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Performance of Sweet Corn as Influenced by Organics in a Clay Loam Soil

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ABSTRACT

A field experiment was conducted in a clay loam soil during *kharif*, 2013 to study the effect of supplementing different levels of nitrogen through organics on growth, yield attributes, yield and economics of sweet corn. Highest plant height was recorded in the integrated treatment that received 50% N- PM + 50% N - Fertilizers while, length of cob, grains per cob and test weight were maximum for sole inorganic treatment. Green cob and fodder yields and drymatter (grain and stover) yields were comparable in treatments received entire nitrogen through fertilizers and 50% N -PM + 50 % N- Fertilizers. The benefit cost ratio was highest (1.40) in treatment supplied with sole inorganics.

Key words : Integrated nutrient use, FYM, Green cob yield, Poultry manure, Test weight.

Though, there is phenomenal progress in food grain production, the greatest challenge to produce enough food to meet the requirement of growing population still remain. Land being the limiting factor, successful management of resources to satisfy the human needs through maintaining the quality of the environment is essential. Use of chemical fertilizers alone may not keep pace with time in maintaining soil health for sustained productivity. In addition nutrient imbalances due to continuous use of NPK fertilizers has been identified as the primary reason for decreased productivity of soils. The imbalanced and skewed application of NPK resulted in stagnated or reduced crop yields and impaired nutrient use efficiency (Tiwari *et al.,* 2006).

It is therefore, appropriate to develop a sustainable crop production technology which can be retrieved through amalgamation of chemical fertilizers with available organic sources of nutrients. FYM and poultry manure are the two commonly available manures which supply all the essential nutrients. Sweet corn is rapidly gaining popularity in all population groups as it is rich in nutrients, protein and fibre and can be eaten directly or as vegetable. Since, the extent of area under sweet corn is increasing there is a need to arrive at nutrient management alternatives for sustained production. Keeping this in view the present investigation was under taken to evaluate the influence of organics alone or in combination with fertilizers on performance of sweet corn.

MATERIAL AND METHODS

A field experiment was carried out during *kharif*, 2013 at Agricultural College Farm, Bapatla. The experimental field was a slightly alkaline, non saline clay loam soil with medium organic carbon (0.51%), low available nitrogen (198 kg ha^{-1}), medium available phosphorus (32.98 kg ha^{-1}) and high potassium (821 kg ha^{1}). The experiment consisted of eight treatments laid out in a randomized block design replicated thrice. The treatment combinations imposed were : T_1 - Control, T_2 - 100% N - Fertilizers, T_3 - 100% N - FYM, T_4 - 100% N - PM, T_5 - 75% N- FYM + 25% N - Fertilizers , T_6 - 75% N - PM + 25% N - Fertilizers, T_7 - 50% N- FYM + 50% N - Fertilizers , T_8 - 50% N - PM + 50% N - Fertilizers. Well decomposed FYM and dried poultry manure were applied 15 days before sowing. Nitrogen was applied in three splits as per the treatments in the form of urea. Phosphorus and potassium were applied in the form of SSP and muriate of potash, respectively to all the treatments considering their contents in organics. Recommended agronomic practices and plant protection measures were followed. Plant hieght at different stages, days to 50% tasseling and silking, length of cob, grains per cob, test weight and green cob and fodder yields

were recorded. Drymatter accumulation (grain and stover) was determined and benefit cost ratios were calculated.

RESULTS ANDDISCUSSION

Influence of organics on plant growth.

Plant height (cm)

At knee high stage the highest plant height (69.4 cm) was observed in T_8 (50 % N - PM + 50 % N- Fertilizers), which was on par with all others except the treatments received the entire nitrogen through FYM (T_3) and control (T_1). At tasseling and harvest stages plant height was significantly superior in all treatments over control, which recorded the lowest values of 116.5 and119.1 cm, respectively. The treatment supplied with 50 % N - PM + 50 % N- Fertilizers (T_8) recorded the highest plant height of 194.1 and 196.0 cm at tasseling and harvest, respectively followed by 100 % N through inorganics (T_2), 50 % N - FYM + 50 % N- Fertilizers (T_7) and 75 % N - PM + 25 % N - Fertilizers (T_6) which were on par with one another (Table 1). The maximum plant height in integrated treatments with 50% N through PM and 50 % N through inorganics might be due to the continuous supply of essential nutrients throughout the growing period which might have improved plant metabolic activity especially in early growth stage of plant (Anburani and Manivannan 2002). Similar performance by thetreatment with 100 % inorganics was due to the immediate supply of nitrogen, whose efficiency was further influenced by split application (Gosavi *et al.,* 2006).

Days to 50 % tasseling and 50 % silking

Number of days taken to reach 50% tasseling and silking stage was significantly affected by different treatments (Table 1). All the treatments, which received nitrogen irrespective of the source recorded significantly less number of days to reach 50% tasseling and silking than control. Across the treatments, number of days taken to 50% tasseling and silking ranged from 56 to 60 and 62 to 66 days, respectively. The more number of days to 50 % tasseling and silking in control treatment may be due to the crop's nitro positive nature i.e., requirement of sufficient nitrogen to stimulate flowering (Samsul *et al.,* 2012).

Influence of organics on yield attributes and yield.

Yield attributes

Cob length of maize was significantly affected by the application of different rates of manures (Table 2). The maximum cob length of 16.5 cm was recorded in treatment with 100 % N-Fertilizers (T_2) which was on par with treatment T_8 that recorded a cob length of 15.9 cm. While, the minimum cob length (8.4 cm) was observed in T_1 treatment, where P and K were applied without nitrogen. Perusal of the data (Table 2) on number of number of grains per cob inferred that significant differences existed among different levels of organics. The highest number of grains per cob (482.7) were obtained in 100 % N- Fertilizers which was comparable with treatment received 50 % N-PM and significantly superior to other integrated, sole organic and control treatments. Recommended dose of chemical fertilizer resulted in maximum grain yield of crop due to the beneficial effects of nitrogen in transportation of growth stimulating materials through phloem tissues there by resulting in enhanced cell division and grain number. The results presented in table 2 indicated that test weight of cobs varied from 7.2 to 12.4. The highest was recorded in T_2 (100 % N -Fertilizers) which was on par with T_8 (50 % N - PM + 50 % N-Fertilizers) treatment and statistically superior over sole organic treatments and control. Similar opinion was expressed by Mosali *et al.* (2006).

Green cob and fodder yield

A perusal of data in table 2 indicated that the highest green cob yield of 9404 kg ha^{-1} was observed in the treatment supplied with 100 % N - Fertilizers (T_2) which was on par with all integrated treatments and significantly superior over sole organics and control. An increase in cob yield of 170 percent was recorded in T_2 over T_1. The higher response to fertilizer application could be a result of well developed root system, which absorbs required nutrients for the effective growth and yield (Prasad *et al*., 2010). Similar higher performance of application of nitrogen through fertilizers was reported by Gaur and Kumawat, (2000). An increase of 163 % green cob yield over control (T_1) in 50% N- PM + 50% N - Fertilizers (T_8) treatment can be ascribed to the continuous

Table 1. Influence of organics growth parameters of sweet corn.

Treatments	Plant height (cm)			Days to 50% tasseling	Days to 50%silking
	Knee high	Tasseling	Harvest		
T_1 - Control (No nitrogen)	43.7	116.5	119.1	60	66
T_2 - 100% N- Fertilizers	68.8	192.5	193.9	57	62
T_3 - 100% N - FYM	54.8	162.1	165.1	57	62
T_4 - 100% N - PM	66.2	173.7	175.4	57	63
T_5 - 75% N - FYM + 25% N - Fertilizers	66.4	177.0	179.3	57	62
T_6 -75% N - PM + 25% N - Fertilizers	68.5	181.8	183.9	56	62
T_7 - 50% N - FYM + 50% N - Fertilizers	68.8	188.1	189.3	56	62
T_8 - 50% N - PM + 50% N - Fertilizers	69.4	194.1	196.0	56	62
SEm±	4.0	5.1	4.8	0.5	0.9
CD @ 0.05	12.0	15.5	14.6	1.0	1.0
CV (%)	11.0	5.1	4.8	1.4	2.1

Table 2. Influence of organics on yield attributes and yield of sweet corn.

Treatments	Length of cob (cm)	No. of grains per cob	100 grain weight (g)	Greencob yield (kg ha^{-1})	Green fodder yield (kg ha^{-1})	Dry matter accumulation	
						Grain yield (kg ha^{-1})	Stover yield (kg ha^{-1})
T1 - Control (No nitrogen)	8.4	100.4	7.2	3449	4922	801	2050
T2 - 100% N- Fertilizers	16.5	482.7	12.4	9404	13103	3233	5353
T3 - 100% N - FYM	9.9	277.2	9.8	6439	10283	2045	4770
T4 - 100% N - PM	11.3	295.5	10.0	6617	10761	2061	4813
T5 - 75% N - FYM + 25% N- Fertilizers	11.4	289.2	10.4	8087	11782	2088	4827
T6 -75% N - PM + 25% N - Fertilizers	12.3	324.5	10.3	8434	12134	2341	5070
T7 - 50% N - FYM + 50% N- Fertilizers	14.4	396.9	10.8	8812	12277	2834	5240
T8 - 50% N - PM + 50% N - Fertilizers	15.9	440.1	11.0	9076	12719	3180	5369
SEm±	0.4	12.2	0.7	555.0	606	159	169
CD @ 0.05	1.3	32.7	2.2	1684	1837	484	512
CV (%)	6.1	6.7	11.2	13	10	12	10

availability of nutrients to plants up to cob development which ultimately increased the cob yield. Among organic treatments the poultry manure applied in all combinations proved to show better performance due to its higher nutritive value with all essential nutrients. Similar observations were made by Reddy and Kumar (2006) and Ashalatha *et al.* (2013).

The results indicated that green fodder yield ranged from 4922 to 13103 kg ha^{-1} (Table 2). The highest fodder yield was recorded when 100 % nitrogen was applied through inorganic fertilizers, which was on par with integrated treatments (T_8 to T_5) and markedly superior to others. An increase of 158 per cent in fodder yield over no nitrogen treatment (T_1)was observed in the treatment imposed with 50 % N-PM + 50% N-

Table 3. Economics of sweet corn as influenced by organics.

Treatments	Cost of cultivation (Rs. ha^{-1})	Gross returns (Rs. ha^{-1})	Net returns (Rs. ha^{-1})	B:C ratio
T1 - Control (No nitrogen)	40009	47298	7289	0.18
T2 - 100% N- Fertilizers	41854	100591	58737	1.40
T3 - 100% N - FYM	47295	69531	22236	0.47
T4 - 100% N - PM	43176	71550	28374	0.66
T5 - 75% N - FYM + 25% N- Fertilizers	44189	86761	42572	0.96
T6 -75% N - PM + 25% N - Fertilizers	41905	90407	48502	1.16
T7 - 50% N - FYM + 50% N- Fertilizers	43197	94256	51059	1.18
T8 - 50% N - PM + 50% N - Fertilizers	40901	98119	57218	1.39

Fertilizers (T_8). The increase in fodder yield might have been an account of overall improvement in the vegetative growth. The combined application of organic and inorganic fertilizers resulted in comparable yield of sweet corn. Similar results were obtained by and Bishit *et al.* (2013). However, in combined application of manures the supremacy of poultry manure might be due to its nutrient richness and ability to supply nutrients continuously in soluble form for a quite longer period (Mohandas and Appavu, 2008).

Drymatter accumulation (grain and stover)

Grain yield (kg ha^{-1})

Grain yield ranged from 801 to 3233 kg ha^{-1}. The increase in grain yield in sole inorganic treatment was 303 percent over control while, the increase in green cob yield over control was only 170 percent. There by it can be interpreted that the grain filling was far less in no nitrogen treatment indicating the role of nitrogen in assimilation of carbohydrates. Application of manures in combination with fertilizers in equal doses (T_7 and T_8) was on par with sole inorganic treatment (T_2). The findings were in conformity with those of Farhad *et al*. (2009) and Shilpasree *et al.* (2012) , who reported that the higher grain yield was due to optimum supply of nutrients at right time of crop requirement, which increased translocation of photosynthates from leaves to the sink for better development of grains.

Stover yield (kg ha^{-1})

The results suggest that the highest stover yield (5369 kg ha^{-1}) was observed when nitrogen was supplied equally through poultry manure and inorganics (T_8). Application of 100 percent N through fertilizer (T_2) was comparable with 50% N - FYM + 50% N - Fertilizers (T_7), 75 % N - PM + 25% N - Fertilizers (T_6). The inorganic treatment produced comparable stover yield to that of integrated treatments except T_5. However in all combinations integrated application of inorganic nitrogen with poultry manure was found to be superior to FYM. This might be due to addition of organic material which can markedly increase soil productivity by providing essential plant nutrients by improving physical properties (Shah *et al.,* 2010).

Economics

The economic evaluation of the study presented in table 3 revealed that the highest net profit of Rs. 58737/- per hectare and B:C ratio of 1.40 were obtained with an application of 100 % N- Fertilizers (T_2) closely followed by 50 % N- PM + 50 % N- Fertilizers treatment (T_8) which registered a net profit of Rs. 57,218/- per hectare and B:C ratio of 1.39. The benefit to cost ratios of sole FYM and PM treatments were 0.80 and 0.66, respectively, which can be considered as minimum values related to all treatments supplied with nitrogen. This can be attributed to lower yields of sole organic treatments, which cannot meet the immediate nutrient requirement of the crop in the first season itself (Murmu *et al*., 2013). In addition

the amount of manure needed for 100 % replacement of nitrogen is bulky hence, though the unit price is less overall cost is increasing. The benefit of 100 % replacement can be reaped if the soils are continuously under organics. However the lowest B:C ratio of 0.18 observed in control (T_1), nevertheless devoid of the nitrogen fertilizer cost was due to the lowest yield and net returns (Rs. 7281/-).

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