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Location Specific Nutrient Management for Sweet Potato in Coastal Saline Soils of Andhra Pradesh

K. Laxminarayana

Regional Centre of Central Tuber Crops Research Institute, Bhubaneswar 751 019, Odisha, India
Corresponding author: K. Laxminarayana, e-mail: klnarayana69@rediffmail.com

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Abstract

A field experiment was conducted for two consecutive *rabi* (winter) seasons during 2009-2010 and 2010-2011 in an Alfisol to optimize the doses of N, P and K for sustainable production of good quality tubers in sweet potato in the coastal saline soil of Andhra Pradesh. The results of the study revealed that Pusa Safed was superior among the seven genotypes in tuber and vine production (13.6 and 14.3 t ha^{-1} respectively) followed by Kishan and Samrat. Application of 75% of the recommended dose of NPK resulted in significantly highest tuber yield (13.1 t ha^{-1}) and starch content (19.8 %). Significantly highest starch content (21.3 %) was observed in Kishan. Crop uptake of N, P, and K was significantly higher in Pusa Safed, Kishan and Samrat. Incorporation of FYM @ 5 t ha^{-1} resulted in higher yield, quality and uptake of nutrients over that of 50% NPK. However, the white-fleshed genotypes exhibited higher yield potential and bio-chemical constituents than the orange-fleshed, indicating that the white-fleshed genotypes were relatively tolerant to salinity stress. Thus, the results indicated that application of 75% of NPK was sufficient and the white-fleshed genotypes, Pusa Safed, Kishan and Samrat were tolerant to moderate salinity (> 10 dS m^{-1}) as these genotypes produced sustainable yields of good quality tubers. This package offers good scope for food and nutritional security in the coastal saline soils of Eastern India.

Key words: Salinity, yield, proximate composition, nutrient uptake, sweet potato

Introduction

Salinity stress adversely affects crop yields throughout the world reducing agricultural production, whether it is for subsistence or economic gains. The plant response to salinity consists of numerous processes that must function in co-ordination to alleviate both cellular hyper-osmolarity and ion disequilibrium (Yokoi et al., 2002). In addition, crop plants must be capable of satisfactory production of biomass in saline environment (yield stability). Tolerance to biotic and/or abiotic stress and yield stability are complex genetic traits that are difficult to establish in crops since salt stress may occur as a catastrophic episode, being imposed continuously or intermittently, or become gradually more severe at any stage during development. It has been estimated that about one billion hectares of land is affected by salinity, 60% of which is cultivated (Goyal et al., 2003). India has a total coastline of about 8129 km and the salt affected soils occupy 9.38 m ha. Out of this about 5.5 m ha are saline soils including 3.1 m ha of coastal saline soils, which constitute 30% of the total salt affected soils of the country, while 3.88 m ha is alkali soils (IAB, 2000). These coastal saline soils are rich in soluble salts of chlorides and sulphates in conjunction with Na, Ca and Mg, but acidic in reaction. Salt content of these soils is generally low i.e. 2 - 3 dS m^{-1} during rainy season due to dilution effect of heavy rains and it rises to 10 - 40 dS m^{-1} during summer. The pH of these soils varied from

5.0 - 8.0 and exchangeable Na dominated by 18 - 27 % followed by Mg and Ca. Excess salts interfere with plant nutrition by affecting nutrient availability, uptake, or their physiological role within the plant. Usually there is a shift in the onset of monsoon rains, occurrence of prolonged dry spell, possibly due to current global warming with the attendant climate change. It is inevitable to reduce the dose of inorganic sources of nutrients and use various organic sources, especially in this era of organic agriculture to sustain the crop productivity and reduce the negative impact of excessive use of chemical fertilizers on climate change.

Dynamic field-specific management of N, P and K fertilizers to optimize the supply and crop demand for nutrients and the nutrient supply from naturally occurring indigenous sources such as the soil, organic amendments, crop residue, manure and irrigation water is necessary in such situations. Selection of suitable crops and efficient genotypes are viable options for sustainable crop production in saline soils besides management practices like land ploughing, levelling, flushing, draining of excess water, application of amendments and flooding with good quality irrigation water. Salt stress hampers the rice productivity in *kharif* while it will not allow cultivation of pulses and other sensitive crops during *rabi* season. The osmotic stress due to salts is the major reason for low biological activity, which can be significantly influenced by application of organic amendments and growing of salt-tolerant crops/cultivars. The relative tolerance of different crops to salinity has been evaluated by many workers (Dagar, 2005).

Sweet potato (*Ipomoea batatas* L.) is tolerant to adverse environmental conditions such as drought, salinity, low soil fertility, high rainfall and it requires very little labor and care as compared to other crops (Abdissa et al., 2011). Nearly half of the sweet potatoes produced in Asia are used for animal feed, whereas it is used for human consumption in Africa referring to its importance as a staple and sustainable crop in the world (CIP, 2008). This highly nutritious crop gives better and faster production under diverse agro-ecological conditions with less inputs (Lim et al., 2007) and has immense potential to combat food shortage, malnutrition and poverty (CIP, 2008). Soil salinity is a serious problem for agriculture in coastal regions and has immense agronomic significance. Hence sustainable production of sweet potato in this region needs suitable interventions (Tripathi et al., 2007; Dasgupta et al., 2008a). Screening of salt tolerant genotypes of sweet potato in saline sites is complicated owing to the large temporal and spatial variations in the soil salinity level, differential ontogenic reactions of the plant to salinity and a large genotype x environment interactions (Ekanayake and Dodds, 1993). Sweet potato varietal improvement against salinity stress is necessary to improve its potential as a food security and famine relief crop, besides production of large amount of fodder for grazing of milch cattle during summer. The present investigation was carried out in a participatory mode in farmer's field in order to optimize the NPK fertilizers for enhanced production of sweet potato under natural conditions in the coastal saline soils of Andhra Pradesh.

Materials and Methods

A field experiment was laid out for two consecutive *rabi* (winter) seasons during January-May in 2009-2010 and 2010-2011 at farmer's field in a participatory mode at Vadapalem village, Baruva Gram Panchayat, Sompeta Mandal, Srikakulam district of Andhra Pradesh to optimize the nutrients for sustainable production of sweet potato in the coastal saline soil of Andhra Pradesh. The experimental site is located about 200 m away from the Bay of Bengal. Composite soil samples were analyzed for physico-chemical properties by standard procedures (Page et al., 1982). The experimental soil is clay loam (Typic Ustalf), neutral (pH 7.12), saline (EC 2.64 dS m^{-1} initial) with 0.44% organic C, 0.084 % total N, 225.8, 28.1 and 632 kg ha^{-1} of available N, P and K respectively. It was observed that the soil salinity rose up to 6.40 dS m^{-1} (1:2 soil: water ratio) at the time of harvest from the initial level due to capillary movement of salts to surface soil under higher temperature. However, the pH showed no significant change during the crop growth period.

The trial was laid out with four white-fleshed genotypes of sweet potato (V_1: Pusa Safed, V_2: Kishan, V_3: Samrat and V_4: Sree Bhadra) and three orange-fleshed genotypes (V_5: CIP-440127, V_6: ST-14 and V_7: CIP-440038) as one factor and four levels of nutrients i.e. T_1: control (no manure or fertilizers), T_2: 50% NPK (38:11:31 kg N, P and K ha^{-1}), T_3: 75% NPK (56:16.4:47 kg N, P and K ha^{-1}) and T_4: FYM @ 5.0 t ha^{-1} as the other factor. The treatments were replicated thrice as a factorial experiment with two factors in a Randomized Block Design. After harvest of lowland *kharif* paddy in December, the field was ploughed, levelled and the treatments were imposed. Well decomposed farmyard manure (FYM) (0.56, 0.26 and 0.72 % N, P and K respectively) was applied 15 days in advance before planting sweet potato in the respective plots. One-third of N in the form of urea, full dose of P as single super phosphate, half of K as muriate of potash was applied at the time of planting. One-third N was applied at 30 days after planting (DAP) and the remaining one-third N and 50% K were applied at 45 DAP. The vine cuttings were dipped for half an hour in monocrotophos (35% EC) solution and planted at a spacing of 60 x 20 cm. The crop was harvested at 120 days and yield parameters like vine length, number of tubers per plant, average tuber weight, tuber yield and vine yield were recorded at harvest.

Tuber and vine samples were collected at harvest, washed thoroughly, oven dried, ground, digested in diacid mixture (HNO_3: $HClO_4$, 7:3) and estimated for total P and K (Jackson, 1973). Plant samples were digested in concentrated H_2SO_4 and analyzed for N content by steam distillation (Humphries, 1956). Uptake of N, P and K was computed by multiplying the nutrient contents with the respective dry matter yield of various plant parts and adding up. Tuber samples were analyzed for bio-chemical constituents. Total sugars were estimated in the alcohol filtrate and the starch was determined in the residue as per the procedure outlined by Moorthy and Padmaja (2002). Dry matter of the tubers was estimated by drying the samples in the oven at 60°C for 120 hrs. The data was analyzed statistically and the critical difference values were computed for comparison and interpretation of data (Panse and Sukhatme, 1978).

Results and Discussion

Yield response

White-fleshed genotypes, Pusa Safed, Kishan and Samrat exhibited higher tolerance for salt stress under natural saline conditions, while the orange-fleshed accessions had relatively low salt tolerance. Significantly highest tuber and vine yields were produced by Pusa Safed (13.63 and 14.26 t ha^{-1} respectively) followed by Kishan, while CIP-440038 produced the lowest tuber yield (9.29 t ha^{-1}) (Table 1). Significantly highest tuber yield (13.09 t ha^{-1}) was observed due to application of 75% NPK with an yield increase of 54% over control (Table 1) followed by 50% NPK which was on par with FYM. Addition of 75% NPK also resulted in significantly highest vine yield (14.50 t ha^{-1}) followed by FYM and 50% NPK.

Table 1. Effect of genotypes and nutrient levels on yield and quality of sweet potato in a coastal saline soil

Treatment	Tuber yield* (t ha^{-1})			Vine yield* (t ha^{-1})			Quality attributes (mean of 2 years data)		
	2009-2010	2010-2011	Mean	2009-2010	2010-2011	Mean	Starch* (%)	Sugars* (%)	Dry matter (%)
Genotypes									
V_1 - Pusa Safed	13.52	13.75	13.63	14.02	14.50	14.26	18.98	3.13	26.92
V_2 - Kishan	13.26	10.97	12.12	16.00	12.02	14.01	21.33	3.18	28.79
V_3 - Samrat	10.71	11.51	11.11	12.09	15.15	13.62	20.38	3.24	27.68
V_4 - Sree Bhadra	10.35	9.80	10.04	11.59	11.08	11.33	18.70	3.11	26.11
V_5 - CIP-440127	9.29	12.84	11.07	8.98	13.63	11.31	17.47	3.13	23.75
V_6 - ST-14	10.01	8.65	9.33	12.23	10.98	11.60	18.09	3.20	23.61
V_7 - CIP-440038	8.38	10.21	9.29	8.83	12.85	10.84	17.59	3.11	23.59
CD (0.05)	1.90	1.13	1.41	1.83	1.22	1.43	0.68	0.11	0.74
Nutrient levels									
T_1 - Control	8.39	8.66	8.52	9.66	10.54	10.10	17.92	2.99	24.25
T_2 - 50% NPK	11.23	11.19	11.20	12.19	12.64	12.41	18.84	3.17	25.79
T_3 - 75% NPK	12.97	13.20	13.09	14.04	14.96	14.50	19.81	3.24	27.18
T_4 - FYM @ 5.0 t ha^{-1}	10.56	11.36	10.96	11.96	13.40	12.68	19.15	3.22	25.89
CD (0.05)	1.43	0.39	0.71	1.38	0.40	0.62	0.26	0.05	0.44

* Values expressed in fresh weight basis

Significantly highest tuber yield (16.65 t ha^{-1}) was observed in the interaction, V_1T_3 i.e. application of 75% NPK in Pusa Safed (Table 2) followed by V_2T_3, i.e. application of 75% NPK in Kishan (Table 2). Among the orange-fleshed genotypes, application of 75% NPK in CIP-440127 (V_5T_3) produced significantly highest tuber yield (13.08 t ha^{-1}). Similar to tuber yield, the orange-fleshed genotypes had lower vine yield than white-fleshed genotypes. Addition of 75% NPK in Pusa Safed (V_1T_3) and Kishan (V_2T_3) resulted in significantly highest vine yield (16.58 t ha^{-1}). Incorporation of FYM showed slightly higher vine yield in all the genotypes in comparison to 50% NPK, which might be ascribed to enhanced nutrient transformations and improvement in soil physical properties (Ossom and Rhykerd, 2008).

The activity of antioxidative enzymes like superoxide dismutase (SOD), guaiacol peroxidase (GPX) and catalase (CAT) activities in the leaves of salt tolerant genotypes increased than that in the susceptible ones, indicating that oxidative stress may play an important role in salt stressed sweet potato plants and the greater protection of tolerant plants from salt induced oxidative

Table 2. Interaction effect of genotypes and nutrient levels on yield and quality of sweet potato in a coastal saline soil

Treatment	Tuber yield* (t ha^{-1})			Vine yield* (t ha^{-1})			Quality attributes (mean of 2 years data)		
	2009-2010	2010-2011	Mean	2009-2010	2010-2011	Mean	Starch* (%)	Sugars* (%)	Dry matter (%)
V_1T_1	9.99	9.98	9.98	12.20	11.78	11.99	18.20	2.96	25.27
V_1T_2	14.30	14.32	14.31	13.40	14.28	13.84	18.65	3.05	26.97
V_1T_3	17.00	16.30	16.65	16.37	16.80	16.58	19.05	3.25	28.22
V_1T_4	12.80	14.38	13.59	14.10	15.14	14.62	20.00	3.27	27.21
V_2T_1	11.30	8.41	9.85	11.07	9.22	10.15	20.68	3.08	27.34
V_2T_2	13.27	10.94	12.11	17.12	11.99	14.55	21.58	3.22	28.19
V_2T_3	15.20	13.86	14.53	19.40	13.77	16.58	22.67	3.28	30.43
V_2T_4	13.25	10.68	11.97	16.40	13.08	14.74	20.39	3.12	29.19
V_3T_1	7.36	9.18	8.27	10.40	12.54	11.47	19.39	2.99	26.07
V_3T_2	11.05	11.42	11.23	12.56	14.83	13.70	20.44	3.29	27.93
V_3T_3	13.25	13.96	13.60	13.27	17.74	15.50	21.78	3.40	29.44
V_3T_4	11.19	11.47	11.33	12.11	15.48	13.80	19.89	3.27	27.27
V_4T_1	7.71	7.22	7.43	9.92	8.94	9.43	17.00	2.92	24.45
V_4T_2	10.78	9.90	10.26	11.67	10.43	11.05	18.32	3.14	25.76
V_4T_3	12.40	11.28	11.84	13.67	12.56	13.11	20.37	3.04	27.66
V_4T_4	10.50	10.78	10.64	11.10	12.37	11.74	19.11	3.33	26.56
V_5T_1	7.93	10.34	9.14	6.40	11.74	9.07	16.46	2.92	22.07
V_5T_2	9.79	12.63	11.21	9.07	14.24	11.65	17.44	3.24	23.75
V_5T_3	10.78	15.38	13.08	10.71	15.88	13.30	17.59	3.22	25.11
V_5T_4	8.65	13.01	10.83	9.74	12.66	11.20	18.37	3.13	24.05
V_6T_1	8.18	7.47	7.83	10.56	8.71	9.63	17.12	3.08	22.03
V_6T_2	10.46	8.68	9.57	12.33	10.34	11.34	18.13	3.24	23.85
V_6T_3	12.05	9.64	10.85	14.18	13.01	13.59	18.75	3.22	24.62
V_6T_4	9.35	8.79	9.07	11.83	11.85	11.84	18.34	3.26	23.95
V_7T_1	6.23	7.99	7.11	7.04	10.84	8.94	16.62	2.98	22.52
V_7T_2	8.96	10.42	9.69	9.16	12.37	10.77	17.33	3.04	24.08
V_7T_3	10.13	11.98	11.06	10.65	14.99	12.82	18.44	3.25	24.78
V_7T_4	8.18	10.44	9.31	8.46	13.20	10.83	17.97	3.15	22.99
CD (0.05)	3.79	1.04	1.87	3.65	1.06	1.63	0.70	0.14	1.18

* Values expressed in fresh weight basis

V_1 - Pusa Safed, V_2 - Kishan, V_3 - Samrat, V_4 - Sree Bhadra, V_5 - CIP-440127, V_6 - ST-14, V_7 - CIP-440038

T_1 - Control, T_2 - 50% NPK, T_3 - 75% NPK, T_4 - FYM @ 5.0 t ha^{-1}

damage resulted through the increase in the activity of antioxidant enzymes (Dasgupta et al., 2008b). Residual effect of organic manures and fertilizers, which were applied to *kharif* paddy and incorporation of crop residues of paddy might have helped in higher response to limited doses of chemical fertilizers for sustainable production of sweet potato.

Proximate composition

Dry matter ranged from 23.59 to 28.79% in the genotypes studied (Table 1). Among the genotypes, Kishan had significantly highest dry matter (28.79%) followed by Samrat and Pusa Safed. However, the orange-fleshed sweet potato genotypes had lowest dry matter ranging from 23.61 to 23.75%. Significantly highest starch content (21.33%) was observed in Kishan followed by Samrat, Pusa Safed and Sree Bhadra (Table 1). Orange-fleshed sweet potato genotypes showed relatively lower starch content. Among the genotypes, Samrat had significantly highest total sugars (3.24%) on par with ST-14 (3.20%). Application of 75% of NPK resulted in significantly highest dry matter (27.18%), with an increase of 12% over control, followed by FYM on par with 50% NPK. Application of 75% of the recommended dose of NPK produced significantly highest starch content (19.81%). The use of inorganic fertilizers not only enhanced the crop yields but also had significant effect on bio-chemical constituents of sweet potato, similar to the findings of Mozafar (1993). The crop response to applied fertilizers depends on soil organic matter, which could be enriched either by natural returns through roots, stubbles and crop wastes as well as application of various organic manures (Ayoola and Adeniyan, 2006).

The orange-fleshed genotypes showed relatively lower dry matter, starch and sugar contents irrespective of the nutrient levels as compared to white-fleshed genotypes. The dry matter content varied from 22.03 to 30.43%. Application of 75% NPK in Kishan (V_2T_3) resulted in significantly highest dry matter (30.43%) and starch contents (22.67%) (Table 2). Application of 75% NPK in Samrat (V_3T_3) produced significantly highest total sugars (3.40%).

Nutrient uptake

Total uptake of N was significantly highest in Pusa Safed (71.64 kg ha^{-1}) (Table 3). Application of 75% of the recommended dose of NPK resulted in significantly highest total uptake of N (71.95 kg ha^{-1}) with an uptake response of 58% over control, followed by FYM and 50% NPK. It was observed that vines had significantly highest

Table 3. Effect of genotypes and nutrient levels on nutrient uptake (kg ha^{-1}) of sweet potato (mean of 2 years data)

Treatment	Tubers			Vines			Total uptake		
	N	P	K	N	P	K	N	P	K
Genotypes									
V_1 - Pusa Safed	26.57	13.52	38.30	45.06	12.63	36.80	71.64	26.15	75.10
V_2 - Kishan	24.71	12.07	40.58	44.28	12.51	37.23	68.99	24.58	77.81
V_3 - Samrat	23.31	12.08	33.49	41.02	12.74	34.25	64.33	24.82	67.74
V_4 - Sree Bhadra	18.81	9.62	30.31	35.06	11.00	30.60	53.87	20.62	60.91
V_5 - CIP-440127	22.67	10.13	28.32	35.62	10.77	30.32	58.29	20.90	58.64
V_6 - ST-14	16.17	8.51	24.45	33.65	10.09	30.49	49.82	18.59	54.93
V_7 - CIP-440038	17.78	8.02	24.84	34.47	10.31	29.16	52.24	18.33	54.00
CD (0.05)	1.55	1.37	3.69	4.34	1.78	3.76	4.75	2.20	5.27
Nutrient levels									
T_1 - Control	14.86	6.99	21.63	30.64	8.94	25.54	45.50	15.94	47.17
T_2 - 50% NPK	21.41	10.41	31.57	37.88	11.27	32.28	59.29	21.68	63.86
T_3 - 75% NPK	27.07	13.62	39.50	44.87	13.39	38.72	71.95	27.01	78.22
T_4 - FYM @ 5.0 t ha^{-1}	22.38	11.22	33.17	40.41	12.13	34.23	62.80	23.36	67.40
CD (0.05)	1.03	0.83	2.23	1.74	0.48	1.63	2.28	1.11	3.17

uptake of N in all the varieties, irrespective of nutrient levels as compared to tubers, which might be due to higher concentration of N in the foliage rather than tubers. Nitrogen regime also had a significant effect on the concentration of N in the leaves of plants, with the higher N regime having higher levels of leaf N and the concentration of N did not differ significantly among the genotypes. However, the variation in the dry matter yields of tubers and vines have contributed to variation in the uptake of NPK by the crop. These results are in accordance to the findings of Mao et al. (2001) and Marti and Mills (2002).

Significantly highest total uptake of P (26.15 kg ha^{-1}) was observed in Pusa Safed (Table 3) followed by Samrat and Kishan. This was found lowest in CIP-440038 (18.33 kg ha^{-1}). Addition of 75% of the recommended dose of NPK resulted in significantly highest total uptake of P

Table 4. Interaction effect of genotypes and nutrient levels on nutrient uptake (kg ha^{-1}) of sweet potato (mean of 2 years data)

Treatment	Tubers			Vines			Total uptake		
	N	P	K	N	P	K	N	P	K
V_1T_1	16.81	8.50	24.76	35.67	9.44	30.35	52.49	17.94	55.11
V_1T_2	27.19	13.71	38.80	44.18	12.13	35.49	71.37	25.84	74.29
V_1T_3	34.13	17.73	49.24	53.08	15.50	43.10	87.21	33.23	92.34
V_1T_4	28.16	14.13	40.41	47.32	13.46	38.25	75.48	27.59	78.66
V_2T_1	17.79	8.14	29.69	31.05	8.99	26.29	48.84	17.13	55.98
V_2T_2	23.80	11.55	39.29	45.89	12.34	37.88	69.69	23.89	77.18
V_2T_3	31.88	15.87	51.66	52.64	14.80	44.58	84.53	30.67	96.24
V_2T_4	25.37	12.71	41.67	47.52	13.90	40.15	72.89	26.61	81.82
V_3T_1	16.19	7.82	22.18	33.40	10.58	27.90	49.59	18.40	50.08
V_3T_2	23.21	12.00	33.80	40.81	12.93	34.55	64.02	24.94	68.35
V_3T_3	29.58	15.95	42.32	45.89	14.26	39.10	75.49	30.22	81.42
V_3T_4	24.24	12.54	35.66	43.97	13.17	35.46	68.22	25.71	71.12
V_4T_1	12.41	6.05	19.58	28.41	8.89	24.58	40.82	14.94	44.16
V_4T_2	18.42	9.22	30.00	32.83	10.63	29.38	51.25	19.85	59.38
V_4T_3	23.81	12.15	37.76	41.32	12.29	36.46	65.13	24.44	74.22
V_4T_4	20.61	11.05	33.88	37.67	12.20	31.98	58.27	23.25	65.86
V_5T_1	16.83	7.14	20.31	28.45	8.47	22.95	45.27	15.61	43.26
V_5T_2	22.84	9.81	28.61	36.23	10.85	30.65	59.07	20.66	59.26
V_5T_3	27.99	12.73	34.41	41.68	12.76	36.09	69.67	25.49	70.50
V_5T_4	23.02	10.84	29.94	36.11	11.01	31.60	59.13	21.84	61.54
V_6T_1	11.86	6.02	17.90	26.28	8.18	24.08	38.14	14.20	41.97
V_6T_2	16.01	8.43	24.98	32.69	10.07	29.16	48.71	18.50	54.14
V_6T_3	20.03	10.64	29.81	39.93	11.83	36.48	59.95	22.47	66.29
V_6T_4	16.77	8.93	25.10	35.71	10.26	32.24	52.48	19.20	57.34
V_7T_1	12.12	5.29	16.98	31.20	8.06	22.64	43.32	13.35	39.62
V_7T_2	18.42	8.15	25.54	32.50	9.96	28.85	50.92	18.11	54.39
V_7T_3	22.06	10.30	31.30	39.58	12.27	35.22	61.64	22.57	66.52
V_7T_4	18.52	8.36	25.55	34.58	10.94	29.91	53.10	19.30	55.46
CD (0.05)	2.73	2.19	5.91	4.61	1.28	4.31	6.02	2.93	8.38

V_1 - Pusa Safed, V_2 - Kishan, V_3 - Samrat, V_4 - Sree Bhadra, V_5 - CIP-440127, V_6 - ST-14, V_7 - CIP-440038

T_1 - Control, T_2 - 50% NPK, T_3 - 75% NPK, T_4 - FYM @ 5.0 t ha^{-1}

(27.01 kg ha^{-1}) in all the varieties. Incorporation of FYM resulted in higher total P uptake than half the recommended dose of NPK. The supplementary and complementary use of organic and inorganic fertilizers augments the efficiency of both to maintain a high level of soil productivity.

The total uptake of K was found highest in Kishan (77.81 kg ha^{-1}) irrespective of nutrient levels, on par with Pusa Safed followed by Samrat (Table 3). All the orange-fleshed genotypes showed lower uptake of K and CIP-440038 had significantly lowest total uptake of K (54.00 kg ha^{-1}). Higher levels of NPK showed an increasing trend for total K uptake and application of 75% of the recommended dose of NPK resulted in significantly highest uptake of K (78.22 kg ha^{-1}) in all the varieties with an uptake response of 65.8% over control. Incorporation of organic manure alone also resulted in significantly higher total uptake of K in comparison to application of half of the recommended dose of NPK, which might be ascribed to improvement in organic matter content of the soil that facilitated higher retention and supply of essential nutrients as well as improvement in soil physical and biological properties. These results corroborates with the findings of Ravindran and Bala Nambisan (1987) and Svotwa et al. (2007).

Perusal of the data in Table 4 revealed that significantly highest total uptake of N and P (87.21 and 33.23 kg ha^{-1} respectively) was observed in the interaction, V_1T_3 (application of 75% of NPK in Pusa Safed). Significantly highest total uptake of K (96.24 kg ha^{-1}) was found due to application of 75% of the recommended dose of NPK in Kishan. Incorporation of organic manure (FYM) alone showed higher NPK contents in tubers and vines of all the genotypes over that of 50% of the recommended dose of NPK. Orange-fleshed genotypes showed relatively lower contents of N, P and K in tubers and vines in comparison to white-fleshed genotypes of sweet potato.

The present study indicated that the white-fleshed genotypes, Pusa Safed, Kishan and Samrat, produced higher tuber and vine yields and exhibited good quality traits over orange-fleshed ones. Among these, Pusa Safed was found to be the most promising with salinity tolerance. The orange-fleshed sweet potato accessions like CIP-440127, ST-14 and CIP-440038 were relatively less tolerant to salinity. Application of NPK @ 56:16:47 kg ha^{-1} produced sustainable yields of good quality tubers. Incorporation of FYM @ 5.0 t ha^{-1} alone resulted in higher response than half of the recommended dose of NPK, suggesting that application of organic manures could meet the nutrient requirements of the crop. Thus cultivation of salt tolerant genotypes of sweet potato offers good scope for livelihood and nutritional security in the coastal saline soils of Andhra Pradesh.

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