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Influence of Integrated Nutrient Management on Growth, Yield and Yield Attributes of Okra (*Abelmoschus esculentus* (L). Moench.) C. V. Arka Anamika under Drip Irrigation

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ABSTRACT

A field experiment was conducted to study the effect of integrated nutrient management on growth, yield and yield attributes of okra (Abelmoschus esculentus (L). Moench.) Cv. Arka Anamika under drip irrigation at College of Horticulture, UHS Campus, GKVK Post, Bengaluru. The experiment was laid out in Randomized Complete Block Design with Nine treatments and Three replications. The results revealed that the highest plant height (132.17 cm), number of leaves (28.30), stem girth (4.76 cm), number of nodes per plant (15.38), number of fruits per plant (21.17), fruit length (22.55), fruit girth (6.50 cm) fruit weight (28.34 g), fruit yield per plant (460.22 g), fruit yield per plot (19.32 kg), total yield per hectare (17.03 t/ha) and lowest number of days taken first flowering (26.09), and days taken for 50% flowering (42.72), was highest in T_9 - 50 % RDF + 25 % Nitrogen through vermicompost + 25% N through neemcake + Panchagavya + 5% cow urine at 30 and 40 days after seed sowing.

Key words: *Okra, nutrient, growth, yield, Arka Anamika*

INTRODUCTION

Okra (*Abelmoschus esculentus* (L). Moench.) is one of the important summer vegetable grown widely in tropical and subtropical regions for its tender pods. India ranks first in the world with a production of 3.5 million tons (70 % of the total world production) from an area of 0.35 million hectares. In Karnataka, it is cultivated in an area of about 0.14 million hectares with a production 0.75 million tons with an average productivity of 8.24 tons/hectare[1]. It is commonly known as lady's finger or bhindi, belongs to the family Malvaceae. It is widely adopted vegetable in Indian kitchens and can be grown round the year. Besides the utility of its tender green fingers as a vegetable, it is used in the preparation of soups and curries.

Continuous application of heavy doses of chemical fertilizers without organic manures or bio fertilizers has lead to a deterioration of soil health in terms of physical and chemical properties of soil, declining of soil microbial activities, reduction in soil humus, increased pollution of soil, water and air.

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Chemical fertilizers are not only in limited supply but also expensive in developing countries like India. Integrated supply of nutrients through organic, inorganic and bio fertilizers are the need of the hour for sustainable productivity and to maintain better soil health[4]. The substitution of nitrogen by biogas spent slurry at 25 per cent level has increased chilli pod yield by 47 per cent and prolonged the rhizosphere microbial activity. The beneficial microorganisms like Azotobacter and VAM fungi found to be active till the harvest of the crop[4].

The beneficial effects of combined application of chemical fertilizers with organic manures *viz.*, farm yard manure, compost, vermicompost, poultry manure, bio fertilizers and many more of such materials are universally known. A balanced application of both organic and inorganic fertilizers with bio fertilizers appears to be an ideal proposition to meet nutrient requirements for most of the horticultural crops. Adoption of integrated nutrient management practices in okra is more essential to realize higher yield, quality and returns.

MATERIAL AND METHODS

The experiment was conducted at Vegetable Science Research Block, College of Horticulture, UHS campus, Bengaluru during *kharif* 2016. The soil of the experimental area is red sandy loam having good physical and chemical properties and PH of the soil was 6.65. This experiment was undertaken to find out the best nutrient sources to obtain good growth, yield and yield attributes in okra. The design followed was RCBD (Randomized Complete Block Design) with nine treatments and three replications. The treatments included under the study were, T_1 – 100 % RDF (125: 75: 63 NPK kg/ha + FYM 25 t/ha), Control, T_2– 50% RDF + 50% Nitrogen through vermicompost + vegetable special at 30 and 40 day after seed sowing, T_3– 50 % RDF + 50% Nitrogen through neemcake + vegetable special at 30 and 40 days after seed sowing, T_4– 50% RDF + 25% nitrogen through neemcake + 25% nitrogen through vermicompost, T_5– 75% RDF + 25% nitrogen through vermicompost, T_6– 75% RDF + 25% nitrogen through neemcake, T_7– 50% RDF + 50% nitrogen through vermicompost + Panchagavya at 30 and 40 days after seed sowing, T_8– 50% RDF + 50% nitrogen through neemcake + 5% cow urine at 30 and 40 days after seed sowing, T_9– 50% RDF + 25% nitrogen through vermicompost + 25% N through neemcake + Panchagavya + 5% cow urine at 30 and 40 days after seed sowing. The crop was raised a spacing of 60 cm x 45 cm. Standard cultural practices recommended for okra was followed uniformly for all the treatments.

RESULTS AND DISCUSSION

Growth parameters

Growth attributes were differed significantly by different treatments (Table 1). The perusal of result indicated that okra plants fertilized with the application of 50% RDF +25% Nitrogen through vermicompost + 25% Nitrogen through neemcake + Panchagavya + 5% cow urine @ 30 and 40 days after sowing (T_9) recorded highest plant height (132.17 cm), number of leaves per plant (28.30), stem girth (4.76 cm), number of nodes per plant (15.38), days taken first of flowering (26.09), and days taken 50 % of flowering (42.72). This was followed by the treatment comprising 50% nitrogen through neemcake + 5% cow urine @ 30 and 40 days after sowing (T_8). The beneficial effect of application of organic manures along with inorganic manures reflected in enhanced growth of the plant. This may be attributed to the synergistic effect of organic manures in making available more plant nutrients by improving the soil physical and chemical conditions and solublizing the nutrients. The increased in growth may also be due to readily available N from inorganic fertilizers which would be responsible for promoting better plant height[5,9,11] in bhendi. Nitrogen is a very important constituent of protoplasm and its favourable effect on chlorophyll content of leaves might have increased the synthesis of carbohydrates, amino acids etc., from which the

phytohormones such as auxins, gibberellins, cytokinins and ethylene have been synthesized resulting in increased plant height[2,8]. Moreover, the organic manures are also significant sources of major and micronutrients which are much needed by the plants[6]. The lowest vegetative growth was recorded with control. Days to 50 per cent flowering shows significant superiority over control might be due to increased photosynthetic activity and uptake of food nutrients resulting in early flowering[5,10] in bhindi. The earliness in inorganic fertilized treatments may be attributed to quick release of nutrients to the soil and quick uptake by the plants resulting better vegetative growth, flowering and fruiting as compared to combined application of inorganic and organic manures[3].

Yield and yield attributes

Various treatments significantly altered most of fruit attributing parameters (Table 2). Maximum number of fruits per plant (21.17), maximum fruit length (23.55 cm), maximum fruit girth (6.50 cm), maximum fruit weight (28.34 g), maximum fruit yield per plant (460.22 g), maximum fruit yield per plot (19.32 kg/ha) and total yield per hectare (17.03 t/ha) was recorded with application of 50% RDF +25% Nitrogen through vermicompost + 25% Nitrogen through neemcake + Panchagavya + 5% cow urine @ 30 and 40 days after sowing, (T_9). Followed by 50% RDF + 50% nitrogen through neemcake + 5% cow urine at 30 and 40 days after seed sowing (T_8). The treatments which received complete organic manures recorded lesser yield compared to pure inorganic and combination of organic and inorganic fertilizers. The superiority in yield and yield attributes with the application of fertilizers over control is mainly attributed to the increased photosynthetic activity and uptake of food nutrients, resulting in significantly longer and wider fruits[10]. The significantly highest yield in inorganic fertilized plots may be due to early vegetative growth, earliness in flowering and fruiting as well as individual fruit weight[3]. Higher yield in response to organic manures is ascribed to improvement in physical and biological properties of the soil which may result in better supply of nutrients to plants which will lead to good crop growth and yield[7].

Table 1: Effect of integrated nutrient management on growth and flowering characters of okra (Cv. Arka Anamika)

Treatments	Plant height (cm)	Number of leaves plant^{-1}	Stem girth (cm)	Number of nodes plant^{-1}	Days taken to first of flowering	Days taken to 50 % of flowering
T_1 (100 % RDF (125: 75: 63 NPK kg/ha + FYM 25 t/ha), Control)	123.36	19.62	4.22	9.29	39.48	52.11
T_2 (50% RDF +50% Nitrogen through Vermicompost+ Vegetable special at 30 and 40 DAS)	126.45	24.93	4.49	12.78	32.17	46.56
T_3 (50% RDF + 50% Nitrogen through Neemcake + Vegetable Special at 30 and 40 DAS)	125.78	23.27	4.44	12.07	33.79	47.61
T_4 (50% RDF + 25% Nitrogen through neemcake + 25% N through Vermicompost)	125.11	22.07	4.36	11.52	34.91	48.68
T_5 (75% RDF + 25% Nitrogen through Vermicompost)	124.45	20.80	4.34	10.48	35.88	49.83
T_6 (75% RDF + 25% Nitrogen through Neemcake)	123.85	19.00	4.31	9.78	36.85	50.80
T_7 (T_7 - 50% RDF + 50% Nitrogen through Vermicompost + Panchagavya at 30 and 40 DAS)	127.13	26.41	4.63	13.85	29.64	45.566
T_8 (50% RDF + 50% Nitrogen through Neemcake + 5% cow urine at 30 and 40 DAS)	130.49	27.38	4.68	14.68	28.02	44.41
T_9 (50% RDF + 25% Nitrogen through Vermicompost + 25% N through Neemcake + Panchagavya + 5% cow urine at 30 and 40 DAS)	132.17	28.30	4.76	15.38	26.09	42.72
SEm±	**0.55**	**0.22**	**0.05**	**0.15**	**0.20**	**0.20**
CD at 5%	**2.27**	**0.65**	**0.16**	**0.45**	**0.61**	**0.61**

Table 2: Effect of integrated nutrient managment on fruit yield and yield attributes of okra (Cv. Arka Anamika)

Treatments	No. of fruits per plant	Fruit length (cm)	Fruit girth (cm)	Fruit weight (g)	Yield per plant (g)	Yield per plot (kg)	Total yield (t/ha)
T_1 (100 % RDF (125: 75: 63 NPK kg/ha + FYM 25 t/ha), Control)	11.71	15.74	4.10	20.59	191.12	8.02	7.07
T_2 (50% RDF +50% Nitrogen through Vermicompost+ Vegetable special at 30 and 40 DAS)	16.48	19.65	5.56	25.55	321.24	13.49	11.88
T_3 (50% RDF + 50% Nitrogen through Neemcake + Vegetable Special at 30 and 40 DAS)	15.92	18.80	5.20	24.35	296.83	12.46	10.98
T_4 (50% RDF + 25% Nitrogen through neemcake + 25% N through Vermicompost)	15.14	17.93	4.87	23.45	272.11	11.42	10.06
T_5 (75% RDF + 25% Nitrogen through Vermicompost)	14.13	17.09	4.63	22.37	243.96	10.24	9.02
T_6 (75% RDF + 25% Nitrogen through Neemcake)	13.41	16.46	4.39	21.23	237.74	9.98	8.79
T_7 (T_7 - 50% RDF + 50% Nitrogen through Vermicompost + Panchagavya at 30 and 40 DAS)	17.5	21.50	5.79	26.50	352.96	14.82	13.06
T_8 (50% RDF + 50% Nitrogen through Neemcake + 5% cow urine at 30 and 40 DAS)	18.98	22.43	6.02	27.50	397.8	16.70	14.72
T_9 (50% RDF + 25% Nitrogen through Vermicompost + 25% N through Neemcake + Panchagavya + 5% cow urine at 30 and 40 DAS)	21.17	23.55	6.50	28.34	460.22	19.32	17.03
SEm±	**0.96**	**0.12**	**0.04**	**0.08**	**0.13**	**0.59**	**0.15**
CD at 5%	**2.86**	**0.35**	**0.13**	**0.25**	**0.40**	**1.76**	**0.43**

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