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Effect of planting geometry and nitrogen on yield, economics and nitrogen uptake of sweet corn *(Zea mays)*

P.P. KAR, K.C. BARIK, P.K. MAHAPATRA, L.M. GARNAYAK, B.S. RATH, D. K. BASTIA AND C.M. KHANDA

Department of Agronomy, Orissa University of Agriculture and Technology, Bhubaneshwar, Orissa 751 003

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ABSTRACT

A field experiment was conducted during rainy seasons of 2002 and 2003 at Central Research Station, OUAT, Bhubaneshwar to study the effect of planting geometry and nitrogen on sweet corn *(Zea mays* L.) cv 'Madhuri'. Twenty treatment combinations, comprising four spacings (45 cm × 30 cm, 45 cm × 20 cm, 60 cm × 30 cm and 60 cm × 20 cm) allotted to the main plots and five nitrogen levels (0, 20, 40, 60 and 80 kg/ha) to the sub-plots, were tested in split-plot design with three replications. The spacing of 60 cm × 20 cm significantly increased the number of prime cobs (54,108/ha), green-cob yield (9.21 tonnes/ha), nitrogen uptake (53.62 kg/ha), protein yield (174.35 kg/ha) and accrued highest net return (Rs 48,571/ha) and benefit : cost ratio (3.55), followed by 45 cm × 30 cm spacing. Application of 80 kg N/ha produced significantly highest number of prime cobs (62,328/ha), green-cob yield (9.80 tonnes/ha), length (17.5 cm) and girth (16.7 cm) of cobs, green-forage yield (17.35 t/ha), total N uptake (91.2 kg/ha) and protein yield (280.8 kg/ha). Significantly highest net returns (Rs 61,532/ha) and benefit : cost ratio (3.76) were realized with 80 kg N/ha, followed by 60 and 40 kg N/ha.

Key words : Sweet corn, Planting geometry, Nitrogen level, Yield, Net return, Nitrogen uptake

Green cobs of maize *(Zea mays)*, baked in fire or steam boiled, form a favourite dish of the urbanites. But the hybrids and composite varieties presently available in the market are neither sweet nor have succulency. Sweet corn *(Zea mays* L.) however, having higher sugar content in green cobs (14-20%), is more delicious. Presently greater emphasis is being given on cultivation of sweet corn to augment the income of farming community dwelling in the outskirts of big cities and metropolis. Compared with the normal hybrids and composites, sweet corn cv 'Madhuri' has a medium plant type and maturing 30 to 45 days earlier. The recommended plant spacing and nitrogen dose for the hybrids and composites may not be applicable for the sweet corn types. As the information on planting geometry and optimum N requirement for sweet corn is very meagre for Orissa conditions, the present experiment was initiated to fill this gap.

MATERIALS AND METHODS

The experiment was conducted during the rainy seasons *(kharif)* of 2002 and 2003 at the Central Research Station, OUAT, Bhubaneshwar (20º15' North, 80º 52' East, 25.9 m above mean sea-level). The soil was loamy sand, having pH 5.7 and organic carbon 0.39%, available N 233.9 kg/ha, P_2O_5 20.7 kg/ha, and K_2O 201.8 kg/ha. The test variety was 'Madhuri'. Twenty treatment combinations consisting of four planting geometries (45 cm × 30 cm, 45 cm × 20 cm, 60 cm × 30 cm and 60 cm × 20 cm) as main plot and five nitrogen levels (0, 20, 40, 60 and 80 kg/ha) as subplot treatments were tried in split-plot design with three replications. Recommended dose of phosphorus (26.2 kg/ha) and potassium (33.3 kg K/ha) along with 25% nitrogen as per the treatment were applied basal and the remaining N was top-dressed as 50% at knee-high stage (25 days after sowing) and 25% at pre-tasselling stage (40 days after sowing). The green cobs were harvested after milk stage at 75 days after sowing and graded into prime and non-prime categories based on their relative size, colour and quality. The prime cobs were distinguished as large, well formed, possessing desirable colour without apparent quality defects.

RESULTS AND DISCUSSION

Planting geometry

The planting geometry significantly influenced the number of prime and non-prime cobs, length and girth of cobs, green-cob and forage yield, net return and benefit : cost ratio of sweet corn (Table 1). The planting geometry of 60 cm × 20 cm significantly increased the number of prime cobs compared with those of 45 cm × 20 cm, 60 cm × 30 cm and 45 cm × 30 cm.

The increased green-cob yield of recorded with 60 cm

Table 1. Effect of planting geometry and nitrogen on yield and economics of sweet corn (pooled data of 2002 and 2003)

Treatment	Green cobs/ha		Length of cob (cm)	Girth of cob (cm)	Green-cob yield (t/ha)	Green-forage yield (t/ha)	Net return (Rs/ha)	B : C ratio
	Non-primes	Primes						
Planting geometry								
45 cm × 30 cm	30.063	40,561	14.9	13.9	4.40	13.62	32,997	2.51
45 cm × 20 cm	46,645	52,101	13.9	12.8	7.92	14.95	44,326	3.04
60 cm × 30 cm	2,981	51,051	16.7	16.3	7.68	10.80	41.991	3.37
60 cm × 20 cm	7,057	54,108	15.4	14.4	9.21	12.24	48,571	3.55
CD (P=0.05)	1,277	491	1.0	0.7	0.17	0.37	645	0.06
Nitrogen (kg/ha)								
0	24,207	30,197	12.5	11.2	3.06	6.68	32,086	1.73
20	16,638	40,514	14.6	13.8	4.75	11.44	40,017	2.48
40	8,768	50,001	15.7	14.6	6.60	13.41	52,062	3.08
60	3,685	57,557	16.6	15.7	8.07	15.50	56,236	3.54
80	1,670	62,328	17.5	16.7	9.80	17.35	61,532	3.76
CD (P=0.05)	1,191	218	0.8	0.8	0.20	0.70	318	0.03

× 20 cm planting geometry was mainly owing to maximum production of marketable prime cobs/ha. However, the increased length and girth of cobs and the lowest number of non-prime cobs at the normal spacing of 60 cm × 30 cm could not compensate the loss in terms of less number of prime cobs, green-cob yield, net return as well as benefit : cost ratio owing to lowest plant density. The net return and benefit : cost ratio were also maximum with 60 cm × 20 cm compared with that with 45 cm × 20 cm and 60 cm × 30 cm spacing, the lowest being with 45 cm × 30 cm spacing. As 'Madhuri' sweet corn is early maturing and medium in stature, higher plant population at 60 cm × 20 cm spacing was optimum for it to obtain more number of marketable cobs with highest net return and benefit : cost compared with the spacing of 60 cm × 30 cm recommended for usual hybrids and composites. The highest population of at closer spacing of 45 cm × 20 cm was not remunerative because of production of more number of non-prime cobs, which was 6.6 times higher than that of 60 cm × 20 cm. However, significantly highest green-forage yield was recorded with closer spacing of 45 cm × 20 cm, which was even 37.8% higher than that of 60 cm × 30 cm mainly due to higher plant population. The highest grain-nitrogen uptake was obtained with 60 cm × 20 cm, which was on a par with that of 60 cm × 30 cm spacing (Table 2). But uptake in stover was maximum with closer spacing of 45 cm × 20 cm or 45 cm × 30 cm. The total N uptake was maximum at 45 cm × 20 cm, which was on a par with the rest except 60 cm × 30 cm. The highest protein yield was obtained with 60 cm × 20 cm spacing. These findings are in agreement with the earlier result of Genter *et al.* (1956).

Table 2. Effect of planting geometry and nitrogen on nitrogen uptake and protein yield of sweet corn (pooled data of 2002 and 2003)

Treatment	N uptake (kg/ha)			Protein yield (kg/ha)
	Green kernel	Stover	Total	
Planting geometry				
45 cm × 30 cm	23.72	29.63	54.68	148.22
45 cm × 20 cm	24.77	31.19	55.96	154.83
60 cm × 30 cm	26.39	25.32	51.75	164.91
60 cm × 20 cm	27.90	27.66	53.62	174.35
CD (P=0.05)	1.76	3.77	3.52	11.02
Nitrogen (kg N/ha)				
0	7.00	14.16	20.41	43.77
20	13.21	19.22	32.41	82.58
40	27.20	26.13	53.34	170.00
60	36.12	36.45	72.60	225.74
80	44.93	46.29	91.22	280.80
CD (P=0.05)	2.21	2.74	3.02	13.78

Nitrogen

Nitrogen application significantly increased the number of prime cobs, length and girth of green cobs, green-forage yield, net return and benefit : cost, but decreased the number of non-prime cobs (Table 1). Consequently the highest green-cob yield was obtained at 80 kg N/ha, which was 220, 160, 48 and 21% higher than that of the control, and 20, 40 and 60 kg N/ha respectively. Maximum green-forage yield was also recorded at the highest nitrogen level (80 kg/ha). Raju *et al.* (1997) also reported that higher doses of nitrogen applied to maize increased its availability and uptake, resulting in production of more photosynthates in terms of dry matter, which ultimately increased the yield. The net return and benefit : cost ratio increased significantly with successive increase in nitrogen and was maximum at 80 kg N/ha. Sahoo and Panda (1999) also reported similar economics owing to nitrogen nutrition in baby corn.

The uptake of N in green kernels and stover increased significantly with successive increase in nitrogen, which led to maximum total N uptake at 80 kg N/ha. This increase was mainly due to increased green-cob yield, green-forage yield, and dry-biomass production. Protein yield increased with increase in N and was maximum at 80 kg N/ha. This might be attributed to maximum N accumulation and extended benefit with congenial biochemical relations at higher N levels (Baghal and Singate, 1986). Nitrogen in corn plants is also strongly associated with the metabolism of protein (Lang *et al.,* 1956).

Optimum planting geometry and nitrogen level for sweet corn 'Madhuri' in a loamy sand soil low in available N were found to be 60 cm×20 cm and 80 kg/ha respectively.

REFERENCES

Baghal, P.K. and Singate, A.K. 1986. Effect of foliar and soil application of nitrogen on composition of maize grains. *Journal of Maharashtra Agricultural Universities* **11** (1) : 115–116.

Genter, C.F., Eheart, J.F. and Linkons, W.N. 1956. Effect of location, hybrid, fertilizer and rate of planting on oil and protein content of corn grain. *Agronomy Journal* **48** : 63–67.

Lang, A.K., Pendleton, J.W. and Dungan, G.H. 1956. Influence of population and nitrogen levels on yield, protein and oil content of nine corn hybrids. *Agronomy Journal* **48** : 284–289.

Raju, M.S., Srinivas, A. and Raju, V. 1997. Performance of promising pre-released maize varieties to different nitrogen levels under rainfed conditions. *Annals of Arid Zone* **36** (4) : 377–379.

Sahoo, S.C. and Panda, M.M. 1999. Effect of level of nitrogen and plant population on yield of baby corn *(Zea mays). Indian Journal of Agricultural Sciences* **69** (2) : 157–158.