertilizers requirement of the crops (Pandey *et al.*, 2009 and Chaurasia and Rai 2009) [13, 6]. Among the organic sources, the old age concept of nutrient application is the utilization of farm yard manure, vermicompost is easily prepared and much effective manure and Fresh poultry manure represents about 5% of live bird weight whereas neem is a bio degradable and eco friendly natural product, nourishes the soil and plants by providing all the macro and micro-nutrients, helps to eliminate bacteria responsible for denitrifying the soil, ideal for cash crops and food crops, increases the yield of crops, helps to reduce the usage of fertilizer,. These manures being good source of essential plant nutrients especially NPK and give good crop stand by virtue of improvement in physical, chemical and biological characteristics of the soil.

Materials and Methods

Field experiment and Treatment Details

An investigation was carried out to study the influence of Integrated Nutrient Management (INM) on vegetative growth and flowering of summer Season Bottle Gourd at Department of Horticulture, National Post Graduate College Barhalganj Gorakhpur, (U.P) India, during the summer season of 2022-23. The experiment was laid out in randomized block design with three replications consisted of nine treatment combinations *viz*. T_0 (Control), T_1 [FYM @20t/ha], T_2 [FYM @ 10t/ha +half N.P.K through chemical fertilizer], T_3 [Neem cake @ 1t/ha], T_4 [Neem cake @0.5t/ha + half N.P.K through chemical fertilizer], T_5 [Vermi compost @ 5t/ha], T_6 [Vermi compost @2.5t/ha + half N.P.K through chemical fertilizer], T_7 [Poultry Manure @ 5t/ha] and T_8 [Poultry Manure @ 2.5t/ha + half N.P.K through chemical fertilizer] were allocated randomly in each plot. The plants were planted at 1m X 1.5m spacing in each $6m^2$ plot size. The soil of the experimental field was sandy loam in texture, poor in nitrogen, comparatively rich in phosphorus and medium in potash with slightly acidic reaction. The data were collected on growth and flowering parameters from five randomly selected plants of each treatment and subjected to Fisher's method of analysis of variance (ANOVA), where the 'F' test was significant for comparison of the treatment means, CD values were worked out at 5% probability level.

Application of fertilizers

According to basal dose of 120 kg N, 60 kg P_2O_5 and 60 kg K_2O/ha along with FYM (20t/h), Neem cake (1t/h), Vermicompost (7t/h) and Poultry manure (5t/h) were applied as per the treatment combinations. One third nitrogen and entire quantity of P and K was applied prior to sowing. Remaining dose of nitrogen was applied in two splits of doses one at 30 and one at 60 days after sowing. FYM, Neem cake, Vermicompost and Poultry manure were applied in the soil at the time of field preparation. The manures and fertilizers as per treatments were thoroughly mixed in the soil with the help of weeding hoe.

Results and Discussion

Growth parameters

Integrated nutrient management (INM) is a very effective and efficient method to supply nutrients to the plants. The findings of the present investigation revealed that the combination of different organic manures and inorganic fertilizers significantly affected growth parameter like vine length, number of branches, length of lateral branches and leaf area/plant (cm^2) during the growth period of bottle gourd as shown in (Table 1). Among the treatments, the highest vine length (8.93m) was recorded with treatment T_8 (Poultry Manure @ 2.5t/ha + half N.P.K through chemical fertilizer) with more number of branches per plant (6.65). Similarly the significant increase in length of lateral branches (4.04m) and leaf area/plant (506.72cm^2) was attained maximum with the use of Poultry Manure @ 2.5t/ha + half N.P.K through chemical fertilizer in treatment T_8 and followed by treatment T_6 (Vermi compost @ 3.5t/ha + half N.P.K through chemical fertilizer) with the same growth parameters. However the lowest mean values in term of vegetative growth traits was observed in T_0 (control). The organic manure applied in the form of FYM, Poultry Manure, Neem Cake and Vermicompost might have improved the soil physical and chemical properties and leading to the adequate supply of nutrients to the plants which might have promoted the maximum vegetative growth while the minimum plant growth was due to limited availability of nutrients. The results reported with Bindiya *et al*. (2006) [5]; Sareedha *et al*. (2006) [14] in gherkin and Opara *et al*. (2013) [12] in cucumber are in close conformity with these findings. Similar results have also been reported by Baghel *et al.* (2017) [2, 3] in bottle gourd and Singh *et al.* (2017) [2] in cucumber.

Table 1: Impact of Integrated Nutrient Management (INM) practices on vegetative growth of summer Season Bottle Gourd.

Treatments No.	Treatments Combination	Vine Length (m)	No. of Branches	Length of lateral branches (m)	Leaf area/ plant (cm^2)
T_0	Full recommended dose of N.P.K (120:60:60)	6.07	3.76	3.18	475.75
T_1	FYM @20t/ha	7.82	5.52	3.72	499.40
T_2	FYM @ 10t/ha + half N.P.K through chemical fertilizer	6.30	4.03	3.30	479.18
T_3	Neem cake @ 1t/ha	7.10	5.34	3.64	495.50
T_4	Neem cake @0.5t/ha + half N.P.K through chemical fertilizer	6.84	4.49	3.51	489.59
T_5	Vermi compost @ 7t/ha	7.29	4.58	3.47	493.67
T_6	Vermi compost @3.5t/ha + half N.P.K through chemical fertilizer	8.54	6.20	3.93	501.64
T_7	Poultry Manure @ 5t/ha	8.10	5.91	3.80	500.33
T_8	Poultry Manure @ 2.5t/ha + half N.P.K through chemical fertilizer	8.93	6.65	4.04	506.72
	F-test	S	S	S	S
	C.D. at 0.5%	1.10	0.78	0.47	9.44
	S.Ed	0.52	0.37	0.22	4.45

Flowering Parameters

The time taken to the first flower appearance is an important pre-requisite which decides the earliness and high yield. The results of the experiment revealed that the combination of different organic manures and inorganic fertilizers significantly influenced the flowering parameters like node no. to first female flower, days to 1st male flower appearance, days to 1st female flower appearance, no. of male flowers, no. of female flowers and percent deformed fruits during the flowering period of bottle gourd. The data relevant to flowering traits is presented in (table 2).

At the minimum node no. to first female flower (11.94), bottle gourd plant taken minimum days to 1st male flower appearance (63.30) with the corresponding minimum days to 1st female flower appearance (66.81) in treatment T_8 (Poultry Manure @ 2.5t/ha + half N.P.K through chemical fertilizer) which resulted in maximum no. of male flowers (76.54) and more no. of female flowers (30.06) with the lowest percent deformed fruits (10.45%) with the use of Poultry Manure @ 2.5t/ha + half N.P.K through chemical fertilizer in treatment T_8 followed by T_6 (Vermi compost @ 3.5t/ha + half N.P.K through chemical fertilizer), while the delayed flowering and less no. of male and female flowers were noted with T_0 (control). The earliness to flowering with more no. of flowers in treatment T_8 might be due to the better translocation of nutrients to the aerial parts. Similar findings were reported by Bairwa and Fageria (2008); Baghel *et al*. (2017) [2, 3] in bottle gourd and Nagar *et al*. (2017) [11].

Table 2: Impact of Integrated Nutrient Management (INM) practices on flowering of summer Season Bottle Gourd.

Treatments No.	Treatments Combination	Node no. to 1st female flower	Days to 1st male flower	Days to 1st female flower	No. of male flower	No. of female flower	Percent deformed fruits
T_0	Full recommended dose of N.P.K (120:60:60)	15.33	75.48	80.06	65.06	16.66	16.44
T_1	FYM @20t/ha	12.80	72.48	74.98	73.07	26.00	12.41
T_2	FYM @ 10t/ha + half N.P.K through chemical fertilizer	14.78	74.13	78.93	66.99	20.09	16.31
T_3	Neem cake @ 1t/ha	13.27	72.81	75.61	70.89	25.02	13.15
T_4	Neem cake @0.5t/ha + half N.P.K through chemical fertilizer	14.07	73.62	76.80	69.74	22.15	14.25
T_5	Vermi compost @ 7t/ha	13.51	73.11	76.31	71.26	22.58	13.82
T_6	Vermi compost @3.5t/ha + half N.P.K through chemical fertilizer	12.12	65.45	69.15	74.84	28.34	10.93
T_7	Poultry Manure @ 5t/ha	12.33	68.87	70.00	73.83	28.00	12.48
T_8	Poultry Manure @ 2.5t/ha + half N.P.K through chemical fertilizer	11.94	63.30	66.81	76.54	30.06	10.45
	F-test	S	S	S	S	S	S
	C.D. at 0.5%	1.40	4.01	4.10	3.94	3.63	1.85
	S.Ed	0.66	1.89	1.93	1.86	1.71	0.87

Conclusion

On the basis of above findings it is concluded that the treatment T_8 (Poultry Manure @ 2.5t/ha + half N.P.K through chemical fertilizer) was recorded the best among all the treatment combinations through Integrated nutrient management (INM) in terms of vegetative growth and flowering attributes.

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