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Role of Organic Manures, Nitrogen and Phosphorous on Growth and Seed Yield of Okra (*Abelmoschus esculentus* L. Moench)

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ABSTRACT

A study was done to find out the effect of Organic manures on growth and seed yield of Okra cv Gujarat Okra-2 during kharif season of the year 2010 and 2011 at the Horticultural Research Farm, Department of Horticulture, B. A. College of Agriculture, Anand Agricultural University, Anand. The experiment was laid out Randomized Block design (Factorial) with eighteen treatment combination and three replications. The results revealed that an application of organic manure i.e vermin compost 5 t/ha recorded significantly the highest plant height at 30 and 60 DAS, number of leaves plant^{-1} at 60 and 90 DAS and total dry weight at 30, 60 and 90 DAS and seed yield. An Application of 100 kg N ha^{-1} recorded significantly higher plant height at 30 and 60 DAS, number of leaves plant^{-1} at 30 and 60 DAS and total dry weight at 60 DAS, while same treatment recorded significantly the highest number of leaves plant^{-1} at 90 DAS and total dry weight at 30 DAS. Application of 50 kg P_2O_5 ha^{-1} to okra crop showed significantly the highest plant height at 90 DAS and total dry weight at 30 and 60 DAS and significantly higher plant height, number of leaves plant^{-1} at 30 DAS and total dry weight at 90 DAS. Application of vermin compost 5 t/ha with 100 kg nitrogen ha^{-1} and 50 kg P_2O_5 ha^{-1} recorded significantly the highest okra seed yield.

Key words: *Abelmoschus esculentus, vermin compost, FYM, Phosphorus, Nitrogen.*

INTRODUCTION

Okra (*Abelmoschus esculentus* L.) is an annual herbaceous plant, native of tropical Africa commonly known as *bhendi* or lady's finger in India. It is an oligo purpose crop, but it is usually consumed for its green tender fruits as a vegetable in a variety of ways throughout India. These fruits are rich in vitamins C (30 mg/100 g), calcium (90 mg/100g), potassium and other mineral matters and Okra is also known for being high in antioxidants. Okra is one of the important vegetable crops of Gujarat, covering an area of 54,500 hectares with a production of 5, 92,500 MT tones with productivity of 10.9 MT ha^{-1}. Organic manures and chemical fertilizers, both play an important role in growth and development of crop plants. Significance of organic manures has increased drastically with the onset of "Organic Revolution" in recent years.

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Nitrogen is important in the vegetative phase while Phosphorous is required for proper root growth. A deficiency of Phosphorous will cause double damage in plant, first by way of reduced root growth and secondly dwindled absorption of other nutrients as most nutrients are absorbed by the plant through a healthy root system. Okra is one of the major vegetable crops grown in India particularly in states like Uttar Pradesh, Bihar, Orissa, West Bengal, Andhra Pradesh, Karnataka and Assam and Gujarat. Any deficiency in nutrition of this crop makes a two way loss to the society, first in terms of decreased yield, hence reduced income to the farmers and secondly, the deficiency is also expressed in human beings who consume such vegetables and hence may suffer deficiency diseases. Hence, nutrition studies in Okra hold immense importance.

MATERIAL AND METHODS

The field experiment was conducted during *kharif* season of the year 2010 and 2011 at the Horticultural Research Farm, Department of Horticulture, B. A. College of Agriculture, Anand Agricultural University, Anand. The treatments consisted of 20 t/ha FYM and 5 t/ha Vermi comost with three levels of Nitrogen (80, 100 and 120 Kg/ha) and three levels of Phosphorous (25, 50 and 75 Kg/ha) in various combinations. Randomized Block Design with factorial concept was adopted 18 treatments and three replications. Except nutrition, the crop was raised with recommended agronomical package of practices adopted for successful crop production.

Plant height (cm)

Five plants were randomly selected and tagged for easy recognition and observations in each net experimental plot. The height was measured in centimeter at 30, 60, 90 DAS and at harvest from ground level to the upper most leaf. The mean plant height was worked out and recorded separately for each treatment.

Number of leaves plant^{-1}

Number of leaves plant^{-1} was counted at 30, 60, 90 DAS and at harvest from previously randomly selected tagged five plants and mean values of leaves plant^{-1} was worked out and recorded separately and used for statistical analysis.

Total dry weight of plant (leaf, shoot and root) (g)

For recording dry weight of plant five tagged plant from each net plot were uprooted and air dried for two to three days under sun and finally in the forced air oven at 60 ± 5^0 C till constant weight. Finally, average dry weight per plant was worked out.

Leaf area (cm^2)

Leaf area represents the total photosynthesizing surface of the plant. For calculation of leaf area, plant were uprooted from border row at 60, 90 DAS and at harvest from each net plot. Leaf area of five plants was recorded with the help of a leaf area meter (Li. Co. Inc.; Model, 3100) in the laboratory of Main Vegetable Research Station. Finally, average value of leaf area per plant was worked out.

Leaf area index (LAI)

For calculation of leaf area, plant were uprooted from border row at 60, 90 DAS and at harvest from each net plot. Leaf area of five plants was measured with the help of a leaf area meter (Li. Co. Inc.; Model, 3100) in the laboratory of Main Vegetable Research Station. Finally, average value of leaf area per plant was worked out. Leaf area index (LAI) was calculated by using following formula given by Watson[13].

$$\text{LAI} = \frac{\text{Leaf area}\,(\text{cm}^2)}{\text{Land area}\,(\text{cm}^2)}$$

$$\text{LAI} = \frac{\text{LA}}{\text{P}}$$

Where,

LA = Leaf area

P = Land area occupied by plant

Crop Growth Rate (CGR) (g/cm^2/day)

Crop growth rate of plant was recorded by measuring the increase in dry weight for one harvest to next harvest. For this plant were dried under sun for two to three days and finally in the forced air oven at 60 ± 5^0 C till constant weight. Finally, average dry weight per plant was worked out.

Crop growth rate (CGR) was calculated by using formula given by Watson[13].

$$CGR\,(g/cm^2/t) = \frac{W_2 - W_1}{t_2 - t_1} \, X \, P$$

Where,

$W_2 - W_1$ = Dry weight difference between time interval

$t_2 - t_1$ = time interval in days

P = Land area occupied by plant

Seed yield plant^{-1}(g)

Dry pods from the randomly selected and tagged five plants were harvested separately and threshed manually. The produce so obtained was cleaned and weighed. The mean seed yield plant^{-1} was worked out.

RESULTS AND DISCUSSION

Effect of organic manures

Data presented in Table-01 indicated that application of vermin compost @ 5 t ha^{-1} recorded significantly the highest plant height (33.65 and 122.29 cm at 30 and 60 DAS) and number of leaves plant^{-1} (25.13 and 34.55 at 60 and 90 DAS), while plant height at 90 DAS and number of leaves plant^{-} at 30 DAS found to be non-significantly. This might be due to better physico-chemical properties of soil and nutrient availability after the decomposition of organic matter in the compost by earth worms[6,11]. Second reason might be due to nutrient uptake by plant slowly in the beginning, rapidly during grand growth stage resulting in slower growth of plant at earlier stage and rapid growth afterward[9].

Further data presented in Table-01 indicated that total dry weight (4.66, 40.01 and 57.64 g plant^{-1}) was recorded significantly the highest in treatment M_2 (vermin compost @ 5t/ha). The result of increase in total dry weight might be due to the positive influence of nitrogen or organic matter on dry matter production of okra and partitioning had been indicated that higher dry matter production at higher nutrient levels favoured the development of plant parameter which culminated in better production of dry matter when nutrient is available in right proportion, the photosynthetic activity of the plants will considerably favoured. This improves high interception, dry matter production, accumulation and partitioning[1].

Perusal of data presented in Table-02 indicated that application of organic manures significantly effects on leaf area, leaf area index and crop growth rate. Significantly the highest leaf area (1226.10 and 1264.18 cm^2), leaf area index (0.68 and 0.70) and crop growth rate (1521.91 and 732.48 g/cm/day) at 60 and 90 DAS. The activity of solubilizing bacteria increased in the presence of organic manures because of the higher availability of organic matter (organic carbon) might have enhanced the multiplication of micro-organisms and thereby more availability of nutrients increasing vegetative growth of plant. The similar results were also reported in okra by Raj and Kumari[10], Alkaff and Hassan[2].

Significantly the maximum seed yield (kg ha^{-1}) i.e.1910 was noted with treatment M_2 (vermicompost @ 5 t ha^{-1}). Treatment M_2 recorded 18.78 % higher seed yield compared to M_1 treatment. The increase in seed yield might be due to application of organic manures increased availability of essential plant nutrients after decomposition which enhanced root and shoot development and thereby growth. Thereafter, it might have influenced the reproductive phase and induced flowering which resulted in increased fruit development.

Effect of Nitrogen

Perusal of data presented in Table-1 indicated that application of 100 kg N ha^{-1} recorded significantly higher plant height (33.90, 121.29 cm at 30 and 60 DAS, respectively) and number of leaves plant^{-1} (7.17 and 23.20 at 30 and 60 DAS, respectively). Plant height at 90 DAS found to be non-significant response and treatment N_2 (100 kg N ha^{-1}) was recorded significantly the highest number of leaves plant^{-1} (33.51) at 90 DAS. The higher plant height might be attributed to increased availability of nitrogen which is a structural component of protein molecules and protoplasm. It might have increased synthesis of protein and carbohydrates in favour of increasing cell division and elongation under sufficient nitrogen supply. These results are in conformity with the findings of Shanke *et al.*[12] in okra.

Total dry weight of okra significantly influenced by different levels of nitrogen (Table-01). Application of 100 kg N ha^{-1} recorded significantly the highest total dry weight (4.99 g $plant^{-1}$) at 30 DAS and significantly higher at 60 DAS (67.98 g $plant^{-1}$). At 90 DAS response of 100 Kg N ha^{-1} found to be non-significant to okra. It is due to the fact that supplemented nitrogen might have increase meristamic growth, number and size of vegetative plant parts and number of leaves, induced greenness in plant leaves by increasing the synthesis of chlorophyll. All these parameters have helped in higher dry matter accumulation $plant^{-1}$ at harvest[5].

Data presented in Table-02 revealed that application of 100 kg N ha^{-1} recorded significantly the highest leaf area (1186.09 cm^2) and higher leaf index (0.66) at 60 DAS. Crop growth rate (1398.68 and 711.27 g/cm/day) was significantly the highest at 60 and 90 DAS. Leaf area and leaf area index at 90 DAS was found to be non-significant. CGR tended to increase with the advance stage of growth due to increase in number of leaves and leaf area. NAR was increased during the reproductive stage was probably due to increased demand of assimilates by the growing seeds[7].

Seed yield (kg ha^{-1}) was found non-significant during the investigation phase with regards to different nitrogen levels (Table-2).

Effect of phosphorus

Phosphorus is constituent of nucleic acid and phospholipids. It is also constituent of majority of enzymes which are of great importance in the transportation of energy in carbohydrate metabolism, fat metabolism and respiration; it is also related to cell distribution and development. Stimulate early root development and growth gives rapid and vigorous start of plant system. Stimulate flowering and help in seed formation[9].

Plant height and Number of leaves plant-1 was significantly influenced by application of phosphorus (Table-1). Treatment P_2 (50 kg ha^{-1}) recorded significantly higher plant height (33.79 cm) at 30 DAS and significantly the highest plant height (129.63 cm) at 90 DAS, while at 30 DAS higher number of leaves $plant^{-1}$ (6.96) was recorded in P_3 (75 kg ha^{-1}) treatment and at 90 DAS higher number of leaves was recorded in P_2 (50 kg ha^{-1}) treatment. At 60 DAS plant height and number of leaves $plant^{-1}$ found to be non-significant. Phosphorus is a key element in the formation of high energy compounds, such as AMP, ADP and ATP, which play essential role in photosynthesis and respiration. It is a vital component of nucleic acids and phospholipids. Plants take up phosphorus in the inorganic form, mainly as the orthophosphate H_2PO_4 ion. Phosphorus supports early phase of crop development, synchronizes the germination process and leading to enhanced plant height and number of leaves $plant^{-1}$, especially in P deficient soil[4].

Total dry weight (g $plant^{-1}$) was significantly influenced by application of phosphorus. Total dry weight (5.07 and 38.68 g $plant^{-1}$) was significantly the highest at 30 and 60 DAS and significantly higher (53.85 g $plant^{-1}$) at 90 DAS.

Perusal of data presented in Table-02 revealed that application of 50 kg P_2O_5 ha^{-1} (P_2) recorded significantly higher leaf area (1209.03 and 1270.54 cm^2 at 60 and 90 DAS, respectively) and leaf area index (0.67 at 60 DAS), while same treatment recorded significantly the highest leaf area index (0.71) at 90 DAS and crop growth rate (1393.26 and 709.93 g/cm/day) at 60 and 90 DAS. The improvement of yield components in 50 kg P_2O_5 was due to better crop growth as evidence by higher leaf area, leaf area index, net assimilation rate and crop growth rate. It was a better source sink relationship in the treatment receiving optimum P_2O_5 i.e. 50 kg ha^{-1}.These result is in accordance with Mandal *et. al*[8].

The significantly maximum seed yield (1825 kg ha^{-1}) was noted in treatment P_2 (50 kg P_2O_5 ha^{-1}). The magnitude of increase seed yield under P_2 was 5.98 and 5.49 %higher over treatment P_3 and $P_{1,}$ respectively Sadat.

Table 1: Effect of different organic manures, different levels of nitrogen and phosphorus on growth of okra

(Two Year Pooled data)

Treatments	Plant height (cm)			Number of leaves plant-1			Total dry weight (g plant^{-1})		
	30 DAS	60 DAS	90 DAS	30 DAS	60 DAS	90 DAS	30 DAS	60 DAS	90 DAS
Organic Manures (M)									
M_1 (FYM @ 20 t ha^{-1})	32.45	114.27	123.03	6.67	19.03	28.66	4.38	32.17	45.81
M_2 (Vermicompost @ 5 t ha^{-1})	33.65	122.29	126.28	6.88	25.13	34.55	4.66	40.01	57.64
S. Em+	0.32	1.19	1.64	0.07	0.32	0.47	0.047	0.334	0.507
C. D. @ 5%	0.89	3.36	NS	NS	0.91	1.31	0.132	0.943	1.433
Nitrogen (N)									
N_1 (80 kg ha^{-1})	31.50	113.75	121.89	6.39	20.43	29.51	4.065	33.23	51.08
N_2 (100 kg ha^{-1})	33.90	121.29	126.86	7.17	23.20	33.51	4.999	37.98	52.58
N_3 (120 kg ha^{-1})	33.76	119.79	125.21	6.76	22.61	31.79	4.760	37.05	51.52
S. Em±	0.39	1.46	2.01	0.09	0.39	0.57	0.057	0.409	0.621
C. D. @ 5%	1.09	4.12	NS	0.24	1.11	1.61	0.162	1.155	NS
Phosphorus (P)									
P_1 (25 kg ha^{-1})	32.09	116.18	122.09	6.41	22.22	31.79	4.322	33.69	47.78
P_2 (50 kg ha^{-1})	33.79	120.50	129.63	6.95	22.33	33.07	5.068	38.68	53.85
P_3 (75 kg ha^{-1})	33.28	118.15	122.24	6.96	21.68	29.96	4.688	35.89	53.53
S. Em±	0.39	1.46	2.01	0.09	0.39	0.57	0.057	0.409	0.621
C. D. @ 5%	1.09	NS	5.67	0.24	NS	1.61	0.162	1.155	1.755
Interaction effect									
M X N	NS	NS	NS	NS	NS	NS	NS	NS	NS
M X P	NS	NS	NS	NS	NS	NS	NS	NS	NS
N X P	NS	NS	NS	NS	NS	NS	NS	NS	NS
M X N X P	NS	NS	NS	NS	NS	NS	NS	NS	NS
C.V. %	7.03	7.39	9.66	7.51	10.68	10.81	7.46	6.79	7.20

Table 2: Effect of organic manure, nitrogen and phosphorus on leaf area, leaf area index, crop growth rate and seed yield of okra

(Two Year Pooled data)

Treatment	Leaf area (cm^2)		Leaf area index		Crop growth rate		Seed yield (kg ha^{-1})
	60 DAS	90 DAS	60 DAS	90 DAS	60 DAS	90 DAS	
Organic Manures (M)							
M_1 (FYM @ 20 t ha^{-1})	1051.36	1083.19	0.58	0.60	1119.29	520.80	1608
M_2 (Vermicompost @ 5 t ha^{-1})	1226.10	1264.18	0.68	0.70	1521.91	732.48	1910
S. Em±	13.79	17.52	0.01	0.01	16.89	8.58	19.78
C. D. @ 5%	38.94	49.50	0.02	0.02	52.58	29.66	55.89
Nitrogen (N)							
N_1 (80 kg ha^{-1})	1102.33	1159.16	0.61	0.64	1270.69	575.47	1779
N_2 (100 kg ha^{-1})	1186.09	1195.71	0.66	0.66	1398.68	711.27	1775
N_3 (120 kg ha^{-1})	1127.76	1166.19	0.63	0.65	1292.44	586.74	1723
S. Em±	16.88	21.46	0.01	0.01	18.99	10.25	24.23
C. D. @ 5%	47.69	NS	0.03	NS	68.78	36.85	NS
Phosphorus (P)							
P_1 (25 kg ha^{-1})	1039.84	1066.88	0.58	0.59	1267.85	562.11	1730
P_2 (50 kg ha^{-1})	1209.03	1270.54	0.67	0.71	1393.26	709.93	1825
P_3 (75 kg ha^{-1})	1167.32	1183.63	0.65	0.66	1300.70	607.88	1722
S. Em±	16.88	21.46	0.01	0.01	18.99	10.25	24.23
C. D. @ 5%	47.69	60.62	0.03	0.03	68.78	36.85	68.45
Interaction effect							
M X N	NS	NS	NS	NS	NS	NS	NS
M X P	NS	NS	NS	NS	NS	NS	NS
N X P	NS	NS	NS	NS	NS	NS	NS
M X N X P	NS	NS	NS	NS	NS	NS	NS
C.V.%	8.90	10.97	9.30	8.60	8.95	10.56	8.27

CONCLUSION

From the foregoing discussion and two years data it can be concluded that individual application of vermicompost @ 5 t ha^{-1}, nitrogen 100 kg ha^{-1} and phosphorus 50 kg ha^{-1} were found effective for seed yield, growth, yield attributes and growth parameters ok okra.

REFERENCES

1. Akanbi, W. B., Togun, A. O., Adediran, J. A. and Ilupeju, E. A. O., Growth, dry matter and fruit yield components of okra under organic and inorganic sources of nutrients. *Am. Eurasian J. Sustain. Agric.*, **4(1):** 1-13 (2010).
2. Alkaff, H. A. and Hassan, A. A. Effect of bio-fertilizer, organic fertilizer and foliar application of Power 4 on the growth and yield of okra plants. *University of Aden Journal of Natural and Applied Sciences*, **7(1):** 25-35 (2003).
3. Anonymous, Indian Horticultural Database-2011, National horticulture board, Director of Horticulture, Gujarat State, Gandhinagar (2012).
4. Arif, M., Ali, S., Shah, A., Javed, N. and Rashid, A., Seed priming maize for improving emergence and seedling growth. *Sarhad J. Agric.*, **21(4):** 539-543 (2005).
5. Batra, B. R., Inder, M. and Arora, S. K., Effect of irrigation and nitrogen levels on dry matter production by okra. *Haryana J. Hort. Sci.*, **29(3&4):** 239-241 (2000).
6. Dademal, A. A. and Dongale, J. H. Effect of manures and fertilizers on growth and yield of okra and nutrient availability in lateritic soil of Konkan. *Journal of Soils and Crops*, **14(2):** 278-283 (2004).
7. Hamid, A., Agata, W., Maniruzzaman, A. F. M. and Ahad, A. M., Physiological aspects of yield improvement in mungbean. Advances in pulses research in Bangladesh. Pp. 95-102. Proc. Second National Workshop on pulses. June 6-8, 1989, Gazipur, Bangaladesh (1991).
8. Mandal, N. N., Chaudhry, P. P. and Sinha, D., Nitrogen, phosphorus and potash uptake of wheat (var. Sonalika). Env. and Eco. 10: 297 *Field Crop Abst.* **46(1):** 30 (1992).
9. Purohit, S. S., Plant Physiology. Published by Students edition, Jodhpur (2007).
10. Raj, A. K. and Kumari, V. L. G., Effect of organic manures and Azospirillum inoculation on yield and quality of okra (*Abelmoschus esculentus* L. Moench). *Veg. Sci*., **28(2):** 179-181 (2001).
11. Ray, R., Patra, S. K., Ghosh, K. K. and Sahoo, S. K., Integrated nutrient management in okra (*Abelmoschus esculentus* L. Moench) in a river basin. *Indian J. Hort*., **62(3):** 260-264 (2005).
12. Shanke, B. R., Jadao, B. J., Ghawade, S. M. and Mahorkar, V. K., Effect of different levels of N and P on growth and seed yield of okra (var. Parbhani Kranti) under Akola condition. *Orissa J. Horti*., **31(1):** 123-124 (2003).
13. Watson, D. J., The physiological basis of variation in yield. Advance Agronomy, **20(1/2):** 18-20 (1952).