Original Research Article

Effect of different organic manure and inorganic fertilizer on growth, yield and quality of okra (Abelmoschus esculentus L.)

Abstract

Due to the heavy application of chemical and fertilizer, land and water bodies are getting polluted. So, to reduce the degradation of soil, we have used combination of organic and inorganic sources of nutrients. The experiment was laid out in a randomized block design with three replications and thirteen treatment combinations. F1 Hybrid Covi Plus was selected for this study. We have found that application of 75% NPK and 25% of vermicompost respectively gave highest yield

Keywords: Vermicompost, NPK, and Yield

INTRODUCTION

Okra [*Abelmoschus esculentus* L.] known as Lady's finger, is indigenous to tropical Africa and grown throughout India in summer and rainy seasons. Okra is erect, herbaceous, annual green and belong to the family Malvaceae. The tender green fruits of okra are cooked in curry and soup. To a limited extmt e finds use in canned, dehydrated or frozen forms for off-season consumption by the army at high altitudes and export. **(Sharma et al., 2015)** The root and stem are used for clearing cane juice in preparation of 'gur'. The high iodine content of fruits helps to control of goiter disease. Okra is said to be very useful against genito-urinary disorders, and chronic dysentery. The dry seed contains 13-22 % edible oil and 20-24 % protein. The oil is used in soap and cosmetic industry, while the protein is used for fortified feed preparation. The crushed seed is fed to cattle for higher milk production and the fibre is utilized in jute textile and paper industry. All parts of okra (Lady's finger) like fresh leaves, buds, flowers, pods, stems and seeds can be used for different purposes and hence it is a multipurpose crop in terms of its uses **(Gemede *et al.,* 2015).**

High application rate of fertilizer and manures are required for better fruit production to promote vigorous growth and quality. Never the less fertilizers are expensive and should be used efficiently and effectively to avoid wastage. Okra being a nutrient loving crop, it responds well to added nutrients. It has been experimentally proved that no single source of fertilizer is capable of supplying plant nutrients in adequate amount and in balanced proportion **(Ajay Varma, 2000).** Therefore, to maintain the soil fertility and to supply plant nutrients in balanced proportion for optimum growth, yield and quality of a crop, a combined use of inorganic, organic and biological sources of plant nutrients should be adopted. This helps in better utilization of added inorganic fertilizer thus helps in reducing its level of application and reducing the deleterious effect of harsh chemical residues that the inorganic fertilizer level in soil**.**

Okra is most popular in India, Nigeria, Sudan, Pakistan, Ghana, Egypt, Berlin, Saudi Arabia, Mexico and Cameron Largest area and production is in India followed by Nigeria. Total area under okra in India reported to be 528.37-thousand-hectare, production 6145.97 thousand tonnes and productive highest in 2018-19. West Bengal is the leading state of area and production of okra, way has area 77.40 thousand hectare and production 913:32 thousand tonnes. Highest production is 17.40 t ha of Andhra Pradesh. Uttar Pradesh climate is good for okra that in total 22.64 thousand hectare and production is 303,05 thousand tonnes in 2018-19 **(NHB data, 2019)**

Application of organic manures alone (or) in combination with chemical fertilizers play a vital role in keeping the soil productivity high. The organic manure acts as a source of major and micronutrients, improves soil texture, increases water holding capacity, increases soil microbial activity, reduces phosphate fixing capacity of soil, helps in slow release of nitrogen and also reduces leaching losses and improves fertilizer use efficiency. The importance of integrated nutrient management in increasing and sustaining crop production has been amply documented

(Meelu, 1996). This study aimed to find out the effect of Organic and inorganic fertilizers on growth, yield and quality of okra.

MATERIALS AND METHODS

The experiment was conducted during kharif (Rainy) season at Horticulture Research Farm, Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology & Sciences, and PRAYAGRAJ (UP) during 2022.

The experiment was conducted on Okra *(Abelmoschus esculentus L.*) Var. F1 KOVI PLUS with thirteen treatment including control and three replications in Randomized Block Design. The result of the investigation concerning the effect of control release fertilizers on 13 treatments i.e. T0 NPK (UREA, SSP, MOP)- 100% (Control), T1 VERMI COMPOST- 100%, T2 POULTRY MANURE- 100%, T3 FYM- 100%, T4 NPK- 50% +VERMI COMPOST- 50%, T5 NPK- 50% +POULTRY MANURE- 50%, T6 NPK- 50% +FYM- 50%, T7 NPK- 75% +VERMI COMPOST- 25%, T8 NPK- 75% +POULTRY MANURE- 25%, T9 NPK- 75% +FYM- 25%, T10 NPK- 25% +VERMI COMPOST- 75%, T11 NPK- 25% +POULTRY MANURE- 75%, T12 NPK- 25% +FYM- 75%. To find out the best performance in terms of growth, yield and quality.

Prayagraj is situated at an elevation of 78 meters above sea level at 25.87 North latitude and 81.150 E longitudes. This region has a subtropical climate prevailing in the South-East part of U.P. with both the extremes in temperature, i.e., the winter and the summer. In cold winters, the temperature sometimes is as low as 20C in December – January and very hot summer with temperature reaching up to 500C in the months of May and June. During winter, frosts and during summer, hot scorching winds are also not uncommon. The average rainfall is around 1013.4 (cm) with maximum concentration during July to September months with occasional showers in winters.

RESULTS AND DISCUSSION

Growth Parameters

Plant height (cm) at 20, 40, and 60 DAS

The maximum plant height was recorded in T7 treatment (11.50, 69.17 and 118.73 cm) which is receiving 75% RDF + 25% vermicompost. This was followed by T8 treatment (10.63, 67.73 and 116.23 cm) which is receiving 75% RDF + 25% farmyard manure. The treatment receiving pure inorganic fertilizer i.e., T1 treatment recorded better results (9.27, 64.57 and 107.73 cm) compared to those receiving pure organic treatments, which recorded lower plant height of all the treatments T3 recorded minimum plant height (9.07, 53.03 and 95.57 cm). Similar findings were reported by **Lakera *et al.*, (2017).**

The findings give a clear indication that application of a combination of organic manure and inorganic fertilizers promoted plant height. This might be due to its positive role in increasing plant height in association with other essential elements.

Leaf Area (cm^2) at harvest time

The observation in term of Leaf Area (cm^2) at harvest time of Okra the results showed that maximum leaf area (cm^2) was recorded in T7 treatment (5124.88 cm^2) which is receiving 75% RDF + 25% vermicompost. This was followed by T8 treatment (4797.07 cm^2) which is receiving 75% RDF + 25% farmyard manure. The treatment receiving pure inorganic fertilizer i.e., T1 treatment recorded better results (2639.63 cm^2) compared to those receiving pure organic treatments, which recorded lower leaf area of all the treatments T3 recorded minimum leaf area (2318.09 cm^2). Similar findings were reported by **Yadav *et al.*, (2017)**

Vermicompost contained macro nutrients, trace elements, organic substances like amino acids and plant growth regulators. These organic fertilizers help in the growth and yield of the plant, such as Nitrogen provides green colour to the plant and enhances vegetative growth.

Number of Leaves $Plant^{-1}$ at 20, 40, and 60 DAS

The results showed that maximum Number of Leaves $Plant^{-1}$ was recorded in T7 treatment (6.53, 14.30 and 42.47 cm) which is receiving 75% RDF + 25% vermicompost. This was followed by T8 treatment (6.40, 14.23 and 41.03 cm) which is receiving 75% RDF + 25% farmyard manure. The treatment receiving pure inorganic fertilizer i.e., T1 treatment recorded better results (4.43, 12.33 and 33.53 cm) compared to those receiving pure organic treatments, which recorded lower Number of Leaves Plant-1 of all the treatments T3 recorded minimum Number of Leaves $Plant^{-1}$ (4.00, 9.73 and 28.87 cm). Similar findings were reported by **Singh et al., (2018).**

The findings give a clear indication that application of a combination of organic manure and inorganic fertilizers promoted plant height. This might be due to its positive role in increasing plant height in association with other essential elements. Vermicompost contained macro nutrients, trace elements, organic substances like amino acids and plant growth regulators. These organic fertilizers help in the growth and yield of the plant, such as Nitrogen provides green colour to the plant and enhances vegetative growth.

Number of Branches $Plant^{-1}$ at 20, 40, and 60 DAS

The maximum Number of Branches $Plant^{-1}$ was recorded in T7 treatment (1.88, 4.07 & 6.40) which is receiving 75% RDF + 25% vermicompost. This was followed by T8 treatment (1.70, 3.90 & 6.20) which is receiving 75% RDF + 25% farmyard manure. The treatment receiving pure inorganic fertilizer i.e., T1 treatment recorded better results (1.24, 3.30 & 5.17) compared to those receiving pure organic treatments, which recorded lower Number of branches Plant-1 of all the treatments T3 recorded minimum Number of Branches $Plant^{-1}$ (1.18, 2.63 & 4.23). Similar findings were reported by **Anburani A. and Manivannan K. (2002).**

Vermicompost contained macro nutrients, trace elements, organic substances like amino acids and plant growth regulators such as auxin, Indole acetic acid (IAA) and gibberellins. The growth and yield such as shoot length, number of leaves, number of branches number of fruits,

length of fruits, weight of fruits, photosynthetic pigment concentration such as chlorophyll 'a', chlorophyll 'b', total chlorophyll and carotenoids was found to be maximum at concentration of Vermicompost. These organic fertilizers help in the growth and yield of the plant, such as Nitrogen provides green colour to the plant and enhances vegetative growth.

Table 1. Various growth parameters of okra as influenced by different organic manure and inorganic fertilizer.

TREATMENT	TREATMENT COMBINATION	Plant Height			Number of leaves per plan			Leaf area (cm^2) at Harvest time	Number of Branches per plant		
		20 DAS	40 DAS	60 DAS	20 DAS	40 DAS	60 DAS		20 DAS	40 DAS	60 DAS
T0	NPK (UREA, SSP, MOP)- 100% (Control)	10.23	67.50	107.90	4.93	12.73	31.97	2388.55	1.35	3.10	5.50
T1	VERMI COMPOST- 100%	9.27	64.57	107.73	4.43	12.33	33.53	2639.63	1.24	3.30	5.17
T2	POULTRY MANURE- 100%	9.67	60.80	105	4.13	11.20	32.07	2561.16	1.20	3.20	4.83
T3	FYM- 100%	9.07	53.03	95.57	4.00	9.73	28.87	2318.09	1.18	2.63	4.23
T4	NPK- 50% +VERMI COMPOST- 50%	10.13	65.80	107.47	5.40	12.13	37.27	3870.27	1.62	3.40	5.60
T5	NPK- 50% +POULTRY MANURE- 50%	9.53	64.73	109.73	5.27	11.63	36.90	3766.51	1.55	3.23	5.50
T6	NPK- 50% +FYM- 50%	9.60	66.63	109.37	5.33	12.27	35.90	3673.40	1.27	3.07	5.43
T7	NPK- 75% +VERMI COMPOST- 25%	11.50	69.17	118.73	6.53	14.23	42.47	5124.88	1.88	4.07	6.40
T8	NPK- 75% +POULTRY MANURE- 25%	10.63	67.73	116.23	6.40	14.30	41.03	4797.07	1.70	3.90	6.20
T9	NPK- 75% +FYM- 25%	10.37	67.27	112.33	6.00	13.73	39.37	4348.05	1.41	3.73	6.17
T10	NPK- 25% +VERMI COMPOST- 75%	10.03	65.07	108.20	6.10	13.20	35.97	3416.11	1.44	3.10	5.37
T11	NPK- 25% +POULTRY MANURE- 75%	9.27	65.37	109.33	5.73	12.47	34.80	3183.39	1.45	2.97	5.27
T12	NPK- 25% +FYM- 75%	9.37	63.80	108.33	5.23	12.90	34.57	3042.10	1.43	3.00	5.27
F-Test		**S**	**S**	**S**	**S**	**S**	**S**	S	**S**	**S**	**S**
S. Ed. ±		**0.55**	**3.31**	**2.96**	**0.35**	**0.62**	**2.04**	**2.78**	**0.13**	**0.13**	**0.48**
CD at 5%		**1.13**	**6.84**	**6.10**	**0.71**	**1.28**	**4.21**	**5.75**	**0.27**	**0.64**	**0.99**
CV		**6.80**	**6.27**	**3.32**	**7.92**	**6.06**	**6.99**	**3.56**	**11.02**	**11.68**	**10.82**

Yield parameters

Number of fruits per plant

The results showed that highest number of fruits per plant were recorded with T7 treatment receiving 75% RDF + 25% vermicompost (18.73) followed by T8 treatment receiving 75% RDF + 25% FYM (18.20). T9 and T4 treatments recorded lesser number of fruits per plant. T3 treatment (FYM-100%) recorded minimum number of fruits per plant (14.27) compared to all other treatments. Similar results were also reported by **Rudra *et al.*, (2022)**

Application of a combination of organic manure and inorganic fertilizers promoted plant growth and yield such as shoot length, number of leaves, number of branches, number of fruits, length of fruits, weight of fruits.

Length of fruit (cm)

The results showed that highest Length of fruits (cm) were recorded with T7 treatment receiving 75% RDF + 25% vermicompost (12.10 cm) followed by T8 treatment receiving 75% RDF + 25% FYM (11.53 cm). T9 and T6 treatments recorded lesser length of fruits. T3 treatment (FYM-100%) recorded minimum length of fruits per plant (9.03 cm) compared to all other treatments. Similar results were also reported by **Yadav *at el.* (2017)** and **Kumar *et al.* (2018)**

Vermicompost contained macro nutrients, trace elements, organic substances like amino acids and plant growth regulators such as auxin, Indole acetic acid (IAA) and gibberellins. This combination organic manure and inorganic fertilizers help growth and yield such as shoot length, number of leaves, number of branches number of fruits, length of fruits, weight of fruits.

Weight of fruit (g)

The results showed that highest Weight of fruits (g) per fruit were recorded with T7 treatment receiving 75% RDF + 25% vermicompost (14.10 g) followed by T8 treatment receiving 75% RDF + 25% FYM (13.23 g). T9 and T6 treatments recorded lesser Weight of fruits (g) per fruit. T3 treatment (FYM-100%) recorded minimum Weight of fruits (9.77 g) per fruit compared to all other treatments. Similar results were also reported by **Ghosh *at el.* (2018)** and **Singh *et al.*, (2018)**

Application of a combination of organic manure and inorganic fertilizers promoted plant growth and yield such as shoot length, number of leaves, number of branches, number of fruits, length of fruits, weight of fruits.

Weight of fruit/plant (g)

The results showed that highest Weight of fruits/plant (g) per fruit were recorded with T7 treatment receiving 75% RDF + 25% vermicompost (264.18 g) followed by T8 treatment receiving 75% RDF + 25% FYM (241.59 g). T9 and T6 treatments recorded lesser Weight of fruits (g) per fruit. T3 treatment (FYM-100%) recorded minimum Weight of fruits (139.37 g) per fruit compared to all other treatments. Similar results were also reported by **Ghosh *et al.* (2018)**.

Vermicompost contained macro nutrients, trace elements, organic substances like amino acids and plant growth regulators such as auxin, Indole acetic acid (IAA) and gibberellins. These organic fertilizers help in the growth and yield of the plant, such as Nitrogen provides green colour to the plant and enhances vegetative growth, Phosphorus increases the plant's resistance to disease, cell formation and helps in root development.

Weight of fruit/plot (kg)

The results showed that highest Weight of fruit/plot (kg) were recorded with T7 treatment receiving 75% RDF + 25% vermicompost (2.38 kg) followed by T8 treatment receiving 75% RDF + 25% FYM (2.17 kg). T9 and T6 treatments recorded lesser Weight of fruit/plot (kg). T3 treatment (FYM-100%) recorded minimum Weight of fruits (1.25 kg) per plot compared to all other treatments. Similar results were also reported by **Singh *et al.* (2018)** and **Mishra *et al.* (2009)**

Yield (t/ha)

The results showed that highest Yield ha^{-1} were recorded with T7 treatment receiving 75% RDF + 25% vermicompost (19.57 t) followed by T8 treatment receiving 75% RDF + 25% FYM (17.82 t). T9 and T6 treatments recorded lesser Yield t/ha. T3 treatment (FYM-100%) recorded minimum Yield (10.32 t) per hector compared to all other treatments. Similar findings were reported by **Krishna *et al.*, (2002) and Davenda *et al.*, (2021).**

Vermicompost contained macro nutrients, trace elements, organic substances like amino acids and plant growth regulators such as auxin, Indole acetic acid (IAA) and gibberellins. These organic fertilizers help in the growth and yield of the plant, such as Nitrogen provides green colour to the plant and enhances vegetative growth, Phosphorus increases the plant's resistance to disease, cell formation and helps in root development and potassium provides disease resistance and makes drought tolerant plant and helps in making chlorophyll.

Table 2. Effect of different organic manure and inorganic fertilizer on yield parameters of okra

Treat-ment	TREATMENT COMBINATION	No. of Fruits/Plant	Aaverage fruit length(cm)	Aaverage fruit Weight(g)	Weight of fruit/plant (g)	Weight of fruit/plot (kg)	Yield (t/ha.)
T1	NPK (UREA, SSP, MOP)- 100% (Control)	15.07	10.08	11.94	179.91	1.62	13.33
T2	VERMI COMPOST- 100%	15.27	9.44	10.40	158.88	1.43	11.77
T3	POULTRY MANURE- 100%	14.90	9.32	9.83	146.47	1.32	10.85
T4	FYM- 100%	14.27	9.03	9.77	139.37	1.25	10.32
T5	NPK- 50% +VERMI COMPOST- 50%	16.07	10.50	12.13	194.86	1.75	14.43
T6	NPK- 50% +POULTRY MANURE- 50%	15.80	10.47	11.79	186.10	1.67	13.78
T7	NPK- 50% +FYM- 50%	16.00	11.03	11.36	181.58	1.63	13.45
T8	NPK- 75% +VERMI COMPOST- 25%	18.73	12.10	14.10	264.18	2.38	19.57
T9	NPK- 75% +POULTRY MANURE- 25%	18.20	11.53	13.23	241.59	2.17	17.82
T10	NPK- 75% +FYM- 25%	17.27	11.23	12.27	211.86	1.91	15.69
T11	NPK- 25% +VERMI COMPOST- 75%	15.87	10.16	11.81	187.37	1.69	13.88
T12	NPK- 25% +POULTRY MANURE- 75%	15.23	10.09	11.70	178.43	1.61	13.22
T13	NPK- 25% +FYM- 75%	15.20	10.34	11.61	176.44	1.59	13.07
F-Test		**S**	**S**	**S**	**S**	**S**	**S**
S. Ed. ±		**0.67**	**0.45**	**0.28**	**8.59**	**0.07**	**0.64**
CD at 5%		**1.38**	**0.93**	**0.58**	**17.73**	**0.16**	**1.31**
CV		**5.14**	**5.32**	**2.96**	**5.59**	**5.59**	**5.59**

Disease incidences and pest occurrence

No diseases were observed in the present experiment, however few insects viz. red cotton bugs were observed during last harvesting of okra fruits.

CONCLUSION

From the present investigation it is concluded that F1 Hybrid Covi Plus okra performed best in treatment T7- (75%RDF + 25% vermicompost) in terms of plant height (118.73) cm, No. of

branches (6.40), No. of leaves (42.47), Number of fruits per plant (18.73), Average Fruit length (12.10) cm, Average Fruit weight (14.10) g and yield (19.56 /ha).

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