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Research Article

# OKRA CROP GROWTH AND YIELD RESPONSES TO DIFFERENT ORGANIC SOURCES OF NITROGEN

**BALLAL ANAND*[1]AND KADAM A.S.[2]**

[1]Department of Vegetable Science, Punjab Agricultural University, Ludhiana-141004, Punjab, India
[2]Department of Horticulture, College Of Agriculture, Latur, 413512, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani, Maharashtra
*Corresponding Author: Email-anandballal0403@gmail.com

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**Abstract-** An experiment was conducted during *kharif* season of 2011-12 under shade net condition to assess the effects of organic sources of nitrogen *viz.* FYM, Poultry manure and Neem cake along with inorganic fertilizer i.e. urea and their various combination levels on the yield performance of okra. Eleven treatments were arranged in randomized block design with three replications. The vegetative growth parameters and yield of okra *var.*-Parbhani Kranti was significantly influenced due to different sources of nitrogen. The maximum values of growth parameters like Plant height (101.51 cm), number of leaves (14.94), leaf area (282 $cm^2$), number of branches (2.20), number of nodes (19.86) per plant and yield (159.12 q $ha^1$) were recorded in the treatment of 60% N through neem cake and 40% N through urea. The keeping quality of fruits was significantly varies among the treatments and storage conditions used. The maximum keeping quality was 4.27, 4.67 and 5.13 days were found in open bag, paper bag and polythene bags of storage conditions respectively in the treatment of $T_{11}$.

**Keywords**- *Abelmoschus esculentus* (L.), Fym, Neem cake, Poultry manures yield

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## Introduction

Okra (*Abelmoschus esculentus*(L.)Moench) is an important vegetable grown commercially all over the world. India is considered as the secondary centre of diversity. In India, okra covers an area of 532.7 thousand hectares with the production of 63.46MT [1]. In India, it is a favourite hot weather vegetable crop extensively cultivated throughout the country. Because of its year-round availability in the country, there is tremendous scope for export. Okra is a good source of carbohydrate, proteins, fats, minerals and vitamins thus play an important role in the human diet [2]. Okra produces fruit for a long time and needs a balanced and sufficient supply of nutrients for higher yield and better quality (3).So it is necessary to add such nutrients inputs to these soils in order to have good continuous crop yields. Such inputs may be either organic or inorganic in form. The use of expensive commercial fertilizers as per requirement of the crop is not much affordable to the average farmers. The continuous use of inorganic fertilizers under intensive agriculture has been associated with reduced crop yield, soil acidity and nutrient imbalance, [4&5] creates poor physical properties of the soil and nutrient retention characteristics hence adversely affect crop growth and yield. [6]. Integrated Nutrient Management (INM) refers to the practice of using optimum combination of different sources of nutrient supply of chemical fertilizer with organic manure, crop residues and bio-fertilizers for efficient crop production. It is a flexible approach to minimize the use of chemical fertilizers, and maximize their use efficiency, so as to provide for excellent soil health and enhanced farmer's profits [7&8]. Therefore, the application of plant nutrients through organic sources like compost, FYM and bio-fertilizers with inorganic fertilizers remain the alternative choice of growers for maintaining its sustainable production [9-11]. Keeping in view, the above facts the present investigation was conducted to work out the growth parameters and yield of okra as influenced by different treatments.

## Materials and Methods

The experiment was conducted in shade net house located at instructional cum research farm, Department of Horticulture, College of Agriculture, Latur, Maharashtra, during *Kharif* season 2011-12. Geographically, Latur is situated at 17°52' North to 18°50' North and 76°18' East to 79°12' East with an elevation of 636 m above mean sea level. There were 11 treatments in three replications. Treatments comprising RDF (100:50:50 kg NPK $ha^{-1}$) ($T_1$), 100 % N through organic manures ($T_2$), 20% N through FYM along with 80% N through urea ($T_3$), 40% N through FYM along with 60% N through urea ($T_4$), 60% N through FYM along with 40% N through urea ($T_5$), 20% N through poultry manure along with 80% N through urea ($T_6$), 40% N through poultry manure along with 60% N through urea ($T_7$), 60% N through poultry manure along with 40% N through urea ($T_8$), 20% N through neem cake along with 80% N through urea ($T_9$), 40% N through neem cake along with 60% N through urea ($T_{10}$) and 60% N through neem cake along with 40% N through urea ($T_{11}$). The standard cultural practices recommended for the crop was followed for all the experimental plots. The observations were recorded on five competitive plants selected randomly for each treatment in each replication. Morphological characters like plant height, number of leaves, number of branches per plant, leaf area, leaf area index (LAI), number of branches per plant, fruit attributes like weight (g), breadth (cm), length (cm) and total yield were recorded from the sample plants during the experiment. The experimental data were statistically analyzed by the technique of analysis of variance using randomized block design as per the method given by [12].

## Results and Discussion

### Effect on growth parameters

The findings of present investigations revealed that among all the treatment applied, the combined use of organic manures and inorganic (Neem cake and

Urea) shows a significant increase in yield and growth attributing characters in okra

**Plant height (cm)**

A perusal of data [Table-1] revealed that the plant height 75 days after sowing was observed in this study varied significantly among the treatments and it ranged from 71.78 to 101.51 cm with a mean of 88.15 cm and CD (P=0.05) 5.22. The highest plant height was recorded in treatment $T_{11}$ (60% N through neem cake along with 40% N through urea) recorded maximum plant height (101.51 cm). The minimum plant height (71.78 cm) was recorded in $T_3$. The reason for increased plant height could be attributed to combined treatment of organic manures at 40 and 60% level along with inorganic fertilizers and better environmental condition of the soil might have helped in increasing the absorption and transportation of nutrients towards the developing part of the plant.

**Number of leaves per plant**

Data shown in [Table-1] reveals that the number of leaves per plant ranged from 11.14 to 14.94 with a mean of 13.08 and CD (P=0.05) 1.00. The treatment $T_{11}$ recorded significantly maximum numbers of leaves (14.94) per plant, which was at par with treatments $T_{10}$ and $T_8$. The lowest numbers of leaves (11.14) were recorded in the treatment of 40% N through FYM along with 60% N through urea ($T_4$). The number of leaves increased in treatment combinations of neem cake, poultry manure and recommended dose of fertilizers could be attributed to the solubilization effect of plant nutrients and its availability to the plant for its further growth and development.

**Leaf area ($cm^2$)**

The treatment $T_{11}$ recorded significantly more leaf area (282 $cm^2$) was at par with treatment ($T_8$) [Table-1]. The lowest leaf area (242.53 $cm^2$) was recorded in the treatment of ($T_3$). Significantly more leaf area ranged from 242.53 to 282 $cm^2$ with a mean of 262.80 $cm^2$ and CD (P=0.05) was 8.64 The increase in leaf area with neem cake application may be due to increased uptake of N and P which might have lead higher cell elongation and multiplication. Similar results were also obtained by [13] in okra.

**Table-1** *Influence of integrated nitrogen management on growth parameters of okra.*

| Treatments | Plant height (cm) | Number of leaves plant $^{-1}$ | Number of branches plant $^{-1}$ | Number of nodes plant $^{-1}$ | Length of internode (cm) | Leaf area ($cm^2$) |
|---|---|---|---|---|---|---|
| $T_1$ | 90.75 | 13.48 | 2.46 | 16.93 | 5.98 | 267.70 |
| $T_2$ | 97.16 | 11.41 | 1.93 | 18.40 | 6.18 | 258.36 |
| $T_3$ | 71.78 | 12.32 | 1.86 | 16.93 | 5.15 | 242.53 |
| $T_4$ | 73.94 | 11.14 | 1.93 | 18.13 | 4.96 | 247.40 |
| $T_5$ | 78.52 | 12.17 | 2.00 | 19.20 | 4.84 | 266.53 |
| $T_6$ | 81.27 | 12.65 | 2.00 | 18.53 | 5.38 | 249.60 |
| $T_7$ | 95.61 | 12.77 | 2.13 | 18.93 | 5.82 | 265.66 |
| $T_8$ | 99.51 | 14.68 | 2.60 | 19.33 | 5.94 | 278.00 |
| $T_9$ | 83.09 | 13.71 | 2.00 | 18.73 | 5.45 | 261.40 |
| $T_{10}$ | 96.52 | 14.69 | 2.53 | 19.46 | 5.91 | 271.70 |
| $T_{11}$ | **101.51** | **14.94** | **2.80** | **19.86** | **5.85** | **282.00** |
| S.E. ± | 1.72 | 0.33 | 0.15 | 0.39 | 0.17 | 2.85 |
| C.D. (P=0.05) | 5.22 | 1.00 | 0.47 | 1.17 | 0.52 | 8.64 |

**Number of branches per plant**

A number of branches ranged from 1.86 to 2.80 with a mean of 2.20 and CD (P=0.05) 0.47 [Table-1]. The maximum number of branches (2.80) was observed in the treatment of 60% N through neem cake with 40% N through urea ($T_{11}$). The least number of branches (1.86) were recorded in the treatment of $T_3$. This is might be due to the slow releasing property of neem cake and to provide the required nitrogen as per the growth stages of the plant. As the nitrogen is essential for the synthesis of proteins, it might have helped in production of more number of branches. The results are in accordance with the findings of [14] in tomato and by [15] in brinjal.

**Number of nodes and intermodal length**

A perusal of data [Table-1] revealed that the number of nodes per plant ranged from 16.93 to 19.86 with a mean of 18.58 and CD (P=0.05) 1.17. The maximum number of nodes (19.86) was recorded in treatment of 60% N through neem cake with 40% N through urea ($T_{11}$) while the lowest number of nodes (16.93) was recorded in the treatment of recommended dose of fertilizers ($T_1$) and of 20%N through FYM along with 80%N through urea ($T_3$). The number of nodes was significantly influenced by the integrated use of inorganic fertilizers with organic sources of nutrients. This might be due to the gradual and steady release of nutrients during growth period as well as enhanced biological activities and proper nutrition to the crop [16-18]. Data reveals that the significantly minimum length of internode (4.84 cm) was recorded in the treatment of 60%N through FYM along with 40%N through urea ($T_5$) while the maximum length of internode (6.18 cm) was recorded in the treatment of 100% N through organic manures ($T_2$).

**Crude fibre content of the fruits**

Data reveals that the results of the crude fibre content were non-significant, the lowest content of crude fibre (12.47 %) was observed in the treatment of 60% N through neem cake along with 40% N through urea ($T_{11}$) while, maximum content of the crude fibre (13.70) was observed in the treatment of 40% N through FYM along with 60% N through urea ($T_4$). Crude fibre content is one of the most important criteria to judge the quality of *A. esculentus* fruit. Low crude fibre content is considered to be a desirable character. This might be due to the easy availability of nutrients leading to balanced C: N ratio enhancing the vegetative growth resulting in high photosynthetic activity. Organic sources with the higher level of nutrients reduced the inorganic fertilizers application in *A. esculentus* was reported by [19].

**Yield**

Data shown in [Table-2] reveals that the fruit yield per plot (8 sq.m)and per hectare [Table-2] has significantly differed with combined application of organic manures and inorganic fertilizers. Among different organic sources of nitrogen, the treatment 60%N through neem cake along with 40% N through urea ($T_{11}$) recorded highest fruit yield per plot (12.73 kg) and fruit yield per hectare (159.12 q) while it was least in treatment of 20% N through FYM along with 80% N through urea ($T_3$) (9.74 kg) and (121.83 q) respectively at CD (P-0.05) 0.80 and 9.58. This might be due to vigorous vegetative growth with accelerated photosynthetic activities thereby increases the supply of carbohydrates to the plants [20] and also contains the alkaloids like nimbine and nimbidin which have nitrification inhibiting properties and release nitrogen slowly to plants [21]. Similar results regarding the beneficial effect of organic manures and neem cake in particular were also obtained by [22-24].

**Economics**

Cost: benefit ratio is an important and ultimate factor which decides the optimum levels of inputs used, yield and returns of any crop. The cost : benefit ratio worked out for pooled data [Table-2] indicated that the plants provided with the treatment of 60%N through neem cake along with 40% N through urea ($T_{11}$) recorded maximum net income per hectare (Rs. 94220) with cost : benefit ratio (1 : 1.76) which was statistically at par with treatment $T_1$ and $T_9$ and the least value of (1:1.39) was found in treatment receiving 20% N through FYM along with 80% N through urea ($T_3$). The higher benefit-cost ratio in ($T_{11}$)could be attributed to higher yields with a moderate cost of cultivation. The application of organic manures with inorganic fertilizers helped in increasing the yields. Similar results were reported by [25,26].

**Table-2** *Effect of integrated nitrogen management on yield and economics of okra*

| Treatment | Cost of cultivation (Rs/ha) | Gross returns (Rs/ha) | Net returns (Rs/ha) | BC ratio | Yield (Q/ha) | Crude fibre (%) |
|---|---|---|---|---|---|---|
| $T_1$ | 128120 | 215060 | 86940 | 1.67 | 143.37 | 13.60 |
| $T_2$ | 138420 | 195740 | 57320 | 1.41 | 130.49 | 13.17 |
| $T_3$ | 130820 | 182740 | 51920 | 1.39 | 121.83 | 13.57 |
| $T_4$ | 133540 | 191840 | 57960 | 1.43 | 127.66 | 13.70 |
| $T_5$ | 136240 | 212060 | 75800 | 1.56 | 141.37 | 13.20 |
| $T_6$ | 132760 | 206300 | 79540 | 1.55 | 137.53 | 13.67 |
| $T_7$ | 137400 | 206800 | 69400 | 1.50 | 137.87 | 13.40 |
| $T_8$ | 142060 | 225860 | 83820 | 1.59 | 150.58 | 12.97 |
| $T_9$ | 130560 | 195500 | 64940 | 1.50 | 130.33 | 13.40 |
| $T_{10}$ | 133000 | 213800 | 80800 | 1.61 | 142.53 | 13.00 |
| $T_{11}$ | **135440** | **238680** | **94220** | **1.76** | **159.12** | **12.47** |
| S.E. ± | - | - | - | - | 3.25 | 0.22 |
| C.D. (P=0.05) | - | - | - | - | 9.58 | NS |

**Conclusion**

The complimentary use of organic manures and inorganic fertilizers is essential for obtaining better growth, higher yield and superior quality of okra fruits. The optimum combination of 60% N through organic manures and 40% N through inorganic fertilizers has produced significant results. Among the different forms of organic studied, the neem cake was found to be superior followed by poultry manure and FYM. Hence, it can be concluded that, for getting higher yield with quality produce from the okra crop grown under net house condition, the crop should be supplied with the recommended dose of fertilizers (100:50:50 NPK kg $ha^{-1}$) in which 60% quantity of N should be supplied through neem cake and 40% N through urea.

**Conflict of Interest: None declared**

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