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Research Article

Effect of Integrated Nutrient Management (INM) on Growth, Yield and Quality of Okra (*Abelmoschus esculentus* L.) cv. 'Arka Anamika'

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ABSTRACT

The present investigation was carried out at Agricultural Research Farm, Department of Horticulture, S.G.V.U., Jaipur (Rajasthan) to study the effect of INM on growth, yield and quality of Okra (Abelmoschus esculentus L.) cv. 'Arka Anamika' during Rabi season of the year 2022-23. The experiment was laid down in RBD which consisted 9 treatment combinations viz; Control (T_0), 100% RDF (T_1), 100% RDF + Vermicompost @5t/ha (T_2), 100% RDF + Poultry manure @2t/ha (T_3), 100% RDF + Neem cake @2t/ha (T_4), 50% RDF + Vermicompost @5t/ha (T_5), 50% RDF + Poultry Manure @2t/ha (T_6), 50% RDF + Neem cake @2t/ha (T_7), 50% RDF + Vermicompost @5t/ha + Poultry Manure @2t/ha + Neem cake @2t/ha (T_8) and treatments were replicated three times. Appraisal of the result indicated that the influence of organic and inorganic fertilizers on important parameters like vegetative growth, yield and quality of Okra were significantly influenced by INM under local agro climatic conditions. The treatment (T_8) had a significant effect on various vegetative growth, yield and quality parameters, and the results revealed that the maximum plant height plant height at 30, 60 and 90 DAS, leaves per plant, days taken to 50% flowering, flowers per plant, fruit length, fruit diameter, fruit per plant, fruit yield, TSS, Ascorbic acid and Titrable Acidity (%) were recorded in T_8. The minimum values of growth, yield and quality parameters were recorded in the control (T_0). Results further indicated that the highest (3.06) benefit: cost ratio was observed in T_8. Whereas, the lowest benefit: cost ratio (1.07) was recorded under control.

Keywords: *Vermicompost, Poultry Manure, Neem Cake.*

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INTRODUCTION

The okra (*Abelmoschus esculentus* L. Moench) is an important fruit vegetable crop and belongs to the family Malvaceae having somatic chromosome number of Okra 2n=130. Okra is an economically important vegetable crop grown in tropical and sub-tropical parts of the world. This crop is suitable for cultivation as a garden crop as well as on large commercial farms. It is called as Lady's finger in England, Gumbo in United State of America and Bhindi in India (Singh et al., 2020).

It is commonly used for its tender pods. The dried stems and roots of okra are used for clarification of sugarcane juice in gur or jiggery manufacture in India. Fully ripen fruits and stem containing crude fibre are used in the paper industry. It is a good source of vitamins A and B, Protein and minerals. It is also an excellent source of iodine and is useful for the treatment of goiter. Fruits are also dried of frozen for use during off-season. Dried fruit contain 13-22% edible oil and 20-24% protein and used for refined edible oil. Dry fruit skin and fibres are used in manufacture of paper, card board and fibres. The requirements of fertilizers in okra are important for the early growth and total production of fruit yield (Meena & Meena, 2018).

The existing strategy of integrated nutrient management concentrates on imparting technical expertise to key stakeholders with the aim of optimizing the utilization of organic and inorganic fertilizers in agriculture. Integrated nutrient management stands out as a crucial approach for minimizing the reliance on chemical fertilizers, incorporating organic materials like vermicompost, poultry manure and neem cake to rectify soil acidity and furnish essential micronutrients. The utilization of vermicompost, poultry manure, and neem cake, in conjunction with chemical fertilizers, results in an enhancement of soil organic carbon and the overall status of nitrogen, phosphorus, and potassium (NPK). Nevertheless, the augmentation of soil microbial growth is observed exclusively when employing organic manure alone or in tandem with inorganic fertilizers. The application of compost presents distinct advantages, including concentrated nutrient content, ease of application, and superior agronomic effects compared to crop residues or animal wastes. Achieving a high crop yield is feasible through the judicious combination of balanced NPK fertilizers and organic matter amendment.

Organic inputs help to increase the health of the soil, which in turn influences how nutrient-dense the harvested produce is. Okra produced with INM techniques might contain higher concentrations of vitamins, minerals, and other phytochemicals, improving its nutritional quality. By incorporating organic materials into INM techniques, synthetic fertilisers are decreased, lowering the possibility of nutrient imbalances and nutrient leaking into groundwater. This strategy encourages environmentally friendly agriculture and lessens the harm that excessive fertilizer use does to the environment. Overall, INM can support the sustainable production of okra by strengthening qualitative traits, enhancing growth, raising yield, and lowering environmental hazards. The precise results, however, may differ based on elements like soil type, climate, crop management techniques, and the precise combination and application rates of both organic and inorganic fertilizers.

MATERIALS AND METHODS

Field experiment was conducted at the experimental farm, Department of Horticulture, School of Agriculture, Suresh Gyan Vihar University, Jaipur (Rajasthan), during the summer season of 2023. The experiment was laid out in a randomized block design with three replications and 9 treatments. Treatment combinations were, T_0 (Control), T_1 (100% RDF), T_2 (100% RDF + 100 %Vermicompost @ 5 t/ha), T_3 (100% RDF + Poultry Manure @ 2t/ha.), T_4 (100% RDF + Neem cake @ 2t/ha), T_5 (50% RDF + Vermicompost @ 5t/ha), T_6 (100% RDF + Poultry Manure @ 2t/ha), T_7 (50% RDF + Neem cake @ 2t/ha), T_8 (50% RDF +

Vermicompost @ 5t/ha + Poultry Manure @ 2t/ha + Neem cake @ 2t/ha). The plot size was 1.8 × 1.2 m and spacing followed was 45 × 30 cm to keep 16 plants per plot for each treatment. The land was brought to a fine tilth through tillage and ploughing. Bunds and irrigation channels were maintained properly. The seeds were sown directly to the field. Light irrigation was given after sowing. All other recommended cultural practices were followed to raise the healthy crop. The observations were recorded in five randomly taken and tagged plants for each replication on morphological traits viz., plant height (cm), leaves per plant, days taken to 50% flowering, number of flowers per plant, fruit length (cm), fruit diameter (mm), Number of fruits per plant, yield per plant (gm), yield per plot (kg), yield per hectare (q) and economic parameters including BC ratio were determined by adopting standard procedures. The data based on the mean of individual plants selected for observations were statistically analysed as described by Panse and Sukhatme (1967).

RESULTS AND DISCUSSION

Growth attributing traits

The growth attributing traits viz, plant height, leaves per plant, days taken to 50% flowering, and flowers per plant were affected significantly due to the 50% RDF + Vermicompost @5t/ha + Poultry Manure @2t/ha + Neem cake @2t/ha (Table 1). The maximum plant height (38.15 cm), (85.64 cm) and (146.55 cm) at 30, 60 and 90 DAS, leaves per plant (25.74), days taken to 50% flowering (32.94 Days), number of flowers per plant (19.68) were recorded from (T_8), while the minimum plant height (28.49 cm), (67.45 cm) and (118.62 cm) at 30, 60 and 90 DAS, leaves per plant (12.27), days taken to 50% flowering (42.68 days), number of flowers per plant (11.44) was recorded were (T_0) control treatment. It is Possibly attributed to the absorption of moisture and nutrients from the soil, coupled with an elevation in auxin concentration resulting from heightened nitrogen levels, causing an upsurge in plant height. Similar results were reported by Singh et al. (2005), Meena and Meena (2018) and Miah et al. (2020) in okra.

Yield and yield attributing traits.

Results revealed that applying organic and inorganic nutrient sources in combination increased the yield attributes (Table 1). The yield and yield attributing traits were increased with RDF and Vermicompost alone and in combination. Application of 50% RDF + Vermicompost @5t/ha + Poultry manure @2t/ha+ Neem cake @2t/ha recorded significantly higher yield attributes viz Fruit length (13.71 cm), Fruit diameter (18.54 mm), number of fruits per plant (15.62), fruit yield per plant (260.20 gm), fruit yield per plot (4.16 kg), fruit yield per hectare (192.75 q/ha) followed by treatment 100% RDF + Vermicompost @5t/ha than other combination and significantly superior over control. The minimum yield attributes viz, Fruit length (9.52 cm), Fruit diameter (9.37 mm), number of fruits per plant (9.61), fruit yield per plant (126.34 gm), fruit yield per plot (2.02 kg), fruit yield per hectare (93.58 q/ha) were recorded in control. The increase in yield and yield attributing traits might be the solubilization effect of plant nutrients by adding RDF, vermicompost, poultry manure and neem cake as evidenced by increased uptake of N, P, K, Ca, Mg, etc. These results are in accordance with those reported by Bairwa et al. (2009), Tripathy and Maity (2009), Sharma et al. (2009), Sharma et al. (2014), Yadav et al. (2015), and Ballal and Kadam (2016).

Quality parameters

Random samples were collected at every picking to know the TSS %, ascorbic acid and acidity percentage content of okra pods (Table 2). Scrutiny of the results indicated that the treatment effects were found to be significant during the course of the investigation. The data showed that 'Arka Anamika' responded well to the combined application of inorganic fertilizer with organic manure in terms of TSS% (2.37˚Brix), acidity (0.13%) and ascorbic acid (18.07 mg/100g) content in pod were recorded maximum in the treatment T_8 (50% RDF + Vermicompost @5t/ha + Poultry manure @2t/ha + Neem cake @2t/ha)

followed by (2.15˚Brix), (0.14%) and (17.43 mg/100g) in the treatment T_2 (100% RDF + Vermicompost @5t/ha), Whereas, the minimum TSS% (1.3˚Brix), acidity (0.31%) and ascorbic acid (14.43 mg/100g) was recorded in T_0 (Control). The increase in vitamin C content with organic manures might be due to the physiological influence of vermicompost and Neem cake and poultry manure on the activity of a number of enzymes. The results were supported by the findings of Patil et al. (2004), Meena et al. (2019) and Amiry et al. (2018) in okra.

Gross income

It is declared from the data procured that a significantly highest fruit yield of 192.75 q/ha was procured in okra treatment T_8 with net return of Rs 188822.43 and cost benefit ratio 3.06 followed by T_2 were noted 170.42 q/ha fruit yield along with net return of Rs 159056.08 and cost benefit ratio 2.55 However, the minimum fruit yield 93.58 q/ha were noted in T_0 with net return of Rs 62945.83 and cost benefit ratio 1.07. Similar findings have been reported by Dar Rukhsara et al. (2010), Firoz (2009), Singh et al. (2014) and Singh et al. (2018) in okra.

Table1. Effect of organic and inorganic fertilizers on growth and yield parameters of the Okra

Treatment Combination		Plant height (cm)			Leaves per plant (cm)	Days taken to 50% flowering	Number of flowers per plant	Fruit length (cm)	Fruit diameter (mm)	Number of fruits per plant	Fruit yield per plant (gm)	Fruit yield per plot (kg)	Fruit yield per hectare (q)
		30 DAS	60 DAS	90 DAS									
T_0	Control	28.49	67.45	118.62	12.27	42.68	11.44	9.52	9.37	9.61	126.34	2.02	93.58
T_1	100% RDF	30.70	68.36	120.53	13.12	40.83	12.45	9.71	10.03	10.64	137.26	2.20	101.68
T_2	100% RDF + Vermicompost @5t/ha	35.10	84.35	144.02	22.26	35.17	17.56	12.05	16.40	14.48	230.06	3.68	170.42
T_3	100% RDF + Poultry manure @2t/ha	33.22	80.45	141.52	18.22	35.82	15.42	11.09	15.43	13.19	217.63	3.48	161.21
T_4	100% RDF + Neem cake @2t/ha	34.92	82.70	142.71	19.05	36.79	14.50	11.76	14.68	12.43	195.79	3.13	145.03
T_5	50% RDF + Vermicompost @5t/ha	31.79	74.65	132.49	15.36	37.97	13.20	10.86	11.17	11.97	173.83	2.78	128.76
T_6	50% RDF + Poultry manure @2t/ha	30.78	70.02	128.04	14.79	38.54	12.15	10.62	10.37	11.91	153.23	2.45	113.50
T_7	50% RDF + Neem cake @2t/ha	32.33	75.98	135.62	16.90	37.15	14.87	10.79	13.47	12.21	176.36	2.82	130.64
T_8	50% RDF + Vermicompost @5t/ha + Poultry manure @2t/ha + Neem cake @2t/ha	38.15	85.64	146.55	25.74	32.94	19.68	13.71	18.54	15.62	260.20	4.16	192.75
CD $_{0.05}$		4.49	7.43	12.01	2.25	3.49	2.07	2.48	1.97	1.80	16.42	0.08	12.16
SE (m±)		1.48	2.46	3.97	0.77	1.15	0.68	0.82	0.65	0.59	5.43	0.26	4.02

Table2. Effect of organic and inorganic fertilizers on quality parameters of the Okra

Treatment Combination		TSS (^{0}Brix)	Ascorbic acid (mg/100g)	Titrable Acidity (%)	BC Ratio
T_0	Control	1.3	14.43	0.31	1.07
T_1	100% RDF	1.38	14.53	0.29	1.14
T_2	100% RDF + Vermicompost @5t/ha	2.15	17.43	0.14	2.55
T_3	100% RDF + Poultry manure @2t/ha	2.03	16.24	0.17	2.34
T_4	100% RDF + Neem cake @2t/ha	2.00	15.53	0.18	2.1
T_5	50% RDF + Vermicompost @5t/ha	1.56	15.58	0.24	1.73
T_6	50% RDF + Poultry manure @2t/ha	1.41	14.61	0.26	1.41
T_7	50% RDF + Neem cake @2t/ha	1.65	15.18	0.21	1.81
T_8	50% RDF + Vermicompost @5t/ha + Poultry manure @2t/ha+ Neem cake @2t/ha	2.37	18.07	0.13	3.06
CD $_{0.05}$		0.711	1.92	0.027	
SE (m±)		0.235	0.63	0.081	

CONCLUSION

The overall results obtained from this present investigation clearly revealed that the application of (50% RDF + vermicompost @5t/ha + Poultry manure @2t/ha + Neem cake @2t/ha) significantly a significant effect on various vegetative growth, yield and quality parameters and the results revealed that the maximum plant height plant height at 30, 60 and 90 DAS, leaves per plant, days taken to 50% flowering, flowers per plant, fruit length, fruit diameter, fruit per plant, fruit yield, TSS, Ascorbic acid and Titrable Acidity (%) performed better response of growth, yield and quality traits in okra under Jaipur condition.

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There is no such evidence of conflict of interest.

Author Contribution
All authors have participated in critically revising of the entire manuscript and approval of the final manuscript.

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