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Kadhavane SR
College of Agriculture, Vasantrao Naik Marathwada Krishi Vidyapeeth, Latur, Maharashtra, India

Karanjikar PN
College of Agriculture, Vasantrao Naik Marathwada Krishi Vidyapeeth, Latur, Maharashtra, India

Lokhande NR
College of Agriculture, Vasantrao Naik Marathwada Krishi Vidyapeeth, Latur, Maharashtra, India

Mirkad SB
College of Agriculture, Vasantrao Naik Marathwada Krishi Vidyapeeth, Latur, Maharashtra, India

Corresponding Author:
Kadhavane SR
College of Agriculture, Vasantrao Naik Marathwada Krishi Vidyapeeth, Latur, Maharashtra, India

Yield, yield attributes and protein quality of sweet corn (*Zea maize* L. *saccharata sturt*.) as influenced by integrated nutrient management

Kadhavane SR, Karanjikar PN, Lokhande NR and Mirkad SB

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Abstract
A field experiment was conducted during *kharif* season of 2019 at the Experimental Farm, Department of Agronomy, College of Agriculture, Latur to study the effect of integrated nutrient management on yield, yield attributes and protein quality in sweet corn (*Zea mays* L. var. *saccharata sturt*). The experiment was laid out in a randomized block design with seven treatments and replicated thrice. The treatments were T_1- 100% RDF, T_2 - 100% RDF + FYM @ 5 t ha^{-1}, T_3 - 75% RDF + FYM @ 5 t ha^{-1}, T_4 - 100% RDF + Vermicompost @ 2.5 t ha^{-1}, T_5 - 75% RDF + Vermicompost @ 2.5 t ha^{-1}, T_6 - 100% RDF + FYM @ 5 t ha^{-1} + Vermicompost @ 1.25 t ha^{-1}+ *Azospirillum* and T_7 -75% RDF + FYM @ 5 t ha^{-1} + Vermicompost @ 1.25 t ha^{-1} + *Azospirillum*. The results revealed that among yield and yield attributes, green cob yield (10621 Kg ha^{-1}), green fodder yield (21369 Kg ha^{-1}), harvest index (33.20%), mean number of cobs plant^{-1} (1.17), number of kernel row cob^{-1} (16.83), number of kernel cob^{-1} (783.33) and total weight of cob plant^{-1} (387.40 g) of sweet corn were significantly highest with the application of 100% RDF + FYM @ 5 t ha^{-1} + Vermicompost @ 1.25 t ha^{-1} + *Azospirillum*. The protein content did not differ significantly among the treatments whereas the highest content (11.9) was observed with application of 100% RDF + FYM @ 5 t ha^{-1} + Vermicompost @ 1.25 t ha^{-1} + *Azospirillum*.

Keywords: INM, maize, protein quality, RBD, yield, yield attributes

Introduction
Maize (*Zea mays* L.) is one of the largest producing cereal crops in the world grown in more than 150 countries having 600 million ha area with 600 million tonnes of production. In India, it is cultivated on an area of 9.0 million ha with a production of 26.0 million tonnes of grain and productivity is 2710 kg ha^{-1} (Anonymous., 2017).

The cereals, maize (*Zea mays* L.) ranks third in the total production after wheat and rice and it is a staple food in many countries, particularly in the tropics and subtropics. Maize is considered as the queen of cereals. Out of various specialty corns, sweet corn is a mutant type with one or more recessive alleles in homozygous condition that enable the endosperm to accumulate twice the sugar content as that of seed corn. In sweet corn best nutritional quality depends on moisture (72.7%) and total solids (22.3%) comprising of carbohydrate (81%), protein (13%) and lipids (3.5%). It is also good source of vitamins C and A. Maize fodder is highly succulent, palatable and digestible which is used for cattle. Hence, it is also called as "King of fodder".

Sweet corn is a exhaustive crop and it is harvested at milky stage and requires fertile soils for optimum production. As the corn is considered as an exhaustive crop, requires more nutrient, organic nutrient management practices play an important role in sustaining productivity of sweet corn. Among the various factors affecting the growth and yield of sweet corn, nutrient management plays a vital role. Well decomposed FYM in addition to supplying plant nutrients acts as binding material and improves the soil physical properties. Due to escalating cost of chemical fertilizers and objective of minimizing environmental pollution, the search of alternative source of plant nutrients is imperative. The integrated plant nutrient supply envisages conjunctive use of inorganic and organic sources of plant nutrients for crop productivity besides sustaining soil health. Nitrogen is considered to be a vitally imported plant nutrient. It plays main role for protein formation, photosynthesis of plant and vegetative growth of plant.

Phosphorous fertilization improves the metabolic and physiological process of plant. Application of organic materials along with inorganic fertilizers in the soil leads to sustained productivity and also vermicomposting technology involves the bio-conversion of organic waste into vermicasts and vermiwash utilizing earthworms. By addition of vermicompost in soil, it increases the soil physical, chemical as well as bio logical properties. Bio fertilizers play an important role in increasing the availability of nitrogen and phosphorus. Among several bio agent *Azospirillum* is known to fix atmospheric nitrogen and increases about 10-15% grain yield in maize.

Considering the nutritive and beneficial effects of organic materials with inorganic fertilizers, the present investigation was carried to find out the influence of integrated nutrient management on yield, yield attributes and protein quality of Sweet corn.

Materials and Methods

The field experiment was conducted during *kharif* season of 2019-20, at Agronomy Farm Section, College of Agriculture, Latur (Maharashtra).The soil of experimental plot was clay in texture color with good drainage. It was low in available nitrogen (125.3 kg ha^{-1}), medium in available phosphorous (18.20 kg ha^{-1}) and very high in available potassium (498.58 kg ha^{-1}). The soil was moderately alkaline in reaction having pH (7.7). The experiment was laid out in a randomized block design with seven treatments and replicated thrice. The treatments were T_1- 100% RDF, T_2 - 100% RDF + FYM @ 5 t ha^{-1}, T_3 - 75% RDF + FYM @ 5 t ha^{-1}, T_4 - 100% RDF + Vermicompost @ 2.5 t ha^{-1}, T_5 - 75% RDF + Vermicompost @ 2.5 t ha^{-1}, T_6 - 100% RDF + FYM @ 5 t ha^{-1} + Vermicompost @ 1.25 t ha^{-1}+ *Azospirillum* and T_7 -75% RDF + FYM @ 5 t ha^{-1} + Vermicompost @ 1.25 t ha^{-1} + *Azospirillum*. A popular sweet corn hybrid in the region, Sugar-75, was used in the present study. The seed were treated with Cyantraniliprole + Thiamethoxam @ 5 ml kg^{-1}. Azospirillum treatment was given to seed as per treatments. Organic manures *viz*., FYM and vermicompost were applied to the respective plots ten days before sowing. *Azospirillum* was applied one day before sowing @ 10 ml kg^{-1}. As per treatments, half dose of nitrogenous fertilizers and full dose of phosphatic and potassic fertilizers were applied. The next half dose of nitrogen fertilizer was applied in bands as top dressing one month after sowing. The sources of nitrogen, phosphorus and potash were urea, single super phosphate (SSP) and muriate of potash (MOP), respectively. Various plant protection measures and intercultural operations were undertaken. Harvesting was done on 23rd October, 2019.

Results and Discussion

Yield attributes

The yield attributing characters of sweet corn *viz.*, mean number of cobs $plant^{-1}$ (1.17), number of kernel row cob^{-1} (16.83), number of kernel cob^{-1} (783.33) and total weight of cob $plant^{-1}$ (387.40 g) (Table 1) were found highest due to application of 100% RDF + FYM @ 5 t ha^{-1} + Vermicompost @ 1.25 t ha^{-1} +*Azospirillum*.

Similar results were observed by Kumar and Thakur (2004), Messy and Gaur (2006), Jadhav and Sheke (2012), Kurne *et al.*, (2017) and Thorat (2016) [7, 4, 8, 11].

Table 1: Influence of integrated nutrient management on yield attributes of sweet corn

Treatment	Mean number of cobs $plant^{-1}$	Number of kernel row cob^{-1}	Number of kernel cob^{-1}	Total weight of cob $plant^{-1}$
T_1-100% RDF	1.00	14.10	656.27	287.80
T_2 - 100% RDF + FYM @ 5 t ha^{-1}	1.00	14.20	683.47	295.67
T_3 - 75% RDF + FYM @ 5 t ha^{-1}	1.00	13.00	617.47	280.93
T_4 - 100% RDF + Vermicompost @ 2.5 t ha^{-1}	1.00	14.63	637.73	300.67
T_5-75% RDF + Vermicompost@ 2.5 t ha^{-1}	1.00	13.17	656.27	284.53
T_6-75% T_6-100% RDF + FYM @ 5 t ha^{-1} + Vermicompost @ 1.25 t ha^{-1}+ *Azospirillum*	1.17	16.83	783.33	387.40
T_7-75% RDF + FYM @ 5 t ha^{-1} + Vermicompost @ 1.25 t ha^{-1} + *Azospirillum*	1.10	15.57	775.13	332.00
SE+	0.17	0.70	32.03	18.80
CD at 5%	NS	2.17	98.70	57.91

Yield

The data on mean green cob yield, green fodder yield was significantly influenced by the various treatments. The application of 100% RDF + FYM @ 5 t ha^{-1} + Vermicompost @ 1.25 t ha^{-1} +*Azospirillum* recorded highest green cob yield (10621 Kg ha^{-1}) and green fodder yield (21369 Kg ha^{-1}) (Table 2) as compared to application of 75% RDF + FYM @ 5 t ha^{-1} + Vermicompost @ 1.25 t ha^{-1} +*Azospirillum*.

Similar results were reported by Sahoo and Mahapatra (2004), Massey and Gaur (2006), Kumar *et al.* (2008) and Jadhav and Shelke (2012) and Kurne *et al.*, (2017) and Thorat (2016) [10, 6, 4, 8, 11].

Similarly, the highest harvest index (33.20%) (Table 2) was recorded with the application of 100% RDF + FYM @ 5 t ha^{-1} + Vermicompost @ 1.25 t ha^{-1} +*Azospirillum* recorded highest green cob yield (10621 Kg ha^{-1}) and green fodder yield (21369 Kg ha^{-1}).These findings are in agreement with the findings obtained by Grazia *et al.* (2003) and Divya Sree (2012) [3, 2].

Table 2: Influence of integrated nutrient management on yield and protein quality of sweet corn

Treatment	Green cob yield (kg ha^{-1})	Green fodder Yield (kg ha^{-1})	Harvest index (%)	Protein (%)
T_1-100% RDF	7946	17300	31.47	10.4
T_2 - 100% RDF + FYM @ 5 t ha^{-1}	8570	18507	31.65	10.9
T_3 - 75% RDF + FYM @ 5 t ha^{-1}	7846	16898	31.71	9.3
T_4 - 100% RDF + Vermicompost @ 2.5 t ha^{-1}	8867	18771	32.08	11.3
T_5-75% RDF + Vermicompost@ 2.5 t ha^{-1}	7866	17099	31.51	10.0

T_6-75%T_6-100% RDF + FYM @ 5 t ha^{-1} + Vermicompost @ 1.25 t ha^{-1}+ *Azospirillum*	10621	21369	33.20	11.9
T_7-75% RDF + FYM @ 5 t ha^{-1} +Vermicompost @ 1.25 t ha^{-1} + *Azospirillum*	9596	19312	33.19	11.8
SE+	568	868	-	1.14
CD at 5%	1751	2675	-	NS

Quality parameter

Protein content in wet kernel (%)

The protein content in wet kernel was not significantly influenced by various treatments. Numerically the highest protein content (11.9%) (Table 2) was noticed with the application of 100% RDF + FYM @ 5 t ha^{-1} + Vermicompost @ 1.25 t ha^{-1} + *Azospirillum* followed by the application of 75% RDF + FYM @ 5 t ha^{-1} + Vermicompost @ 1.25 t ha^{-1} + *Azospirillum.* The protein content of kernel was also confirmed by Keerthi *et al.* (2012) and Kurne *et al.,* (2017) and DivyaSree (2012) [5, 8, 2].

Conclusion

Higher yield and yield attributes, green cob yield (10621 Kg ha^{-1}), green fodder yield (21369 Kg ha^{-1}), harvest index (33.20%), mean number of cobs plant^{-1} (1.17), number of kernel row cob^{-1} (16.83), number of kernel cob^{-1} (783.33) and total weight of cob plant^{-1} (387.40 g) of sweet corn were recorded with the application of 100% RDF + FYM @ 5 t ha^{-1} + Vermicompost @ 1.25 t ha^{-1} + *Azospirillum*. The protein content did not differ significantly among the treatments whereas the highest content (11.9) was observed with application of 100% RDF + FYM @ 5 t ha^{-1} + Vermicompost @ 1.25 t ha^{-1} + *Azospirillum*.

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