Original Research Article

Influence of organic manures and inorganic fertilizers on growth, yield and quality of okra (*Abelmoschus esculentus* L.)

ABSTRACT

The experiment was conducted in the Horticulture Research Farm, Department of Horticulture, Naini Agriculture Institute, Sam Higginbottom University of Agriculture Technology and Sciences, Prayagraj (UP) during Ferbruary 2022- April 2022. The experiment was laid out in RBD with 9 treatments with 3 replications. The results revealed that T_1 (100% through chemical fertilizers + 10t vermicompost) performed the best in term in days to germination (9.20 DAS), days to emergence (19.87 DAS), days to 50% flowering (49.20 DAS), plant height (75.03 cm), days to first harvest (56 DAS), number of fruits per plant (10), fruit length for marketability (10.71 cm), average fruit weight for 10 capsule (109 g), fruit yield per plant (194.93 g), fruit yield per hectare (116.96 q/ha), total soluble solids (5.80^0 Brix), ascorbic acid (18.54 mg), fruit colour (138.33) and B:C ratio (2.81). Therefore, the treatment T_1 (100% through chemical fertilizers + 10t vermicompost) is the best when compared to all other treatments. As the highest benefit cost ratio was observed in T_1 (100% chemical fertilizers + 10t vermicompost) i.e., (2.81) which states that it is economically profitable compared to all other treatments.

Keywords: growth, yield, quality, vermicompost, neem cake, FYM

Introduction

Okra or bhindi scientifically known as (*Abelmoschus esculentus* L.) is an important vegetable crop in many tropical and sub-tropical countries including India. It's a largely self-pollinated annual plant. It belongs to the family Malvaceae and with somatic chromosome number 2n=130. This crop is suitable for the cultivation as a garden crop as well as on long commercially forms. It is grown commercially in India, Ghana, Cyprus, Ethiopia and Southern United States. In India, it is cultivated in 528 thousand hectares area with the production of 6146 million tonnes with productivity of 11.9 MT/ha the crop share about 5.7% of total area under vegetables cultivation and 3.9% of the total vegetable production. The cultivated okra is an important fruit vegetable crop cultivated in tropical, subtropical and mild temperate parts of the world, it is grown during summer and rainy seasons for its tender pod,

which are cooked and consumed as a vegetable. Organic manures can supply practically all the elements of soil fertility that the crops require, though not in adequate amounts and in right proportions. The plant food elements contained in manure are released in an available form upon decomposition by soil microorganisms.

The most important elements present in inorganic fertilizers are nitrogen, phosphorus, and potassium which influence vegetative and reproductive phase of plant growth. Compared to inorganic fertilizers the organic fertilizer having lowered the nutrient content, solubility and nutrient release rates are typically low than inorganic fertilizers and therefore inorganic fertilizers are more preferred than organic fertilizers.

Material and Method

The present investigation entitled "Influence of organic manures and inorganic fertilizers on growth, yield and quality of okra" was carried out at the field of Department of Horticulture, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj during the year 2022. It is situated at an elevation of 78 meters above sea level at 25.87^0 North latitude and 81.15^0 East longitude. This region has a sub-tropical climate prevailing in the south-east part of U.P. with both the extremes in temperature, i.e., the winter and the summer. The sowing of experimental material was done on February 9, 2022. The experiment was laid out in randomized block design (RBD) with three replications and nine treatments. Treatments involved were T_0 – 100% NPK + 20 t/ha FYM, T_1 – 100% CF + 10t vermicompost, T_2 – 100% CF + 2t neem cake, T_3 – 75% CF + 25% FYM, T_4 – 75% CF + 25% vermicompost, T_5 – 50% CF + 50% neem cake, T_6 – 50% CF + 50% FYM, T_7 – 50% CF + 50% vermicompost, T_8 – 50% CF +50% neem cake. The land was brought to a fine tilth through ploughing and tillage. Irrigation channels and bunds were prepared according to layout. The seeds were soaked overnight and sown in the field directly. Light irrigation was given just after sowing of seeds. Organic manures were applied one week before sowing. Full dose of phosphorus, potassium and half dose of nitrogen as per treatments were applied just before. The remaining half dose of nitrogen was applied twenty-five days after sowing. All cultural practices were followed regularly during crop growth and observations were recorded on yield and yield attributing characters.

Result and Discussion

It was observed that yield as well as yield attributing characters like days to germination (cotyledons), days to emergence (true leaf), days to 50% flowering, plant height (cm), days to first harvest, number of fruits per plant, fruit length for marketability (cm), average fruit weight (g), fruit yield per plant (g), fruit yield per hectare (q/ha), total soluble solids and ascorbic acid were significantly influenced by different treatments.

Application of nutrients through combinations of organic manures and inorganic fertilizers were proved beneficial in increasing growth, yield as well as quality of okra (Table 1, 2 and 3).

Growth parameters

Days to germination (cotyledons)

The days to germination was least in T_1 (100% chemical fertilizer + 10t Vermicompost) at 9.20 DAS, followed by T_7 (50% chemical fertilizer + 50% through vermicompost) with 9.40 DAS, whereas maximum days to germination at 11.73 DAS was recorded in control. The present findings corroborate with the findings of El Balla, M.M., Saidahmed, A., & Makkawi, M. (2011).

Days to emergence (true leaf)

The days to emergence was least in T_1 (100% chemical fertilizer + 10t Vermicompost) at 19.87 DAS, followed by T_7 (50% chemical fertilizer + 50% through vermicompost) with 20.07 DAS, whereas maximum days to 50% flowering at 22.20 DAS was recorded in control. Similar findings were obtaibed by Gadakh *et al*. (1990)

Days to 50% flowering

The days to 50% flowering was recorded minimum in T_1 (100% chemical fertilizer + 10t Vermicompost) at 49.20 DAS, followed by T_7 (50% chemical fertilizer + 50% through vermicompost) with 49.67 DAS, whereas maximum days to 50% flowering at 52.93 DAS was recorded in control. The present finding is in accordance with same type of results obtained by Sendur kumaran (1996).

Plant height (cm)

The plant height was maximum in T_1 (100% through chemical fertilizer + 10t Vermicompost) at 75.03cm, followed by T_7 (50% through chemical fertilizer + 50% through Vermicompost) with 73.24cm, whereas minimum plant height at 60.75cm was recorded in control. This is in general agreement with report of Meyer and Anderson (2003) and Barani and Anburani (2002).

Days to first harvest

The days to first harvest was least in T_1 (100% chemical fertilizer + 10t Vermicompost) at 56 days to first harvest, followed by T_7 (50% chemical fertilizer + 50% through vermicompost) with 57 days to first harvest, whereas maximum at 60.33 days to first harvest was recorded in control.

Table.1 Influence of organic manures and inorganic fertilizers on growth of okra.

Treatment	Days to germination	Days to emergence	Days to 50% flowering	Plant height	Days to first harvest
T_0	11.73	22.20	52.93	60.75	60.33
T_1	9.20	19.87	49.20	75.03	56.00
T_2	11.00	21.07	50.93	68.99	58.73
T_3	10.33	20.53	50.47	71.85	58.13
T_4	10.13	20.33	50.13	72.37	57.53
T_5	11.20	21.47	52.00	67.92	59.13
T_6	10.80	20.73	50.67	70.48	58.33
T_7	9.40	20.07	49.67	73.24	57.00
T_8	11.40	21.73	52.00	67.27	59.60
S.Ed (±)	0.29	0.19	0.29	1.37	0.35
CD at 5%	0.61	0.40	0.62	2.91	0.75

Yield parameter

Number of fruits per plant

The number of fruits per plant recorded maximum in T_1 (100% chemical fertilizer + 10t Vermicompost) at 10.00, followed by T_7 (50% chemical fertilizer + 50% through vermicompost) with 9.73, whereas minimum number of fruits per plant at 7.47 was recorded in control. The present findings corroborate with the findings of Prabhu *et al.* (2003) and Mal *et al.* (2013).

Fruit length for marketability (cm)

The fruit length for marketability recorded maximum in T_1 (100% chemical fertilizer + 10t Vermicompost) at 10.71 cm, followed by T_7 (50% chemical fertilizer + 50% through vermicompost) with 10.49 cm, whereas minimum fruit length for marketability at 8.86 cm was recorded in control. Similar results were also obtained in okra by Gayathri and Reddy (2013) and Mal *et al.* (2013).

Average fruit weight (g)

The average fruit weight recorded maximum in T_1 (100% chemical fertilizer + 10t Vermicompost) at 109.00g, followed by T_7 (50% chemical fertilizer + 50% through vermicompost) with 103.50g, whereas minimum average fruit weight at 68.67g was recorded in control. Similar findings were reported by Rabindra Kumar and Srivastava (2006).

Fruit yield per plant (g)

The fruit yield per plant recorded maximum in T_1 (100% chemical fertilizer + 10t Vermicompost) recorded maximum fruit yield per plant at 194.93 g, followed by T_7 (50% chemical fertilizer + 50% through vermicompost) with 175.30 g, whereas minimum fruit yield per plant at 79.63 g was recorded in control. The results obtained were in agreement with the findings of Premsekhar and Rajashree (2009).

Fruit yield per hectare (q/ha)

The fruit yield per hectare recorded maximum in T_1 (100% chemical fertilizer + 10t Vermicompost) at 116.96 q/ha, followed by T_7 (50% chemical fertilizer + 50% through vermicompost) with 105.18 q/ha, whereas minimum fruit yield per hectare at 47.77 q/ha was recorded in control. These results are in support with findings of Prabhu *et al*. (2002) and similar reports by Sharma *et al.* (2010).

Table 2. Influence of organic manures and inorganic fertilizers on yield of okra.

Treatment No.	Number of fruits per plant	Fruit length for marketability (cm)	Average fruit weight (g)	Fruit yield per plant (g)	Fruit yield per hectare (q/ha)
T_0	7.47	8.86	68.67	79.63	47.77
T_1	10.00	10.71	109.00	194.93	116.96
T_2	8.40	9.56	89.00	117.90	70.74
T_3	9.00	10.21	94.17	142.40	85.44
T_4	9.27	10.38	98.33	152.70	91.62
T_5	8.07	9.19	85.00	106.27	63.76
T_6	8.67	9.85	91.50	125.90	75.54
T_7	9.73	10.49	103.50	175.30	105.18
T_8	7.67	9.03	72.83	95.17	56.95
S.Ed (±)	0.13	0.12	5.55	4.44	2.66
C.D. at 5%	0.28	0.26	11.76	9.42	5.64

Quality parameter

Total Soluble Solids (TSS)

The total soluble solids recorded maximum in T_1 (100% chemical fertilizer + 10t Vermicompost) at 5.80^0 Brix, followed by T_7 (50% chemical fertilizer + 50% through vermicompost) with 5.51^0 Brix, whereas minimum total soluble solids at 2.30^0 Brix was recorded in control. The findings get full support with the findings of Yadav *et al.* (2016) and Singh *et al.* (2018).

Ascorbic acid

The ascorbic acid recorded maximum in T_1 (100% chemical fertilizer + 10t Vermicompost) recorded maximum ascorbic acid at 18.54 mg, followed by T_7 (50% chemical fertilizer + 50% through

vermicompost) with 17.96 mg, whereas minimum ascorbic acid at 14.55 mg was recorded in control. Similar findings were reported by B. Naveen Kumar, G. Padmaja and P. Chandrasekhar Rao (2017).

Fruit colour

The fruit colour recorded maximum in T_1 (100% chemical fertilizer + 10t Vermicompost) at 138.33, followed by T_7 (50% chemical fertilizer + 50% through vermicompost) with 136.4, whereas minimum fruit colour at 132.06 was recorded in control. Similar findings were reported by Chao *et al.* (2014).

Table.3. Influence of organic manures and inorganic fertilizers on quality of okra.

Treatment No.	Total soluble acid	Ascorbic acid	Fruit colour
T_0	2.30	14.55	132.06
T_1	5.80	18.54	138.33
T_2	3.67	15.95	133.8
T_3	4.53	17.18	134.46
T_4	4.95	17.46	135.13
T_5	3.20	15.74	133.73
T_6	4.03	16.80	134
T_7	5.51	17.96	136.4
T_8	2.57	14.89	132.66
S.Ed (±)	0.14	0.26	0.76
C.D at 5%	0.30	0.56	1.61

Conclusion

Based on the present experimental findings, it was concluded that the treatment T_1 (100% through chemical fertilizer + 10t vermicompost) was found superior in days to germination, days to emergence, days to 50 flowering, plant height, days to first harvest, number of fruits per plant, fruit length for marketability, average fruit weight, fruit yield per plant, fruit yield per hectare, total soluble solids, ascorbic acid and fruit colour of okra. Regarding economics of various treatments, maximum gross return (Rs. 350880) and net return (Rs. 226422) along the cost benefit ratio (2.81) was also obtained in T_1 (100% through chemical fertilizer + 10t vermicompost).

References

Attigah A.S, Asiedu E.K, Agyardo K and Dapaah H.K (2013). Growth and yield of okra (*Abelmoschus esculentus* L.) as affected by organic and inorganic fertilizers.

Barnwal A.K., Pal A.K., Tiwari A., Pal S. and Singh A.K. (2017). Effect of Picking Stages on Fruit and Seed Development in Okra [*Abelmoschus esculentus* (L.) Moench] Cultivars Kashi Pragati and Kashi Kranti *International Journal of Agriculture, Environment and Biotechnology* Citation: IJAEB: **10**(6): 695-701, December 2017

Chitra KN, Siji KP and Thomas B. (2015). Phosphate solubilizing bacteria (PSB) and its priming effect on the germination and growth of Okra (*Abelmoschus esculentus* L.) a case study. *Journal of Science*. **5**(2): 71-76.

Chaudhary K, More SJ and Bhandheri DR. (2015). Impact of bio-fertilizers and chemical fertilizers on growth and yield of okra (*Abelmoschus esculentus* (L.) Moench). *Journal of Environmental Science*. **9** (1&2): 67-70.

Fagwalawa, L.D. Yahaya, S.M. (2016). Effect Organic Manure on the Growth and Yield of Okra *Imperial Journal of Interdisciplinary Research* (IJIR*) Vol-2, Issue-3, 2016 ISSN: 2454-1362.*

Gayathri K and Reddy PS. (2013). Effect of integrated nutrient management growth and yield of okra (*Abelmoschus esculentus* (L.) Moench) cv. Arka Anamika. Vegetable Science. **40**(2): 246-248.

Gemede HF, Ratta N, Haki GD, Woldegiorgis AZ, Beyene F (2015). Nutritional Quality and Health Benefit of Okra: A review. *Journal of Food Processing and Technology* **6**:458. doi: 10.4172/2157-7110.1000458.

Miglani A., Gandhi N., Singh N., Kaur J. (2017). Influence of different organic manures on the growth and yield of okra *International Journal of Advance Research in Science and engineering* vol.no.**6** 2017.

Naim A.H. and Abker N.M. (2016). Effects of Chicken Manure and Nitrogenous Fertilizer on Growth, Yield and Yield Components of Okra (*Abelmoschus esculentus* (L.) Moench) under rainfed conditions *International Journal of Scientific and Engineering Research* **7**(6). July 2016.