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Influence of Integrated Nutrient Management Practices on Gwoth and Yield Parameters of Sweet Corn

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ABSTRACT

A field experiment was conducted to study the influence of integrated nutrient management on growth and yield of sweet corn hybrid during rabi, 2015. The experiment was laid out in a randomized block design with eight treatments replicated thrice viz.,100% recommended NPK (180:60:50 kg N,P_2O_5,K_2O ha^{-1})(T_1),75% RDF+FYM @ 5 t ha^{-1} (T_2),50% RDF+FYM @ 5 t ha^{-1} (T_3), 75% RDF+ Vermi compost @ 2. 5 t ha^{-1} (T_4), 50% NPK + Vermi compost @ 2.5 tha^{-1} (T_5), 75% RDF + poultry manure @ 2. 5 t ha^{-1} (T_6), 50% RDF + poultry manure @ 2.5 t ha^{-1} (T_7) and control (T_8). Maximum plant height (230.6 cm), Dry matter (12747.22 kg ha^{-1}), Test weight (15.43 g), Green cob yield (11000 kg ha^{-1}) and green fodder yield (12791 kg ha^{-1}) were recorded with application of 75% RDF + poultry manure @ 2. 5 t ha^{-1} (T_6) which was on par with the application of entire dose of recommended NPK through fertilizer (T1). Treatment which was applied with 75 % RDF along with Vermi compost @ 2.5 t ha^{-1} (T_4), 75 % RDF along with FYM @ 5 t ha^{-1} (T_2), 50 % RDF + poultry manure @ 2.5 t ha^{-1} (T_7) were on par with each other but significantly superior over other treatments.

Key words: *Poultry manure, Vermi compost, Farm Yard Manure etc.*

INTRODUCTION

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.

Presently, greater emphasis is given to the cultivation of sweet corn due to its increasing demand. There is an increasing tendency to produce sweet corn at commercial level, to augment the income of the farming community dwelling in the outskirts of big cities and metropolities. Since there is a limited scope to increase the area under cultivation, the only alternative is through enhancement of productivity by various management factors. 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.

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Inorganic fertilizer on the other hand have high concentration of nutrients and readily available to crops but its excessive use is harm full to the crop as well as to the environment. 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. It is an established fact that the higher grain yield depends on different nutrient management practices. Integration of different organic and inorganic manures effects the yields. By using these combinations to produce the highest possible yields with the greatest efficiency has been the aim of this study.

MATERIAL AND METHODS

The experiment was conducted during *rabi,* 2015 at Regional Agricultural Research Station, Warangal to study the productivity and uptake of N, P and K as influenced by integrated nutrient management practices. The soil of experimental field was clay loam, slightly alkaline (pH7.8) with low organic carbon (1.25%) and available nitrogen (301.7 kg ha-1), medium in available phosphorus (63.42 kg ha-1) and high in available potassium(868.7 kg ha-1). (Table 1). The experiment was laid out in randomized complete block design with three replications.

Table 1: Physical and chemical properties of the representative soil of the experimental site

Particulars	Value	Method of analysis
Physical analysis		
Sand (%)	14.84	Bouyoucos Hydrometer method (Piper,1966)
Silt (%)	26.72	
Clay (%)	58.44	
Textural class	Clay	
Chemical analysis		
Soil reaction (pH)	8.05	Glass Electrode pH meter (Jackson, 1973)
Electrical conductivity (dS m^{-1})	0.54	Conductivity bridge method (Jackson, 1973)
Organic carbon (%)	1.25	Walkely and Black method (Jackson, 1973)
Available nitrogen (kg ha-1)	301.7	Alkaline permanganate method (Subbaiah and Asija, 1956)
Available phosphorus (kg ha-1)	63.42	Olsen method (Olsen *et al.*, 1954)
Available potassium (kg ha-1)	868.7	Flame photometer method (Jackson, 1973)

Treatments:

T_1 -100% RDF (180:60:50 N: P_2O_5: K_2O Kg ha-1)
T_2 -75%RDF +FYM @ 5 t ha-1
T_3 -50% RDF +FYM @ 5 t ha-1
T_4 - 75%RDF +Vermicompost @ 2.5 t ha-1
T_5 - 50% RDF + Vermicompost @ 2.5 t ha-1
T_6 - 75%RDF + +Poultry manure @ 2.5t ha-1
T_7 -50%RDF+Poultry manure @ 2.5 t ha-1
T_8 - Control

The recommended dose of FYM (5 t ha-1) was applied to treatments T2 and T3 treatments two weeks before sowing of seeds. The recommended dose of Poultry Manure (2.5 t ha-1) was applied to treatments T6 and T7 treatments and Vermicompost (2.5 t ha-1) to T4 and T5 treatments two weeks before sowing. At the time of sowing, recommended dose of phosphorus (60 kg P2O5 ha-1) and potassium (50kg K2O ha-1) were applied in the form of single super phosphate and murate of potash to treatment T1. Inorganic (fertilizer) nitrogen as mentioned in the treatments was applied in splits i.e., 50 percent at time of sowing and the remaining 50 percent of nitrogen in two splits (30 and 60 days after sowing) at the time of sowing. Then the sweet corn seeds were sown in each plot with a spacing of 60 cm between the rows and 30 cm between the plants. Weeds were removed as and when they appeared and also other inter cultivation operations were taken up as per package of practices.

RESULTS AND DISCUSSION

Plant height was significantly influenced by different treatments and it differed significantly at all stages of crop growth. In general there was a linear increase in the plant height of the crop up to maturity and reached peak at harvest. Among the treatments, significantly higher plant height (230.7 cm) at harvest was obtained with the application of 75% RDF + poultry manure @ 2.5 t ha-1 (T6)

and the lowest plant height (150.0 cm) at harvest was recorded in the control. Almost similar trend was observed at 30, 60 DAS. There was almost 54% increase in the plant height was observed compared to the control. (Table 2).

The leaf area of sweet corn was significantly influenced by different treatments at all growth stages. (Table 2). The treatment applied with 75% RDF + poultry manure @ 2.5 t ha-1 (T6) was recorded highest leaf area and it is on par with the treatment received with 100 % RDF (T1). The leaf area was higher at 60 DAS (437.7 cm2) than at harvest because of drying and shrinking of leaves. Leaf area was increased 45% with the treatment applied with 75% RDF + poultry manure @ 2.5 t ha-1 (T6) than control (301 cm2). Between organic treatments FYM and vermicompost are worked as soil conditioners in addition to supplying plant nutrients and resulted in improvement in plant height and leaf area at different stages of plant growth. These results were in the agreement with the findings of Ali *et al.*[1]; Kannan *et al.*[4].

The total dry matter production 30, 60 DAS and at harvest differed significantly among various treatments (Table 2). The maximum total dry matter production at 30 DAS (2167 kg ha-1), 60DAS (8280 kg ha-1) and at harvest was observed in the treatment (T6) 75 % RDF + poultry manure @ 2.5 t ha-1 (12747 kg ha-1) and it is on par with 100 % RDF (T1). The lowest dry matter production (7991 kg ha-1) was recorded in the control. 59% dry mater was increase with the application of 75 % RDF + poultry manure @ 2.5 t ha-1 (T6). Significantly higher dry matter accumulation in poultry manure applied plots was observed. Addition of N and P fertilizer enhances root development, which improves the supply of other nutrients and water to the growing parts of the plants, resulting in an increased photosynthetic area and thereby more dry matter accumulation. Increased dry matter accumulation in poultry manure, vermi compost and FYM treated plots might be attributed due to the continuous steady release of nutrients which might have enabled the leaf area duration to extend, thus favouring the plants to increase the photosynthetic rate which in turn, could have led to higher accumulation of dry matter. It improves soil fertility by adding both major and essential nutrients as well as soil organic matter which improve moisture and nutrient retention. Similar results were reported by Kumar and Dhar.[2]; Rasool *et al.*[7].

The highest cob length of 18.5 cm was recorded with application of 75 % RDF + poultry manure @ 2.5 t ha-1 (T6) and it was on par with the application of 100 % RDF (T1), these are significantly differed with the treatments 75 % RDF + vermi compost @ 2.5 t ha-1 (T4) and 75 % RDF + FYM @ 5 t ha-1 (T2). The lowest cob length of 9.6 cm was observed in control. The cob girth also recorded highest 14.9 cm in the poultry manure applied treatment and remaining followed the same order. (Table 4)). Sole application of chemical fertilizer (T1) and 75 % RDF + poultry manure @ 2.5 t ha-1 (T6) produced the highest cob length due to greater availability of nutrients. The results of 75 % RDF + vermi compost @ 2.5 t ha-1 (T4) and 75 % RDF + FYM @ 5 t ha-1 (T2) are on par with (T1) and (T6). This might be due to integration of organic and inorganic, there would be a continuous supply of nutrient throughout the crop growth. The results were in close conformity with Khadtare *et al.*[6], Rasool *et al.*[7].

The grain yield is a function of combined effect of the individual yield components nourished under applied inputs and 100 grain weight is important one of them. The data (Table 4) indicated that 100 grain weight was significantly affected by different levels of organic and inorganic fertilizers. The maximum test weight (15.4 g) was recorded with application of 75 % RDF + poultry manure @ 2.5 t ha-1 (T6) and it was on par with the application of 100 % RDF (T1) followed by 75 % RDF + vermi compost @ 2.5 t ha-1 (T4) and 75 % RDF + FYM @ 5 t ha-1 (T4). These were on par with each other and significantly higher over rest of the treatments. The lowest test weight (8 g) was recorded in control (T8). The increase in 100 grain weight with addition of poultry manure could be due to balanced supply of food nutrients from poultry manure throughout the

growing period.The higher availability of nitrogen increased the grain weight producing well developed and bold grains. Higher dry matter production in plants, effective translocation of photosynthates from source to sink might have further improved the size of grains. Similar trend was also reported by Ali *et al.*[1] and Kannan *et al*[4].

Green cob yield was significantly influenced by integration of different organic and inorganic sources. (Table 5). Application of NPK along with organic sources of fertilizer significantly influenced the green cob yield of sweet corn. The maximum cob yield (11000 kg ha-1) was obtained with the application of 75 % RDF + poultry manure @ 2.5 t ha-1 (T6). There was an increase of 50% more yield in best treatments (T6) and 100 % RDF (T1) when compared to control which recorded the lowest green cob yield (3949 kg ha -1). Green cob yield was almost doubled than the control with the application of 75% RDF + poultry manure @ 2.5 t ha-1 (T6). The increase in grain yield in treatment T6 (75% RDF + poultry manure @ 2. 5 t ha-1) may be due to the supply of nutrients, especially N and P by the poultry manure which is known to be the most spectacular in plant growth and development. This increase in grain yield may also be connected with the positive increase associated with poultry manure on the yield components, especially the 100-grain weight. Nitrogen being the major constituent of chlorophyll, amino acids and proteins as well as 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 findings of the present study are in corroboration with those reported by, Hossain *et al.*[3], Keerthi *et al.*[5], Rasool *et al.* [7].

Similar to green cob yield, green fodder yield (12791 kg ha-1) was also significantly influenced by different organic and inorganic sources. (Table 5). Similar green fodder yield was recorded highest with the application of 75% RDF + poultry manure @ 2.5 t ha-1 (T6) and it was on par with the application of 100 % RDF (T1). Stover yield was improved 140% with the application of 75% RDF + poultry manure @ 2.5 t ha-1(T6). This might be due to application of recommended dose of nitrogen in three splits to a short duration crop resulted in higher vegetative growth of sweet corn whereas increase in cob yield under treatments 75% RDF + Vermi compost @ 2.5 t ha-1(T4) and 75% RDF + FYM @ 5 t ha-1 (T2) might be due to the fact that organic manures like poultry manure, FYM and vermicompost released nutrients from the native sources in soil due to high biological activity in soil which improved physical conditions of soil and aid better uptake of nutrients that leads to better growth of plant. The results are in close accordance with those reported by Chauhan[2], Shilpashree *et al.*[8], Rasool *et al*[7].

Table 1: Effect of integrated nutrient management practices on Plant height, Leaf area and Dry matter producton of sweet corn

Treatment	Treatment details	Plant height (cm)			Leaf area plant^{-1} (cm^2)			Dry matter producton(kg ha-1)		
		30 DAS	60 DAS	At harvest	30DAS	60DAS	At harvest	30 DAS	60 DAS	At harvest
T_1	100% RDF(180:60:50 NPK kg ha-1	101.67	214.02	226.68	290.00	432.33	380.67	2160.67	8200.00	12123.89
T2	75% RDF+FYM @ 5t ha-1	88.87	190.02	205.02	261.00	384.67	332.33	1865.33	7205.33	10082.33
T3	50% RDF+FYM @ 5t ha-1	73.57	162.68	175.02	221.00	336.67	280.00	1485.33	6232.33	8987.89
T4	75% RDF+Vermi compost @2. 5t ha-1	90.77	192.35	207.68	263.33	391.67	338.33	1875.33	7321.67	10396.22
T5	50% RDF+Vermi compost @2. 5t ha-1	74.97	167.35	179.35	230.33	342.00	290.33	1503.00	6358.33	9007.78
T6	75% RDF + poultry manure @2. 5t ha-1	105.67	218.68	230.68	291.67	437.67	385.00	2166.67	8280.00	12747.22
T7	50% RDF + poultry manure @ 2.5t ha-1	86.87	187.68	200.35	259.00	379.67	327.00	1784.00	7036.33	9986.44
T8	Control	60.77	140.68	150.02	192.33	301.00	247.67	1114.33	5007.33	7991.11
S.Em+_		2.641	5.756	6.069	7.42	10.84	9.503	79.227	211.626	324.957
CD (p=0.05)		8.011	17.459	18.406	22.52	32.88	28.823	240.297	641.869	985.605

Table 2: Effect of integrated nutrient management practices on Cob length, Cob girth and Test weight of sweet corn

Treatment	Treatments	Cob length (cm)	Cob girth (cm)	Test weight (g)
T_1	100% RDF(180:60:50NPK kg ha-1	18.43	14.70	15.00
T2	75% RDF+FYM @ 5t ha-1	17.03	13.10	12.56
T3	50% RDF+FYM @ 5t ha-1	14.03	11.60	10.10
T4	75% RDF+Vermi compost @2. 5t ha-1	17.10	13.17	13.10
T5	50% RDF+Vermi compost @2. 5t ha-1	14.67	11.73	10.50
T6	75% RDF + poultry manure @2. 5t ha-1	18.47	14.87	15.43
T7	50% RDF + poultry manure @ 2.5t ha-1	16.90	12.97	12.33
T8	Control	9.63	9.10	8.00
S.Em+_		0.408	0.379	0.52
CD (p=0.05)		1.238	1.148	1.60

Table 3: Effect of integrated nutrient management practices on grain and stover yield of sweet corn

Treatment	Treatment details	Yield (kg ha-1)	Green Stover yield
T_1	100% RDF(180:60:50NPK kg ha-1	10827	12683
T2	75% RDF+FYM @ 5t ha-1	8005	9803
T3	50% RDF+FYM @ 5t ha-1	6866	8598
T4	75% RDF+Vermi compost @2. 5t ha-1	8233	10030
T5	50% RDF+Vermi compost @2. 5t ha-1	7008	8806
T6	75% RDF + poultry manure @2. 5t ha-1	11000	12791
T7	50% RDF + poultry manure @ 2.5t ha-1	7895	9693
T8	Control	3949	5679
S.Em+_		235	288
CD (p=0.05)		712	876

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