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Effect of organic fertilizers on growth yield and quality of Okra (*Abelmoschus esculentus* L.) Kashi Lalima

Anil Kumar Reddy Kota, Anita Kerketta, Samir E Topno, Vijay Bahadur and Pratyasha Tripathi

Abstract
A trial was conducted at the Vegetable Research Farm, Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology &Sciences, Prayagraj, (UP) during March 2021- May 2021 to study the "Effect of organic fertilizers on growth yield and quality of Okra (*Abelmoschus esculentus* L.) Kashi Lalima" Results revealed that maximum plant height (110.93 cm), days for first flowering(33.13 days), days for 50% flowering (38.67 days), number of pods per plant (20.69 pods), Pod length (12.93 cm), Pod weight (9.17 g), Pod width (1.69 g), Yield per plant (189.83 g), yield per plot (3.03 Kg), yield per hectare (10.68 t/ha) were recorded with T_9 {Vermicompost +Poultry manure (50%)} +Goat manure (50%). The minimum values growth parameters, yield parameters and quality parameters were recorded with treatment T_2 Vermicompost (75%) + Poultry manure (25%).

Keywords: Organic, fertilizers, Okra, Kashi Lalima, *Abelmoschus esculentus* L.

Introduction
Okra or lady's finger is considered as an important vegetable of the tropical and sub-tropical regions of the world. It is popular in India, Pakistan, Cameroon, Iraq and Ghana. India ranks first in the world with a production of 5.78 Mt (72% of total world production) of over 0.498 m ha land. Okra is available in in India throughout the year and its production can be tailored according to the demand. After onion, Okra has the major share in revenue generation through export of vegetables. Andhra Pradesh, West Bengal, Bihar, Gujarat, Odisha, Jharkhand and Maharashtra are the leading Okra producing states in India.

Okra fruits contain fibre, vitamin C, vitamin B_9 and antioxidants. The edible fruit is valuable for very good supplement of proteins, vitamins and minerals in diets of people from the developing countries, where they depend on cereal crops, which are lacking them.

Kashi Lalima is the Okra variety released by IIVR, Varanasi in the year 2019. The fruits are reddish purple fruits tolerant to YVMV and OLCV. Medium tall and short internodes with red-coloured petioles. Rich in anthocyanin and phenolics. Suitable for both summer and Kharif season.

Poultry manure supplies both macro and micro nutrients sufficiently for growth, yield and quality of horticultural crop production. Poultry manure has also gained sufficient importance in crop production practices owing to nutritional support for crops and maintaining the soil physical and chemical properties. If left exposed, 50% of its N is lost within 30 days. Poultry manure contains high N and P compared to other organic manures. The average nutrient content is 3.03% of N; 2.63% P_2O_5 and 1.4% K_2O.

Vermicompost is a nutritive "organic fertilizer" rich in NPK and micronutrients such as Calcium (Ca), Magnesium (Mg), Zinc (Zn) and Manganese (Mn). Vermicompost contains 0.5-0.15% of Nitrogen; 0.1-0.30% of Phosphorus; 0.15-0.16% of Potash; 0.6-0.30% of Sodium; 22.67-47.60 mg\100g of Calcium and Magnesium; 2-9.50 mg\kg of copper; 2-9.30 mg\kg of Iron; 5.70-11.50 mg\Kg of Zinc and 128-548 mg\Kg of Sulphur. It also contains enzymes like amylase, lipase, cellulase and chitinase which continues to break down organic matter in the soil (to release the nutrients and make it available to the plant roots) even after they have been excreted.

The droppings of sheep and goats contain higher nutrients than farmyard manure and compost. On an average, the manure contains 3 per cent N, 1 per cent P_2O_5 and 2 per cent K_2O. It is applied to the field in two ways. The sweeping of sheep or goat sheds are placed in pits for decomposition and it is applied later to the field.

Materials and Methods

Experimental site

The experiment was carried out at the Horticulture Research Farm, Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj.

Design and treatments

The experiment was conducted in Randomized Block Design with 10 various treatments such as T_1-FYM 100%; T_2-Vermicompost (75%) + Poultry manure (25%); T_3-Vermicompost (75%) + Goat manure (25%); T_4-Vermicompost (50%) + Poultry manure (50%); T_5-Vermicompost (50%) + Goat manure (50%); T_6-Vermicompost (25%) + Poultry manure (75%); T_7-Vermicompost (25%) + Goat manure (75%); T_8-{Vermicompost+ Poultry manure (75%) } + Goat manure (25%); T_9-{Vermicompost + Poultry manure (50%)} + Goat manure; T_{10}-{Vermicompost + Poultry manure (25%)} + Goat manure (75%). The allocation of treatments of the individual plots using random number in each replication. The size of each plot was 1.5 m × 1.5 m.

Fertilizers

FYM @ 20 t/ha, Poultry manure @ 2.5 t/ha, Vermicompost @ 5 t/ha and Goat manure @ 3 t/ha are applied to the plots before sowing.

Parameters

Growth parameters: Plant height (cm) No. of leaves No. of branches per plant

Earliness Parameters: Days for first flowering, Days for 50% flowering, No. of days from anthesis to pod formation

Yield parameters: No. of fruits per plant, Fruit length (cm), Fruit weight (gm), Fruit diameter (mm), Yield per plant, Yield per plot (kg), Pod yield per hectare (t).

Quality parameters: Ascorbic acid (mg/100 g of edible part), TSS (%)

Results and Discussion

Plant height: Among different levels of organic fertilizers T_9 {Vermicompost + Poultry manure (50%)} + Goat manure (50%)} recorded maximum height of 110.93cm followed by T_{10} {Vermicompost + Poultry manure (25%)} + Goat manure (75%)} with 109.71cm, whereas minimum plant height of 100.31cm was recorded in T_2 [Vermicompost (75%) + Goat manure (25%)]. It might be due to moisture and nutrient absorption from the soil. It is due to the effect of the increase in concentration of auxin supply with higher levels of nitrogen brought about increase in the plant height and also due to nitrogen availability during early period of plant growth which leading to conductive nutritional environment in root zone of soil and promotes physiological activity. Nitrogen plays a key role in plant growth and development. Increase supplies of available phosphorus are playing an important role in metabolic reaction, energy conservations and biological energy transformations. Formation of storage compounds (ATP and ADP) leads to increased activity in cell growth and provide energy to the cells. Similar findings were also reported by (Sachan *et al.,* 2017) [18].

Days for first flowering

Among the different levels of organic fertilizers T3 [Vermicompost (75%) + Goat manure (25%) recorded maximum days to first flowering 35.27 days, followed by T_4 Vermicompost (50%) + Poultry manure (50%) 34.67 days whereas minimum days for first flowering 33.13 days was recorded in T_9 {Vermicompost +Poultry manure (50%)} + Goat manure (50%)}. Application of Vermicompost along with poultry manure of the recommended doses of organic fertilizers induced early flowering and first flowering. Increased production of leaves might have helped to encouraged more photosynthetic and induced flowering stimulus, thus effecting early initiation of flower bud. It might be due to formation indole acetic acid and enhanced nitrogenise activity and leads to early flowering. Higher amount of nitrogen results to delay flowering. The application of higher dose of nitrogen ultimately leads to luxurious growth during vegetative phase ultimately delayed flowering. This is in close conformity with the findings of Jose (1988) [8] and Nandhakumar (1997) [16] in brinjal.

Days for 50% flowering

Among the different levels of organic fertilizers T_2 Vermicompost (75%) + Poultry manure (25%) recorded maximum days to 50% flowering 41 days, followed by T_5 Vermicompost (50%) + Goat manure (50%) 41 days whereas minimum days for 50% flowering 38.67 days was recorded in T_9 {Vermicompost +Poultry manure (50%)} + Goat manure (50%)}.

No. of pods per plant: Among the different levels of organic fertilizers T_9 {Vermicompost +Poultry manure (50%)} + Goat manure (50%)} recorded highest number of pods 20.69 pods, followed by T_{10} {Vermicompost + Poultry manure (25%)} + Goat manure (75%) with 19.47 pods, whereas minimum number of pods were 16.07 pods recorded in T_3 Vermicompost (75%) + Goat manure (25%).

Pod length (cm): Among the different levels of organic fertilizers T_9 {Vermicompost +Poultry manure (50%)} + Goat manure (50%)} recorded maximum pod length of 12.93 cm, followed by, T_{10} {Vermicompost + Poultry manure (25%)} + Goat manure (75%) with 12.83 cm, whereas minimum pod length of 8.30 cm recorded in T_3 Vermicompost (75%) + Goat manure (25%).

Pod weight: Among the different levels of organic fertilizers T_9 {Vermicompost +Poultry manure (50%)} + Goat manure (50%)} recorded maximum pod weight of 9.17 g, followed by T_9 {Vermicompost + Poultry manure (75%)} + Goat manure (25%) with 8.78 g, whereas minimum pod weight of 7.35 g recorded in T_3 Vermicompost (75%) + Goat manure (25%). The higher fruit weight in these treatments might be due to accelerated mobility of photosynthetic from the source to the sink as influenced by the growth hormone, released or synthesized due to the organic sources of fertilizers (Susan, 1995) [22]. The findings of this study are in accordance with those of Mal *et al.* (2014) [10] in okra.

Pod width: Among the different levels of organic fertilizers T_9 {Vermicompost +Poultry manure (50%)} + Goat manure (50%)} recorded maximum pod width of 1.69 cm, followed by T_{10} {Vermicompost + Poultry manure (25%)} + Goat manure

(75%) with 1.65 cm, whereas minimum pod width of 1.33 recorded in T_2 Vermicompost (75%) + Poultry manure (25%) and T_3 Vermicompost (75%) + Goat manure (25%).

Pod yield per plant in grams

Among the different levels of organic fertilizers T_9 {Vermicompost +Poultry manure (50%)} + Goat manure (50%)} recorded maximum pod yield of 189.83 g, followed by T_{10} {Vermicompost + Poultry manure (25%)} + Goat manure (75%) with 170.28 g, whereas minimum pod yield of 118.15 g recorded in T_3 Vermicompost (75%) + Goat manure (25%).

Table 1: Effect of organic fertilizers on plant height, days for first flowering, days for 50% flowering, number of pods per plant, Pod length, Pod weight, Pod width, Yield per plant, yield per plot, yield per hectare of Okra (*Abelmoschus esculentus*. L) Kashi Lalima

Treatments	Plant height(cm)	Days for first flowering	Days for 50% flowering	No. of fruits\plant	Pod length (cm)	Pod weight (g)	Pod width (mm)	Yield\plant (g)	Yield\plot (Kg)	Yield\hectare (t)
T_1	102.80	34.93	40.67	18.24	10.77	8.51	1.61	155.39	2.49	8.74
T_2	100.31	34.60	41.00	16.34	9.21	7.45	1.33	121.77	1.95	6.85
T_3	101.21	35.27	40.67	16.07	8.30	7.35	1.33	118.15	1.89	6.65
T_4	102.41	34.67	39.67	18.07	10.51	8.43	1.46	152.36	2.44	8.57
T_5	102.93	35.13	41.00	17.90	10.25	8.61	1.57	154.18	2.47	8.67
T_6	102.91	34.13	40.67	17.80	10.62	8.39	1.53	149.39	2.39	8.40
T_7	101.57	33.27	39.67	18.11	9.83	8.55	1.53	154.89	2.48	8.71
T_8	106.45	34.80	40.67	18.24	10.39	8.78	1.54	160.15	2.56	9.01
T_9	110.93	33.13	38.67	20.69	12.93	9.17	1.69	189.83	3.03	10.68
T_{10}	109.71	34.00	39.33	19.47	12.83	8.74	1.65	170.28	2.72	9.58
Grand mean	104.12	34.39	40.20	18.09	10.56	8.40	1.52	152.64	2.44	8.59
F test	S	S	S	S	S	S	S	S	S	S
SE(d)	1.01	0.54	0.71	0.16	0.50	0.17	0.08	3.69	0.06	0.21
CV	1.18	1.92	2.16	1.10	5.84	2.42	6.19	2.96	2.98	2.96
CD at 5%	2.06	1.10	1.45	0.33	1.03	0.34	0.16	7.55	0.12	0.42

Pod yield per plot in Kg.: Among the different levels of organic fertilizers T_9 {Vermicompost +Poultry manure (50%)} + Goat manure (50%)} recorded maximum pod yield of 3.03 Kg, followed by T_{10} {Vermicompost + Poultry manure (25%)} + Goat manure (75%) with 2.72 Kg, whereas minimum pod yield of 1.89 Kg recorded in T_3 Vermicompost (75%) + Goat manure (25%).

Pod yield per hectare: Among the different levels of organic fertilizers T_9 {Vermicompost +Poultry manure (50%)} + Goat manure (50%)} recorded maximum pod yield of 10.68 t ha^{-1}, followed by T_{10} {Vermicompost + Poultry manure (25%)} + Goat manure (75%) with 9.58 t ha^{-1}, whereas minimum pod yield of 6.65 t ha^{-1} recorded in T_3 Vermicompost (75%) + Goat manure (25%).

Conclusion

The obtained data showed that the significant effect of [Vermicompost + Poultry manure (50%)] + Goat manure (50%) is more effective for plant height, number of leaves, days taken to first flowering, days took to 50% flowering, pod length, pod weight, pod width number of fruit per plant, fruit yield per plant (g), fruit yield per plot (kg) and fruit yield per hectare per (t).

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