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Yield and yield attributes of sweet corn (*Zea mays* L. Saccharata) to different sources of organic and inorganic nitrogen

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Abstract
A field experiment was carried out during the *Rabi* season of 2015-16 at Crop Research Farm, Department of Agronomy, Allahabad School of Agriculture, SHIATS, Allahabad (U. P.) to evaluate the "Response of different sources of organic and inorganic nitrogen on growth and yield of sweet corn (*Zea mays* L. Saccharata). The experiment was laid out in Randomized Block Design (RBD) and replicated thrice. The treatments consisted of three level of Nitrogen 120:90:60 kg ha^{-1}, and 120:60:30 kg N through Farm yard manure (FYM), and Poultry manure (PM). The result showed under treatment T_4 (120 kg N through FYM), recorded maximum number of cob $plant^{-1}$ (*i.e.*1.60) and cob girth (*i.e.*20.02 cm), however application of (120 kg N ha^{-1}) significantly showed under treatment T_1 green cob weight (*i.e.*359.37 g cob^{-1}), while significantly the highest, cob length (*i.e.*26.33 cm), fresh cob yield (*i.e.*32733.33 kg ha^{-1}), green fodder yield (*i.e.*35 t ha^{-1}), and harvest index (*i.e.*48.32%) were observed in treatment T_8 which consist of (90 kg N, and 30 kg N through PM). Further the highest gross return (₹209500.00 ha^{-1}), net return (₹153324.24 ha^{-1}), and benefit cost ratio (1: 3.73) were also recorded in treatment T_8 respectively.

Keywords: Sweet corn, N fertilizer, Poultry manure, FYM, green cob yield.

Introduction

Maize (*Zea mays*. L) is one of the largest producing cereal crops in the world covering about 162 m ha and producing about 844 m tones Maize contribute 15 % protein and 19 % of the calories derived from food crops in the peoples' diet globally. In Afghanistan maize occupied about 0.4 and 0.5 m ha during sixties and seventies when the country was self sufficient in cereal production whereas presently we are cultivating maize over 180,000 ha only contributing only 7.0 % of cereal production signifying a huge gap to be filled by increasing the acreage as well as productivity. Maize in Afghanistan is produced by farmers of east and south zone of Afghanistan where irrigation is not sufficient for rice cultivation (Eurasian, 2012) [1].

Sweet corn (*Zea mays* L.) popularity known as maize is one of the most important cereal of the world, ranking third amongst the food crops, next to rice and wheat both in respect of area and production. In Gujarat maize is one of the important traditionally grown crops of tribal areas. Comprising the districts of Panchmahals, Sabarkantha, Banaskantha and Part of Baroda and Kheda districts, now recently this crop may be introduce in South Gujarat districts like Surat, Tapi. Among these districts Panchmahals is a leading district. Among various types of maize, sweet corn is very popular for the use of its green cabs in the United States of America. It differs from the field corn due to its higher sweetness, as it has high amount of sugar and alcoholic material. Besides, its consumption as vegetable purpose, it is also utilized for extracting sucrose as an industrial purpose. The role of organic manure for increasing crop production has been universally established, as it plays significant role in improving physical and chemical properties of the soil. Application of 12-15 t of FYM helps in increasing the yield of maize crop to the tune of 1.5 to 5.6 percent ha^{-1}. Sweet corn is one of the heavy consumers of plant nutrients. It remains about 72 kg N, 35 kg P_2O_5 and 220 kg K_2O ha^{-1}. Nitrogen is the key element in crop growth and is the most limiting nutrient in Indian soils. The importance of nitrogen for increasing the yield has been widely accepted. Maize is one of the crop that responses well to phosphetic fertilizer in almost all the soil types. (Chauhan and Patel 2011) [2].

Nitrogen has a very important role in the efficiency development of corn cultivation so that nitrogen one of the main inputs in corn farming systems with high production potential. Nitrogen was increases the protoplasm content and thus increases cell size, leaf area and photosynthetic activity. A main part of the environmental pollution caused by denitrification of nitrogen and accumulation of nitrogen in sub soil. At least the past 30 years, the nitrate content in irrigated water in the field, has increased. Increase nitrogen use efficiency by increasing yields, improving soil fertility, especially nitrogen management is possible nutrient use efficiency in agronomy can be defined as the ratio of yield to the amount consumed nutrient nitrogen efficiency of absorption (apparent recovery) use nitrogen needed for corn production Depending on the soil conditions, variety and purpose of yield production Provide the appropriate amount of nitrogen not only maximize revenue collection either reduced a large accumulation of nitrate or will stop reducing agronomic nitrogen efficiency. In fact varieties with maximum performance were actually more efficient when you had enough nitrogen in the soil. Nitrogen use efficiency had positive correlation with increase in fertilizer intake nitrogen consuming efficiency had positive effect either with nitrogen use efficiency, but the nitrogen uptake efficiency andnitrogen use efficiency had a weak negative correlated with each other (Nemati and Sharifi 2013).

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Materials and Methods

The experiment was conducted during the *Rabi* season 2015 at the Crop Research Farm, Department of Agronomy, Allahabad School of Agriculture, SHIATS, Allahabad. The Crop Research Farm is located at 25^0 24' 42" N latitude 81^0 50' 56" E longitudes and 98 m altitude above the mean sea level. This area is situated on the right side of the river *Yamuna* and by the opposite side of Allahabad Rewa Road about 5 km away from Allahabad city. The soil of the experimental area was sandy loam with moderately alkaline pH (7.5) low in organic carbon (0.42%) and available N (197 kg ha^{-1}), available P (22.50 kg ha^{-1}) and available K (343.00 kg ha $^{-1}$) during *Rabi* season 2015 respectively. The experiment was laid out in Randomized Block Design (RBD) and replicated thrice. Fertilizers were applied as side placement, for which 4-5 cm deep furrows were made along the seed rows with a *hand hoe*. The nutrient sources were urea, Di-Ammonium Phosphate (DAP), Muriate of potash (MOP) and organic fertilizer Farm yard manure, Poultry manure. The recommended dose of 120:60:40 kg N: P: K ha^{-1}, and organic fertilizer farm yard manure (FYM) and poultry manure (PM) were applied according to the treatment details. Nitrogen was applied in three split doses ½ nitrogen, whole of phosphorus, potash at the time of sowing and remaining ¼ nitrogen at 30 days after sowing and ¼ nitrogen at 60 days after sowing. All the agronomic practices were carried out uniformly to raise the crop. To record various yield observations on sweet corn a sample consisting of five plants was selected at random. The randomly selected five plants were utilized for recording the average value of the number of cobs $plant^{-1}$.The length and girth of five randomly selected cobs (with husk) from each plot was measured and the average was worked out to get cob length and cob girth. The selected cobs were weighed (with husk) and the mean values of the weight of cob were recorded. The total number of cobs obtained from individual plant per square meter was weighed and the mean values were recorded for yield estimation. The cobs were picked up treatment wise and the harvested cobs were weighted after which the total number of cobs obtained from individual plants per square meter recorded and converted into number of cobs ha^{-1}. Green fodder was collected plot wise before dry plants were cut from ground level after picking of the cobs. It was weighted and the value obtained was converted into t ha^{-1}.

Results and Discussions

Yield and yield attributes: Data presented in Table 1and Fig 1, revealed that yield attributes of sweet corn as number of cobs per plant, cob girth and length, green cob weight g cob^{-1}, fresh cob yield (kg ha^{-1}), Green fodder yield (t ha^{-1}) and harvest index were influenced by various treatments of different levels of nitrogen through urea, farm yard manure (FYM) and poultry manure (PM) application during the period of investigation. Maximum number of cobs (*i.e.*1.60 $plant^{-1}$), was observed in treatment T_8 (75% RDN through urea + 25% RDN through PM) while the minimum number of cobs (*i.e.*1.33 $plant^{-1}$) was recorded in T_3 (50% RDN through urea), maximum cob girth (*i.e.*20.07cm), was observed in treatment T_4 (100% RDN through FYM), while T_1 (100% RDN through urea),T_5 (100% RDN through PM), T_6 (75% RDN through urea + 25% RDN through FYM), T_7 (50% RDN through urea + 50% RDN through FYM), T_8 (75% RDN through urea + 25% RDN through PM), and T_9 (50% RDN through urea + 50% RDN through PM) were found to be statistically at par values with T_4 although the minimum cob girth (*i.e.*17.80 cm) was recorded in T_2 (75% RDN through urea), maximum cob length (*i.e.*26.33 cm), was observed in treatment T_8 (75% RDN through urea + 25% RDN through PM), while T_1 (100% RDN through urea), T_4 (100% RDN through FYM), T_5 (100% RDN through PM), T_6 (75% RDN through urea + 25% RDN through FYM), T_7 (50% RDN through urea + 50% RDN through FYM), and T_9 (50% RDN through urea + 50% RDN through PM), were found to be statistically at par values with T_8 while the minimum cob length (*i.e.*17.80 cm) was recorded in T_2 (75% RDN through urea), maximum green cob weight (*i.e.*359.37 g cob^{-1}) was observed in treatment T_1 (100% RDN through urea), while T_7 (50% RDN through urea + 50% RDN through FYM), and T_8 (75% RDN through urea + 25% RDN through PM), were found to be statistically at par values with T_1, however the minimum green cob weight (*i.e.*293.81 g cob^{-1}) was recorded in T_3 (50% RDN through urea) maximum fresh cob yield (*i.e.*32733.33kg ha^{-1}) was observed in treatment T_8 (75% RDN through urea + 25% RDN through PM), while the minimum fresh cob yield (*i.e.*23966.67kg ha^{-1}) was recorded in T_3 (50% RDN through urea), maximum green fodder yield (*i.e.* 35.00 t ha^{-1}) was observed in treatment T_8 (75% RDN through urea + 25% RDN through PM), while T_1 (100% RDN through urea), T_5 (100% RDN through PM), and T_9 (50% RDN through urea + 50% RDF through PM), were found to be statistically at par values with T_8, while the minimum green fodder yield (*i.e.* 29.33 t ha^{-1}) was recorded in T_3 (50% RDN through urea), maximum harvest index (*i.e.* 48.32%), was observed in treatment T_8 (75% RDN through urea + 25% RDN through PM), while the minimum harvest index (*i.e.* 44.96%) was recorded in T_3 (50% RDN through urea).

Maximum cob girth (cm), in treatment T_4 (100% RDN through FYM), might be due to application of FYM along with N, and P recommended dose of fertilizer (RDF) it might also due to greater availability of nitrogen, and phosphorus on account of increasing fertilization, which in phosphorus into plant utilizable form are low cost eco- friendly inputs for farmers. Similar finding have been recorded by (Singh *et al.*, 2012) [4].

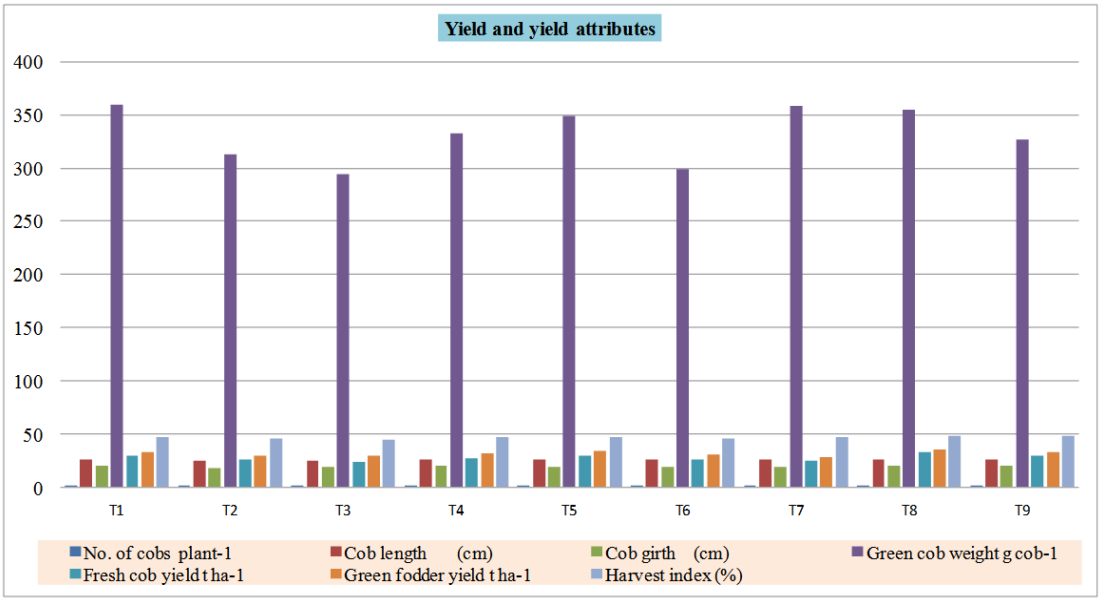
The maximum green cob weight (g cob^{-1}) in treatment T_1 (100% RDN through urea), could be assigned to more number of cobs $plant^{-1}$, and length of the cob coupled with higher cob weight, adequate nitrogen nutrition has promoted growth stature as well as the enhanced yield structure of specialty corn, resulting in higher cob yield. Similar finding have been reported by (Prathyusha and Hemalatha 2013) [5].

The probable reasons for recording the maximum number of cobs $plant^{-1}$, cob length, cob yield, green fodder and harvest index in treatment T_8 (75% N from urea + 25% N from poultry manure) gave significantly higher yields as compared to other treatments. This increased might be due more and readily available nutrients in poultry manure and better supply of N from the higher rates of organic and inorganic sources. Similar finding have been reported by (Khan *et al.*, 2013) [6]. In addition it might be due to more available nutrients from two source of nitrogen and it might also due to higher mineralization potential of poultry manure (PM) enabling it to actively and quickly release its nutrients for plant uptake and use. Similar finding was observed by (Uwah *et al.*, 2014) [7]. Moreover, it could be attributed to the better vegetative growth and narrow C: N ratio of poultry manure and conversion of non-available nutrients to available form. Similar finding was observed by (Thavaprakash *et al.*, 2005) [8]. Finally, this might be due more photosynthetic activities of the plant on account of

adequate supply of N. it might also due to essential requirement of nitrogen for cob and kernel growth in maize. Similar finding have been observed by (Khan *et al.*, 2008) [9].

Table 1.1: Response of sweet corn to different sources of organic and inorganic nitrogen on yield and yield attributes

	Treatments	No. of cobs plant^{-1}	Cob length (cm)	Cob girth (cm)	Green cob weight g cob^{-1}	Fresh cob yield t ha^{-1}	Green fodder yield t ha^{-1}	Harvest index (%)
T_1	100% RDN	1.47	26.27	19.87	359.37	29.16	33.33	46.66
T_2	75% RDN	1.40	24.27	17.80	312.59	25.50	29.66	46.22
T_3	50% RDN	1.33	24.47	18.73	293.81	23.96	29.33	44.96
T_4	100% RDN through FYM	1.47	26.33	20.07	332.80	27.50	31.33	46.74
T_5	100% RDN through PM	1.47	25.67	19.00	348.91	29.70	33.66	46.87
T_6	75% RDN + 25% N through FYM	1.40	25.80	19.07	298.40	26.10	30.33	46.24
T_7	50% RDN + 50% N through FYM	1.33	25.60	19.07	357.97	24.80	28.30	46.67
T_8	75% RDN + 25% N through PM	1.60	26.33	19.80	355.41	32.73	35.00	48.32
T_9	50% RDN + 50% N through PM	1.53	26.33	19.73	327.27	29.96	33.00	47.59
	F- test	NS	S	S	S	S	S	S
	S. Ed. (±)	0.251	0.475	0.550	3.266	0.720	1.075	0.271
	C. D. (P = 0.05)	0.518	0.979	1.135	6.741	1.486	2.219	0.560



From the above findings it may be concluded that, application of 90kg RDN + 30 kg nitrogen through Poultry manure, in addition to the recommended dose of Phosphorus (60 kg ha^{-1}), and Potash (40 kg ha^{-1}) was recorded significantly highest sweet corn yield (*i.e.*32733.33 kg ha^{-1}) while it has a highest benefit cost ratio (1: 3.73) as compared with other treatments. Since these findings are based on the research done in one season, it may be repeated for confirmation.

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