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Effect of organic manures and inorganic fertilizers on growth, yield and quality of Okra [*Abelmochus esculentus* (L.) Moench]

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Abstract An experiment was conducted to access the influence of organic manures and inorganic fertilizers on growth, yield and quality of Okra. Among 25 treatments under study, (FYM 3 t + SM 2 t + PM 0.5 t + VC 0.6 t + BF 7 kg + 60:30:30 $N:P_2O_5:K_2O$ kg ha^{-1} recorded maximum values for plant height (186.82 cm), number of nodes main stem (28.82), number of fruits $plant^{-1}$ (28.93), fruit yield ha^{-1} (272.17 q), protein content (3.01%), Vitamin C content (17.59 mg 100^{-1}g) and dry matter content (12.95%). Besides recording a minimum fiber content of 1.28%. PM 3 t + 60:30:30 $N:P_2O_5:K_2O$ kg ha^{-1} was next best treatment. Organic integration proved superior over sole applications but recorded lower values than 120:60:60 $N:P_2O_5:K_2O$ kg ha^{-1}. Treatment FYM 6 t + SM 4 t + PM 1 t + VC 1 t + BF 7kg ha^{-1} proved better, followed by PM 3 t + VC 3 t ha^{-1}. Among sole applications of organics, T_4 PM 6 t ha^{-1} proved better than rest of the organic sources.

Keywords: Organic manurs, Yield, Okra, (*Abelmochus esculentus*)

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Introduction

Okra (*Abelmochus esculantus (L) Moench*) is an important vegetable crop in India, with an annual production of 33.45 lacs tones (Anonymous, 2005).In Jammu and Kashmir, it is grown as a kharif crop with an annual production of 28700 metric tones (Anonymous, 2005).Okra produces fruit for a long time and needs balanced and sufficient supply of nutrients for higher yield and better quality. Indiscriminate use of inorganic fertilizers has resulted in decreased nutrient uptake, poor quality of vegetables and deterioration of soil health (Ganeshe *et.al.,* 2000, Agrawal, 2003). All this underlines the need to utilize organic manures/bio-fertilizers for sustainable Okra production. Organic manures constitute a dependable source of macro and micro nutrients and are helpful in improving physical, chemical and biological health of soil, reduces nutrient losses, increases nutrient availability and uptake leading to sustainable production devoid of harmful residues, besides improving quality of vegetables (Acharya *et.al.*, 2000, Singh *et.al.,* 2000).It has been observed that sole application of organic manures or inorganic fertilizers are not able to sustain the soil fertility and crop productivity. However their integration has proved superior than individual components with respect to yield, quality and nutrient uptake (Abusaleha and Shanmulagavelu, 1988; Malewar *et.al.,* 1998; Usha Kumari *et.al.,* 1999; Magray, 2002; Chattoo *et.al.,* 2003).

Since a very meager work has been conducted under Kashmir conditions in this regard, an investigation has been conducted to access the influence of organic manures and inorganic fertilizers both as sole as well as in integration on growth, yield and quality of Okra, besides studying the comparative economics of various organic and inorganic sources of plant nutrients.

Materials and methods

A field experiment was conducted during kharief 2004 and 2005 at experimental fields of Division of Olericulture,

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Table-1: Effect of organic manures and inorganic fertilizers on growth, yield and quality attributes of Okra cv. SKBS-11.

Treatment	Plant height (cm)	No. of nodes plant^{-1} (main stem)	No. of fruits plant^{-1}	Fruit yield plot^{-1} (kg)	Fruit yield ha^{-1} (q)	Protein content of fresh fruits (%)	Vitamin C content (mg)	Fibre content fruits (%)	Dry matter content (%)
T_1	178.64	25.57	28.45	23.31	259.08	2.63	13.18	2.07	11.95
T_2	149.48	22.26	24.18	18.81	209.00	2.01	14.45	1.81	9.87
T_3	155.65	22.98	25.31	19.90	221.14	2.19	15.11	1.69	9.96
T_4	165.98	24.29	26.50	21.48	238.78	2.47	16.03	1.58	10.74
T_5	161.19	23.58	25.95	20.80	231.19	2.13	15.15	1.38	10.35
T_6	99.12	15.73	18.56	13.96	155.13	1.84	13.60	1.58	9.43
T_7	176.61	25.67	27.84	22.95	254.99	2.45	16.13	1.40	11.17
T_8	154.98	23.09	25.22	19.98	221.08	2.18	14.63	1.60	10.00
T_9	162.48	24.25	26.86	21.29	236.67	2.25	15.38	1.57	10.66
T_{10}	161.24	23.84	26.21	20.73	230.37	2.13	15.10	1.45	10.47
T_{11}	153.84	22.78	24.75	19.27	214.13	2.13	14.91	1.60	9.89
T_{12}	166.01	24.22	27.25	22.17	246.38	2.36	15.98	1.55	10.91
T_{13}	162.48	23.89	26.06	20.97	233.00	2.32	15.77	1.47	10.51
T_{14}	157.90	23.45	25.45	20.15	223.95	2.29	15.34	1.57	10.46
T_{15}	170.56	24.64	27.30	22.33	248.18	2.45	16.37	1.36	11.12
T_{16}	167.91	24.34	26.97	22.03	244.77	2.35	16.05	1.48	10.87
T_{17}	165.90	24.13	26.50	21.45	238.30	2.30	15.59	1.38	10.59
T_{18}	115.17	17.90	19.93	15.34	170.50	1.93	12.81	2.03	9.73
T_{19}	165.30	24.21	26.87	211.91	243.34	2.51	15.40	1.48	11.43
T_{20}	171.31	25.00	27.62	22.89	254.33	2.52	15.51	1.33	11.92
T_{21}	181.01	25.90	27.98	23.40	260.08	2.77	16.83	1.35	12.24
T_{22}	177.07	25.54	27.86	23.18	257.56	2.66	16.42	1.33	11.93
T_{23}	163.25	23.76	26.39	21.40	237.79	2.52	16.21	1.42	10.09
T_{24}	186.82	26.82	28.93	24.53	272.71	3.01	17.59	1.28	12.95
T_{25}	69.88	11.56	12.43	8.87	98.56	1.38	11.51	2.58	9.13
CD @ 5%	3.58	0.62	0.63	0.59	6.59	0.13	0.85	0.12	0.38

Sher-e-Kashmir University of Agricultural Sciences and Technology, Shalimar Srinagar. The soil of the experimental plot was clay loam in texture, neutral in reaction, medium in organic carbon, low in available phosphorus, medium in available potassium and low in available sulphur. The experiment was laid out in simple square lattice design with two replications, each replication comprised of 25 treatments which include T_1-Recommended fertilizer dose 120:60:60 $N:P_2O_5:K_2O$ kg ha^{-1}, T_2-Farm yard manure (FYM) 30 t ha^{-1}, T_3-Sheep manure (SM) 20 t ha^{-1}, T_4-Poultry manure (PM) 6 t ha^{-1}, T_5-Vermicompost (VC) 6 t ha^{-1}, T_6-Bio-fertilizers (BF) *Azospirillium + Phosphobacteria* 7 kg ha^{-1}, T_7-FYM 6 t + SM 4 t + PM 1 t + VC 1 t + BF 7kg ha^{-1}, T_8-FYM 15 t + SM 10 t ha^{-1},T_9-FYM 15 t + PM 3 t ha^{-1}, T_{10}-FYM 15 t + VC 3 t ha^{-1},T_{11}-FYM 15 t + BF 7kg ha^{-1},T_{12}-SM 10 t + PM 3 t ha^{-1}, T_{13}-SM 10 t + VC 3 t ha^{-1}, T_{14}-SM 10 t + BF 7kg ha^{-1}, T_{15}-PM 3 t + VC 3 t ha^{-1}, T_{16}-PM 3 t + BF 7kg ha^{-1},T_{17}-VC 3 t + BF 7 kg ha^{-1}, T_{18}-RFD 50% 60:30:30 $N:P_2O_5:K_2O$ kg ha^{-1},T_{19}-FYM 15 t + 60:30:30 $N:P_2O_5:K_2O$ kg ha^{-1}, T_{20}-SM 10 t + 60:30:30 $N:P_2O_5:K_2O$ kg ha^{-1}, T_{21}-PM 3 t + 60:30:30 $N:P_2O_5:K_2O$ kg ha^{-1}, T_{22}-VC 3 t + 60:30:30 $N:P_2O_5:K_2O$ kg ha^{-1},T_{23}-BF 7kg + 60:30:30 $N:P_2O_5:K_2O$ kg ha^{-1}, T_{24}-FYM 3 t + SM 2 t + PM 0.5 t + VC 0.6 t + BF 7 kg + 60:30:30 $N:P_2O_5:K_2O$ kg ha^{-1}, and T_{25} without application fertilizer, vermi compost, biofertilizer. The seeds of Okra cv.SKBS-11 were sown on 20th May in plots of size 3.0 x 3.0 meters at spacing of 50 x 30 cm during both the years. Full dose of phosphorus, potash and ½ dose of nitrogen was applied as basal dose, while remaining nitrogen was applied as split dose one month after sowing. The source of nitrogen, phosphorus and potash were urea, single super phosphate and muriate of potash respectively. Well decomposed organic manures/Vermicompost were incorporated thoroughly as basal dose. Bio-fertilizers were applied both as seed treatment (1.0 kg ha^{-1}) and soil application (2.5 kg ha^{-1}).All cultural operations were performed as per recommendations. Observations on growth, yield and quality attributes were recorded from 10 random plants of each replication. Pooled data was subjected to analysis, using nested classification procedure as suggested by Gupta and Prasad (2006).Tabular analysis was performed to access the economics of production of Okra.

Results and discussion

Growth related attributes were significantly influenced by various treatments. Treatment T_{24} (FYM 3 t + SM 2 t + PM 0.5 t + VC 0.6 t + BF 7 kg + 60:30:30 N:P_2O_5:K_2O kg ha^{-1}) registered significantly higher value for plant height (186.82 cm) number of nodes main stem (28.82) as compared to rest of the treatments (Table 1).Among sole application of organics,T_4 (Poultry manure 6 t ha^{-1}) recorded maximum value for plant height (165.89 cm) and number of nodes main stem (24.29) and was found significantly superior to T_2 (FYM 30 t ha^{-1}), T_3 (SM 20 t ha^{-1}) T_6 (BF 7kg ha^{-1}), T_{18} (60:30:30 N:P_2O_5:K_2O kg ha^{-1}) and T_{25} (Control) but was significantly lower than the value recorded with T_1 (120:60:60 N:P_2O_5:K_2O kg ha^{-1}).Among organic integrations in equal proportion(50:50) treatment T_7 (FYM 6 t + SM 4 t + PM 1 t + VC 1 t + BF 7kg ha^{-1}) recorded maximum value of 176.61 cm and 25.67 for plant height and number of nodes (main stem) respectively and was found significantly superior to all organic integration treatments,T_{18} and T_{25} (Table 1).Integration of individual organic sources with inorganic fertilizer in equal proportion (50:50), exhibited a beneficial response. Treatment T_{21} (PM 3 t + 60:30:30 N:P_2O_5:K_2O kg ha^{-1}) registered maximum plant height (181.01 cm) and maximum number of nodes main stem (25.90),which was significantly superior to T_{18},T_{19}(FYM 15 t + 60:30:30 N:P_2O_5:K_2O kg ha^{-1}), T_{20} (SM 10 t + 60:30:30 N:P_2O_5:K_2O kg ha^{-1}).T_{23} (BF 7kg + 60:30:30 N:P_2O_5:K_2O kg ha^{-1}) and T_{25} but was comparable with T_1 (Table.1)

Yield and yield related attributes of Okra exhibited a beneficial response to all treatments under study. Treatment T_{24},registered significantly higher value for number of fruits $plant^{-1}$ (28.93),fruit yield $plot^{-1}$ (25.53 kg) and fruit yield ha^{-1}(272.17 q) (Table 1).Treatment T4,recorded significantly higher number of fruits $plant^{-1}$ (26.50),fruit yield $plot^{-1}$ (21.48kg) and fruit yield ha^{-1} (238.79q) as compared to T_2,T_3,T_5,T_{16},T_{18} and T_{25} but were significantly lower than T_1 (Table 1) Treatment

Table-2: Economics of production, breakeven analysis and relative share of various factors of production in Okra cultivation

Treatment	Yield ha^{-1}	Cost of cultivation ha^{-1} (Rs.)	Gross income ha^{-1} (Rs.)	Net returns ha^{-1} (Rs.)	Returns Re^{-1} invested	*Break even ha^{-1} (q)	Margin of safety ha^{-1} (q)	Factor share ha^{-1} (Rs.)		
								Land	Labour	Capital
T_1	259.08	46948.76	129540.00	82591.24	2.75	48.30	210.78	0.778	0.127	0.095
T_2	209.00	5712.20	146300.00	88787.80	2.54	33.72	175.28	0.731	0.114	0.155
T_3	221.14	58512.20	154798.00	96285.80	2.64	33.40	187.74	0.739	0.108	0.153
T_4	238.78	51372.20	167145.00	115772.80	3.25	33.01	205.77	0.802	0.099	0.099
T_5	231.19	60372.20	161833.00	101460.80	2.68	33.17	198.02	0.740	0.102	0.158
T_6	155.13	42512.20	108591.00	66078.80	2.55	35.89	119.29	0.775	0.152	0.073
T_7	254.99	53325.20	178493.00	125140.80	3.34	32.70	222.29	0.803	0.093	0.104
T_8	221.08	57872.20	154756.00	96883.80	2.67	33.41	187.67	0.744	0.107	0.149
T_9	236.67	54372.20	165669.00	111296.80	3.04	33.05	203.62	0.782	0.100	0.118
T_{10}	230.37	58872.20	161259.00	102386.80	2.73	33.19	197.18	0.747	0.103	0.150
T_{11}	214.13	50152.20	149891.00	99738.80	2.98	33.58	180.55	0.786	0.111	0.103
T_{12}	246.38	54872.20	172466.00	117593.80	3.14	32.85	213.53	0.787	0.096	0.117
T_{13}	233.00	59372.20	163100.00	103727.80	2.74	33.13	199.87	0.747	0.102	0.151
T_{14}	223.95	50652.20	156765.00	106112.80	3.09	33.34	190.61	0.792	0.106	0.102
T_{15}	248.18	55872.20	173726.00	117853.80	3.10	32.82	215.36	0.783	0.095	0.122
T_{16}	244.17	47152.20	171339.00	124186.80	3.63	32.89	211.88	0.831	0.097	0.072
T_{17}	238.30	51652.20	166810.00	115157.80	3.22	33.02	205.28	0.800	0.099	0.101
T_{18}	170.50	44520.48	85250.00	40729.52	1.91	53.95	116.55	0.690	0.192	0.118
T_{19}	243.34	52090.48	121670.00	69579.52	2.33	48.94	194.40	0.721	0.136	0.143
T_{20}	254.33	52590.48	127165.00	74574.52	2.41	48.49	205.84	0.729	0.130	0.141
T_{21}	260.08	49090.48	130040.00	80949.52	2.64	48.27	211.81	0.762	0.127	0.111
T_{22}	257.56	53590.48	128780.00	75189.52	2.40	48.36	209.20	0.725	0.128	0.147
T_{23}	237.79	44800.48	118895.00	74094.52	2.65	49.19	188.60	0.766	0.138	0.086
T_{24}	272.71	50520.48	136355.00	85834.52	2.70	47.82	224.89	0.763	0.121	0.116
T_{25}	98.56	41812.20	49280.00	7467.52	1.17	71.86	26.70	0.518	0.326	0.156

T_7,recorded maximum number of fruits plant^{-1} (27.84), fruit yield plot^{-1} (22.95kg) and fruit yield ha^{-1} (254.99q) and was significantly superior to all organic integrations,T_{18} and T_{25} (Table.1). Treatment T_{21} registered maximum fruit number plant^{-1} (27.98),fruit yield plot^{-1} (23.40kg) and fruit yield ha^{-1} (260.08q) and was significantly superior to T_{18},T_{19},T_{23} and T_{25}.Treatment T_1,recorded higher value for number of fruits plant^{-1} (28.45),fruit yield plot^{-1} (23.31kg) and fruit yield ha^{-1} (259.08q) except that of T_{24} and T_1 (Table-1).

Improvement in growth and yield attributes of Okra due to integration of Organic and inorganic sources as well as integration among organic sources could be attributed to balanced C/N ratio, higher organic matter build up, efficient microbial activity, synergistic interaction between organic manures, Vermicompost and bio-fertilizers, resulting in more supply and availability of nutrients, better translocation of nutrients to aerial parts for enhanced synthesis of carbohydrates, protoplasmic proteins and other compounds. Superiority of poultry manure over other organic sources could be attributed to its nutritional richness, quick mineralization ,balanced C/N ratio, more availability of nitrogen, other compounds, growth promoting substances leading to better growth and yield whether used as sole application or in combination with organic or inorganic sources. Improvement in growth and yield due to inorganic fertilizers could be attributed to quick and ready availability of plant nutrients. Similar observations have also been made by other workers Singh *et.al.,* 1973, Abusaleha and Shanmugavelu, 1988., Jose *et.al.,* 1988, Sharma and Bhalla 1995, Usha Kumari *et.al.,* 1999, Aliyu, 2000, Datt *et.al.,* 2003 and Dash *et.al.,* 2005 in Okra and other vegetable crops.

Quality attributes of Okra fruits were significantly influenced by various treatments under study. Treatment T_{24} registered higher values for protein content (3.01%), vitamin C content (17.59%) and dry matter content (12.95%) over rest of the treatments, but was at par with T_{21} with respect to vitamin C content. T_{24} recorded significantly lower fiber content of 1.28% (Table-1).Treatment T_4, recorded significantly higher value for protein content (2.47%),vitamin C content (16.03mg) and dry matter content (10.74%) as compared to T_2,T_5,T_6,T_{18} and T_{25} but was significantly lower than T_1 for protein and dry matter content (Table-1). Treatment T_7 registered significantly higher value for protein content (2.45%) Vitamin C content (16.13mg) and dry matter content (11.17%) over rest of the organic integrations, T_{18} and T_{25}.Lower fiber content of 1.36% was recorded with T_{15} (PM 3 t + VC 3 t ha^{-1}) which was statistically at par with T_7 (Table 1).Treatment T_{21}, registered significantly higher value for protein content (2.77%), vitamin C content (16.83mg) and dry matter content (12.24%) over T_{19}, T_{18}, and T_{25}. Treatment T_{22} recorded a significantly lower fiber content of 1.33 as compared to T_{19},T_1,T_{18}, and T_{25} (Table-1).Treatment T_1, recorded higher values for protein content (2.63%) and dry matter content (11.95%) as compared to other treatments except T_{21} and T_{24} but recorded lower vitamin C content (13.18mg).T_1 registered higher fiber content of 2.07% as compared to other treatments except T_{25} (Table-1) .Improvement in quality attributes of Okra fruits due to integration of organics as well as integration of organics and inorganic sources could be attributed to balanced C/N ratio, production of growth promoting substances by organics, improvement in soil physical, chemical and biological properties, which might have collectively lead to improvement in quality attributes. The superiority of poultry manure and Vermicompost could be attributed to their nutritional richness and stimulatory behavior. Reduction in quality attributes due to chemical fertilizers can be attributed to the fact that they provide either single or two essential nutrients. Similar observation have also been reported by other workers Abusaleha and Shanmugavelu, 1988., Jose *et.al.,* 1988., Naidu *et.al.,* 2000 and Magray *et.al.,* 2002 in Okra and other vegetable crops. The economics of the crop worked out in the present study (Table-2) revealed that maximum net returns of Rs.1,25,140.00 was registered in T_7 while as maximum returns per rupee invested of 3.63 was recorded with T_{16} followed by 3.34,3.25,3.22,3.14 with T_7,$T_4$$T_{17}$, and T_{12}, indicating that these treatment combinations are profitable. Minimum BEP of 32.70 q ha^{-1} and maximum margin safety 224.8 q ha^{-1} was recorded in T_7 and T_{24} respectively, indicating more profits. Minimum relative share of land (Rs.0.518 ha^{-1}), labour (Rs.0.093 ha^{-1}) and capital (Rs.0.072 ha^{-1}) was recorded in T_{25}, T_7 and T_{16} respectively, indicating that there is further scope to exploit land, labour and capital resources to generate more income and consequently employment by using these treatment combinations in Okra production.

सारांश

भिण्डी की वृद्धि उपज एवं गुणात्मकता के कार्बनिक खाद एवं अकार्वनिक उर्वकर को प्रभाव का एक प्रयोग आयोजित किया। 25 पंक्तियों के अध्ययन में (YFM3 टन + SM2 टन + PM 0.5 टन + VC 0.6 टन + BF 7 किग्रा. + 60:30:30 N:P_2O_5: K_2O किग्रा/हे.) अधिकतम मूल्य पौध ऊँचाई (186.82 सेमी.) गाँठ संख्या मुख्य तना (28.82), फल संख्या प्रति पौध (28.93), फल उपज प्रति है. (272. 17 कुन्तल), प्रोटीन (3.01 प्रतिशत), विटामिन C स्तर (17.59 मिग्रा.

100 प्रति ग्राम) और शुष्क पदार्थ स्तर (12.95 प्रतिशत) अंकित किया गया। इसके अलावा भी निम्न रेशा स्तर (1.28%), PM 3 टन + 60:30:30 N:P_2O_5 : K_2O किग्रा. प्रति हे. की अपेक्षा कम था। पंक्ति FYM 6 टन + SM 4 टन + PM 1 टन + VC 1 टन + BF 7 किग्रा. प्रति हे., PM 3 टन + VC 3 टन प्रति हे. की अपेक्षा उच्चतम था। कार्वनिक के सोल प्रयोग के मध्यम में + T_4 PM6 टन प्रति हे., कार्वनिक स्रोतो के अपेक्षा उच्चतम सिद्ध हुआ।

References

Abusaleha and Shanmugavelu KG (1988) Studies on the effect of organic VS. inorganic sources of nitrogen on growth, yield and quality of Okra (*Abelmoschus esculentus*). Indian Journal of Horticulture 45: 312-318.

Acharya CL and Mandal KG (2002) Integrated plant nutrient supply in vegetable crops pp 79-104. In: *Compendium Recent Advances in Vegetable Production Technology*. Proceedings of Winter School, 2-23 December, 2002, Indian Institute of Vegetable Research, Varanasi (U.P.).

Agarwal AK (2003) Role of organic enrichers in management of soil salinity. Agrobios 2: 21-23.

Aliyu L (2000) Effect of organic and mineral fertilizer on growth, yield and composition of pepper (*Capsicum annum* L.). Biological Agriculture and Horticulture 18: 29-36.

Anonymous (2003) *Agricultural Research Data Book*. Indian Agricultural Statistics Research Institute, New Delhi, pp. 126.

Anonymous (2005) Information on area production and productivity of vegetable, tuber and spice crops of Jammu and Kashmir. Directorate of Agriculture, Jammu and Kashmir Division.

Chattoo MA, Ahmed N, Narayan S and Faheema S (2003) Influence of organic manures on cabbage cv. Golden Acre p 940 In: *Souvenir National Seminar on Organic Products and their Future Prospectus*, October 21-22, 2003, Sher-e-Kashmir University of Agricultural Sciences and Technology, Shalimar, Srinagar (J&K).

Dash AC, Tomar GC and Katkar PH (2005) Effect of integrated nutrient management on growth and dry matter accumulation of soybean. Journal of Soils and Crops 15: 39-45.

Datt N, Sharma RP and Sharma GD (2003) Effect of supplementary use of farm yard manure along with chemical fertilizers on productivity and nutrient uptake by vegetable pea and build up of soil fertility in Lahaul valley of Himachal Pradesh. Indian Journal of Agronomy 73: 266-268.

Ganeshe RK, Pandey RP and Rawat AK (2000) Influence of biofertilizers and nitrogen on growth, yield, shelf life and economics of Okra. JNKVV Research Journal 32: 33-37.

Gupta VK and Prassad R (2006) Fundamentals of Design of Experiments. Statistical Manual 2: MIII 9-41.

Jose D, Shanmugavelu KG and Thumburaj K (1988) Studies on the efficacy of organic VS. inorganic form of nitrogen in brinjal. Indian Journal of Horticulture 45: 100-103.

Magray GH (2002) Effect of organic and inorganic fertilizers on growth, yield and quality of capsicum (*Capsicum annum* L.). M.Sc. (Agri.) thesis submitted to Sher-e-Kashmir University of Agricultural Sciences and Technology, Shalimar, Srinagar Kashmir J&K.

Malewar GU, Ismail S and Rudreksha GB (1998) Integrated nutrient management in chilli (*Capsicum annum* L.). Bulletin of Indian Institute of Soil Science 2: 156-163.

Naidu K, Kushwah SS and Dwivedi YC (2000) Performance of organic manures, biofertilizers and chemical fertilizers and their combination on microbial population of soil and growth and yield of Okra. *JNKVV Research Journal* 33: 34-38.

Sharma NK and Bhalla PL (1995) Influence of integrated nutrient management on growth, yield and economics in Okra. Vegetable Science 22-14.

Singh B (2002) Trends in Production Technology of Okra pp 287-295. In: *Compendium Recent Advances in Vegetable Production Technology*. Proceedings of Winter School, 3-23 December, 2002, Indian Institute of Vegetable Research, Varanasi (U.P).

Singh K, Minhas MS and Srivastava OP (1973) Studies on poultry manure in relation to vegetable production, II potato. Indian Journal of Horticulture 30: 537-541.

Singh SR, Prakash S and Kumar J (2000) Organic farming technology for sustainable vegetable production in Himachal Pradesh. Himachal Journal of Agriculture Research 26: 69-73.

Usha Kumari, K Prabhakumari P and Padmaja P (1999) Efficiency of Vermicompost on growth, and yield of summer crop Okra. Journal of Tropical Horticulture 37: 87-88.