



ISSN (E): 2277- 7695

ISSN (P): 2349-8242

NAAS Rating: 5.03

TPI 2020; 9(8): 281-284

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[www.thepharmajournal.com](http://www.thepharmajournal.com)

Received: 10-06-2020

Accepted: 29-07-2020

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## Effect of integrated nutrient management on growth and yield of bhendi (*Abelmoschus esculentus* L.)

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### Abstract

The main aim of this experiment was to study the effect of integrated nutrient management on growth and yield attributes of bhendi variety Arka Anamika. Different traits like plant height, number of branches, days to first flowering, number of flowers per plant, number of pods per plant, pod length, pod girth and pod weight were recorded in this study. Among the ten treatments, (T<sub>9</sub>) - FYM (6.25 t/ha) + sheep and goat manure (1.25 t/ha) + poultry manure (1.25 t/ha) + vermicompost (1.25 t/ha) with recommended dose of fertilizers was found to influence the vegetative growth parameters like plant height (102.8 cm), number of leaves (14) and number of branches per plant (7). Similarly this treatment recorded higher number of flowers (25.1), higher number of pods (22.1), higher pod weight (17.8 g), pod length (16.4 cm) and pod diameter (3.4 cm). With regard to yield, (T<sub>9</sub>) - FYM (6.25 t/ha) + sheep and goat manure (1.25 t/ha) + poultry manure (1.25 t/ha) + vermicompost (1.25 t/ha) with recommended dose of fertilizer recorded higher yield (5.6 t/ha) in bhendi. This study showed the integrated nutrient management used to get sustainable yield.

**Keywords:** Fertilizer, growth and yield

### Introduction

Okra (*Abelmoschus esculentus*, L. Moench) belongs to the Malvaceae family. There are two cultivated types of okra, (*Abelmoschus esculentus*, L. Moench) and West African okra, (*Abelmoschus caillei*). Okra plays an important role in the diet by supplying carbohydrate, protein, fat, minerals and vitamins that are usually deficient in the stable food. It is an important vegetable crop grown throughout the tropical and subtropical regions of Asia and Africa [2]. Okra is believed to originate from South East Asia (Ethiopia). The crop covers 4.98 lakhs ha in area and production is 57.84 lakhs tonnes and India shares 73.25 % in world production. It contains 90% of water, 7% carbohydrates, dietary fiber, lysine, tryptophan, folate, thiamine, vitamin-C, vitamin-K and Mg. Organic manures improve the water holding capacity, physical, chemical and biological properties of soil and leads to enhancement of crop sustainability. The input containing microorganisms are capable of mobilizing nutritive elements to available form through biological processes. The prolonged heavy use of inorganic fertilizers promotes degradation of soil nutrient, which consequently results in soil acidity, nutrient imbalance, deteriorate the environment and low crop yields. Hence, thus study was taken up to standardize the integrated nutrient management to increase the growth and yield of bhendi.

### Materials and Methods

The experiment was conducted at Adhiparasakthi Horticultural College (Affiliated to Tamil Nadu Agricultural University), Kalavai during January-April 2017. The experiment was conducted in a Randomized Block Design (RBD) replicated thrice with 10 treatments. The plot size for each treatment was 3x3 m. Ridges and furrows were formed and seeds were sown at a spacing of 45x30 cm. Arka Anamika was the variety used in this study. Cultural practices were followed as per recommended package of practices. The organic manures applied basally at 15 days before inorganic fertilizer application. Different Organic manures and Bio-fertilizer with recommended dose of fertilizers (40:50:30 kg NPK/ha) furnished in Table 1.

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**Table 1:** Different Organic manures and Bio-fertilizer with recommended dose of fertilizers (40:50:30 kg NPK/ha)

Treatments	Treatment details
T <sub>1</sub>	FYM (25 t/ha) + RDF
T <sub>2</sub>	Poultry manure (5 t/ha) + RDF
T <sub>3</sub>	Vermicompost (5 t/ha) + RDF
T <sub>4</sub>	Panchgavya (500 lit/ha) + RDF
T <sub>5</sub>	Sheep and Goat manure (5 t/ha) + RDF
T <sub>6</sub>	Azospirillum (2 kg/ha) + RDF
T <sub>7</sub>	FYM (12.5 t/ha) + Poultry manure (2.5 t/ha) + RDF
T <sub>8</sub>	Sheep and Goat manure (2.5 t/ha) + Vermicompost (2.5 t/ha) + RDF
T <sub>9</sub>	FYM (6.25 t/ha) + Sheep and Goat manure (1.25 t/ha) + Poultry manure (1.25 t/ha) + Vermicompost (1.25 t/ha) + RDF
T <sub>10</sub>	Control (RDF)

Data were collected on growth parameters such as plant height, number of leaves per plant and number of branches per plant, flower parameters such as days to first flowering and number of flowers per plant, fruit parameters such as fruit weight, fruit length and fruit girth and yield parameters such as number of fruits per plant, yield of fruits per plant and estimated yield. The data were collected on 30<sup>th</sup>, 60<sup>th</sup>, 90<sup>th</sup> days and mean value was taken.

The plant height was measured using a measuring tape from the soil level to the meristamatic tip and expressed in centimeters. Total number of branches, days to first flowering, number of flowers and fruits per plant were counted and recorded. The weight of ten fruits per plant per harvest in each treatment was recorded and mean was worked out and expressed in grams. The length of ten fruits per plant per harvest in each treatment was recorded and average was worked out and expressed in centimeter. The girth of the ten fruits was recorded in centimeter at the central portion of the fruit in each treatment and the average was worked out. Number of fruits from each harvest till the final harvest was recorded and the total number was arrived by summing up. The weight of the fruits per plot in each harvest was recorded till the final harvest and the weight was summed up for all the harvest to get the yield per plot. From the values of yield per plot, the yield per hectare was computed and expressed in tonnes.

## Results and Discussion

### Growth characters

The data on growth parameters was recorded and furnished in Table 2. It was found to vary significantly as influenced by organic manures and bio-fertilizer. Among the various treatments T<sub>9</sub> recorded the highest plant height of 102.80 cm followed by T<sub>7</sub> which recorded 100.50 cm. The plant height was found to be less in T<sub>10</sub> (control) which recorded 74.10 cm. T<sub>9</sub> recorded more number of leaves (14.0) followed by T<sub>7</sub> which recorded 13.0 leaves per plant. Among the various treatments T<sub>9</sub> recorded more number of branches (7.0) followed by T<sub>7</sub> which recorded (6.20) number of branches. On

the other hand T<sub>10</sub> (control) recorded the least number of branches (4.20).

Organic manure have the ability to supply nutrients and also improve soil fertility by activating soil microbial load and nutrient recycling [4] which lead to increased up take of NPK, reduces the nutrient losses, improving the fertilizer use efficiency and sustains cropping system [3]. Application of organic manure which might have accelerated vigorous growth, increased yield of bhendi plant. Manures are the source of all plant needed macro and micro nutrients in available forms, thereby improving the physical and biological properties of the soil.

**Table 2:** Effect of integrated nutrient management on vegetative and flower characters of bhendi variety Arka Anamika

Treatments	Plant height (cm)	Number of leaves	Number of branches	Days to first flowering	Number of Flowers
T <sub>1</sub>	96.9	10.2	4.9	42.9	19.4
T <sub>2</sub>	98.6	10.8	5.4	37.4	22.8
T <sub>3</sub>	94.3	9.5	4.8	38.3	21.7
T <sub>4</sub>	79.0	9.0	4.3	39.4	19.1
T <sub>5</sub>	99.8	11.0	6.0	37.2	23.8
T <sub>6</sub>	81.2	9.2	4.7	40.3	17.7
T <sub>7</sub>	100.5	13.0	6.2	34.2	24.8
T <sub>8</sub>	100.0	11.0	6.1	35.2	24.1
T <sub>9</sub>	102.8	14.0	7.0	33.0	25.1
T <sub>10</sub>	74.1	8.5	4.2	42.9	17.2
Mean	92.6	10.5	5.2	38.0	21.5
S.Ed	0.5	0.2	0.2	0.1	0.4
CD (p=0.05)	1.1	0.3	0.3	0.3	0.2

### Flower and yield characters

The data on flower and yield characters were recorded and furnished in Table 3 and Table 4. All the treatments were found to be superior over control in advancing the days to first flowering and ranged from 33 days (T<sub>9</sub>) to 42.90 days (T<sub>10</sub>). Among the treatments T<sub>9</sub> was found to be a best for early flowering (33.0 days) followed by T<sub>7</sub> in (34.0 days) than control (43.0 days). Significant influence on the number of flowers was observed in different treatments. Among the treatments T<sub>9</sub> produced the highest number of flowers per plant (25.0) followed by T<sub>7</sub> which produced 24.0 flowers per plant. Pod length was observed maximum (16.40 cm) in T<sub>9</sub> followed by T<sub>7</sub> which recorded 15.50 cm. The pod with highest diameter of 3.40 cm was recorded in T<sub>9</sub> followed by T<sub>7</sub> which recorded 3.20 cm. Among them T<sub>9</sub> recorded the highest pod weight of 17.80 g followed by T<sub>7</sub> with a pod weight of 16.80 g. The highest number of pods per plant (22.10) was observed T<sub>9</sub> followed by T<sub>7</sub> which recorded 22.0 pods (Figure 1). The highest yield per plot (5.20 kg) in T<sub>9</sub> followed by T<sub>7</sub> (4.80 kg) (Figure 2). Control recorded the lowest yield of 3.20 kg. The estimated yield per hectare (Table 3) also shows similar trend where T<sub>9</sub> recorded the yield of 5.60 t/ha followed by T<sub>7</sub> with 5.2 t/ha and control registered the lowest yield of 3.60 t/ha (Figure 3).

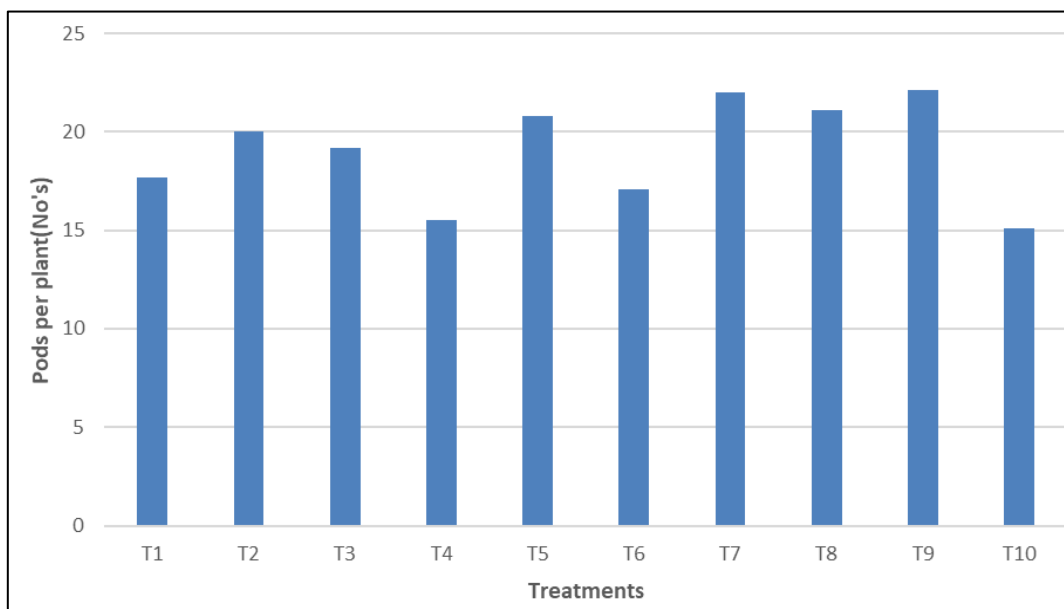
**Table 3:** Effect of integrated nutrient management on yield characters of bhendi variety Arka Anamika

Treatments	Pod length (cm)	Pod Diameter (cm)	Pod weight(g)	Number of pods per plant	Yield per plot(Kg)	Estimated yield(t/ha)
T <sub>1</sub>	13.6	2.3	16.3	17.7	3.5	3.9
T <sub>2</sub>	13.8	2.4	15.2	20.0	4.1	4.5
T <sub>3</sub>	13.4	2.2	14.6	19.2	4.0	4.4
T <sub>4</sub>	12.4	2.1	13.2	15.5	3.6	3.6
T <sub>5</sub>	14.1	2.5	15.5	20.8	4.3	4.7

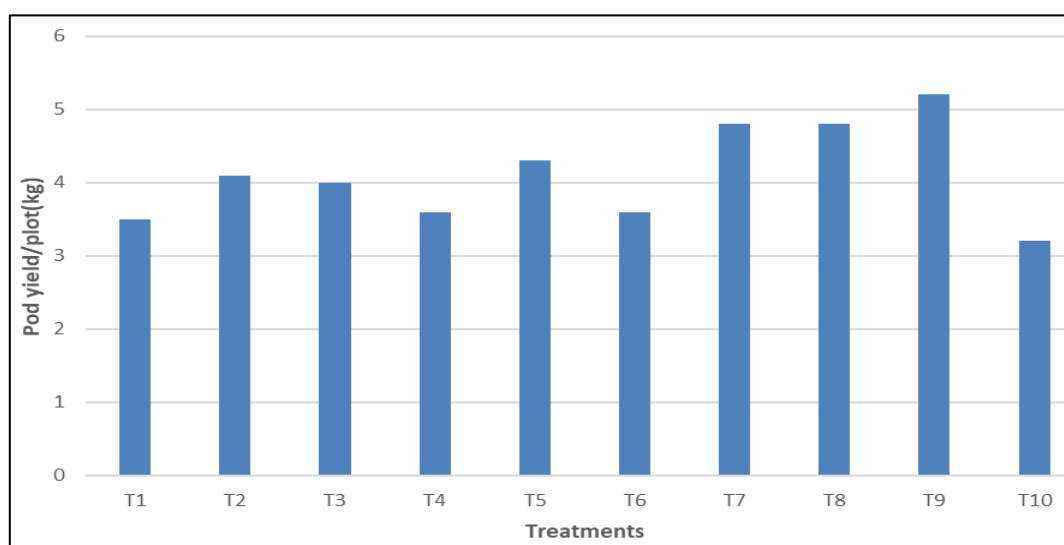
T <sub>6</sub>	12.3	2.4	13.7	17.1	3.6	4.0
T <sub>7</sub>	15.5	3.2	16.8	22.0	4.8	5.2
T <sub>8</sub>	14.8	2.5	16.7	21.1	4.8	5.2
T <sub>9</sub>	16.4	3.4	17.8	22.1	5.2	5.6
T <sub>10</sub>	11.2	2.1	12.2	15.1	3.2	4.0
Mean	13.6	2.5	15.2	19.1	4.1	4.5
S.Ed	0.2	0.1	0.1	0.3	0.2	0.1
CD (p=0.05)	0.3**	0.3**	0.2**	0.7**	0.4**	0.3**

Application of organic fertilizers along with inorganic nutrients the increased photosynthetic activity of bhendi results in improved production, accumulation and partitioning of dry matter. Application of organic manure accelerated the vigorous growth, increase the yield of bhendi <sup>[1]</sup>. Poultry manure application helps in easy solubilisation of nutrient leading to nutrient availability to plant and high yield <sup>[5]</sup>. Application of sheep and goat manures improves soil nutrient status, sustainable production of crops and also improvement in soil chemical properties; soil pH, total N, available P, organic matter and cation exchange capacity were improved <sup>[6]</sup>. Application of sheep and goat manure resulted in improved growth and yield performances. Vermicompost

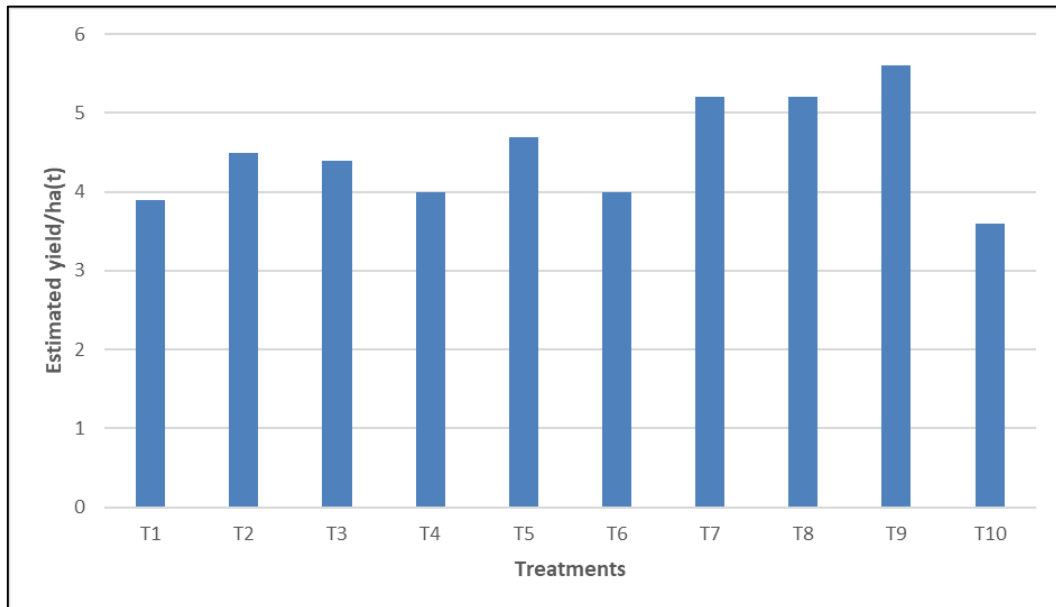
improves the quality of soil by enhancing microbial load, it helps in nutrient recycling and production of plant growth regulator. The study revealed that the combined application of FYM, sheep and goat manure, poultry manure and vermicompost along with recommended dose of fertilizer increased the growth and yield of Okra. The combined treatments also maintain sustainability and soil fertility status of the soil. Based on the finding of this study, it may be recommended that the use of combined organic manure such as FYM (6.25 t/ha) + sheep and goat manure (1.25 t/ha) + poultry manure (1.25 t/ha) + vermicompost (1.25 t/ha) will give positive results in improving the yield of bhendi.



**Fig 1:** Effect of integrated nutrient management on number of pods per plant in Bhendi



**Fig 2:** Effect of integrated nutrient management on pod yield per plot (kg) in Bhendi



**Fig 3:** Effect of integrated nutrient management on estimated yield per hectare (tonnes) in Bhenidi

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