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Effect of Integrated Nutrient Management and Spacing on Green Cob Yield, Quality Parameter and Economic of Sweet Corn (*Zea mays saccharata* Sturt)

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A field experiment was conducted at the College Agronomy Farm, Department of Agronomy, B. A. College of Agriculture, Anand Agricultural University, Anand, Gujarat during *kharif* season of the years 2006 and 2007 on loamy sand soil with a view to study the effect of spacing and integrated nutrient management on green cob yield and quality of sweet corn [*Zea mays saccharata* sturt]. Twenty treatment combinations comprising two levels of spacing (45 cm x 20 cm and 60 cm x 20 cm), two levels of FYM (0 t FYM/ha and 10 t FYM/ha) and five fertility levels (100 % RDF, 75 % RDF + *Azotobacter*, 75 % RDF + *Azotobacter* + PSB, 50 % RDF + *Azotobacter* and 50 % RDF + *Azotobacter* + PSB) were tried under split plot design with four replications. The results revealed that sowing of sweet corn at narrow spacing (45 cm x 30 cm) and application of 10 t FYM ha-1 with application of 100 % RDF were significantly influence on green cob yield, green fodder yield and get maximum monetary return.

Key words: Sweet corn, Green cob, Green fodder, Protein content and sugar content.

Sweet corn (*Zea mays* L) is popular vegetable and ranks seconds in farm values and fourth in commercial values among all commercial crops in India. The productivity potential of sweet corn is higher than wheat and nutritive status superior to rice on account of which it will no longer a “coarse grain” but a “nutritious grain” (Patel *et.al*., 2014). It is popularly known as corn and considered as the “Queen of cereals”. Among the various types of maize, sweet corn (*Zea Mays* saccharata sturt) is very popular for the use of its green cobs all around the world. It is good source of anti-oxidents, vitamin C and it is also free from saturated fat and cholesterol.

Fresh sweet corn having good nutrition status based on moisture (70.78 %), total solids (12-20 %), carbohydrates (81.00 %), protein (13 %), lipid (3.50 %) and total sugar content (15-20 %). The significant increase in crop production achieved through green revolution came mainly by the use of improved high yielding varieties and greater input of fertilizers and plant protection chemicals, at the cost of soil III health. As a result, in spite of liberal application of NPK fertilizers, a declining or stagnating yield trend was found which might be attributed to multiple nutrient deficiencies and imbalance of nutrients. With short supply and escalating price of chemical fertilizers, an increasing awareness in favour of adopting biological routes of soil fertility management for preventing soil degradation and for sustaining crop production invited attention. In sweet corn, an integrated approach of nutrient supplying by chemical fertilizers along with bio-fertilizer and organic manures is gaining importance because this system not only reduced the use of inorganic fertilizers but it also environmental friendly. Integrated nutrient management which is one of the most important components of agricultural production system to sustain higher crop yields *vis a vis* organic and inorganic sources, is

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maintaining soil health. The interactive advantage of combining organic and inorganic sources of nutrients in integrated nutrient management have shown additive effect in comparison to the use of each component separately (Bashir *et.al.*2014).

MATERIAL AND METHOD

A field experiment was conducted at the College Agronomy Farm, Department of Agronomy, B. A. College of Agriculture, Anand Agricultural University, Anand, Gujarat during ***kharif*** season of the years 2006 and 2007 on loamy sand soil with a view to study the effect of spacing and integrated nutrient management on green cob yield and iv quality of sweet corn [*Zea mays saccharata* sturt]. Sweet corn *var.* Madhuri was used in the present research. Twenty treatment combinations comprising two levels of spacing (45 cm x 20 cm and 60 cm x 20 cm), two levels of FYM (0 t FYM/ha and 10 t FYM/ha) and five fertility levels (100 % RDF, 75 % RDF + *Azotobacter*, 75 % RDF + *Azotobacter* + PSB, 50 % RDF + *Azotobacter* and 50 % RDF + *Azotobacter* + PSB) were tried under split plot design with four replications. All the agronomical practices were carried out during the experiment. The soil of experimental plot was low in available nitrogen and organic carbon and high in available phosphorus and available potash. At harvesting, data on grain yield and various yield attributes were recorded. All the data recorded were analyzed by ANOVA method as suggested by Cochran and Cox (1957).

RESULTS AND DISCUSSION

Effect of spacing

The differences in green cob yield due to spacing treatment levels were found significant. Data presented in Table-1 indicated that treatment S1 (45 cm X 20 Cm) recorded significantly the highest green cob (11988 kg ha-1) and green fodder (14012 kg ha-1) yields as compared to treatment S1. Narrow spacing treatment (S1) recorded higher seed yield that increase at the extent of 7.71 % over spacing level S2 (60 cm x 20 cm), respectively. Optimum plant population under closer spacing of 45 cm x 20 cm (S1) would have resulted in higher green cob yield, while v lower plant stand under wider spacing S2 (60 cm x 20 cm) reduced the green cob yield. The possible reason for increased green cob yield under closer spacing (S1) might be due to more number of plants as compared to wider spacing having the lower plant stand not sufficient for giving higher production. Green fodder yield increase might be due to higher plant population under narrower spacing which resulted into higher utilization of natural resources such as space, nutrients, moisture, carbon dioxide and radiant energy. Thus, it was owing to increase in economic sink strength and ultimately into higher green fodder yield of maize crop. These finding corroborate the results of Bangarwa *et al.*, 1988 and Gaikwad *et.al*., 2015.

Quality parameters also influenced by spacing treatment. Wider spacing (60 cm X 20 cm) recorded significantly the highest sugar content (18.12 %) from green cob seed. Protein content did not differ significantly due to spacing treatment. There might be due to less competition among the plants for light, energy, space, water and nutrients ultimately resulting into better plant growth as compared to narrow spacing resulting into sufficient interception of sun light, efficient photosynthetic activities and ultimately greater accumulation of photosynthates which favored the higher sugar content.

Effect of FYM

Result presented in Table-1 indicated that an application FYM @ 10 t/ha significantly increased the green cob yield (12178 kg/ha) and vi green fodder yield (14957 kg ha-1) as compared to control treatment. The magnitude of increase grain yield 11.31 %, respective over no FYM treatment. It is also evident that growth, yield attributes like number of cobs/plant and number of rows/cob, number of grains/cob, girth and weight of cob were significantly increased with an application of 10 t FYM/ha which might be ultimately resulted into higher green cob yield. These might also be due to the increased availability of both the native and applied nutrients in soil and their uptake by plants through improved root system and these might also be due to the decomposition and humification of organic manures which produces humus and helps in improving the physical, chemical and biological properties of soil which favorably improved yield attributes and ultimately the yield of crops, Pattanshetti *et al.*, (2002). Increasing green fodder yield might be due to organic manure

Table 1. Effect of spacing, FYM and fertility lelvel/biofertilizer on yield, quality and monetary return on sweet corn (Two year pooled data)

Treatments	Yield (Kg ha^{-1})		Quality Parameters			Econ-mics
	Green Cob yield	Green fodder yield	Sugar content in grain (%)	Protein contain (%)	Net realization	BCR
Spacing (cm)						
S1: 45 cm × 20 cm	11988	14692	17.16	7.19	80805	4.60
S2: 60 cm × 20 cm	11130	14012	18.12	7.35	73994	4.35
S.Em.+	169.60	214.83	0.24	0.11	-	-
C. D. at 5 %	503.90	638.29	0.73	NS	-	-
FYM (t/ha)						
F1 : 0 tone/ha	10940	13747	16.45	6.87	73500	4.52
F2 : 10 tone/ha	12178	14957	18.83	7.67	81303	4.44
S.Em.+	169.60	214.83	0.24	0.11	-	-
C. D. at 5 %	503.90	638.29	0.73	0.32	-	-
C. V. %	13.12	13.39	12.42	13.10	-	-
Fertility levels / Biofertilizers (B)						
B1 : 100 % RDF	12145	15210	18.91	7.68	81598	4.52
B2 : 75 % RDF + *Azotobacter*	11603	14323	17.67	7.51	77593	4.46
B3 : 75 % RDF + *Azotobacter* + PSB	11794	14560	18.17	7.56	79124	4.52
B4 : 50 % RDF + *Azotobacter*	10901	13468	16.16	6.72	72467	4.37
B5 : 50 % RDF + *Azotobacter* + PSB	11352	14199	17.31	6.86	76219	4.51
S.Em.+	204.18	258.63	0.30	0.14	-	-
C. D. at 5 %	573.17	726.01	0.85	0.39	-	-
C. V. %	9.99	10.19	9.74	10.76	-	-
Interaction effect						
S X F	NS	NS	NS	NS	-	-
S X B	NS	NS	NS	NS	-	-
F X B	NS	NS	NS	Sig.	-	-
S X F X B	NS	NS	NS	NS	-	-

increased the leaf area index and photosynthetic pigment in leaves, resulting in more photosynthesis and dry matter production. Organic manure i.e., FYM also improves macro and micro nutrient balance and soil *rhizosphere* environment resulted in improving the yield. The increase in green fodder yield is due the increased growth and growth attributing characters like plant height and leaf area index (Pattanshetti *et al*., 2002). Increased in seed and strover yields might be due to addition of FYM resulted in stimulation of the enzyme activities which promotes the recycling of nutrients in the soil ecosystem (Chatra ram *et.al.*, 2015).

Sugar and protein content significantly affected by application of FYM. Significantly the highest sugar (18.83 %) and protein (7.67 %) content over no application of FYM. The significant increase sugar and protein content in grains due to FYM application might be due to organic manures which improve macro and micro nutrient balance and soil rhizosphere environment resulting in more photosynthesis and ultimately into higher photosynthetic rate and chlorophyll content.

Effect of integrated nutrient management

An application of 100 % RDF (B1) recorded significantly higher green cob (12145 kg ha-1) and green fodder (15210 kg ha-1) yields. However, green cob yield remained at par with B3 (75 % RDF + *Azotobacter* + *PSB*) and B2 (75 % RDF + *Azotobacter*) treatments While, green fodder yield was statistically at par with treatment B3 (75 % RDF+ Azotobacter). The increase in green cob and green fodder yields might be due to the efficient utilization of resources by crops under recommended chemical fertilization resulting in higher rate of assimilation and maximum accumulation of nutrients and extended benefits with congenial biochemical relations with higher rate of photosynthetic activity. The increase in green cob yield and green fodder yield with the recommended chemical fertilizers may be attributed probably to the development of extensive root system, which enabled the plants to absorb more nutrients from the soil depth and due to enhanced photosynthetic activities. The increase in green cob and fodder yields viii might be also due to the increase in growth, growth attributes and yield attributes (Sahoo and Mahapatra 2004 and Khadatre *et al.*, 2006).

Application of 100 % RDF (B1) to sweet corn maize recorded significantly higher sugar (18.91 %) and protein (7.68 %) content but sugar content was statistically at par with B3 treatment and protein content was statistically at with treatment B2 and B3. This improvement in quality of grains might be due to the efficient utilization of resources easily available due to more amount of chemical fertilization resulting into higher rate of assimilation and maximum accumulation of nutrients and extended benefits with congenial biochemical relations with higher rate of photosynthetic activity which finally might be resulted into higher content of sugar and protein in grains. These results are akin to those reported by Raja (2001).

Economic

The data revealed that narrow spacing S1 (45 cm X 20 cm) resulted in higher net income of Rs/ha 80,805/- with BCR of 4.60. Data concerning the mean effect of FYM on net realization (Table-1) indicated that maximum net realization of Rs./ha 81,303/- was accrued under treatment F2 (10 tone FYM ha-1) with BCR value 4.52. While in fertilizer management treatment maximum net realization of Rs./ha 81,598/- with BCR value 4.52 was recorded under treatment B1 (100 % RDF).

A perusal of data (Table-2) revealed that maximum net realization of Rs./ha 87,834/- was recorded under treatment ix combination S1F2B1 followed by treatment combinations S1F2B3 (Rs./ha 86,139/-) and S1F2B2 (Rs./ha 85,436/-). Whereas, maximum values of BCR (4.74) was obtained under the treatment combination S1F1B1 and followed by treatments combination S1F1B5 and S1F1B3.

CONCLUSION

From the foregoing results it is concluded that sweet corn maize variety Madhuri grown in *Kharif* season produced higher green cob yield with good quality and higher net return when it was sown at the spacing of 45 cm x 20 cm and applied 10 t FYM/ha along with recommended dose of fertilizer (120 kg N + 40 kg P2O5/ha) or fertilized with 75 % RDF + *Azotobacter* + PSB.

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