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Effect of Graded Levels of Poultry Manure and Fertilizers on Growth and Yield of Sweet Corn

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ABSTRACT

A field experiment was conducted on sandy loam soil of Agricultural College, Naira during *rabi*, 2020-21 with four fertilizer levels and four levels of poultry manure. Among graded levels of fertilizers, application of 100 % RDF (180-60-60 kg N, P_2O_5 and K_2O ha^{-1}) and among the graded levels of poultry manure, application of 7.5 t ha^{-1} recorded the highest growth, yield structure and fresh cob yield. Combined application of 100 % RDF along with 7.5 t ha^{-1} of poultry manure resulted the peak growth parameters (plant height, number of leaves and dry matter production), yield attributes and fresh cob yield in sweet corn.

Keywords: *Fertilizers, Cob yield, Sweet corn, Poultry manure and Yield attributes.*

Sweet corn (*Zea mays* L. sub sp. *saccharata*) is consumed as human food in soft dough stage found gaining popularity in nook and corners of the country because of its high sugar and low starch content. Like normal maize, sweet corn also a heavy feeder requiring high amount of nitrogen, phosphorus and potassium. Application of NPK is vital for obtaining better plant growth and higher yield of good quality sweet corn. Usage of higher doses of high analysis fertilizers leads to soil health problems such as acidity, alkalinity, multiple nutrient deficiencies, especially the micro and secondary nutrients. This results in total loss of soil health, besides environmental pollution and lowers the productivity. Yields in organic farming are lower than chemical farming during initial years of practice and it is very difficult to practice in crops like sweet corn which is a heavy feeder. Use of organic manures along with inorganic fertilizers not only reduces the demand of inorganic fertilizers, but also, increases the efficiency of applied nutrients due to favourable effect on physical, chemical and biological properties of soil. Therefore a study was proposed with poultry manure and levels of fertilizers to develop a location specific integrated nutrient management package for sweet corn in North Coastal Andhra Pradesh.

MATERIAL AND METHODS

A field experiment was conducted at Agriculture College Farm, Naira of Acharya N. G. Ranga Agricultural University, Andhra Pradesh during *rabi*, 2020-21. The study comprises of four fertilizer levels *viz.*, 0% RDF (control), 50% RDF, 75% RDF and 100% RDF; four levels of poultry manure (0, 2.5, 5 and 7.5 t ha^{-1}) laid out in Split plot design and each treatment replicated thrice. The soil was sandy loam having pH 7.2, EC 0.073 dSm^{-1}, organic carbon 0.41 %, available N 192 kg ha^{-1}, available P_2O_5 20.7 kg ha^{-1} and available K_2O 222 kg ha^{-1}. The cultivar used for the experiment was Sugar-75. Field

operations such as weeding, irrigation and plant protection measures were taken as per requirement. 100% RDF is N, P_2O_5 and K_2O @ 180-60-60 kg ha^{-1} out of that, one third of the nitrogen, total dose of phosphorus and half potassium was applied at the time of sowing as basal while, the remaining nitrogen and potassium were applied as top dressing at knee high stage and tasseling stage uniformly in all treatments. The data on highest plant height, dry matter production, no. of cobs $plant^{-1}$, cob yield (with husk) and stover yield were recorded as per standard procedures. Data was analyzed using ANOVA and the significance was tested by Fisher's least significance difference (p=0.05).

RESULTS AND DISCUSSION

Growth parameters

Results of growth parameters like plant height, number of leaves $plant^{-1}$ and dry matter production of sweet corn (Table 1) revealed that, there was a progressive and significant increase in growth parameters with increase in fertilizer levels from 0 to 100 % RDF. Among fertilizer levels the higher stature of growth of sweet corn was recorded with 100 % RDF (180-60-60 kg N, P_2O_5 and K_2O ha^{-1}), which was significantly higher over rest of all other levels of fertilization (Table 1). The highest level of nutrient supply might have enable the crop to absorb adequate amounts of major nutrients at peak physiological requirements of the crop and thus resulted in the largest growth stature *i.e.* taller plants, maximum number of leaves $plant^{-1}$ and higher dry matter production. Increase in plant stature with enhanced fertilizer levels as evident in this present investigation in line with findings of Lahay *et al*. (2019), Pinjari *et al*. (2019) and Praveena *et al*. (2019).

With respect to the levels of poultry manure, there was a progressive and significant increase in growth parameters like plant height, number of leaves $plant^{-1}$ and dry matter production with incremental levels of poultry manure from 0 to 7.5 t ha^{-1}. Application of poultry manure @ 7.5 t ha^{-1} realized the highest growth stature among poultry manure levels, which was significantly higher over rest of all the levels of poultry manure. The best growth exhibited by plants fertilized by the highest poultry manure rate was probably due to adequate supply and availability of nutrients particularly organic C, N, P, K, Ca and lowest C: N ratio which promoted crop performance which obviously stimulated rapid crop growth. Poultry manure enhances the absorption and holding a capacity of water so that the roots more easily absorb nutrients contained in the soil. Increasing plant growth with increasing levels of poultry manure was also reported by Adekiya *et al*. (2020), and Kharche *et al.* (2020).

Yield attributes

Results of yield attributes of sweet corn (Table 2) *viz.*, number of cobs $plant^{-1}$, number of grain rows cob^{-1}, number of grains row^{-1}, fresh cob weight, cob length and cob girth of sweet corn revealed that, there was a progressive increase in yield parameters with the increase in fertilizer levels from 0 to 100 % RDF. Among fertilizer levels the highest yield of sweet corn was recorded with 100 % RDF (180-60-60 kg N, P_2O_5 and K_2O ha^{-1}). Which was higher by 11.80% over 75% RDF, 31.40 % over 50 % RDF and 128.0 % over control (No fertilization) among fertilizer levels. The larger growth stature with augmented levels of fertilization might have increased the interception, absorption and utilization of radiant energy which in turn elevated the yield. Increasing yield attributes with incremental levels of fertilizers was also reported by Singh *et al*. (2019) and Khan *et al.* (2018).

Among poultry manure levels, the highest number of yield parameters of sweet corn was

Table 1. Growth parameters of sweet corn at tasseling as influenced by levels of fertilizers and poultry manure.

Treatments	Plant height (cm)	Number of leaves plant^{-1}	Dry matter production (kg ha^{-1})
Fertilizer levels (RDF-180-60-60 kg ha^{-1})			
M_1: 0	127	10.25	5562
M_2: 50 % RDF	159	11.11	7465
M_3: 75 % RDF	176.1	11.73	8628
M_4: 100 % RDF	186.4	12.32	9345
S.Em ±	2.52	0.18	197
CD (P=0.05)	8.72	0.61	683
CV (%)	5.38	5.37	8.83
Poultry manure levels (t ha^{-1})			
S_1: 0	133.4	10.31	5648
S_2:2.5	157.8	11.05	7575
S_3: 5.0	175	11.85	8529
S_4: 7.5	182.2	12.2	9248
S.Em ±	2.07	0.11	143
CD (P=0.05)	6.05	0.34	416
CV (%)	4.43	3.51	6.37
Interaction			
CD (P=0.05)	S	S	S

recorded with application of poultry manure @ 7.5 t ha^{-1} (Table 2). Application of poultry manure@ 7.5 t ha^{-1} with augmented the fresh cob yield by the extent of 13 % over 5 t ha^{-1}, 41.66 % over 2.5 t ha^{-1} and 104.4% over control (Zero level of poultry manure). The good yield attributes were found in 7.5 t ha^{-1} poultry manure treatment which might be assigned to higher mineralization potential of poultry manure enabling it to active and fast release of its nutrients for plant uptake reflected within the better source-sink relationship, which successively enhanced the yield attributes. Increasing yield attributes with incremental levels poultry manure was also reported by Kharche *et al.* (2020).

Fresh cob yield

Fresh cob yield of sweet corn was a continuous and remarkable increase with the increase in fertilizer levels from 0 to 100 % RDF and levels of poultry manure from 0 to 7.5 t ha^{-1}. The highest fresh cob yield was recorded with 100 % RDF (180-60-60 kg N, P_2O_5 and K_2O ha^{-1}) among fertilizer levels, application poultry manure @ 7.5 t ha^{-1} with regards to poultry manure levels(Table 2). The linear response observed in yields are also supported by the similar trend noticed with all growth and yield attributing characters studied with incremental levels of NPK, which could suggest that adequate nutrition is important for both source and sink development. This increase

Table 2. Yield attributes and fresh cob yield of sweet corn as influenced by fertilizer levels and levels of poultry manure.

Treatments	No. of cobs plant^{-1}	Kernel rows cob^{-1}	Kernels row^{-1}	Cob length (cm)	Cob girth (cm)	Cob weight (g)	Fresh cob yield (kg ha^{-1})
Fertilizer levels (RDF-180-60-60 kg ha^{-1})							
M_1: 0	0.88	10.04	19.03	11.85	9.09	206	7066
M_2: 50 % RDF	1.06	12.75	29.53	15.59	11.5	317.1	12264
M_3: 75 % RDF	1.19	13.51	33.05	17.93	12.42	353.5	14414
M_4: 100 % RDF	1.23	14.28	36.14	19.74	13.34	379.1	16115
S.Em ±	0.02	0.21	0.52	0.27	0.28	6.72	467.5
CD (P=0.05)	0.08	0.73	1.82	0.95	0.96	23.25	1618
CV (%)	7.22	5.83	6.18	5.85	8.32	7.41	12.99
Poultry manure levels (t ha^{-1})							
S_1: 0	0.9	10.333	20.53	11.89	9.43	222.8	7920
S_2:2.5	1.08	12.65	28.23	15.45	11.29	303.5	11430
S_3: 5.0	1.15	13.42	32.98	18.1	12.44	350.6	14317
S_4: 7.5	1.23	14.18	36.02	19.67	13.2	3789	16192
S.Em ±	0.02	0.19	0.48	0.26	0.21	5.02	278
CD (P=0.05)	0.06	0.55	1.41	0.75	0.63	14.65	810.8
CV (%)	6.17	5.14	5.66	5.43	6.4	5.54	7.72
Interaction							
CD (P=0.05)	S	S	S	S	S	S	S

Table 3. Fresh cob yield (kg ha^{-1}) of sweet corn due to incremental levels of fertilizers at various levels of poultry manure

Treatments	Fresh cob yield (kg ha^{-1})				
	M_1: 0	M_2: 50 % RDF	M_3: 75 % RDF	M_4:100 %RDF	Mean
S_1: Poultry Manure @ 0 t ha^{-1}	720	6897	10180	13885	7920
S_2: Poultry Manure @ 2.5 t ha^{-1}	5166	10783	13917	15854	11430
S_3: Poultry Manure @ 5.0 t ha^{-1}	9689	14413	16164	17004	14317
S_4: Poultry Manure @ 7.5 t ha^{-1}	12691	16963	17394	17718	16192
Mean	7067	12264	14414	16115	

	S.Em ±	CD (P=0.05)
S	468	1618
M	278	811
S at M	556	1622
M at S	671	1958

could be ascribed to availability of more nutrients quickly especially N due to faster mineralization of nitrogen with its narrow C: N ratio (15:1-20:1) of poultry manure.

Whereas in interaction effect, 100 % RDF in combination with 7.5 t ha^{-1} of poultry manure realized the highest fresh cob yield (Table 3). The higher fresh cob might be attributed to the fact that the favourable influence of consistent and adequate availability of nutrients at the eco-rhizosphere of the sweet corn crop throughout the crop period which enables the production of large quantity of photosynthates with better partitioning to sink. This indicates that sweet corn responded well to integrated nutrient supply through poultry manure owing to synchronized release of major and micro nutrients as per the crop needs. These findings are in conformity with those reported by Meseret and Martini (2020), Pinjari *et al*. (2019), Shakunthala *et al*. (2019) and Dhanwade *et al*. (2018).

CONCLUSION

Integrated supply of 100 % RDF ((180-60-60 kg N, P_2O_5 and K_2O ha^{-1}) along with application of poultry manure @ 7.5 t ha^{-1} was productive nutrient management option for sweet corn during *Rabi* in North Coastal Andhra Pradesh.

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