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# Conjunctive use of Organic and Inorganic Sources of Nitrogen on Yield and Yield attributes of Sweet Corn (*Zea mays*)

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**ABSTRACT**

An experiment was conducted at Agricultural Research Station, Seethampeta during *Rabi* season, 2018 to study the Conjunctive use of organic and inorganic sources of nitrogen on yield andyield attributes of sweet corn (*Zea mays*). It was carried out witheight different treatments namely : (1) Control (Absolute control) (2) Inorganic fertilizers (RDF) N-$P_2O_5$-$K_2O$ ( 3) 50% RDF N through inorganic fertilizer + 50% equivalent N through FYM (4) 50% RDF N through inorganic fertilizer + 50% equivalent N through vermicompost (5) 50% RDF N through inorganic fertilizer + 50% equivalent N through poultry manure (6) 75% RDF N through inorganic fertilizer + 25% equivalent N through FYM (7) 75% RDF N through inorganic fertilizer + 25% equivalent N through vermicompost (8) 75% RDF N through inorganic fertilizer + 25% equivalent N through poultry manure, laid out in randomized block design with three replications. Among the eight treatments, T8 - 75% RDF N through inorganic fertilizer + 25% equivalent N through poultry manure recorded highest Plant height (204 cm), Cob length (16.1 cm), Cob girth (14.2 cm), No. of grains per cob (426.2), Green cob yield(10046 kg/ha)significantly superior over 75% RDF N + 25% N through vermicompost (T7) and was at par with 100% RDF (T2).

**Keywords:** *Green cob Yield, Nutrient management, Organic and inorganic sources, Poultry manure and Sweet corn*

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. High demand has also been observed in India for sweet corn because of its higher economic returns within a short span of time. Among the several corns sweetcorn has gained major importance in urban areas due to its savour preferred for human consumption. Sweet corn is a nutrient rich, good source of sugars 14-20%, niacin, vitamin C, beta carotene and minerals (Goutamibai *et al*., 2021). In north coastal Andhra Pradesh, maize and sweetcorn are emerging as important cash crops and it accounts for 25% grain production (Visalakshi *et al*., 2019).

Now a days, use of chemical fertilizer is increasing to boost up crop production. Simultaneously, cost of chemical fertilizer is increased constantly, besides these, only use of inorganic fertilizers is injurious to soil health and soil productivity. The imbalanced and skewed application of NPK results in stagnated or reduced crop yields and impaired nutrient use efficiency (Tiwari *et al*., 2006 and Sujala *et al*., 2016). Among several management practices that affect soil quality, fertilizer application is of paramount importance for its role in growth and development of the crop (Mohan Rao *et al.,* 2016). 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. There is a need to arrive at nutrient management involving chemical fertilizers and organic manures for sustained productivity as it reduces dependence on chemical fertilizers, but also improves soil productivity (Divya *et al*., 2017).

Keeping in view the facts afore mentioned, present investigation was conducted to work out the possible response of sweetcorn crop to various organic and inorganic sources of nitrogen and its influence on the soil status.

## MATERIAL AND METHODS

A field experiment was conducted during *rabi,* 2018 at Agricultural Research Station, Seethampeta to study the response of Conjunctive use of organic and inorganic sources of nitrogen on yield andyield attributes of sweet corn. The available N, P and K content in the soil were 165 kg $ha^{-1}$, 16 kg $ha^{-1}$and 188 kg $ha^{-1}$ respectively. The soil was slightly alkaline in reaction having pH 7.74.

The experiment comprised of eight treatments namely (1) Control (Absolute control) (2) Inorganic fertilizers (RDF) N-$P_2O_5$-$K_2O$ (3) 50% RDF N through inorganic fertilizer + 50% equivalent N through FYM (4) 50% RDF N through inorganic fertilizer + 50% equivalent N through vermicompost (5) 50% RDF N through inorganic fertilizer + 50% equivalent N through poultry manure (6) 75% RDF N through inorganic fertilizer + 25% equivalent N through FYM (7) 75% RDF N through inorganic fertilizer + 25% equivalent N through vermicompost (8) 75% RDF N through inorganic fertilizer + 25% equivalent N through poultry manure imposed under randomized block design in three replications.

Before sowing, the fertilizer and manures application was done according to the treatments in the form of urea, diammonium phosphate (DAP), and muriate of potash (MOP), FYM, poultry manure and vermi-compost respectively. Sweet corn yield and yield attributes such as plant height (cm), Plant height (cm), Cob length (cm), Cob girth (cm), No. of grains per cob (No.), Green cob yield(kg $ha^{-1}$) were recorded.The post harvest soil samples were collected from 0-15 centimeter depth for analyzing available nutrient status.

## RESULTS AND DISCUSSION

### Yield and yield attributes of sweetcorn

Readily available NPK and micro nutrients available in organic nutrient sources might have influenced the yield attributes of the crop (Rayees and Wani, 2017).

**Plant height (cm)**

The plant height with the application of 75 % RDN + 25 % N through PM (204.0 cm) was on par with the treatments T6 and T7 and shows significant difference with $T_1$,$T_2$,$T_3$,$T_4$ and $T_5$. This might be due to application of poultry manure and fertilizer thereby increase in soil microorganism and also due to better moisture and nutrient availability (Khandelwal *et al*., 2017). Similar results were obtained by Pinjari (2007) in sweet corn.

**Length of the cob:** The highestCob length was recorded by the T8 treatment and shows significant difference with the treatments T1, T3, T4, T5 and was on par with $T_2$, T6, T7 treatments. These results suggested that adequate supply of nutrients from both organic and inorganic source throughout vegetative growth was necessary for proper cob development (Karan Verma *et al*., 2018).

**Cob Girth :** The maximum Cob Girth was recorded in treatment 75 % RDN + 25 % N through Poultry manure and also shows similar trend as length of the cob.

Number of grains per cob and 100 grain weight was recorded highest by the T8 treatment.

**Green cob yield (kg/ha) :**A perusal of data in table indicated that the highest green cob yield of 10046 kg/ha was observed in the treatment supplied with 75% RDN+ 25% N Poultry manure (T8) which was on par with $T_7$, $T_6$ and $T_2$ treatments. 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 and Sujala *et al*., 2016).

**Grain yield (kg/ha)**

The highest grain yield was recorded with the treatment T8 (3316 kg/ha). Higher grain yield with combined application of inorganic and organic sources of nutrients could be ascribed to efficient utilization of nutrients from combined sources compared to the single source (Rayees and Wani, 2017). This might be due to the increase in the yield components might be connected with the release of essential nutrient elements by the poultry litter and increase of nutrient availability (Khandelwal *et al*., 2017).

**Table 1. Effect of conjunctive use of organics and inorganics on yield and yield attributes of sweet corn**

| Treatments | Plant height (cm) | Cob length (cm) | Cob girth (cm) | No. of grains per cob | 100 Grain weight (gms) | Green cob Yield kg/ha | Grain yield kg/ha |
|---|---|---|---|---|---|---|---|
| T1- Control | 133.3 | 9.8 | 8.2 | 148.5 | 7.5 | 3829 | 912 |
| T2 – (RDF) N-$P_2O_5$-$K_2O$ | 182.3 | 14.5 | 13.2 | 347.2 | 11.4 | 8495 | 2605 |
| T3 – 50% RDN + 50% N FYM | 165.7 | 11.9 | 11.7 | 272.4 | 10.1 | 6857 | 2190 |
| T4 – 50% RDN + 50% N vermicompost | 168.7 | 13.2 | 12.4 | 294.3 | 10.3 | 7234 | 2268 |
| T5 – 50% RDN + 50% N poultry manure | 179 | 13.4 | 12.6 | 340.9 | 10.5 | 8112 | 2377 |
| T6 – 75% RDN +25% N FYM | 186 | 14.9 | 13.9 | 394.4 | 12.2 | 8851 | 2924 |
| T7 - 75% RDN + 25% N vermicompost | 191.7 | 15.3 | 14.1 | 405.3 | 12.6 | 9780 | 3221 |
| T8 - 75% RDN + 25% N poultry manure | 204 | 16.1 | 14.2 | 426.2 | 13.2 | 10046 | 3316 |
| S.E (m) | 6.3 | 0.6 | 0.4 | 11.7 | 0.7 | 558 | 161 |
| CD | 19 | 1.9 | 1.3 | 35.4 | 2.2 | 1692 | 487 |
| CV % | 6.1 | 7.7 | 5.8 | 6.2 | 11.4 | 12 | 11 |

**Table 2: Effect of conjunctive use of organics and inorganics on soil physico-chemical properties**

| Treatments | pH (1:2.5) | EC (dS/m) | OC (%) | BD ($Mg/m^3$) | WHC (%) |
|---|---|---|---|---|---|
| $T_1$ : Control | 7.74 | 0.32 | 0.62 | 1.33 | 58.64 |
| $T_2$ : (RDF) N-$P_2O_5$-$K_2O$ | 7.73 | 0.33 | 0.65 | 1.33 | 60.75 |
| $T_3$ : 50% RDN + 50% N FYM | 7.66 | 0.36 | 0.71 | 1.31 | 63.16 |
| $T_4$ : 50% RDN + 50% N vermicompost | 7.62 | 0.30 | 0.72 | 1.31 | 63.27 |
| $T_5$ : 50% RDN + 50% N poultry manure | 7.60 | 0.35 | 0.74 | 1.30 | 64.33 |
| $T_6$ : 75% RDN +25% N FYM | 7.71 | 0.33 | 0.66 | 1.32 | 60.77 |
| $T_7$ : 75% RDN + 25% N vermicompost | 7.65 | 0.30 | 0.68 | 1.32 | 60.95 |
| $T_8$ : 75% RDN + 25% N poultry manure | 7.66 | 0.39 | 0.70 | 1.31 | 62.22 |
| SEm± | - | - | - | - | - |
| CD (0.05) | NS | NS | NS | NS | NS |
| CV (%) | - | - | - | - | - |
| **Initial** | 7.74 | 0.24 | 0.61 | 1.33 | 57.63 |

Improvement in soil organic carbon in T8 treatment due to addition of organic manures compared to recommended NPK alone was also reported by Ramesh *et al.* (2009).Compare to initial value the Bulkdensity decreased in75% RDF N through inorganic fertilizer + 25% equivalent N through poultry manure treatment.The main reason of decreasing bulk density was aggregation of soil particle due to increasing organic matter as well as stability of aggregates which leads to increase the total pore space in soil (Kalhapure *et al*., 2013**)**. Islam *et al.* (2012) has been also concluded that addition of organic matter through organic fertilizers decreases the bulk density of soil (Table 2).

Application of 75% RDF N through inorganic fertilizer + 25% equivalent N through poultry manurein sweetcorn recorded N, $P_2O_5$ and $K_2O$ status of 196, 31.5 and 224 kg/ha, respectively, which was significantly higher than the control. The appreciable buildup in available P with organics and inorganics might be attributed to the influence of inorganic manure in increasing available P in soil through complexing of cations, which were responsible for the fixation of P (Kumar *et al.,* 2005 and Mohan Rao *et al*., 2016). The buildup of available K in soil was due to beneficial effect of organic manure on the reduction of K fixation, releasing K due to the interaction of organic matter with K resulting in addition of K to the available of K to the available pool of K (Mallareddy and Devenderreddy, 2008) (Table 3). An increase in availability of Zn in soil might be due to formation of organic chelates which decreased the susceptibility of Zn adsorption, fixation and precipitation resulting in enhanced its availability in soil (Table 3).

**Table 3. Effect of conjunctive use of organics and inorganics on available macro and micro nutrients**

| Treatments | N | $P_2O_5$ | $K_2O$ | Zn | Fe | Cu | Mn |
|---|---|---|---|---|---|---|---|
| | kg/ha | | | (ppm) | | | |
| $T_1$ : Control | 140 | 12.4 | 163 | 0.49 | 4.67 | 2.11 | 10.31 |
| $T_2$ : (RDF) N-$P_2O_5$-$K_2O$ | 184 | 27.2 | 204 | 0.68 | 4.74 | 2.18 | 10.46 |
| $T_3$ : 50% RDN + 50% N FYM | 175 | 21.4 | 194 | 1.01 | 5.2 | 2.34 | 12.89 |
| $T_4$ : 50% RDN + 50% N vermicompost | 179 | 22.9 | 198 | 1.08 | 5.24 | 2.37 | 12.84 |
| $T_5$ : 50% RDN + 50% N poultry manure | 183 | 25.2 | 202 | 1.16 | 5.33 | 2.42 | 12.76 |
| $T_6$ : 75% RDN +25% N FYM | 185 | 29.1 | 216 | 0.87 | 4.81 | 2.21 | 12.09 |
| $T_7$ : 75% RDN + 25% N vermicompost | 192 | 30.3 | 218 | 0.97 | 4.96 | 2.23 | 12.57 |
| $T_8$ : 75% RDN + 25% N poultry manure | 196 | 31.5 | 224 | 0.97 | 5.12 | 2.26 | 12.75 |
| SEm± | 11 | 1.8 | 10 | 0.07 | - | - | - |
| CD (0.05) | 33 | 5.6 | 29 | 0.2 | NS | NS | NS |
| CV (%) | 10 | 12.8 | 8 | 12.7 | - | - | - |
| **Initial** | 165 | 16 | 188 | 0.78 | 4.73 | 2.21 | 11.09 |

On the basis of the findings of the present investigation, it can be concluded that conjunctive use of 75% RDF N through inorganic fertilizer + 25% equivalent N through poultry manure was found most suitable method among all the methods of integrated nutrient management. The study on the Conjunctive use of 75% RDF N through inorganic fertilizer + 25% equivalent N through poultry manure to sweet corn not only enhanced productivity of sweet corn over the control and Recommended NPK, respectively, but also improved soil fertility in termsof higher available N, P, K and organic carbon.

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