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## EFFECT OF INTEGRATED NUTRIENT MANAGEMENT ON GROWTH AND YIELD OF OKRA (*ABELMOSCHUS ESCULENTUS* (L.) MOENCH)

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### KEYWORDS

Vermicompost  
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## ABSTRACT

A field experiment was conducted during the *Kharif* season of 2013 to evaluate the “Integrated nutrient management in Okra [*Abelmoschus esculentus*(L.) Moench]”. The experiment was laid out in Randomized Block Design with three replications and ten treatments. Two organic sources of nutrition, vermicompost and biogen were combined with NPK fertilizers and the performance was compared with the sole chemical fertilization. Among 10 treatments under study, T<sub>8</sub> (75% RDF + 25% Vermicompost + Biogen) recorded maximum values for plant height (59.64 cm), total yield per plot (1866.97 g), and also recorded minimum days (4.33 days) to 50% germination of seeds. The highest length of fruits (9.18 cm) with the application of 50% RDF + 50% vermicompost + biogen (T<sub>7</sub>), fruit weight (9.00 g) and fruit girth (5.22 cm) with the application of 25% RDF + 75% vermicompost (T<sub>2</sub>) were observed. This study suggests that 75% RDF + 25% vermicompost+ biogen are potential source for plant growth, fruit yield and highest cost benefit ratio in okra.

## INTRODUCTION

Vegetables are the integral part of the balanced diet of human since time immemorial. Globally, the role of vegetables has been recognized in solving the problem of food and nutritional security. Okra (*Abelmoschus esculentus* L.) is an important vegetable crop of Malvaceae family, which supplies higher nutrition (carbohydrates, fats, protein, minerals and vitamins) in our diet. Okra is a fast growing annual which has captured a prominent position among the vegetables in India. It is a multiple use crop. It is grown practically in all agro-ecological zones of India mainly for its immature fruits which are eaten as cooked vegetable. Dried seeds are nutritious food. It contains upto 20% protein and the fiber from okra canes is a possible paper pulp source, while the dried canes are a fuel source (Lyngdoh *et al.*, 2013).

The main challenge before India is to increase the production of quality food in a sustainable manner and feeding the country's large population and increasing the income of the farmer. The requirements of fertilizers in okra are important for the early growth and total production of fruit yield. Integrated use of organic and inorganic fertilizers can improve crop productivity (Mal *et al.*, 2013). Okra requires heavy manuring for its potential production. Indiscriminate use of inorganic fertilizers leads to nutrient imbalance in soil causing ill effect on soil health and microflora. Hence, there is need to reduce the use of chemical fertilizers and encourage the application of organic sources to the maximum possible level. Organic sources fix appreciable amount of atmospheric nitrogen in soil, enhance plant growth by production of organic acid and growth substances, and make available the complex phosphorus to the plant, which may cause an appreciable reduction in consumption of inorganic fertilizers. Organic sources are inputs containing micro-organisms capable of mobilizing native elements from non usable form to usable form through biological processes (Bahadur and Manohar, 2001). However, the use of expensive commercial fertilizers as per a requirement of the crop is not much affordable to the average farmers. Therefore, the application of plant nutrients through organic sources likes compost, farm yard manure and bio fertilizers remain the alternative choice of the growers for maintaining its sustainable production (Gayathri and Reddy, 2013). The modern system of farming, it is increasingly felt, is becoming unsustainable as evidenced by declining crop productivities, damage to environment, chemical contaminations, etc. The necessity of having an alternative agriculture method which can function in a friendly eco-system while sustaining and increasing the crop productivity is realized now (Ipsita Das and Singh, 2014). Biogen helps the root zone from unwanted gases suffocation, keeps the roots healthy and fresh, provides a long term oxygen reservoir, releasing oxygen slowly, adjust pH (Soil and water) value and prevent ammonium damage, enhances microbial metabolism to remediate pollutants. Biogen works in a wide range of temperature and pH of soil and water. Hence, the present investigation was conducted to frame integrated nutrient management strategy for okra.

## MATERIALS AND METHODS

The present investigation was conducted at Vegetable Research Farm, Department

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of Horticulture, SHIATS, Allahabad during 2013-14, with ten treatments viz., T<sub>1</sub> (100:60:50 kg NPK recommended dose of fertilizers (RDF), T<sub>2</sub> (25% RDF + 75% Vermicompost), T<sub>3</sub> (50% RDF + 50% Vermicompost), T<sub>4</sub> (75% RDF + 25% Vermicompost), T<sub>5</sub> (RDF + Biogen), T<sub>6</sub> (25% RDF + 75% Vermicompost + Biogen), T<sub>7</sub> (50% RDF + 50% Vermicompost + Biogen), T<sub>8</sub> (75% RDF + 25% Vermicompost + Biogen), T<sub>9</sub> [100 % Biogen (alone)] and T<sub>10</sub> [100 % Vermicompost (alone)]. The experiment was laid out in a Randomized Block Design with three replications. All the recommended package of practices was followed timely for raising a healthy good crop. Seeds of okra cultivar "Kashi Kranti" were dibbled manually with a recommended seed rate of 10 kg ha<sup>-1</sup> on 7th October, 2013. Three seeds were dibbled at each hill in well prepared plot of 2.25m x 1.80m, 30 cm apart within row and 45 cm between rows. Observations with respect to growth, yield and chemical attributes were recorded during the growth period of crop including economics. The entire dose of vermicompost, biogen, phosphorus, potassium and half dose of nitrogen as per treatment combination per plot were applied at the time of sowing as basal dressing. The remaining half dose of nitrogen was applied in two split doses as top dressing at 30 and 45 days of sowing, respectively. Economics was worked out on the basis of the existing values of output and inputs used. The crude fiber of the okra was determined using the standard AOAC (1990) method. The data recorded during the course of investigation were subjected to statistical analysis by analysis of variance (ANOVA) technique (Fisher, 1958) for drawing conclusions.

## RESULTS AND DISCUSSION

### Growth attributes

The minimum days (4.33 days) to 50% germination were recorded in the treatment T<sub>8</sub> (75% RDF + 25% Vermicompost + Biogen), while maximum days (7.33) were recorded in T<sub>10</sub> [100% Vermicompost (alone)]. The minimum days to 50% germination were observed in the treatment T<sub>8</sub> may be due to addition of vermicompost and biogen improved soil tilth, aeration, water holding capacity and increased organic carbon content in the soil. The loose soil as a result of vermicompost and biogen was probably favorable for germination. Similar result was reported by Manivannan *et al.* (2009). At 60 days after sowing the maximum plant height (59.64 cm) was observed in T<sub>8</sub> (75% RDF + 25% Vermicompost + Biogen) followed by (59.40 cm) in T<sub>4</sub> (75% RDF + 25% Vermicompost), while the minimum plant height (43.83 cm) was observed in T<sub>9</sub> [100 % Biogen (alone)]. The significantly higher plant height in the treatment T<sub>8</sub> (75% RDF + 25% Vermicompost + Biogen) may be due to higher metabolic activity by optimum nutrient supply from vermicompost resulting higher production of carbohydrates and phytohormones which were manifested in the form of enhance growth. Similar result was reported by Atiyeh *et al.* (1999). At 60 days after sowing the maximum plant leaves (15.60) were observed in T<sub>9</sub> [100 % Biogen (alone)] followed by (15.33) in T<sub>10</sub> [100 % Vermicompost (alone)], while the minimum plant leaves (14.93) were observed in T<sub>2</sub> (25% RDF + 75% Vermicompost). At 60 days after sowing the maximum plant branches (6.00) were observed in T<sub>5</sub> (100 % RDF +

Table 1: Effect of integrated nutrient management on growth and yield characters of okra

S. Treatments No.	Days to 50% germination of seeds	Plant Height Days after sowing			Number of leaves Days after sowing			Number of branches Days after sowing	Fruit length	Fruit girth	Fresh wt. of fruit	Yield per hectare (q)
		30	45	60	30	45	60					
1	6.33	22.87	52.52	58.70	7.13	12.86	15.00	4.33	8.85	4.84	7.80	35.73
2	6	21.90	52.08	59.15	6.73	12.86	14.93	4.33	8.89	5.22	9.00	36.45
3	6.66	22.01	49.98	56.78	6.93	12.86	15.00	4.33	9.00	4.98	7.13	38.29
4	6	25.10	52.14	59.40	6.06	12.80	14.93	4.20	8.88	4.78	8.00	38.92
5	5.66	25.30	50.37	58.00	6.40	12.86	15.06	4.53	8.79	4.99	8.73	40.14
6	5	21.99	45.78	53.68	6.53	12.86	15.26	4.40	8.64	4.62	7.46	42.00
7	5	21.14	47.16	54.96	6.13	13.13	15.20	4.40	9.18	4.78	7.40	46.00
8	4.33	23.94	52.22	59.64	6.60	12.73	15.20	4.26	8.62	4.98	8.20	46.09
9	6	18.16	35.54	43.83	6.33	13.40	15.60	4.40	8.66	4.74	8.53	31.49
10	7.33	18.39	37.47	44.96	6.80	13.33	15.33	4.40	9.10	4.70	8.66	33.00
F-test	S	NS	S	S	NS	NS	NS	S	NS	S	S	S
SEm ±	0.69	2.25	4.03	3.83	0.46	0.29	0.25	0.08	8.85	0.13	0.37	2.02
CD	1.45	4.73	8.48	8.05	0.97	0.61	0.53	0.17	8.89	0.27	0.78	6.01

Biogen) followed by (5.86) in T<sub>9</sub> [100 % Biogen (alone)], while the minimum plant branches (5.46) were observed in T<sub>7</sub> (50% RDF + 50% Vermicompost + Biogen). The higher number of plant branches were observed in the treatment T<sub>5</sub> (100 % RDF + Biogen) may be due to the fact that, biogen improved the chemical and biological conditions of soil which would also have facilitated better nutrient absorption from the soil and enhanced the plant growth. This result is in conformity with the study by Abdul et al. (2012). Application of Organic manures like vermicompost showed an increased growth in terms of height and yield of the plant, it could be a better alternative to inorganic fertilizers (Tamilselvi and Devi, 2009).

#### Yield attributes

The maximum fruit length (9.18 cm) was observed in T<sub>7</sub> (50% RDF + 50% Vermicompost + Biogen) followed by (9.10 cm) in T<sub>10</sub> [100 % Vermicompost (alone)]. The finding is in close conformity with the findings of Vitakar et al. (2007). There was significant difference among the treatments for fruit girth. The maximum fruit girth (5.22 cm) was observed in T<sub>2</sub> (25% RDF + 75% Vermicompost) followed by (4.99 cm) in T<sub>5</sub> (100 % RDF + Biogen), while the minimum fruit girth (4.62 cm) was observed in T<sub>6</sub> (T<sub>2</sub>+Biogen). The finding is in close conformity with the findings of Vitakar et al. (2007). There was significant difference among the treatments for fresh weight of fruits. The maximum fresh weight of fruit (9.00 g) was observed in T<sub>2</sub> (25% RDF + 75% Vermicompost) followed by (8.33 g) in T<sub>5</sub> (100 % RDF + Biogen), while the minimum fresh weight of fruit (7.13 g) was observed in T<sub>3</sub> (50% RDF + 50% Vermicompost). Similar result was obtained by Suthar (2009). The maximum total yield per hectare (46.09 q) was observed in T<sub>8</sub> (75% RDF + 25% Vermicompost + Biogen) followed by (46.00 q) in T<sub>7</sub> (50% RDF + 50% Vermicompost + Biogen), while the minimum total yield per hectare (31.49 q) was observed in T<sub>9</sub> [100 % Biogen (alone)]. The total yield was influenced by integrated nutrient management treatment. In organic and inorganic combinations, the nitrogenous sources applied through inorganic fertilizers might have taken care of the nutrient requirement in the early stages of growth, and in the later stages the mineralized N form organic manures are available to the plant. Hence, there was a continuous supply of nutrients resulting in higher growth and yield contributing characters in the treatments helping to record higher yield. Similar result was found by Sharma et al. (2010).

Application of vermicompost and biogen attributed to better growth of plant and yield by slow release of nutrients for absorption with making available additional nutrients like gibberellins, cytokinins and auxins and it also promote humification, increased microbial activity and enzyme production, which in turn, bring about the aggregate stability of soil particles resulting in better aeration and a property of binding mineral elements like Ca, Mg and Potash in the form of stable aggregates of soil particles for desired porosity to sustain the plant growth. Soil microbial biomass and enzyme activity improved as a result of vermicompost addition, which favoured the total increase in plant produce (Ansari, 2008). The significant increase in the yield by the application of 75% RDF through inorganic fertilizers + 25% RDF through Vermicompost + Biogen) might be due to improved soil physical, chemical and biological properties. Higher availability of all plant nutrients resulted in the improved plant growth and yield characters. These findings are in conformity with the findings of, Kumar et al. (2004) in french bean.

Indirabai et al. (2009) reported that application of Organic manures showed an increased growth in terms of yield of the plant.

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