

Effect of Organic Manures and Inorganic Fertilizers on Nutrient Uptake in Okra (*Abelmoschus esculentus* (L.) Moench)

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Abstract

An experiment was conducted during *kharif* of 2004 and 2005 to study the effect of organic manures and inorganic fertilizers on nutrient uptake in okra (*Abelmoschus esculentus* (L.) Moench). Out of various treatments tested, treatment combination of FYM 3 t + SM 2 t + PM 0.5 t + VC 0.6 t + BF 7 kg + 60 : 30 : 30 N : P₂O₅ : K₂O kg/ha, recorded maximum uptake of 132.33, 31.91, 139.35, 21.51, 135.37 and 75.80 kg/ha for nitrogen, phosphorus, potassium, sulfur, calcium and magnesium respectively and was found significantly superior over rest of the treatments. Among sole application of organics, poultry manure 6t/ha registered maximum uptake of 91.37, 18.64, 79.74, 13.79, 94.08 and 48.58 kg/ha and was significantly superior to other sole applications of organic manures.

Key words : Inorganic fertilizers, Nutrient uptake, Okra, Organic manures.

Okra (*Abelmoschus esculentus* (L.) Moench) is an important vegetable crop in India, with an annual production of 33.45 lac tones (Anonymous 2003). In Jammu and Kashmir, it is grown on an area of 2,050 hectares with an annual production of 28,700 metric tones (Anonymous 2005). Okra produces fruits for a long time and needs balanced and sufficient supply of nutrients for higher and sustainable yields. Indiscriminate use of inorganic fertilizers have significantly decreased nutrient uptake, resulting a decrease in yield and quality of vegetables besides, deteriorating soil health (Ganeshe et al. 2000, Agarwal 2003). The long term sustainable production needs balanced supply of essential nutrients, which can be very well met, by using organic manures, composts, vermicompost, bio-fertilizers and inorganic fertilizers. Organic sources constitute a dependable source of macro and micro nutrients, while inorganic fertilizers can provide one or two major nutrients. It has been observed that sole application of organic manures or inorganic fertilizers exhibit a lower nutrient uptake but their integration was proved to be superior than individual sources (Jose et al. 1988, Abusaleha 1992, Narayan et al. 2004). Since a very meager work has been conducted under Kashmir conditions on okra in this regard, an investigation was conducted to access the influence of organic manures and inorganic fertilizers on nutrient uptake in okra.

Methods

A field experiment was conducted during *kharif* of 2004 and 2005 at experimental field of Division of Olericulture, 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 nitrogen, high in available phosphorus, medium in available potassium and low in available sulfur. The experiment was laid out in simple square lattice design with two replications, each replication comprised 25 treatments which included T₁—Recommended fertilizer dose (RFD) 120 : 60 : 60 N : P₂O₅ : K₂O kg/ha, T₂—Farm yard manure (FYM) 30 t/ha, T₃—Sheep manure (SM) 20 t/ha, T₄—Poultry manure (PM) 6 t/ha, T₅—Vermicompost (VC) 6 t/ha, T₆—Bio-fertilizers (BF) *Azospirillum* + *Phosphobacteria* 7 kg/ha, T₇—FYM 6 t + SM 4 t + PM 1 t + VC 1 t + BF 7 kg/ha, T₈—FYM 15 t + SM 10 t/ha, T₉—FYM 15 t + PM 3 t/ha, T₁₀—FYM 15 t + VC 3 t/ha, T₁₁—FYM 15 t + BF 7 kg/ha, T₁₂—SM 10 t + PM 3 t/ha, T₁₃—SM 10 t + VC 3 t/ha, T₁₄—SM 10 t + BF 7 kg/ha, T₁₅—PM 3 t + VC 3 t/ha, T₁₆—PM 3 t + BF 7 kg/ha, T₁₇—VC 3 t + BF 7 kg/ha, T₁₈—RFD 50% 60 : 30 : 30 N : P₂O₅ : K₂O kg/ha, T₁₉—FYM 15 t + 60 : 30 : 30 N : P₂O₅ : K₂O kg/ha, T₂₀—SM 10 t + 60 : 30 : 30 N : P₂O₅ : K₂O kg/ha, T₂₁—PM 3 t + 60 : 30 : 30 N : P₂O₅ : K₂O kg/ha, T₂₂—VC 3 t

Table 1. Effect of organic manures and inorganic fertilizers on nutrient uptake in okra cv SKBS-11.

Treatment	Nitrogen (kg/ha)	Phosphorus (kg/ha)	Potassium (kg/ha)	Sulfur (kg/ha)	Calcium (kg/ha)	Magnesium (kg/ha)
T ₁	107.36	19.74	101.42	15.21	102.98	52.03
T ₂	63.86	14.26	62.56	12.10	82.16	42.64
T ₃	70.86	15.20	71.93	12.74	86.67	44.38
T ₄	91.37	18.64	79.74	13.79	94.08	48.58
T ₅	78.81	15.58	75.86	13.25	90.29	46.81
T ₆	50.49	10.52	73.74	9.86	61.67	31.92
T ₇	104.71	19.54	98.88	14.99	100.96	52.07
T ₈	71.34	15.67	72.58	12.89	87.17	45.02
T ₉	88.47	18.20	86.45	13.75	93.88	48.26
T ₁₀	83.46	16.41	75.65	13.29	90.66	46.71
T ₁₁	73.07	14.71	64.35	12.37	84.74	43.77
T ₁₂	95.33	18.92	89.68	14.25	97.32	58.21
T ₁₃	88.01	16.94	83.71	13.43	92.06	47.33
T ₁₄	79.80	16.26	77.66	12.92	88.49	45.37
T ₁₅	101.35	19.17	90.54	14.30	97.82	50.38
T ₁₆	94.22	18.51	88.86	14.34	97.03	50.31
T ₁₇	89.94	18.12	87.39	14.01	94.72	49.06
T ₁₈	67.76	10.69	45.94	10.81	67.49	35.03
T ₁₉	100.67	20.03	98.84	18.22	123.21	63.29
T ₂₀	109.22	22.67	110.56	18.82	129.01	65.86
T ₂₁	121.88	27.92	125.51	20.97	132.15	67.20
T ₂₂	113.33	24.52	114.33	19.26	131.09	66.78
T ₂₃	99.01	22.14	96.38	18.62	120.21	61.82
T ₂₄	132.33	31.91	139.35	21.51	135.37	70.50
T ₂₅	28.69	5.73	24.40	6.30	37.33	19.27
CD at 5%	3.08	0.84	4.22	0.44	3.18	1.63

+ 60 : 30 : 30 N : P₂O₅ : K₂O kg/ha, T₂₃—BF 7 kg + 60 : 30 : 30 N : P₂O₅ : K₂O kg/ha, T₂₄—FYM 3 t + SM 2 t + PM 0.5 t + VC 0.6 t + BF 7 kg + 60 : 30 : 30 N : P₂O₅ : K₂O kg/ha and T₂₅—NO OM/VC/BF/RFD. The seeds of okra cv SKBS-11 were sown on 20 May in plots of size 3.0 × 3.0 meters at spacing of 50 × 30 cm during both the years. Full dose of phosphorus, potash and ½ dose of nitrogen were applied as basal dose, while remaining nitrogen was applied in split application 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 in the field thoroughly as basal dose. Biofertilizers were applied both as seed inoculant (1.0 kg/ha) and soil inoculant (2.5 kg/ha). All cultural operations were performed based on package of practice. Five plants out of ten observational plants and representative sample of okra fruits were selected randomly from each treatment at final harvest stage to serve as a substrate for plant nutrient analysis using standard

procedures. Pooled data were analyzed using nested classification (Gupta and Prasad 2006).

Results and Discussion

Nutrient uptake in okra was significantly influenced by various treatments under study. Treatment T₂₄, registered maximum uptake of 132.33, 31.91, 139.35, 21.51, 135.37, and 70.58 kg/ha for nitrogen, phosphorus, potassium, sulfur, calcium and magnesium respectively and was found to be significantly superior over rest of the treatments (Table 1). Among sole application of organics, treatment T₄, recorded maximum uptake of 91.37, 18.64, 79.74, 13.79, 94.08 and 48.58 kg/ha and was significantly superior to rest of sole organics, T₁₈ and T₂₅ but recorded significantly lower values than T₁ (Table 1). Integration among organics exhibited an increase in nutrient uptake. Treatment T₇, exhibited higher uptake of 104.71, 19.54, 98.88, 14.99, 100.96 and 52.07 kg/ha for nitrogen, phosphorus, potassium, sulfur, calcium, and magnesium respectively

and was significantly superior to all organic integrations, sole application of organics, T₁₈ and T₂₅ but was statistically at par with T₁ (Table 1). Combined application of individual organic sources with recommended fertilizer dose in equal proportions (50 : 50) exhibited an increase in nutrient uptake over sole application of organics, inorganic fertilizer and organic integrations. Treatment T₂₁ registered higher nutrient uptake of 121.88, 27.92, 125.51, 20.97, 132.15, and 67.20 kg/ha and was significantly superior to T₁, T₇, T₁₈, T₁₉, T₂₀, T₂₂, T₂₃ and T₂₅, but exhibited at par results T₂₀ and T₂₂ for calcium and magnesium (Table 1).

Enhanced nutrient uptake by okra plants due to integration with inorganic fertilizers and conjugation among organic sources in equal proportion could be attributed to balanced C/N and C/P ratios, higher organic matter build up, more nutrient retention, less leaching, more nutrient availability and more microbial activity leading to higher nutrient uptake. Besides, this synergistic effect among organic sources might have also increased nutrient availability. Increase in nitrogen and phosphorus have synergistic effect on potassium, calcium, and magnesium uptake. Increase in uptake of sulfur, calcium, and magnesium is attributed to organics, as they are excellent source of these nutrients (Tandon 1993). Superiority of poultry manures either as sole application or in combination with other organic sources and inorganic fertilizers with respect to nutrient uptake over rest of the organics can be attributed to its nutritional richness, quick mineralization, narrow C/P ratio. Enhanced nutrient uptake due to inorganic fertilizer over sole application of organics and their integration could be attributed to the reason that plants take nutrient in inorganic form and these become readily available to plants. Similar observations were made by other research workers (Jose et al. 1988, Abusaleha 1992,

Prabhakran 2003, Swain et al. 2003, Dademal and Dongole 2004, Narayan et al. 2004) in okra and other vegetable crops.

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