



EFFECT OF NUTRIENT MANAGEMENT PRACTICES ON COB YIELD, PROTEIN CONTENT, NPK UPTAKE BY SWEET CORN AND POST HARVEST N, P₂O₅ AND K₂O

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ABSTRACT

A field experiment was conducted on sandy loam soil of Agriculture College Farm, Naira during *rabi*, 2012-13. The experiment was laid out in randomized block design with the seven treatments, each replicated four times. Among the fertility levels tried, application of 180-75-60 kg N P K ha⁻¹ + vermiwash at 20, 35 and 50 DAS recorded the highest growth parameters, yield attributes and cob yield which was however, found parity with 180-75-60 kg N P K ha⁻¹ + vermicompost. Integrated nutrient management treatments exhibited their superiority at the highest levels of fertilization over the same levels under chemical sources in enhancing green cob yield. The lowest cob yield was associated with non-supply of fertilizers.

KEY WORDS: Sweet corn, vermicompost, vermiwash, integrated nutrient management.

INTRODUCTION

Maize (*Zea mays* L.) is a miracle crop emerging as the third most important cereal crop in the world after wheat and rice, both as food for human consumption and as a feed for live stock. Out of various specialty corns, sweet corn is a mutant type with one or more recessive alleles in homozygous condition that enable the endosperm to accumulate twice the sugar content as that of seed corn. Recently, sweet corn is gaining popularity among nutritive and health conscious urban masses in India with an immense potential in domestic and international market. Sweet corn is an excellent source of sugars, dietary fibre, vitamin-C, beta-carotene, niacin, in addition to calcium and potassium. It is highly prized by corn fanciers due to succulent and tender kernels with sweet flavour. Sweet corn is marketed fresh, roasted or boiled and canned for future use. Due to its extra sweetness (14-20 % sugar), short duration and impressive returns sweet corn is gaining attractiveness and ample awareness has been created among the farming community. Judicious use of plant nutrients is a key to realize higher productivity as it alone contributes 40 – 60 % of the crop yield in Maize (Dayanand, 1998). Although increased levels of production can be achieved by increased use of inorganic fertilizers alone but it may lead to deterioration in soil quality besides pollution problems (Gaur and Kumawat, 2000). The use of organic fertilizers such as animal manures and composted materials has been proposed as one of the main pillars of sustainable agriculture as they provide large amounts of macro and micro nutrients for crop growth and eco-friendly besides being renewable alternatives to mineral fertilizers. The use of vermicompost helps in maintaining soil fertility since the mineral elements contained in it were changed to forms more that could be readily taken up by plants such as nitrates, exchangeable phosphorous, soluble potassium, calcium, manganese *etc.* vermiwash is an indispensable part of vermicompost,

which is a watery extract of earthworms that contains N, P, K, Ca and hormones such as auxin, cytokinine and some other secretions and its spray founds to plays an important role in the plant growth and development.

MATERIALS & METHODS

The field experiment was conducted on dryland block of Agriculture College Farm, Naira to find out the optimum fertilizer requirement for *rabi* sweet corn in North Coastal Zone of A.P. The soil of the experimental site was sandy loam in texture with low in organic carbon (0.37 %), medium in available N (295.4 kg ha⁻¹) and available P (17.5 kg ha⁻¹) and high in available K (295.7 kg ha⁻¹). The experiment was laid out in a randomized block design with the seven treatments *viz.*, T₁: Absolute control, T₂: 120-50-40 kg N, P and K ha⁻¹, T₃: 180-75-60 kg N, P and K ha⁻¹, T₄: 120-50-40 kg N, P and K ha⁻¹ + 30 kg N ha⁻¹ through vermicompost, T₅: 180-75-60 kg N, P and K ha⁻¹ + 30 kg N ha⁻¹ through vermicompost, T₆: 120-50-40 kg N, P and K ha⁻¹ + b application of vermiwash thrice at 20, 35 & 50 DAS, T₇: 180-75-60 kg N, P and K ha⁻¹ + application of vermiwash thrice at 20, 35 & 50 DAS and each treatment was replicated four times. The test variety was Sugar-75. The crop was sown on shallow ridges opened at 60 cm apart with a marker and 2 seeds per hill were dibbled to 5 cm deep at 20 cm spacing within the row. The required quantity of vermicompost as per treatments was applied for each plot at the time of sowing on the soil surface and mixed into the soil. One third of the recommended dose of nitrogen, total dose of phosphorus and half of the recommended dose of potassium were applied at the time of sowing as basal dose as per treatments. Nitrogen, phosphorus and potassium were applied in the form of urea, Single super phosphate (SSP) and muriate of potash (MOP) respectively. Remaining dose of nitrogen and potassium were applied as top dressing at knee high stage (45 DAS) and tasseling stage to the respective treatments.

vermiwash is collected after the passage of water through a column of worm action and was used for foliar spray. Next day after sowing of sweet corn, the pre-emergence herbicide, atrazine @ 4.0 g l⁻¹ was sprayed when the field was in moist condition and one hand weeding was done at 30 days after sowing for effective control of all groups of weeds. First irrigation was given immediately after sowing and subsequent irrigations were given at periodical intervals uniformly for all treatments till harvesting of green cobs as per the need. Timely and need based measures were taken to protect the crop from pests and diseases. Green cobs harvested from the net plot was weighed and expressed in t ha⁻¹ the plant samples of sweet corn utilized for recording dry matter accumulation at harvest were ground in a wiley mill to pass through 40 mesh sieves. The ground material was collected in butter paper bags and later used for chemical analysis. Nitrogen, Phosphorus and Potassium content of grain and stover were estimated by micro Kjeldahl's method, vanado molybdate phosphoric yellow colour method (Jackson, 1973) and Flame photometer (Jackson, 1973) method

respectively and it was expressed in percentage. Uptake was calculated by multiplying the nutrient content by the respective cob and stover yields and then summed up to represent total nutrient uptake at harvest. The uptake of N, P and K were expressed in kg per ha. The soil samples were analyzed for available nitrogen Subbiah and Asija (1956), phosphorus and potassium Jackson (1973) of the soil. Data were statistically analysed by following the method of analysis of variance as suggested by Panse and Sukhatme (1978). Critical difference was worked out at 5 per cent level of probability, wherever the treatment at differences were found significant.

RESULTS & DISCUSSION

Nutrient management practices were found to influence the green cob yield of sweet corn to a significant level (Table.1). Maximum green cob yield was recorded with application of 180-75-60 kg N, P and K ha⁻¹ + vermiwash thrice at 20, 35 & 50 DAS (T₇) which was however found parity with application of 180-75-60 kg N, P and K ha⁻¹ + 30 kg N ha⁻¹ through vermicompost (T₅).

TABLE 1. Cob yield (t ha⁻¹), kernel protein content Nutrient (N, P, K) uptake by cob and stover of sweet corn cob and Post-harvest soil fertility as influenced by different nutrient management practices.

Treatments	Cob yield (t ha ⁻¹)	Protein content (%)	uptake(kgha ⁻¹) by cob			uptake(kgha ⁻¹) by stover			Post-harvest status in soil		
			N	P	K	N	P	K	N (kg ha ⁻¹)	P ₂ O ₅ (kg ha ⁻¹)	K ₂ O (kg ha ⁻¹)
T ₁ : Absolute control	6.46	5.72	43.82	12.63	76.88	22.77	9.25	42.56	192	11.4	165
T ₂ : 120-50-40 kg N, P and K ha ⁻¹	12.25	10.22	70.08	32.73	134.09	48.26	24.50	94.07	237	16.24	198
T ₃ : 180-75-60 kg N, P and K ha ⁻¹	18.03	13.20	100.55	47.80	164.64	66.06	30.87	117.94	259	22.80	225
T ₄ : T ₂ + 30 kg N ha ⁻¹ through Vermicompost	16.10	12.55	85.72	38.10	146.60	57.39	26.71	103.36	252	21.47	219
T ₅ : T ₃ + 30 kg N ha ⁻¹ through Vermicompost	20.85	15.62	122.57	52.93	180.29	80.39	35.65	130.47	266	25.36	239
T ₆ : T ₂ + application of Vermiwash thrice at 20, 35 & 50 DAS	16.44	12.78	88.55	40.29	148.27	58.32	29.13	106.81	248	20.52	215
T ₇ : T ₃ + application of Vermiwash thrice at 20, 35 & 50 DAS	21.17	15.85	126.81	54.46	182.44	84.32	36.60	134.96	263	23.08	231
S.Em ±	0.408	0.605	3.847	1.633	3.490	1.607	0.571	2.115	5.53	0.49	3.68
CD (P=0.05)	1.211	1.80	11.428	4.851	10.368	4.774	1.697	6.282	16.43	1.47	10.95

the increase in green cob yield was higher by 227.7 with highest dose of NPK+ vermiwash (T₇) and 222.7% with the same level of NPK supplemented with vermicompost (T₅) over non-supply of nutrients. While, the yield advantage with the integration of the highest dose of NPK with vermiwash was 17.4% and 15.6% with vermicompost over sole application of NPK at the same level through chemical sources alone. Irrespective to the levels of fertilization, application of Vermiwash thrice at 20, 35 & 50 DAS or application of 30 kg N ha⁻¹ through Vermicompost exerted similar effect on cob yield. Non-supply of nutrients (T₁) resulted in the lowest green cob yield. Nitrogen being the major constituent of chlorophyll, aminoacids and proteins, phosphorus being the component of energy compounds viz., ATP, NADP and potassium serving as an activator/ cofactor for various enzymes involved in photosynthesis and CO₂ fixation, could have promoted satisfactory plant growth, photosynthetic surface, yield structure and finally to cob yield under adequate and balanced supply of nutrients at higher level. The finding of the present study were in corroboration with those reported by Raja (2001), Sahoo and Mahapatra (2004). The protein content of sweet corn kernel was significantly influenced by different nutrient management

practices compared to non application of nutrients (Table 1). Integrated nutrient management practices across the fertility levels tried, exhibited their statistical superiority in the accumulation of grain protein content over the same level of nutrients supplied through chemical sources except application of 180-75-60 kg N, P and K ha⁻¹ (T₃). The highest grain protein content was observed when the highest level of NPK was supplemented with vermiwash (T₇), which was however, found parity with the same level of NPK supplemented with vermicompost (T₅). There was an increase in the grain protein content to the tune of 2.65%, and 2.42% when the highest level of NPK through chemical sources alone was integrated with vermiwash (T₇) and vermicompost (T₅) respectively over the same level supplied through chemical sources. The protein content was minimum under non supply of nutrients (T₁) to sweet corn. Nitrogen, being the principle constituent of protein might have substantially increased the protein content of kernel due to increased uptake of nitrogen under higher nutrient level when integrated with vermiculture compounds. Thus, better physiological and bio chemical activity of sweet corn under adequate and balanced nutrient supply might have enhanced the protein content of kernel as was also confirmed by Kar *et al.* (2006) and

Sunitha and Maheswara Reddey (2012). Nutrient management practices exerted conspicuous influence on the uptake of N, P and K by cob and stover of sweet corn (Table 1). Sweet corn crop supplied with the highest level of NPK integrated with vermiwash (T₇) or vermicompost (T₅) registered the highest values for N P K uptake by cob as well as stover which were however, comparable but both significantly superior to rest of the treatments tried. Between the sole chemical sources of nutrient supply, T₃ (180-75-60 kg N, P and K ha⁻¹) was found to be statistically superior to T₂ (120-50-40 kg N, P and K ha⁻¹) in the uptake of nutrients. However, when the lower level of chemical sources was integrated either with vermiwash (T₆) or vermicompost (T₄) were found to be significantly superior over chemical source alone at the same level (T₂). The lowest NPK uptake by cob and stover was registered with absolute control (T₁). This amply demonstrate that the slowly mineralisable nitrogen from integrated sources ensures adequate availability at greater level of absorption and translocation to the plant parts during growing period thereby increased quantities of N in cob and stover. Similarly, the organic sources of N made P and K in available forms for longer period in soil which improved P and K uptake with integrated nutrient supply. Higher values for the uptake of N P K by maize with enhanced levels of nutrient supply was also evidenced by earlier researchers (Massey and Gaur, 2006., Singh and Yadav, 2007 and Sunitha and Maheswara Reddey, 2012). The post harvest available N, P₂O₅ and K₂O status of the soil was altered significantly due to different nutrient management practices (Table 1). Post harvest soil fertility status with respect to available N, P₂O₅ and K₂O was found to be improved with each successive level of nutrient supply and further increased when the successive graded levels were integrated with vermicompost or vermiwash. Significantly higher values for post harvest soil available N, P₂O₅ and K₂O were registered with the application of the highest dose of 180-75-60 kg NP and K ha⁻¹ + 30 kg N ha⁻¹ through vermicompost (T₅), which were however, comparable with application of 180-75-60 kg N, P and K ha⁻¹ + application of vermiwash thrice at 20, 35 & 50 DAS (T₇), 180-75-60 kg N, P and K ha⁻¹, 120-50-40 kg N, P and K ha⁻¹ + 30 kg N ha⁻¹ through vermicompost incase of N and to the same level of NPK + vermiwash (T₇) pertaining to K₂O. The lowest content of post harvest soil available N was observed in plots which received no fertilizer application (T₁). Despite the fact that the uptake of N, P and K were higher with the highest level of NPK when integrated with vermiwash (T₇) or vermicompost (T₅), considerable quantities of nutrients were left over in soil which might have remained after meeting the maximum requirement of sweet corn. These results are in agreement with the findings of Ashoka *et al.* (2009) and Singh *et al.* (2012).

CONCLUSIONS

Based on the outcome of the study, it can be inferred that the integrated nutrient management practice consisting of application of 180-75-60 kg NPK+ vermiwash at 20, 35 and 50 DAS (T₇) or vermicompost at the same level of NPK (T₅) was found to be the best nutrient management option for realizing the highest green cob yield of sweet corn

without any deleterious effect on soil fertility in North Coastal zone of Andhra Pradesh.

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