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Effect of Various Nutrient Management Practices on Yield Attributes, Quality Parameters and Economics of Sweet Corn

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ABSTRACT

A field experiment was conducted by using different organic and inorganic nutrient input sources in Sweet corn (*Zea mays* L. saccharata) during *Rabi*, 2021-22 at Agricultural College Farm, Naira. The soil was sandy loam having pH 7.2, EC 0.051 dSm^{-1}, organic carbon 0.45%, available N 221 kg ha^{-1}, available P_2O_5 16.7 kg ha^{-1} and available K_2O 245 kg ha^{-1}. The experiment was laid out in randomized block design, replicated thrice with nine treatments. Results revealed that application of 100% RDF (180-60-60) NPK Kg ha^{-1} resulted in significantly higher cob girth (15.10 cm), single cob weight without husk (270.3 g), fresh cob yield (10,486 Kg ha^{-1}), kernel uptake N (136.67 kg ha^{-1}), P (30.40 kg ha^{-1}) and K (55.53 kg ha^{-1}), kernel protein content (8.50%), TSS (15.67%) and sugar content (13.63%). The highest gross returns ha^{-1} (Rs. 1,84,935/-), net returns ha^{-1} (Rs. 1,16,677/-) and B:C ratio (2.71) were recorded under 100% RDF treatment. The treatment combination at 75% RDF along with poultry manure @ 2 t ha^{-1} decomposed with waste decomposer solution remained on parity for the yield attributes, quality parameters and economics without having any significant variation with integrated nutrient management treatments having substitution of 25 to 50% RDF with various organic sources of nutrients under study.

Keywords: *Organic, Poultry manure, Total Soluble Solids, Paddy straw and Waste decomposer.*

Sweet corn (*Zea mays* L. saccharata) is a variety of maize which is being popularized in recent times for its preferable value as a table dish in the western countries and also gaining popularity among farmers across the India due to its multiple uses, commercial value, good market support and fitting to crop intensification. Sweet corn is a nutritious rich snack with heavy dump of sugars, fibers, vitamins and commonly sold fresh, frozen, or canned as a vegetable. High demand has also been observed in India for sweet corn because of its higher economic returns within a short span of time. Continuous use of inorganic fertilizers that are not balanced with organic fertilizers renders soil fertility low. Use of organic and inorganic sources in maintaining good physio-chemical characteristics and soil fertility in addition to increasing the sweet corn yields markedly (Swain *et al.*, 2019). Various organic input sources like poultry manure which is an excellent source of organic fertilizer containing higher amounts of macro (N, P, K) and little amount of micro nutrients when applied has quick release pattern into the soil. Vermicompost is a well-broken peat like organic material with high porosity, soil conservation tendency and well microbial activity produced by microorganisms and earthworms. Biochar offers a significant, multi-dimensional opportunity to convert excess agricultural waste into variable soil amendment (Bera *et al.*, 2018). Waste

decomposer, works as a bio-fertilizer, bio-control and as soil health reviver as it is a consortium of beneficial micro-organisms isolated from desi cow dung.

Present investigation was carried out to study the effect of various nutrient input sources on yield attributes, yield, quality parameters and economics of Sweet Corn.

MATERIAL AND METHODS

The field experiment was conducted at Agriculture College Farm, Naira of Acharya N. G. Ranga Agricultural University located in the North Coastal zone of Andhra Pradesh, which is geographically situated at $18^0 22' 56''$ N latitude, $83^0 56' 38''$ E longitudes and at an altitude of 12 m above mean sea level during *Rabi*, 2021-2022. The soil of the experimental site was sandy loam in texture, with pH 7.2, organic carbon 0.45 %, available nitrogen 221 kg ha^{-1}, available P_2O_5 16.7 kg ha^{-1} and available K_2O 245 kg ha^{-1}. The weather conditions during the crop growth period were normal.

The experiment was laid out in a randomized block design with nine treatments replicated thrice *viz.*, T_1 Control, T_2 (100% RDF(180-60-60) NPK Kg ha^{-1}), T_3 (75% RDF + Biochar @ 2 ton ha^{-1} + Vermicompost @ 2 ton ha^{-1}), T_4 (75 % RDF + Poultry manure @ 2 ton ha^{-1} + Waste decomposer), T_5 (75% RDF + Paddy straw @ 10 ton ha^{-1} + Waste decomposer), T_6 (50% RDF + Biochar @ 2 ton ha^{-1} + Vermicompost @ 4 ton ha^{-1}), T_7 (50 % RDF + Poultry manure @ 4 ton ha^{-1} + Waste decomposer), T_8 (50% RDF + Poultry manure @ 2 ton ha^{-1} + Paddy straw@ 10 ton ha^{-1} +Waste decomposer), T_9 (50% RDF + Biochar @1 ton ha^{-1} + Paddy straw @ 10 ton ha^{-1} + Poultry manure @ 2 ton ha^{-1} + Waste decomposer). The cultivar used for the experiment was Sugar-75. One seed per hill was dibbled at 20 cm apart with 60 cm row spacing on 19th January, 2022. Poultry manure and paddy straw decomposed with waste decomposer solution was incorporated into the soil. Biochar was prepared under the low oxygen conditions by pyrolysis process with dried mesta sticks which has 33.6 per cent recovery. Waste decomposer solution has been prepared by mixing 2 kg jaggery along with 200 litres water in a drum containing microbial culture and stored it for 5-7 days for complete decomposition. After a week, the solution was sprayed on a compost material such as paddy straw and allowed it to decompose. The compost would be ready to use after 30 days. Pre-prepared biochar along with vermicompost were applied to individual plots as per treatments before sowing of crop. One third of the recommended dose of nitrogen, total dose of phosphorus and one third of recommended dose of potassium was applied at the time of sowing as basal dose as per treatments. Remaining nitrogen and potassium were applied as top dressing at knee high stage and tasseling stage uniformly. Nitrogen, phosphorus and potassium were applied in the form of Urea, Single Super Phosphate (SSP) and Murate of Potash (MOP) respectively. The data was recorded on cob girth, single cob weight without husk (g), fresh cob yield (kg ha^{-1}), NPK uptake by kernel at harvest, kernel protein content (%), brix %, sugar content. Based on the total cost of cultivation economic analysis *i.e.*, gross returns, net returns and B:C ratio were also calculated as per treatments.

RESULTS AND DISCUSSION

Yield attributes & yield

Application of 100% RDF (T_2) recorded highest values for characters *i.e.*, cob girth, single cob wt. without husk and fresh cob yield, which were significantly higher over all the other treatments (Table 1). Application of 75% RDF along with poultry manure @ 2 ton ha^{-1} decomposed with waste decomposer solution (T_4) registered highest cob girth,

single cob wt. without husk and fresh cob yield by showing no disparities with all the other integrated nutrient management treatments having substitution of 25 to 50% RDF with different organic nutrient sources (T_3, T_5, T_6, T_7, T_8 & T_9). While, significantly lowest values were recorded in the absolute control (T_1). Higher yield attributes of sweet corn with integrated use of different sources might be due to favorable influence of consistent and adequate availability of nutrients at the eco-rhizosphere of sweet corn crop throughout crop period which enables the production of large quantity of photosynthates with better partitioning to sink. These findings are in conformity with those reported by Meseret and Martini (2020), Pinjari *et al*. (2019) and Shakunthala *et al*. (2019).

NPK uptake

The highest uptake of NPK by kernel at harvest was recorded with the application of 100% RDF (T_2), which did not show any significant variation with various integrated nutrient management treatments which were having substitution of 25 to 50% RDF with different organic sources of nutrition (T_3, T_4, T_5, T_6, T_7, T_8 & T_9) (Table 1). Whereas, significantly lowest uptake of NPK by kernel was recorded with the absolute control (T_1). The nutrient uptake and nutrient content were influenced by the dry matter production, green cob yield and stover yield in the sweet corn. Higher N, P and K uptake with recommended dose of inorganic fertilizer compared to other levels of nitrogen in organic form at all stages could be ascribed to the increase in the available nitrogen. The increased nutrient uptake might be accredited to favorable soil condition and also increased foraging capacity of roots which stimulates more vegetative growth in the crop plants. These results are in close concordance with Sunita *et al*. (2019) and Shakunthala *et al*. (2019). Increase in NPK uptake with increased levels of fertilizers was also reported by Shetye *et al.* (2019) and Khan *et al.* (2018).

Quality parameters

The highest kernel protein content, brix % and sugar content of sweet corn was obtained with the application of 100 % RDF (T_2) (Table 1). The quality parameters did not show any significant variation with various integrated nutrient management treatments which were having substitution of 25 to 50% RDF with different organic sources of nutrition (T_3, T_4, T_5, T_6, T_7, T_8 & T_9). Whereas, the significantly lowest values for above quality parameters were recorded in absolute control (T_1). The protein content of kernel was increased due to increase in levels of fertilizers applied to the treatment. The major nutrient, nitrogen being the principle constituent of protein, might have augmented the kernel protein content due to its increased nitrogen uptake in the plant. Increasing protein content with incremental levels of inorganic fertilizer in combination with organic nutrient sources like poultry manure was also reported by Bharathi *et al*. (2020). Increase in sugar content of sweet corn might be due to starch protein hydrolysis to soluble sugar and carbon skeleton has been used for amino acid synthesis and subsequently protein biosynthesis by increasing photosynthetic rate and chlorophyll content which enhanced total soluble sugar of sweet corn. Increasing sugar content with incremental levels poultry manure was reported by Darwin *et al*. (2020).

Economics

By considering the input cost and cost of cultivation, maximum gross returns, net returns and B:C ratio were registered with application of 100% RDF (T_2) which was significantly higher over all other nutrient management treatments (Table 2). The gross returns Rs.137153 ha^{-1} and net returns Rs.129895

Table 1. Yield attributes, Yield, NPK uptake and quality parameters of sweet corn as influenced by various organic and inorganic nutrient input sources.

Treatment details	Cob girth (Cm)	Single cob wt. without husk (g)	Fresh cob yield (kg ha^{-1})	Kernel Uptake (kg ha^{-1})			Kernel Protein content %	TSS (% Brix reading)	Sugar Content (%)
				N	P	K			
T_1: Control	6.30	115.33	2676.00	52.33	14.83	27.73	3.27	11.63	10.40
T_2: 100% RDF(180-60-60 NPK Kg ha^{-1})	15.10	270.33	10486.00	136.67	30.40	55.53	8.54	15.67	13.63
T_3: 75% RDF + Biochar @ 2 ton ha^{-1} + Vermicompost @ 2 ton ha^{-1}	13.07	239.33	9076.00	126.00	27.37	51.10	7.88	14.50	12.60
T_4: 75% RDF + Poultry manure @ 2 ton ha^{-1} + Waste decomposer	13.50	244.33	9157.00	129.33	27.77	53.00	8.08	15.33	12.83
T_5: 75% RDF + Paddy straw @ 10 ton ha^{-1} + Waste decomposer.	12.80	237.67	8853.00	124.67	26.60	50.67	7.79	14.43	12.40
T_6: 50% RDF + Biochar @ 2 ton ha^{-1} + Vermicompost @ 4 ton ha^{-1}	12.40	227.67	8107.00	117.67	25.60	46.67	7.35	13.87	11.67
T_7: 50% RDF + Poultry manure @ 4 ton ha^{-1} + Waste decomposer	12.60	230.00	8210.00	118.33	25.83	47.33	7.40	14.07	11.87
T_8: 50% RDF + Poultry manure @ 2 ton ha^{-1} + Paddy straw@ 10 ton ha^{-1} +Waste decomposer	12.33	224.67	8035.00	115.33	25.33	46.33	7.25	13.33	11.53
T_9: 50% RDF +Biochar @1 ton ha^{-1} +Paddy straw@ 10 ton ha^{-1} + Poultry manure@ 2 ton ha^{-1} +Waste decomposer	12.73	233.00	8397.00	120.67	26.00	48.00	7.54	14.20	12.00
SEm+	0.52	7.99	396.20	7.10	1.62	3.05	0.44	0.68	0.58
C.D(P=0.05)	1.50	23.91	1187.00	21.50	5.17	9.50	1.34	2.50	2.11
C.V (%)	7.3	6.1	8.4	10.7	11	11.1	10.7	7.9	8

Table 2. Economics of sweet corn as influenced by various organic and inorganic nutrient input sources.

Treatment details	Total Cost of Cultivation (₹ ha^{-1})	Gross returns (₹ ha^{-1})	Net returns (₹ ha^{-1})	B:C Ratio
T_1: Control	61000	47782	-13218	0.78
T_2: 100% RDF(180-60-60 NPK Kg ha^{-1})	68258	184935	116677	2.71
T_3: 75% RDF + Biochar @ 2 ton ha^{-1} + Vermicompost @ 2 ton ha^{-1}	95243	160326	65083	1.68
T_4: 75% RDF + Poultry manure @ 2 ton ha^{-1} + Waste decomposer	68443	161740	93297	2.36
T_5: 75% RDF + Paddy straw @ 10 ton ha^{-1} + Waste decomposer.	70643	156431	85788	2.21
T_6: 50% RDF + Biochar @ 2 ton ha^{-1} + Vermicompost @ 4 ton ha^{-1}	113429	141549	28120	1.25
T_7: 50% RDF + Poultry manure @ 4 ton ha^{-1} + Waste decomposer	68629	145276	76647	2.12
T_8: 50% RDF + Poultry manure @ 2 ton ha^{-1} + Paddy straw@ 10 ton ha^{-1} +Waste decomposer	70829	134645	63816	1.9
T_9: 50% RDF +Biochar @1 ton ha^{-1} +Paddy straw@ 10 ton ha^{-1} + Poultry manure@ 2 ton ha^{-1} +Waste decomposer	75229	148511	73282	1.97
SEm+	-	6602	6602	0.08
C.D(P=0.05)	-	19792	19792	0.26
C.V (%)	-	8.0	17.4	8.0

ha^{-1} are higher over absolute control and Rs.23195 ha^{-1} and Rs.23380 ha^{-1} higher over best integrated nutrient supply treatment *i.e.*, application of 75% RDF along with poultry manure @ 2 ton ha^{-1} decomposed with waste decomposer solution (T_4). Among integrated nutrient management treatments, application of 75% RDF along with poultry manure @ 2 ton ha^{-1} decomposed with waste decomposer solution (T_4) was recorded highest gross and net returns and they were at par with other integrated nutrient management treatments having substitution of 25 to 50 % RDF with different organic sources of nutrition (T_3, T_5, T_7 & T_9). Whereas, significantly minimum gross returns, net returns and B:C ratio were recorded in absolute control (T_1). The increase in net returns might be due to increased cob yield with low cost of input supply that reflected in terms of monitory benefit.

CONCLUSION

From the experimental findings, it was concluded that application of 100% recommended dose of fertilizers (180-60-60 kg N, P_2O_5 and K_2O ha^{-1}) alone was the best nutrient management practice for achieving better growth, yield, quality and higher returns in sweet corn. While in integrated nutrient input combination options with organic sources, by considering cost of cultivation, application of 75% recommended dose of fertilizer along with poultry manure @ 2 ton ha^{-1} decomposed with waste decomposer solution was emerged as the best organic input sources for sweet corn to achieve maximum yields.

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