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Effect of Different Organic Nutrient Sources on Growth, Yield and Quality of Okra (*Abelmoschus Esculentus* L.)

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ABSTRACT

Organic nutrient sources namely New Suryamin, Aishwarya, EM compost and Urban compost were evaluated in combination with inorganic fertilizers on plant growth, yield and quality of okra (bhendi) during *kharif*, 2011 at College Farm, ANGRAU, Rajendranagar. The treatments consisted of T_1 (control), T_2 (Inorganic NPK-100%RDF), T_3 (New Suryamin @ 50 kg ha^{-1}), T_4 (New Suryamin @ 25 kg ha^{-1} + 50% RDF), T_5 (Aishwarya @ 120 kg ha^{-1}), T_6 (Aishwarya @ 60 kg ha^{-1} + 50% RDF), T_7 (EM compost @ 5 t ha^{-1}), T_8 (EM compost @ 2.5 t ha^{-1} + 50% RDF), T_9 (Urban Compost @ 5 t ha^{-1}) and T_{10} (Urban Compost @ 2.5 t ha^{-1} + 50% RDF). Plant growth in terms of plant height, leaf area and dry matter production; fruit yield and quality in terms of ascorbic acid were studied. Initially, at vegetative phase Aishwarya @ 60 kg ha^{-1} + 50% RDF and later at fruiting stage EM compost @ 2.5 t ha^{-1} + 50% RDF combinations recorded highest values of plant height and leaf area. EM compost @ 2.5 t ha^{-1} + 50% RDF combination performed best recording highest values of drymatter, yield (5.7 t ha^{-1}) and ascorbic acid (13.67 mg per 100 g).

Key words : Organic nutrient sources, Okra, Quality, Yield.

Okra (*Abelmoschus esculentus* L.) is an annual herb and vegetable crop grown throughout the tropical and subtropical parts of the world. Okra plays an important role in the human diet by supplying carbohydrate, protein, fats, minerals and vitamins that are usually deficient in the staple food. Despite the nutritional value of okra, its optimum yield and quality have not been attained in the tropical countries partly because of a continued decline in soil fertility. Making all the nutrient elements available is one of the most important factors for exploiting the yield potential and quality fruits as the imbalanced use of nutrients through chemical fertilizer application alone leads to deficiencies. Palm *et al*., (1997) gave the importance of organic and inorganic fertilizers as essential tools in okra production. Organic waste from different sources helps in boosting vegetable crop growth and yield as they contain most of the nutrients essential for plant growth.

MATERIAL AND METHODS

A field experiment was conducted in the College Farm, College of Agriculture, Rajendranagar during *kharif,* 2011 with ten treatments replicated thrice in RBD. The treatments consisted of T_1 (control), T_2 (Inorganic NPK - 100% RDF-120-60-60), T_3 (New Suryamin @ 50 kg ha^{-1}), T_4 (New Suryamin @ 25 kg ha^{-1} + 50% RDF), T_5 (Aishwarya @ 120 kg ha^{-1}), T_6 (Aishwarya @ 60 kg ha^{-1} + 50% RDF), T_7 (EM compost @ 5 t ha^{-1}), T_8 (EM compost @ 2.5 t ha^{-1} + 50% RDF), T_9 (Urban Compost @ 5 t ha^{-1}) and T_{10} (Urban Compost @ 2.5 t ha^{-1} + 50% RDF). Inorganic N, P and K were supplied through urea, single super phosphate and muriate of potash, respectively.

Organic and inorganic nutrient sources were applied as per the treatments. Plant growth in terms of plant height, leaf area and drymatter production was recorded at vegetative phase (45 DAS) and fruiting stage (90 DAS) on 5 plants sampled from each plot. Chlorophyll content was recorded at vegetative stage on intact leaves with SPAD-502 meter. Number of fruits and fruit weight per plant were recorded in all the 15 pickings and cumulative values are shown in results. Fresh fruit samples at 90DAS were analyzed for ascorbic acid

content. The results of present study were subjected for statistical analysis as per the procedures outlined by Snedecor and Cochran (1967).

RESULTS AND DISCUSSION

Data recorded at 45 and 90 DAS is given in tables 1 and 2 and discussed below.

Plant height:

At vegetative stage (45 DAS), the highest plant height was recorded in T_6 plots (Aishwarya + 50% Inorganic NPK), followed by T_8 (EM compost + 50% Inorganic NPK) and lowest was recorded in T_1 (control) as shown in table 1. Whereas, at fruiting stage taller plants were observed with EM compost + Inorganic NPK combination compared to T_{10} (Aishwarya + Inorganics NPK). Organic sources alone did not show any significant effect compared to 100%RDF throughout the crop growth period. However, application of organic sources in combination with inorganic NPK recorded significantly higher values compared to inorganic sources alone.

Leaf Area:

Leaf area at both 45 and 90 DAS was significantly affected by the treatments (Table 1), initially highest was recorded in T_6 (Aishwarya + 50% Inorganic NPK) and later (90 DAS) in T_8 (EM compost + 50% Inorganic NPK). Combination of organic and inorganic nutrient sources performed better over each alone.

Chlorophyll content:

Chlorophyll content was measured with SPAD-502 meter on intact leaves of okra at vegetative (45 DAS) stage only (Table 1). The data indicated that addition of fertilizers either organic or inorganic recorded higher SPAD values over control. Organics in combination with inorganic NPK recorded higher SPAD units over organics alone, but the effect was not significant. Vani Anusha (2011) reported similar non significant effect of New Suryamin and Aishwarya in tomato.

Dry matter production:

Dry matter production reported in terms of kg ha^{-1} at 45 and 90 DAS of okra crop is presented in table 2. The effect of different treatments on dry matter production was significant at both the stages. At both the stages there was increase in dry matter production in the treatments with organics alone and also in the treatments with combined use of organic and inorganic sources when compared with T_2 (Inorganic NPK). At 90 DAS, an increase of 15 and 22.5% was recorded by the application of New Suryamin (T_3) and Urban compost (T_9) respectively over application of inorganic sources alone, T_2. The dry matter production was increased by 4.0 to 11.1% when reduced doses of organic fertilizers/manures were applied in combination with 50% RDF (inorganic NPK) compared to organic sources alone in doubled doses. Mahmoud *et al.* (2009) recorded highest shoot dry weight of cucumber in the treatment with combination of '75% mineral N + 25% organic N supplied by animal compost'.

Fruit Yield

Number of fruits per plant:

Number of fruits per plant counted over 15 pickings is presented in table 2. The highest number of fruits per plant (9.6) was found in T_4 (New suryamin + Inorganic NPK) and T_8 (EM compost + Inorganic NPK). This was followed by treatment T_{10} (Urban compost + Inorganic NPK) and lowest was recorded by T_1 (control). EM compost and New Suryamin when applied in combination with inorganic NPK resulted in significantly higher number of fruits per plant compared to either organics or inorganics alone. Olaniyi *et al.* (2010) reported that the highest value of number of fruits per plant of okra was recorded when 3 t ha^{-1} of organo mineral fertilizers were applied in combination with NPK @ 150kg ha^{-1}.

Fruit weight:

The highest yield was obtained by the treatment where in all nutrients were supplied through EM compost 2.5 t ha^{-1} + 50% RDF (T_8) which recorded 5.7 t ha^{-1} followed by T_4 (New suryamin + Inorganic NPK) and T_{10} (Urban compost + Inorganic NPK). The yield recorded by T_5 (Aishwarya alone) and T_6 (Aishwarya + Inorganic NPK) were statistically on par with T_2 (Inorganic NPK). Any organic source either alone or in combination with inorganic NPK recorded higher yield over inorganic NPK (Table 2). The

Table 1. Effect of organic nutrient sources on plant hight, leaf area and chlorophyll content.

Treatments		Plant height (cm)		Leaf area (cm^2)		Chlorophyll content (SPAD units)
		At 45 DAS	At 90 DAS	At 45 DAS	At 90 DAS	At 45 DAS
T_1	Soil alone	37.9	50.1	253	621	42.25
T_2	Inorganic NPK (100% RDF)	39.3	54.2	258	641	42.34
T_3	New Suryamin	41.2	57.9	277	670	43.54
T_4	New Suryamin + 50% RDF	43.3	62.3	294	701	44.78
T_5	Aishwarya	42.2	56.2	278	666	43.50
T_6	Aishwarya + 50% RDF	45.3	61.7	350	693	44.27
T_7	EM compost	40.3	58.1	293	699	44.22
T_8	EM compost + 50% RDF	44.1	65.3	314	746	46.20
T_9	Urban compost	41.7	55.0	283	687	44.17
T_{10}	Urban compost + 50% RDF	43.5	63.8	301	715	45.79
	CD (5%)	4.1	5.3	41	68	NS

Table 2. Effect of organic nutrient sources on drymatter production, fruit yield and quality of okra.

Treatments	Dry matter (kg ha^{-1})		No. of fruits per plant	Fruit Yield (t ha^{-1})	Ascorbic acid (mg per 100g sample)
	At 45 DAS	At 90 DAS	Upto 90 DAS		At 90 DAS
T_1 Soil alone	123	639	7.7	4.02	8.3
T_2 Inorganic NPK (100% RDF)	126	666	8.3	4.33	9.67
T_3 New Suryamin	128	766	8.5	4.85	10.98
T_4 New suryamin + 50% RDF	130	820	9.6	5.34	11.66
T_5 Aishwarya	128	668	8.5	4.33	10.10
T_6 Aishwarya + 50% RDF	136	724	9.0	4.59	10.53
T_7 EM compost	132	782	8.8	5.04	11.66
T_8 EM compost + 50% RDF	136	869	9.6	5.73	13.67
T_9 Urban compost	131	815	8.7	5.24	11.66
T_{10} Urban compost + 50% RDF	135	848	9.3	5.35	12.56
CD (5%)	8	78	0.7	0.61	1.23

treatment where only inorganic NPK was used recorded 4.3 t ha^{-1} which was increased by 1.4 t ha^{-1} by the addition of EM compost as in T_8 (EM compost + Inorganic NPK) and a further increase by 1.0 t ha^{-1} by the addition of Urban compost as in T_{10} (Urban compost + Inorganic NPK). However, the effect of different treatments on the yield of okra was significant. Abd El-Kader *et al.* (2010) reported that okra plant growth and yield were greater in drip irrigation with chicken manure as compared to plant residues.

Fruit Quality:

Ascorbic acid content (mg per 100g) of the pods of okra measured during fruiting stage (90 DAS) is presented in Table 2. The highest mean ascorbic acid content of 13.67 was recorded by T_8 (EM compost + Inorganic NPK). The effect of different organic nutrient sources on the ascorbic acid content of the fruit was significant. There was a significant increase by 20.6% (1.99 mg per 100g) in the treatment with EM compost (T_7) over the treatment with inorganic NPK (T_2) and also showed a significant increase by 17.2% (2.01 mg per 100 g) when treated in combination with inorganic NPK. Olayini *et al.* (2010) reported that highest ascorbic acid content was recorded in the treatment with the combination of 75 kg NPK ha^{-1} + 3 t ha^{-1} of organomineral fertiliser.

Thus it can be concluded that the organic inputs tested in this experiment performed well compared to the inorganic fertilizers in terms of dry matter, fruit yield and quality of okra. This study confirmed that EM compost @ 2.5 t ha^{-1} in combination with 50% RDF through inorganics (T_8) performed the best with respect to growth, yield and quality among all the organic and inorganic combinations studied.

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