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Original Research Article

Influence of Planting Methods, Spacing and Fertilization on Yield and Quality of Sweet Corn (*Zea mays* L.)

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Keywords

Fertilizer rates, Planting methods, Spacing, Sweet corn, Yield and quality

A B S T R A C T

A field experiment was conducted during *Rabi* season of 2014-15 at T.C.A, Dholi Farm to study the influence of planting methods, spacing and fertilizer doses on sweet corn composite variety 'Madhuri'. Twenty four treatment combinations with two methods of planting (furrow and flat bed) as main plot factors and four spacings (45 cm x 15 cm, 45 cm x 20 cm, 60 cm x 15 cm and 60 cm x 20 cm) and three fertilizer doses (90:45:45, 120:60:45 and 150:75:45 N:P_2O_5:K_2O kg/ha) as sub – plot factors, were tested in a split plot design with factorial concept in three replication. The flat bed method of planting resulted in 14.17% yield improvement over furrow method of planting. The spacing of 45 cm x 15 cm with fertilizer doses 120:60:45 N:P_2O_5:K_2O kg/ha raised on flat beds not only increased the seed yield but also found superior for 100 – seed weight and protein content. The highest protein and starch contents were noticed with a spacing of 60 cm x 20 cm and 150:75:45 N:P_2O_5:K_2O dosed where as similar values for oil content record was at 45 cm x 20 cm spacing and fertilizer level of 120:60:45 N:P_2O_5:K_2O kg/ha.

Introduction

Maize is the third most important cereal in the world. India ranks fifth in area and third in production and productivity among cereal crops. Maize growers are shifting to spatiality corn production due to higher returns and also opening opportunities for employment generation especially in peri-urban areas. Among specialty corns, sweet corn has high market potential and great genetic variability and scope to improve its nutritive value.

The quality of sweet corn depends on the type of gene involved for sweetness. Besides, genetic architecture conferring the sweetness, crop management practices also play a critical role in realizing the desired sweetness in the cobs. Among different agronomic practices, planting technique is of considerable importance. It ensures optimum plant population and enables plants to utilize land and other resources efficiently for better growth and development. Moreover, major maize area is under rainfed situations and hence adoption of suitable planting method is also of considerable importance in getting desired yield and quality. Further, inter and intra row spacing and balanced nutrition of NPK is an essential component of nutrient management and improving quality. The recommended plant spacing and nitrogen doses vary for the

hybrids and the same may not be applicable for the composite like sweet corn. As the information on planting geometry and fertilizer requirement for sweet corn is very meager, the present experiment was initiated as a part of All India Co-ordinated Programme on Maize to study the influence of planting methods, spacing and fertilizer doses on yield and quality of sweet corn.

Materials and Methods

The experiment was conducted during the Rabi season of 2014-15 at the Tirhut College of Agriculture. The test variety was Madhuri (composite). Twenty four treatment combinations of two methods of planting (furrow and flat bed) as main plot factors and four spacings (45 cm x 15 cm, 45 cm x 20 cm, 60 cm x 15 cm and 60 cm x 20 cm) and three fertilizer doses (90:45:45, 120:60:45 and 150:75:45 N:P2O5:K2O kg/ha) as sub – plot factors, were tested in a split plot design with factorial concept in three replications.

Each treatment was imposed in a plot size of 21.6 m2. The experimental field was sandy loam. Entire phosphorus and potassium along with half of the nitrogen as per the treatment was applied as basal in band placement in small grooves. The remaining half of the nitrogen was top dressed in two split doses at knee high stage and flowering stage of the crop. Plant protection measures were taken as per the recommended schedule. Five plants were selected randomly from each treatment for recording data on yield components like plant height, cob length, seeds/ cob, shelling percentage, seed yield /ha and test weight and seed quality parameters like germination percentage, percentage of protein, oil and starch contents in sweet corn seed were estimated in laboratory by standard methods.

Results and Discussion

Yield attributes

In the present study, though furrow method of planting (300.4) numerically out yielded with respect to seeds / cob, was found statistically on par with flat bed method of planting (287.4) (Table 1). Application of 120:60:45 $N:P_2O_5:K_2O$ kg/ha resulted in more seeds/cob (306.7) and was statistically on par with higher doses of fertilizers which indicates a non-significant improvement in number of seeds/cob as the NPK dose was raised from 120:60:45 to 150:75:45. However, it was 281.5 seeds/cob with application of 90:45:45 $N:P_2O_5:K_2O$ kg/ha. Though, higher dose is directly related to enhanced seed rows per cob upto a level and further decline as doses of fertilizer increase suggesting that application of optimum dose of fertilizers (120:60:45 $N:P_2O_5:K_2O$ kg/ha) not only results in high yield attributing characters but also realized higher economic yield. In contrary, Mahesh *et al* (2010) reported increased seed number with higher fertilizer dose of 150:75:45 $N:P_2O_5:K_2O$ kg/ha. Bores *et al* (2009) indicated the importance of in increased dose of NPK for attaining desirable number of seeds per cob. Similarity the different spacing (60 cm x 15 cm, 45 cm x 20 cm, 60 cm x 20 cm and45 cm x 15 cm) also reflected a non significant improvement in seeds/cob in sweet corn.

All the treatments *viz,* planting methods, fertilizer doses and spacings have not shown significant improvement in terms of cob length of sweet corn (Table: 1). However, numerically the sweet corn planted at wider row spacings with higher fertilizer application has resulted in marginal increase in length of the cob compared to narrow spacings.

Table.1 Yield and Yield attributing characters of sweet corn

Treatments	Cob length	Seeds/ cob	Shelling %	Seed yield q/ha	100-seed Weight q/ha	germination	Oil content (%)	Protein Content (%)	Moisture (%)	Starch Content (%)
Planting methods										
Furrow	13.2	300.3	80.9	13.20	12.39	99.05	12.50	13.45	5.9	52.29
Flat bed	13.2	287.4	81.8	15.07	13.11	97.10	12.83	13.14	6.0	5.29
S.Em +	0.20	8.03	0.61	0.41	0.48	0.36	0.15	0.16	0.06	0.32
C.D (P=0.05)	0.41	16.18	1.23	0.82	0.81	0.73	0.31	0.32	0.13	0.64
Spacing (cm)										
45 x 15	12.9	279.5	80.9	14.96	13.14	96.88	12.58	12.87	6.0	53.03
45 x 20	13.2	298.0	81.4	14.20	12.68	98.96	12.75	13.42	5.9	52.12
60 x 15	13.3	303.3	81.4	13.48	12.49	98.38	12.73	13.16	5.9	52.29
60 x 20	13.4	294.7	81.7	13.90	12.69	98.08	12.60	13.73	6.0	52.33
S. Em +	0.29	11.36	0.87	0.58	0.57	0.51	0.21	0.23	0.09	0.45
C.D (P=0.05)	0.57	22.88	1.74	1.16	1.14	1.03	0.43	0.46	0.18	0.90
Fertilizer rate (N:P_2O_5:K_2O kg/ha)										
90:45:45	13.0	281.4	80.8	13.46	12.71	97.86	12.54	13.12	5.9	52.60
120:60:45	13.2	306.7	82.0	13.38	12.93	98.19	12.81	13.30	5.9	52.20
150:75:45	13.4	293.6	81.2	15.07	12.62	98.18	12.65	13.48	6.0	52.53
SEm ±	0.25	9.84	0.75	0.50	0.49	0.44	0.19	0.20	0.08	0.39
CD (P=0.05)	0.50	19.81	1.51	1.01	0.99	0.89	0.37	0.40	0.16	0.78

Table.2 Interaction effects for yield of sweet corn

Treatments	**Seed Yield**					
	90:45:45	N:P_2O_5:K_2O	120:60:45	N:P_2O_5:K_2O	150:75:45	N:P_2O_5:K_2O
	F.M	Fb.M	F.M	Fb.M	F.M	Fb.M
45 cm x 15 cm	14.32	14.09	13.53	14.95	16.07	16.83
45 cm x 20 cm	14.25	11.34	13.49	16.87	13.39	15.87
60 cm x 15 cm	11.84	14.68	13.19	12.57	13.43	15.15
60 cm x 20 cm	11.38	15.74	11.28	15.18	12.24	17.59
Mean	12.95	13.96	12.87	14.89	13.78	16.36
PM *S	PM * F	S*F	PM*S*F			
SEm ±	0.82	0.71	1.00	1.42		
CD (P=0.05)	1.65	1.43	2.02	2.85		

F.M = Furrow method of planting ; Fb.M = Flat bed Planting ; PM = Planting method ; S = Spacing and F = Fertilizer doses

These results are in conformity with the work of Sikandar Ajam *et al.* (2007) who suggested that higher cob dimensions were realized at wider planting geometry in combination with higher fertilizer dose of NPK.

Hundred seed weight is another important yield attributing trait. However, in the present study, the methods of planting, spacing and fertilizer doses could not realized significant improvement (Table: 1). Similar to seed size, non significant improvement in shelling percentage was noticed with respect to the factors indicating that test weight and shelling percentage are least influenced by management practices like planting method, planting geometry and nutrition.

Yield

Significant differences were noticed among the treatments for all the characters under study. Significantly higher yield was resulted in flat bed planting over the furrow planting. The yield increases was 14.17% over the furrow method of planting (Table: 1). Maize planted at 45 cm inter row spacing with 15/20 cm intra row spacing gave higher yield (14.96 q/ha and 14.20 q/ha respectively) compared to wider row spacing of 60 cm x 15 cm and 60 cm x 20 cm (13.48 q/ha and 13.90 q/ha). However, Maize planted at 45 cm x 20 cm spacing was found optimum to obtain higher yields. Considering the three way interaction of different treatment combinations irrespective of row spacing, flat bed method of planting at higher fertilizer dose (150:75:45 $N:P_2O_5:K_2O$ kg/ha) showed superior performance in realizing higher seed yields compared to lower fertilizer doses (120:60:45 $N:P_2O_5:K_2O$ kg/ha and 90:45:45 $N:P_2O_5:K_2O$ kg/ha) (Table:2). However , the sweet corn planted in flat bed at a row spacing of 45 x 20 cm and application of 120:60:45 $N:P_2O_5:K_2O$ kg/ha excelled for all the parameters and found to be promising due to its capacity to exploit inherent yield potential using moderate resources.

Quality parameters

Significantly higher percentage of protein, oil and starch contents in sweet corn seed was realized under flatbed method (Table 1). It might be due to higher seed yields with higher test weight indicating the better quality of seed compared to furrow method. Similarity, the wider row spacing of 45 cm x 20 cm at optimum fertilizer dose of 12:80:45 $N:P_2O_5:K_2O$ kg/ha have resulted in the higher oil content (Table 1). In contrast, higher protein and starch contents were resulted in 60 cm x 20 cm spacing with lower dose of fertilizers 150:75:45 $N:P_2O_5:K_2O$ kg/ha. This geometry (60 cm x 20 cm spacing) might have facilitated most efficient utilization of sunlight and performed perfect translocation of assimilates leading to higher seed reserves and seed yield / plant.

Sowing maize on flat beds with 45 cm spacing between rows and 20 cm between plants along with application of 120:60:45 $N:P_2O_5:K_2O$ kg/ha was found superior for seed yields beside other yield attributing traits *viz*, seeds / cob^{-1}, 100- seed weight, plant height and high protein content.

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