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Impact of organic and inorganic sources of fertilization on growth and yield of okra (*Abelmoschus esculentus* L. Moench)

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Abstract
A field experiment was conducted at Demo field, Krishi Vigyan Kendra, Theni during 2018 to evaluate the impact of organic and inorganic sources of fertilization on growth and yield of okra (*Abelmoschus esculentus* L. Moench). Brinjal variety CO 3 was used as a test variety during the study. The experiment was conducted in a randomized block design with eight treatments replicated thrice. The treatment details are as follows,T_1 - 100% NPK, T_2 - 125% NPK, T_3 - 75% NPK + FYM + PSB, T_4 - 75% NPK + FYM + Azotobactor, T_5 - 75% NPK + FYM + Azotobactor + PSB, T_6 - 50% NPK + FYM + PSB, T_7 - 50% NPK + FYM + Azotobactor, T_8 - 50% NPK + FYM + Azotobactor + PSB. Nitrogen was applied at the rate of 125%, 100%, 75% and 50% kg/ha as per recommended dose of fertilizer. As per the treatment, remaining nitrogen was supplied through FYM (FYM = As per treatment, PSB = Azotobactor = 2 kg/ha). The biometric observation *viz*., growth attributes like plant height (cm), number of leaves per plant, number of branches per plant, number of flowers per plant and yield attributes like pod length, number of pods per plant, pod weight (g), yield (kg ha^{-1}) were recorded. Among the different treatment application of 75% NPK + FYM + Azotobactor + PSB (T_5) produced significantly higher plant height (30.95cm), number of leaves per plant (18.73), number of branches per plant (7.09), number of flowers per plant (11.1) and pod length (cm), number of pods per plant (10.75), pod weight (g), yield of 750 kg ha-1compared to other treatments. Over all, from the experimental results, it could considered that application of 75% NPK + FYM + Azotobactor + PSB as a better option for achieving higher productivity and profitability of Bhendi.

Keywords: Bhendi, Azotobactor, PSB, growth, yield attributes, yield, high profit

Introduction

Vegetables contribute an important part of the diet to many people in the tropics more especially in India. Okra, (Abelmoschus esculentus, L. (Moench) belongs to the malvaceae family. Okra (*Abelmoschus esculentus* L. Moench) is the native of tropical and subtropical Africa. It is one of the most important vegetables grown commercially almost during the whole year in India. Okra plays an important role in the diet by supplying carbohydrate, protein, fat, minerals and vitamins that are usually deficient in the staple food (Savello *et al*, 1982) [6]. India ranks first in the world with 35 million tons (70% of the total world production) of okra produced from 0.35million hectares of land (FAOSTAT, 2010). The major bhendi producing states in India are Uttar Pradesh, Bihar, West Bengal, Orissa, Assam, Andhra Pradesh, Tamil Nadu and Karnataka. Integrated nutrient management (INM) system envisages use of organic manures, green manures, bio-fertilizers along with chemical fertilizers. From the stand point of crop yield and quality, nutrient supply from both organic and inorganic sources is important. The INM helps to restore and sustain soil fertility and crop productivity. It may also help to check the emerging deficiency of nutrient other than N, P and K. Nutritional imbalances in the soil cause instability in productivity & hidden hunger of nutrient besides resulting in poor nutritional quality of vegetable. The maintenance of sustainability in production through integrated use of different sources may also help to maintain the fertility of soil and avoids depletion of soil organic matter & plant nutrients besides suppression of some insect pest & diseases.

Materials and Methods

A field experiment was conducted at Demo field, Krishi Vigyan Kendra, Theni during 2018 to evaluate the impact of organic and inorganic sources of fertilization on growth and yield of okra (*Abelmoschus esculentus* L. moench). Brinjal variety CO 3 was used as a test variety during the study. The experiment was conducted in a randomized block design with eight treatments replicated thrice. The treatment details are as follows,T_1 - 100% NPK, T_2 - 125% NPK, T_3 - 75% NPK + FYM + PSB, T_4 - 75% NPK + FYM + Azotobactor, T_5 - 75% NPK + FYM + Azotobactor + PSB, T_6 - 50% NPK + FYM + PSB, T_7 - 50% NPK + FYM + Azotobactor, T_8 - 50% NPK + FYM + Azotobactor + PSB. Nitrogen was applied at the rate of 125%, 100%, 75% and 50% kg/ha as per recommended dose of fertilizer. As per the treatment, remaining nitrogen was supplied through FYM (FYM= As per treatment, PSB = Azotobactor = 2 kg/ha). A full dose of FYM with PSB and azotobacter was applied at the time of transplanting, while urea was applied in two split doses i.e. half at the time of transplanting and the remaining half dose 30 days after transplanting. Phosphorus and potash were applied as basal dose in all plots as per treatment. Data of growth, yield and quality attribute recorded were subjected to randomized block design (RBD) as advocated by Fisher (1950). Analysis of variance were calculated and critical difference (cd) at 5% level of significance was tested through 'F' test as given in tables and appendices.

Results and Discussion

The results of the experiment conducted to study the "Impact of organic and inorganic sources of fertilization on growth and yield of okra (*Abelmoschus esculentus* L. moench))" are presented below (Table 1).

Growth parameters

Plant height (cm)

The plant height was found to vary significantly as influenced by application of inorganic fertilizer along with organic source of fertilizer. Among the various treatments T_5 (75% NPK + FYM + Azotobactor + PSB) recorded the highest plant height of 105.8 cm followed by T_2 (125% NPK) which recorded 104.3 cm. The plant height was found to be less in T_8 which recorded as 92.7 cm. The increase in plant height might be due to more availability of nitrogen in soil physically improved by organic manure (Bairwa *et al*. 2009) [1],

Number of leaves per plant

Among the various treatments T_5 (75% NPK + FYM + Azotobactor + PSB) recorded more number of leaves 25.6 followed by T_2 (125% NPK) which recorded 25.1 number of leaves. On the other hand T_8 recorded the least number of leaves of about 21.5. This might be due to increasing the uptake of nitrogen and other nutrients and produced more number of leaves. Similar findings due to integrated nutrient management were reported by Patil *et al*. (2003) [3].

Number of branches per plant

Among the various treatments T_5 (75% NPK + FYM + Azotobactor + PSB) recorded more number of branches 4.6 followed by T_2 (125% NPK) which recorded 4.1 number of branches. On the other hand T_8 recorded the least number of branches of about 2.9. This might be due to increased organic manure in combination with Azotobacter and PSB which received reduced doses of RDF in treatments (Tripathy and Maity, 2009).

Number of flowers per plant

Significant influence on the number of flowers was observed in different treatment. Among the treatments T_5 (75% NPK + FYM + Azotobactor + PSB) produced the highest number of flowers per plant 23.2 followed by T_2 (125% NPK) which produced 22.9 flowers per plant. The least number of flowers was recorded in T_8 control of about 18.6 flowers. This might be due to organic manures and biofertilizer application could be attributed to factors such as higher productions of flowers per plant and increased fruit set (Patil *et al.* 2010).

Yield attributes

Pod length (cm)

The maximum pod length of 14.0 cm was recorded in T_5 (75% NPK + FYM + Azotobactor + PSB) followed by T_2 (125% NPK) which recorded 13.8 cm. The least pod length of 10.4 cm was recorded in T_8. This might be attributed to be increased microbial biomass nitrogen mineralization for the development of floral organ leading to increased pod length (Sharma and Kanaujia, 1992) [7].

Number of pods per plant

The treatments differences were statistically significant for this trait. The highest number of pods per plant 15.3 was recorded T_5 (75% NPK + FYM + Azotobactor + PSB) followed by T_2 (125% NPK) which recorded 14.9 pods. The least number of pods (11.0) was recorded in T_8. It might be due to supply of balance nutrients with nitrogen and improving the P2O5 availability through PSB which causes both boosting of vegetative growth and number of pods per plant (Roy *et al*. 2005) [5].

Pod weight (g)

The treatments Influence was statistically significant for this trait. All treatment was superior to control. Among them T_5 (75% NPK + FYM + Azotobactor + PSB) recorded the highest pod weight of 19.4 g followed by T_2 (125% NPK) with a fruit weight of 18.9 g. On the other hand the lowest pod weight was recorded in T_8 of about 14.2 g. This might be due to the higher uptake of PSB and nitrogen by the plant. Similar result under the combination of different fertilizers and biofertilizers along with organic manure treatments were reported by Prabhu *et al*. (2003) [4].

Yield

The estimated yield per hectare (Table 2) and (Fig 1) also showed similar trend where the T_5 (75% NPK + FYM + Azotobactor + PSB) recorded yield of 14.5 t ha^{-1}followed by T_2 (125% NPK) with 14.3 t ha^{-1}. T_8 registered the lowest yield of 11.6 t ha^{-1}. This might be due to increased nitrogen application through chemical fertilizer, biofertilizers and organic manure. Similar results under the combination of different fertilizers along with organic manure and biofertilizer treatments were reported by Prabhu *et al*. (2006) and Bairwa (2009) [1].

Table 1: Impact of organic and inorganic sources of fertilization on growth and yield of okra

Treatments	Plant height (cm)	No of leaves $Plant^{-1}$	Number of branches $Plant^{-1}$	Number of flowers $Plant^{-1}$
T_1 - 100% NPK	99.5	24.4	4.0	22.3
T_2 - 125% NPK	104.3	25.1	4.4	22.9
T_3 - 75% NPK + FYM + PSB	95.7	23.8	3.6	21.1

T_4 - 75% NPK + FYM + Azotobacter	93.3	22.6	3.2	19.4
T_5 - 75% NPK + FYM + Azotobacter + PSB	105.8	25.6	4.6	23.2
T_6 - 50% NPK + FYM + PSB	97.8	24.2	3.8	21.9
T_7 - 50% NPK + FYM + Azotobacter	94.2	23.4	3.4	20.4
T_8 - 50% NPK + FYM + Azotobacter + PSB	92.7	21.5	2.9	18.6
S.Ed	0.85	0.28	0.14	0.23
CD (p=0.05)	1.8	0.6	0.3	0.5

Table 2: Impact of organic and inorganic sources of fertilization on growth and yield of okra

Treatments	Pod length (cm)	No. of pods plant^{-1}	Pod weight (g)	Yield (t ha^{-1})
T_1 - 100% NPK	12.9	14.2	18.1	13.9
T_2 - 125% NPK	13.8	14.9	18.9	14.3
T_3 - 75% NPK + FYM + PSB	12.5	13.3	17.0	13.2
T_4 - 75% NPK + FYM + Azotobacter	11.1	11.5	15.7	12.4
T_5 - 75% NPK + FYM + Azotobacter + PSB	14.0	15.3	19.4	14.5
T_6 - 50% NPK + FYM + PSB	12.6	13.8	17.6	13.7
T_7 - 50% NPK + FYM + Azotobacter	11.7	12.5	16.5	12.7
T_8 - 50% NPK + FYM + Azotobacter + PSB	10.4	11.0	14.2	11.6
S.Ed	0.38	0.23	0.28	0.14
CD (p=0.05)	0.8	0.5	0.6	0.3

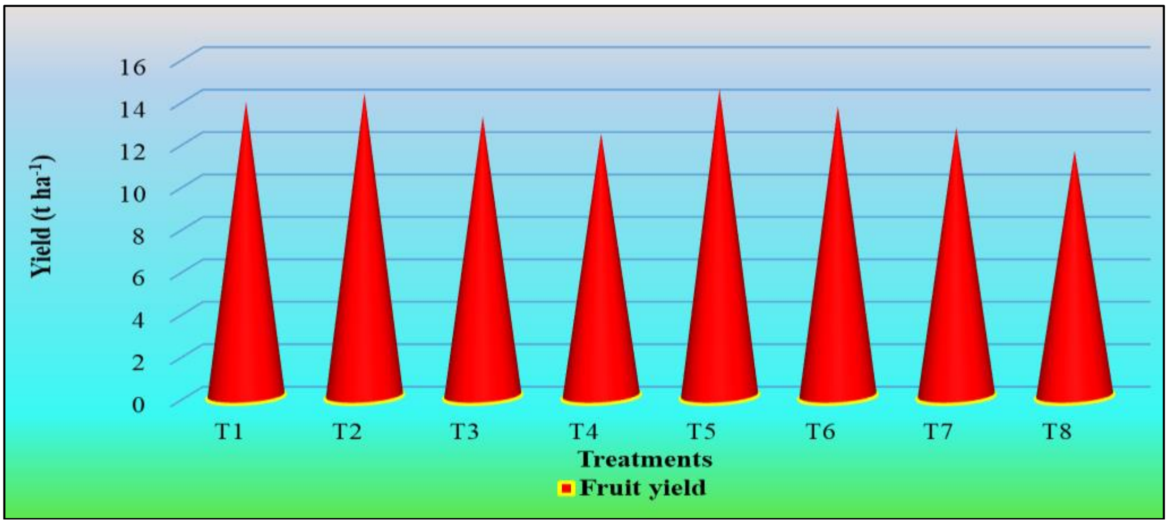

Fig 1: Impact of organic and inorganic sources of fertilization on yield of okra

Conclusion

Based on the results of the above study, it is concluded that application of 75% NPK + FYM + Azotobacter + PSB was recommended to get profitably higher yield besides improving the quality of Bhendi. Over all, from the experimental results, it could considered that application of 75% NPK + FYM + Azotobacter + PSB as a better option for achieving higher productivity and profitability of Bhendi.

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