International Archive of Applied Sciences and Technology
Int. Arch. App. Sci. Technol; Vol 10 [4] December 2019 : 122-127

[ISO9001: 2008 Certified Organization]
www.soeagra.com/iaast.html

IAAST
ONLINE ISSN 2277- 1565
PRINT ISSN 0976 - 4828

CODEN: IAASCA ORIGINAL ARTICLE

DOI: .10.15515/iaast.0976-4828.10.4.122-127

Assessment of Performance Of Balanced Fertilization And Integrated Use Of Vermicompost On Yield of Okra (*Abelmoschus esculentus L.*) var. Kashi Kranti

K.P. Singh, C.N. Choudhary, R.K. Roy, Ravindra Kumar And Brajesh Patel
Krishi Vigyan Kendra, Katihar (Bihar), Pin – 854105
(Bihar Agricultural University, Sabour, Bihar, India)
E-Mail- kpsinghhort@gmail.com

ABSTRACT
A field experiment was conducted to study the assessment of performance of balanced fertilization and integrated use of vermicompost on yield of okra (Abelmoschus esculentus L.) var. Kashikranti. The experiment was laid out in RBD with four treatments each replicated ten times. The treatments involved was T_1 – Farmers practice (use of only urea 120kg/ha), T_2 – 100% recommended dose of fertilizers (120:60:40kg/ha), T_3 – 50% recommended dose of fertilizers + 50% of vermicompost (12.5q/ha) and T_4 - 100% of vermicompost (25q/ha). The results revealed the application of T3 brought a significant effect on growth and yield of Okra. Field experiment showed that the maximum plant height (116.10cm), 50% flower initiation (40.00DAS), number of branches per plant (4.50), number of fruits per plant (22.24), fruit length (16.20cm), fruit diameter (5.24cm), fruit weight (25.30g), fruit yield per plant (151.44g) and yield per hectare. (132.24q/ha).Vermicompost applied at very low rate (2.5ton/ha) can significantly increase yield of highly valuable vegetable and fruit crops. Vermicompost enhanced the quality of soil by enhancing microbial biomas which are key component in nutrients recycling production of PGR and protecting plants from soil borne disease (Pascual et al., 1997). Combination of vermicompost and inorganic chemical fertilizer resulted in the maximum number of flowers and fruits per plant of Okra plant. Hence, the combined application of appropriate dose of vermicompost and chemical fertilizers in the field acts as growth promoter resulting in higher yield of Okra. Proper combination of inorganics and organics least damage the soil health and helps to sustainits fertility for a longer period.
Key words:*-Abelmoschus esculentus, KashiKranti, Chemical fertilizers, Vermicompost.*

Received 11.05.2019 Revised 23.05.2019 Accepted 01.06.2019

CITATION OF THIS ARTICLE
K.P. Singh, C.N. Choudhary, R.K. Roy, Ravindra Kumar And Brajesh Patel. Assessment of Performance Of Balanced Fertilization And Integrated Use Of Vermicompost On Yield of Okra (*Abelmoschus esculentus L.*) var. Kashi Kranti. Int. Arch. App. Sci. Technol; Vol 10 [4] December 2019 : 122-127

INTRODUCTION

Okra is a common annual vegetable belonging to the family Malvaceae which is grown as a garden or home yard crop throughout the tropical and sub-tropical part of the world. India is the largest producer of Okra followed by Nigeria and Pakistan. Bihar, West Bangal, Odisa, Maharashtra and Gujarat are major Okra growing states in India. Bhindi shares about 5.3% of total vegetable production in India and its productivity is about 13 tons/ha. It is more remunerative than other leafy vegetables. Okra may be cultivated upto an altitude of 400 feets and grows best under temperature ranges of 25°C to 35°C. It is very rich source of vitamins, proteins and minerals. Bhindi is also a good source of iodine [15]. Root and stem of Lady's finger is used in cleaning sugar and in paper mills. Application of nitrogen, phosphorus and potash influences vegetative and reproductive phases of crop [1-4]. Nitrogen is essential macronutrient and one of the chief determinants of growth and

development of this crop. It plays a vital role in the synthesis of protein, nucleic acid, hormones and vitamins. Nitrogen also helps in cell division, cell elongation and linear increase in green pod yield of Okra [8]. Phosphorus can influence fruiting and fruit development of crop and is regarded as key of life as it is directly involved in the most of living processes. It is also a key constituent of ATP,which transforms energy to the plant, takes part in various physiological processes and helps in nutrient uptake by promoting root growth, thereby ensuring a good pod yield [18].

However, use of chemical fertilizers for long time has resulted in poor soil health; reduced production and enhancement in disease and pest infestation [3]. Among various factors affecting successful cultivation of Okra the judicious and integrated use of inorganics and vermicompost is one of the vital importance. Vermicompost is greatly humified is through the fragmentation of parent organic materials by earth worms and colonization by microorganisms (Edwasd; 1998). It is a rich source of micro and macronutrients and acts as a chelating agent.

Bhindi being a short duration crop, its growth and yield are largely influenced by appropriate management practices. Researches shows that the cost invested on inorganic fertilizer can be reduced to a great extent by application of plant nutrients through organic sources. This would increase nutrient use efficiency, soil fertility, besides enhancing crop production as well as quality. Therefore, the present trial was carried out to assess the performance of balanced fertilization and integrated use of vermicompost on yield of Okra var. KashiKranti.

MATERIAL AND METHODS

A field experiment was conducted during the summer season of 2015-16 at the fields of adopted farmers of KrishiVigyan Kendra, Lodipur Farm, Arwal, under Bihar Agricultural University, Sabour, Bhagalpur for assessing the performance of balanced fertilization and integrated use of vermicompost in different combination on yield of Okra var. KashiKranti. The experiment was laid out in Randomized Block Design involving 10 replications having net plot size of 4.5m x 3m. Each plot divided with 4 different combinations of chemical fertilizers and vermicompost as follows: T_1 – Farmers Practice (use of only urea 150kg/ha), T_2 – 100% of recommended dose of fertilizers (120:60:40kg/ha), T_3 – 50% of recommended dose of fertilizers (60:30:20kg/ha) + 50% of vermicompost (12.5q/ha) and T_4 – 100% of vermicompost (25q/ha). The number of experimental plots was 40 having spacing of 45cm x 30cm. Before sowing of the crop, initial soil sample was collected and analysed in soil and water laboratory at ARI, Patna (Bihar) to know the physico-chemical properties of soil. After analysis it was found that soil was slightly acidic in nature and its physico-chemical properties is presented in Table A. Inorganic fertilizers were applied in each plot on the recommended dose of NPK @ 120:60:40kg/ha, through urea, ssp and mop (Firoz, 2009) and 2.5 ton/ha vermicompost [6] throughout the crop duration. Seed was soaked for 24 hours in plain water and thereafter itwas treated with Imidachlorprid 70ws@15kg/ha before sowing. Plant height and number of branches per plant were counted at 90 DAS. Number of fruits per plant, fruit length, fruit diameter, days to 50% flower initiation and yield/plant were recorded regularly. Fruits of randomly selected treatment wise 5 plants, for every replicationwas harvested to calculate yield (q/ha). A comparative data was prepared for each combination of treatments. The collected data were analyzed statistically with ANOVA one way difference test at 0.05 probability levels, to find the significant difference in the parameters studied between various treatments.

RESULTS AND DISCUSSION

The results obtained from present investigation are summarized below:-

Plant height:- The data related to plant height parameters and yield is presented in table1. The plant height of Okra varied from 91.54cm to 116.10cm. It was also found that plant height was the maximum (116.10cm) with the application of 50% chemical fertilizers + 50% vermicompost (T_3) and the minimum plant height (91.54cm) in T_1. It was also found that T_3had highly significant effect on plant height. It might be due to higher amount of nitrogen, having greater availability of salts like nitrate, phosphate and potash which significantly increased plant height. Observation regarding plant height is in close conformity with the findings of Ansari and Sukhraj [2].

Plant height was recorded at the time of last edible pod's harvest. It was observed that different levels of chemical fertilizers and vermicompost exhibited significant effect on the plant height (Table1). Higher dose of nitrogen and vermicompost might have enhanced cell division and formation of more tissues resulting in luxuriant vegetative growth and thereby increased plant height in Okra, as reported by Mayer Anderson [11] and Sultan [20].

Number of branches per plant:-

Analysis of data (Table1) showed that number of branches per plant varied from 2.89 to 4.50. The maximum (4.50) number of branches per plant was observed when 50% chemical fertilizer + 50% vermicompost were applied in the soil. It was also found that the minimum (2.89) number of branches per plant were produced with use of urea alone. i.e. farmers practice. It was also observed that T_3 outperformed T_1. The maximum number of branches per plant might be due to more branches present on plant and due to availability of significant amount of primary growth elements as expressed by Naeem *et al.* [13].

Number of fruits per plant:-

During the trial it was found that number of fruits per plant varied from 14.12 to 22.24. The maximum number of fruits (22.24) per plant were produced with the application of 50% chemical fertilizer + 50% vermicompost whereas the minimum number of fruits (14.12) per plant was obtained with T_3. It was also observed that T_3 was significantly superior to other treatments. The maximum number of fruits per plant might be due to the significant effect of nitrogen and phosphorus as reported by Ahmed et al. (1990). They further concluded that higher number of fruits per plant of Okra were observed with the application of N-120kg/ha, however, Sadat [17] found that P_2O_5 @ 120kg/ha significantly increased number of green fruits per plant.

Fruit length:-

Perusal of data revealed that the length of fruit varied from 9.15cm to 16.20cm. The maximum length of fruit (16.20cm) was found with T3 and the minimum (9.15cm) with T_1. It was also found that T_3 was statistically superior to other treatments. Longer fruits might be due to the supplementation of micronutrients by inorganic phosphorus, besides the synergistic effect of vermicomposton vigour and growth of fruits as expressed by Singh *et al.* [19].

Fruit diameter:-

Perusal of recorded data showed that fruit diameter varied from 4.22cm to 5.24cm. The lowest (4.22cm) value of fruit diameter was observed under farmers' practice (T_1) followed by T_4 (4.49cm) and both were at par with T_3 which resulted in the maximum (5.24cm) fruit diameter closely followed by T_2 (4.89cm) and both of them differed significantly among themselves and rest of the treatments. Higher value of fruit diameter might be due to the balanced application of nitrogen, phosphorus and potassium,besides the synergistic effect of vermicompost, as expressed by Singh *et al.* [19].

Fruit weight:-

Data recorded on fruit weight depicted that fruit weight varied from 21.10g to 25.30g. The maximum (25.30g) value of fruit weight was recorded under T_3 whereas farmers' practice (T_1) revealed the lowest value (21.10g) of fruit weight. The fruit weight under T_2 (24.20g) was next to T_3(25.30g) followed by T_4 (22.40g) and all the four were significantly apart among themselves. The maximum fruit weight might be due to higher dose of nitrogen and phosphorus as similar viewed by Naik and Singh [14].

Fruit yield per plant:-

Observation of recorded data showed that fruit yield per plant varied from 116.64g to 151.44g. T_3 recorded the maximum (151.44g) fruit yield per plant closely followed by T_2 (135.42g) and both these resulted in significantly superior fruit yield per plant over T_4 (120.48g) and farmers' practice (T_1) which resulted in the lowest (116.64g) although treatment T_4 and farmers' practice (T_1) were at par in terms of fruit yield per plant. Higher yield per plant might be due to higher dose of nitrogen and phosphorus as similar viewed by Naik and Singh [14].

Yield per ha:-

The data indicated that yield of Okra varied from 82.41q/ha to 132.24q/ha. The maximum yield (132.24q/ha) of Okra was recorded with T_3 and the minimum yield (82.41q/ha) with T_1. It was found that T_3 was highly significant to all other treatments.Higher yield might be due to more number of fruits and higher fruit weight per plant which ultimatly resulted in

higher fruit yield in those plots. This result is similar to the findings of Sultana [20] in Okra Cv. BARI DHEROSH – 1.

Days to 50% flower initiation:-

Analyzed data of Table1 depicted that flower initiation varied from 40 to 48 DAS. It was found that early flowering were observed with T_3(40 DAS) however, days to flower initiation in T_4at 48 DAS. Early flowering might be due to the synergistic effect, as vermicompost have soil microbes, nitrogen fixing bacteria, phosphate solubilizing bacteria, growth hormones, auxins, gibberlines and cytokinins which enhanced efficiency of nitrogen greater than that of chemical fertilizers alone ultimately influencing early flowering.

Cost of cultivation:-

The data related to cost of cultivation have been presented in table3. It is clear from the data that the cost of cultivation of Okra Var. KashiKranti varied from Rs. 52,530.00 to Rs. 56,000.00 per ha. The maximum cost of cultivation was observed with T_4 and the minimum with T_1. It might be due to bulk application of vermicompost in conjunction with chemical fertilizers together with improvement in the physico-chemical properties of soil leading to availability of plant nutrients in balanced proportion which ultimately increased total production over farmers' practice. It is also clear from the table that the cost of cultivation might decrease with combined application of vermicompost and chemical fertilizers in the ratio of 50:50 (T_3). It is highly co-related to the findings of Firoz [7].

Gross income:-

It is clear from the data presented in table3 that the gross income of Okra varied from Rs. 103012.50 to 165300.00 per ha. The maximum gross income was Rs. 165300.00 with T_3 (50% chemical fertilizer + 50% vermicompost) and the minimum (Rs. 103012.50) with T_1(application of only 120kg urea/ha). It is clear from our findings that the maximum return with T_3 might be due to the highest yield of fruits/ha. It might be due to the combined application of organic manure and inorganic fertilizers leading to the increased availability of plant nutrients which ultimately increased total production and also enhanced gross return. This finding is also highly co-related with the result of Firoz [7] and Bairwa *et al.* [5].

Net income:-

It was observed from data (Table 3) that net income with the application of different combination of fertilizers and vermicompost varied from Rs. 50482.50 to Rs. 111075.00 per ha. Net income was the maximum (Rs. 111075.00) with the T_3 and the minimum (Rs. 50482.50) with the T_1. The minimum income might be due to more expenditure on vermicompost and comparatively lower corresponding yield of fruits per ha. Similar views were expressed by Munroe [12].

Benefit-cost ratio:-

The data in Table 3 revealed that B:C ratio varied from 1.96 to 3.09. In terms of B:C ratio of Bhindi cultivation under this experiment T_3 (3.09) outperformed all the rest treatments (T_2 – 2.71, T_4 – 2.15 and T_1 – 1.96) which clearly indicated that T_3 is worth advocating for the economic benefit of vegetable growers, whereas farmers' practice i.e. control (T_1) resulted in B:C ratio of just 1.96 which was also the lowest value under this experiment.

Table 1:- Soil status of the experimental plots.

Replications	PH	ECe (dsm^{-1})	OC (%)	N (Kg/ha)	P (Kg/ha)	K (Kg/ha)
1	5.74	0.18	0.60	273.00	420.50	115.98
2	6.00	0.17	0.62	292.00	25.90	177.60
3	5.99	0.20	0.67	300.00	23.85	65.90
4	5.87	0.25	0.33	212.00	13.76	73.82
5	5.98	0.23	0.12	160.00	27.49	100.20
6	5.90	0.32	0.75	320.00	14.99	98.95
7	5.78	0.22	0.70	302.00	10.16	95.12
8	5.92	0.30	0.61	252.00	14.75	91.31
9	5.71	0.32	0.54	240.00	22.96	87.93
10	6.05	0.26	0.52	230.00	32.99	182.50

Table 2:- Meteorological observations during experimental period.

Months	Temperature-2015		Temperature-2016		Humidity (%)		Rainfall (mm)	
	Min. Temp. (°C)	Max. Temp. (°C)	Min. Temp. (°C)	Max. Temp. (°C)	Max. 2015	Max. 2016	2015	2016
Jan	4.90	30.00	7.30	27.60	100	99	9.12	4.14
Feb	7.30	20.20	8.80	30.90	100	99	13.16	0.00
Mar	12.30	37.50	14.40	35.90	99	95	14.82	4.54
Apr	19.40	39.30	20.40	42.80	95	86	20.14	0.00
May	23.60	44.90	23.00	43.10	85	91	0.70	1.36
Jun	23.60	45.10	24.60	42.20	98	95	183.92	0.70

Table 3:- Effect of balanced fertilizers and vermicompost on the yield of Okra.

Treatments	Plant height (cm)	50% flower initiation (DAS)	Number of branches/plant	Number of fruits/plant
T_1 – Farmers practice (use of only urea 120kg/ha)	91.54	43.00	2.89	14.12
T_2 – 100% recommended dose of fertilizers (120:60:40kg/ha)	108.12	45.00	3.20	20.65
T_3 – 50% recommended dose of fertilizers + 50% of vermicompost (12.5q/ha)	116.10	40.00	4.50	22.24
T_4 - 100% of vermicompost (25q/ha)	94.14	48.00	2.95	16.40
CD (0.05)	4.9269	3.0666	0.2124	0.9580
CV (%)	5.72	7.30	4.98	6.15
Diff. mean	2.4012	1.5075	0.1289	0.4727
SE/plot	5.3632	3.3812	0.2912	1.0335

Table 4:- Effect of balanced fertilizers and vermicompost on the yield of Okra.

Treatments	Fruit length (cm)	Fruit diameter (cm)	Fruit weight (g)	Fruit yield/plant (g)	Yield (q/ha)
T_1 – Farmers practice (use of only urea 120kg/ha)	9.15	4.22	21.10	116.64	82.41
T_2 – 100% recommended dose of fertilizers (120:60:40kg/ha)	13.20	4.89	24.20	135.42	120.82
T_3 – 50% recommended dose of fertilizers + 50% of vermicompost (12.5q/ha)	16.20	5.24	25.30	151.44	132.24
T_4 - 100% of vermicompost (25q/ha)	12.30	4.49	22.40	120.48	96.10
CD (0.05)	0.9054	0.3228	0.9650	8.6354	6.1012
CV (%)	6.65	5.16	6.25	7.36	7.14
Diff. mean	0.4420	0.1401	0.4825	4.2136	2.9662
SE/plot	0.9942	0.3124	1.0435	9.4036	6.6089

Table 5:- Economic indicator of Okra.

Treatments	Cost of cultivation (Rs/ha)	Gross income (Rs/ha)	Net income (Rs/ha)	B:C ratio
T_1 – Farmers practice (use of only urea 120kg/ha)	52530.00	103012.50	50482.50	1.96
T_2 – 100% recommended dose of fertilizers (120:60:40kg/ha)	53620.00	151025.00	97405.00	2.71
T_3 – 50% recommended dose of fertilizers + 50% of vermicompost (12.5q/ha)	54225.00	165300.00	111075.00	3.09
T_4 - 100% of vermicompost (25q/ha)	56000.00	120125.00	64125.00	2.15

REFERENCES

1. Ahmad, F., Ishtia, M. and Muhammad, S (1999). Effect of different level of nitrogen alone and in combination with constant dose of phosphorus and potassium on growth and yield of Okra cv. T-13 Sarhad J. Agric., 15(5): 405-407.
2. Ansari, A.A. and Ismil, S.A. (2001).A case study of organic farming in Uttar Pradesh. J. Soil Bio. Ecol., 27: 25-27.
3. Ansari, A.A. and Sukhraj, K. (2010).Effect of vermi wash and vermicompost on soil parameter and productivity of Okra in GUYANA. African J. Agric. Res., 5(4): 1994-1998.
4. Attarde, S.B., Narkhede, S.D., Patil, R.P. and Ingle, S.T. (2012).Effect of organic and inorganic fertilizers on growth and nutrient content of Abelmoschusesculantus (Okra crop).Internet. J. Curr. Res., 4(10): 137-140.
5. Bairwa, H.L., Shukla, A.K., Mahawer, L.N., Kaushik, R.A., Shukla, K.B. and Ameta, K.D. (2009).Response of integrated nutrient management on yield, quality and physic-chemical characteristics of Okra cv. ARKA ANAMIKA. Indian J. Hort., 66(3): 310-314.
6. CRIDA (2009).Vermicompost from waste pub.of central research institute for dry land agriculture, Hyderabad (unit of Indian Council of Agricultural Research). 78pp.
7. Firoz, Z.A. (2009). Impact of nitrogen and phosphorus on the growth and yield of Okra in hillslop condition.Bangladesh J. Agril. Res. 34(4): 713-722.
8. Hooda, R.S., Pandita, M.L. and Sindhu, A.S. (1980). Studies on the effect of nitrogen and phosphorus on the growth and green pod yield of Okra (*Abelmoschus esculantus* L.). Hariyana J. Hort. Sci., 9: 180-183.
9. Jeyabal, A. and Kuppuswamy, G. (2001).Recycling of organic wastes for the production of vermicompost and its response in rice-legume cropping system and soil fertility. European J. Agron., 15(13): 153-170.
10. Kurup, B.S., PushpaKumari, R. and Isac S.R. (1997).Enhancing nitrogen use efficiency in Okra with nitrification inhibitors. Veg. Sci., 24(1): 10-12.
11. Mayer, B.S. and Anderson, D.B.I. (1970).Plant physiology.East west press pvt.ltd., NEW DELHI (India).
12. Munroe, G. (2007). Manual of on farm vermicomposting and vermi culture. Publication of organic Agriculture Centre of Canada, Nava Scotia, CANADA.
13. Naeem, M., Iqbal and Bakhash, A. (2006).Comparative study of inorganic fertilizer and organic manure on yield and yield components of mungbean (*Vigna radiat* L.). J. Agric. & Soc. Sci., 2(4): 227-229.
14. Naik, L.B. and Singh, R.V. (1999).Response of Okra to nitrogen, phosphorus and spacing. Res. J. Birsa. Agric. Univ., 11(1): 35-37.
15. Narkhede, S.D., Attarde and Ingle, S.T. (2011). Study on effect of chemical fertilizer and vermicompost on growth of chilli paper (Capsicum annum). J. Appl. Sci. Environ. Sanita., 6(30): 327-323.
16. Rajagopal, R. and Rao, I.S. (1974).Chance in the endogenous level of Auxin and Gibberalins like substance in the short spices of nitrogen deficient Tomato plant (Lycopersicone sculentus Miel). Australian J. Bot., 22(3): 429-435.
17. Sadat, M.S. (2000). Studies on the effect of different levels of nitrogen, phosphorus and potassium on the growth yield and seed production of Okra (Abelmoschusesculantus L.). M.Sc. Thesis, Department of Horticulture, Bangladesh Agricultural University, Mymensingh, BANGLADESH.
18. Sharma, B.M. and Yadav, J.P.S. (1976).Availability of phosphorus on two grain as influenced by phosphetic fertilization and irrigation. Indian J. Agric. Sci., 46: 205-210.
19. Singh, J., Sreekrisna, B and Sundaram, M.R. (1997).Performance of scotch bonnet chili in Karnataka and its response to vermicompost. Indian Cocoa, Areca nut & Spice J., 21:9-10.
20. Sultana, S. (2002).Effect of nitrogen, phosphorus, potassium, sulpher and boron on Okra. M.Sc. Thesis, Department of Soil Science, Banghabandhu Sheikh MuijiburRahmanAgril. Univ., GAZIPUR (BANGLADESH).