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RESEARCH PAPER

Growth, yield and quality of *Rabi* sweet corn as influenced by different spacing and fertilizer levels

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Abstract : A field experiment was conducted during *Rabi* 2011 Navsari to assess the response of *Rabi* sweet corn to spacing and fertilizer levels under south Gujarat condition. The experiment comprised of sixteen treatment combinations consisting four levels of plant spacing (60 x 15, 45 x 20, 30 x 30 and 60 x 30 cm) and four fertility levels (60-30, 90-45, 120-60 and 150-75 kg N-P_2O_5/ha). Plant spacing of 60 x 30 cm, 45 x 20 cm and 60 x 15 cm attained significantly higher plant height compared to 30 x 30 cm. While stem diameter and number of leaves per plant were not influenced by different spacing levels. The sweet corn plants exhibited significantly maximum values of yield attributes *viz.*, cob length, cob girth, under spacing of 45 x 20 cm. Number of cobs per plant and cob yield per plant were higher under spacing of 60 x 30 cm. The highest green cob yield was recorded at spacing of 45 x 20 cm closely followed by 30 x 30 cm. Quality parameters *viz.*, crude protein content in cob and fodder reducing and non-reducing sugar content of grains were higher at spacing 45 x 20 cm. The growth of sweet corn in terms of plant height, number of leaves per plant, stem diameter were maximum with application of 150-75 kg N-P_2O_5/ha. The sweet corn plants exhibited maximum values of yield attributes *viz.*, number of cobs per plant under 150-75 kg N-P_2O_5/ha and found at par with those recorded under 120-60 kg N-P_2O_5/ha. Whereas cob length, cob were under 120-60 kg N-P_2O_5/ha and found at par with those recorded under 150-75 kg N-P_2O_5/ha. Application of 150-75 and 120-60 kg N-P_2O_5/ha significantly increased green cob yield over 90-45 and 60-30 kg N-P_2O_5/ha. Quality parameters *viz.*, protein content of cob and fodder were significantly enhanced. Thus, from the present study, it seems quite logical to conclude that higher production and net returns from *Rabi* sweet corn (var. Madhuri) can be secured by sowing the crop at 45 cm x 20 cm spacing and fertilizing with 120-60 kg N-P_2O_5/ha on clayey soil under south Gujarat condition.

Key Words : Sweet corn, Spacing, Fertilizer

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INTRODUCTION

Among the cereals, maize (*Zea mays* L.) ranks third in total world production after wheat and rice and it is a staple food in many countries, particularly in the tropics and sub-tropics. Maize is considered as the "queen of cereals". Being a C4 plant, it is capable to utilize solar radiation more efficiently even at higher radiation intensity.

Specialty corns *viz.*, sweet corn, pop corn, baby corn, high-oil corn etc. assume tremendous potential market not only in India but also in the international market. The kernels of sweet corn taste much sweeter than normal corn especially at 18 to 21 days after pollination. In addition, fodders derived after harvest may

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be sold, which bring additional income to the farmers.The urban people have great interest in consuming green cobs and it is found that sweet corn is more delicious when it is steamed boiled and consumed and a pinch of salt in boiling water may increase the taste. Higher yield of sweet corn can be obtained through the use of nutrients.

In order to achieve higher cob yields, maintenance of plant density is the most important factor. A spatial arrangement of plant governs the shape and size of the leaf area per plant, which in turn influences efficient interception of radiant energy, proliferation, growth of roots and their activity. Maximum yield can be expected only when plant population allows individual plant to achieve their maximum inherent potential. Thus, there is need to work out an optimum population density by adjusting inter and intra row spacing in relation to other agronomic factors.

The agronomic requirement like optimum plant population and nitrogen and phosphorus requirement for maize crop has been worked out but the recommended plant spacing and nitrogen and phosphorus dose for hybrid and composites of normal maize may not be applicable to the sweet corn. In India much work has not been done so far for the sweet corn (Kumar, 2009). The requirements of plant spacing, fertilizer dose are yet to be standardized for sweet corn. Therefore, the present experiment was proposed to work out the planting density and fertilizer requirement of sweet corn.

MATERIAL AND METHODS

A trial was conducted during *Rabi* 2011 at College Farm, Department of Agronomy, College of Agriculture, Navsari Agricultural University, Navsari to assess the response of *Rabi* sweet corn (*Zea mays* L. var. saccharata Sturt) to spacing and fertilizer levels under south Gujarat condition. The experiment comprised of sixteen treatment combinations consisting four levels of plant spacing (60 x 15, 45 x 20 , 30 x 30 and 60 x 30 cm) and four fertility levels (60-30, 90-45, 120-60 and 150-75 kg N-P_2O_5/ha). These treatments were replicated three times in a split plot design. The experimental soil was clayey and high in available N and high in available potash. Other agronomical operations were carried out as per recommendation. The growth, yield attributes and yield were recorded at the time of harvest of crop. Crude protein content of cob and fodder was calculated.

RESULTS AND DISCUSSION

The results obtained from the present investigation as well as relevant discussion have been summarized under following heads :

Growth characters :

The plant height at harvest (Table 1) was significantly influenced by spacing. Significantly the highest values of this growth parameter was observed with treatment S_4 (60 x 30 cm), which remained at par with treatment S_2 (45 x 20 cm). The results revealed that number of leaves per plant and stem diameter (Table 1) failed to show perceptible variation under the influence of plant spacing. It is an established fact that growth of crop is outcome of genetic and environmental interaction. Under present investigation the profound influence of plant spacing on performance of sweet corn crop could be an area available for each plant which indirectly dictated the availability of various growth inputs to individual plants in the community and also the extent of competition between and within the plants for various growth inputs. The significant reduction in plant height with increased inter row spacing and decreased intra row spacing seems to be the resultant of mutual shading due to overcrowding of plants. The result is in close accordance with findings of Sahoo (1995); Patil (1997) and Paradkar (2004).

Growth parameters *viz.*, plant height at 30, 60 DAS and harvest, stem diameter at harvest and number of leaves per plant (Table1) were significantly influenced by fertilizer levels. Significantly the highest values of these growth parameters were observed with application of 150-75 kg N-P_2O_5/ha. While, significantly the lowest value were recorded under 60-30 kg N-P_2O_5/ha. The improvement in growth parameters with application of 150-75 kg N-P_2O_5/ha might have resulted in better and timely availability of N and P for their utilization by plant as judged from nitrogen and phosphorus content of cob and fodder. Under the present investigation, profound influence of N and P, a component of fertilizer management, on crop growth seem to be due to maintaining congenial nutritional environment of plant system on account of their greater availability from soil media. The significant improvement in nutrient status of plant parts (cob and fodder) might have resulted in greater synthesis of amino acids, proteins and growth promoting substances, which seems to have enhanced the meristematic activity and increased cell division and their

elongation. The enhanced growth with nitrogen was reported by Chillar and Kumar (2006) in sweet corn, Singh (2001) in baby corn and with phosphorus by Thakur (1997) and Thakur *et al.* (1998) in baby corn.

Yield attributes :

The yield attributes such as number of cobs per plant, cob length and cob girth differed significantly due to alteration in crop geometry. The yield attributes *viz.*, cob length, cob girth and dry weight of 100 grains (Table 1) were significantly higher under 45 x 20 cm (S_2) and 30 x 30 cm (S_3) over 60 x 30 cm (S_4) and 60 x 15 cm (S_1). Whereas cobs per plant and cob yield per plant were significantly higher under 60 x 30 cm (S_4).The enhanced yield components under 45 x 20 cm might be due to increased number of leaves, leading to higher photosynthetic rate and accumulation of more assimilates which in turn increased the sink size. Higher nutrient uptake by sweet corn was also evident in the present investigation. Though naturally cob per plant and cob yield per plant was significantly higher under wider spacing of 60 x 30 cm, but it could not be compensated due to lower plant population /ha. The present findings are in close agreement with the results obtained by Kar *et al.* (2006) in sweet corn and Allie (2005) in baby corn.

The yield attributes *viz.*, number of cobs per plant, cob length, cob girth, dry cob weight (Table 1) were significantly influenced by fertilizer levels. Significantly the highest number of cobs, cob girth, cob length fresh significantly the highest per cent barren plants and the lowest values of these yield attributes were observed under treatment 60-30 kg N-P_2O_5/ha (F_1). In the preceding section, it was emphasized that fertilizer levels of 150-75 and 120-60 kg N-P_2O_5/ha caused about significant improvement in overall growth of the crop expressed in terms of plant height, functional leaves, stem diameter, leaf area index, leaf chlorophyll content, dry matter accumulation and crop growth rate by virtue of increased photosynthetic efficiency. Thus, greater availability of photosynthates, metabolites and nutrients to develop reproductive structures seems to have resulted in increased productive plants, cob girth, cob length and cob weight with these fertilizer levels. The present findings are within the close vicinity of those reported by Kumar (2007); Kumar (2009) and Khazaei *et al*. (2010) .

Table 1 : Effect of spacing and fertilizer levels on growth and yield attributes

Treatments	Plant height (cm)	No. of leaves/ plant	Stem diameter (cm)	No. of cobs/ plant	Cob length (cm)	Cob girth (cm)
Spacing (cm)						
S_1 - 60 x 15	167.36	12.81	2.00	1.24	15.33	14.01
S_2 - 45 x 20	176.68	13.19	2.05	1.55	16.63	15.31
S_3 - 30 x 30	164.35	13.08	2.09	1.44	16.41	15.30
S_4 - 60 x 30	177.51	13.54	2.11	2.24	16.18	14.93
S.E.±	2.90	0.37	0.04	0.06	0.24	0.27
C.D. (P=0.05)	10.06	NS	NS	0.20	0.85	0.93
C.V.%	5.87	9.84	7.29	12.84	8.31	9.92
Fertilizer levels (kg N-P_2O_5/ha)						
F_1 - 60-30	165.26	11.20	1.98	1.39	15.59	14.48
F_2 - 90-45	168.77	12.19	2.07	1.50	15.87	14.72
F_3 - 120-60	171.73	14.05	2.04	1.68	16.47	15.02
F_4 - 150-75	180.62	15.23	2.16	1.88	16.62	15.32
S.E.±	2.86	0.19	0.02	0.06	0.21	0.20
C.D. (P=0.05)	8.37	0.57	0.08	0.17	0.63	0.58
C.V.%	5.8	5.18	4.72	11.70	9.70	7.67
Interaction (S x F)						
S.E.±	5.73	0.39	0.05	0.08	0.43	0.40
C.D. (P=0.05)	NS	NS	NS	NS	NS	NS

NS= Non-significant

Green cob and fodder yield :

A close perusal of data on green cob yield and green fodder yield (Table 2) indicate that plant spaced at 45 x 20 cm produced significantly the highest green cob yield but there was no significant effect on green fodder yield. Since, yield of the crop is a function of several yield components which are dependent on complementary interaction between vegetative and reproductive growth of the crop evidently resulted in significantly higher yields under 45 x 20 cm (S_2) and 30 x 30 cm (S_3) over 60 x 15 cm (S_1) and 60 x 30 cm (S_4). Significant increase in green cob yield under treatments 45 x 20 cm and 30 x 30 cm appears to be on account of their influence on increase in plant height, number of leaves and possibly a result of higher uptake of nutrients. The higher cob yield was under close row spacing of 45 cm and 30 cm compared to wider row spacing of 60 cm, because narrow row spacing produced more number of cobs per plant with larger and heavier cobs. Since plant stand per unit area was same under different spacings, improved performance of individual plant under 45 x 20 cm and 30 x 30 cm ultimately reflected in higher cob yield over 60 x 15 cm and 60 x 30 cm (S_4). The present findings are in close agreement with the results obtained by Kar *et al*. (2006) in sweet corn and Allie (2005) in baby corn.

A close perusal of data presented in Table 2 indicates that application of 150-75 (F_4) and 120-60 kg N-P_2O_5/ha (F_3) produced significantly higher green cob yield and green fodder yield over 60-30 kg N-P_2O_5/ha (F_1). Since, yield of the crop is a function of several yield components which are dependent on complementary interaction between vegetative and reproductive growth of the crop. As these growth and yield attributes showed significantly positive correlation with green cob yield, evidently resulted in higher yields under higher fertilizer levels. Significant increase in green fodder yield under these fertilizer levels appears to be on account of their influence on increase in plant height, functional leaves, number of leaf, stem diameter and possibly a result of higher uptake of nutrients. The present findings are in close agreement with the results obtained by Raja (2001); Sahoo and Mahapatra (2004) and Kumar (2007) in sweet corn and Sahoo (1995); Thakur *et al.* (1997); Thakur (1997); Patil (1997); Singh (2001) and Gaur (2002) in baby corn.

Quality parameters :

The crude protein content of cob and fodder (Table 2) was significantly influenced by spacing levels. These quality parameters were significantly improved under treatments 60 x30 cm (S_4), 45 x 20 cm (S_1) over 30 x 30 cm (S_3) and 60 x 15 cm (S_1) and adequate availability of nutrients and subsequent absorption of these nutrients

Table 2 : Yield and quality parameters as influenced by different spacing and fertilizer levels

Treatments	Green cob yield (t/ha).	Green fodder yield (t/ha).	Crude protein content (%)	
			Grain	Fodder
Spacing (cm)				
S_1 - 60 x 15	6.98	31.95	8.80	4.29
S_2 - 45 x 20	8.08	33.54	11.04	5.02
S_3 - 30 x 30	7.65	33.28	10.83	4.71
S_4 - 60 x 30	7.37	32.70	11.19	4.44
S.E.±	0.18	0.86	0.37	0.10
C.D. (P=0.05)	0.64	NS	1.28	0.34
C.V.%	11.64	9.11	12.32	7.51
Fertilizer levels (kg N-P_2O_5/ha)				
F_1 - 60-30	6.98	30.90	9.58	4.36
F_2 - 90-45	7.48	32.12	10.31	4.58
F_3 - 120-60	8.10	34.12	10.88	4.70
F_4 - 150-75	7.68	34.33	11.09	4.82
S.E.±	0.15	0.80	0.27	0.11
C.D. (P=0.05)	0.43	2.35	0.76	0.32
C.V.%	6.89	8.49	8.72	8.33
Interaction (S X F)				
S.E.±	0.30	1.61	0.52	0.22
C.D. (P=0.05)	NS	NS	NS	NS

NS= Non-significant

by plant under optimum spacing of 45 x 20 cm might have been responsible for enhanced cob quality.

The crude protein content of cob and fodder (Table 2) was significantly influenced by fertilizer levels. The better values of this quality parameter was observed with application of 150-75 kg N-P_2O_5/ha (F_4) and 120-60 kg N-P_2O_5/ha (F_3) over 60-30 kg N-P_2O_5/ha (F_1). The higher protein content of cob and fodder under 150-75 and 120-60 kg N-P_2O_5/ha as compared to 60-30 kg N-P_2O_5/ha (F_1) is due to its dependence on nitrogen content. In the present investigation, higher N content in cob and fodder and subsequently higher N uptake by cob and fodder were recorded with the above mentioned levels that lend support to enhance protein content under the effect. This could also be explained on the basis of better availability of required nutrients in crop root zone and enhanced photosynthetic and metabolic activity resulting in better partitioning of photosynthates to sinks, which reflected in quality enhancement in terms of protein. This finding closely associated with those of Kumar (2007) and Singh (2001).

Conclusion :

From the present findings, it could be suggested that *Rabi* sweet corn (var. Madhuri) crop should be sown at 45 cm x 20 cm spacing and fertilizing with 120-60 kg N-P_2O_5/ha for securing higher production under south Gujarat condition.

REFERENCES

Allie (2005). Effect of N levels and plant spacing on performance of baby corn. Annual Report, AICMIP, Directorate of Maize Research, New Delhi, A-87.

Chillar, R. K. and Kumar, A. (2006). Growth and yield behaviour of sweet corn (*Zea mays* L. saccharata) under varying plant population and nitrogen levels. In : Extended Summaries of Golden Jubilee National Symposium on Conservation Agriculture and Environment. Indian Society of Agronomy held at New Delhi during Oct. 26-28, 2006, pp. 277-278.

Gaur, B.L. (2002). Effect of cultivar, nitrogen, phosphorus and plant population on baby corn productivity. *Haryana J. Agron.,* **18** : 159-160.

Kar, P. P., Baric, K. C., Mahapatra, P. K., Garnayak, L. M., Rath, B. S., Basta, D. K. and Khanda, C. M. (2006). Effect of planting geometry and nitrogen on yield, economics and nitrogen uptake of sweet corn. *Indian J. Agron.,* **51** (1) : 43-45.

Khazaei, F., Alikhani, M. A., Yari, I. and Khandan, A. (2010). Study the correlation, regression and path co-efficient analysis in sweet corn (*Zea mays* var. saccharata) under different levels of plant density and nitrogen rate. *J. Agric. & Biological Sci.,* **5** (6) : 14-19.

Kumar, A. (2007). Productivity, economics and nitrogen-use efficiency of specialty corn (*Zea mays*) as influenced by planting density and nitrogen fertilization. *Indian J. Agron.,* **52** (4) : 306-309.

Kumar, A. (2009). Production potential and nitrogen-use efficiency of sweet corn (*Zea mays*) as influenced by different planting densities and nitrogen levels. *Indian J. Agric. Sci.,* **79** (5) : 351-355.

Paradkar, V. K. (2004). *Effect of N levels and plant spacing on performance of baby corn at Chindwara*. Annual Progress Report, Directorate of Maize Research, IARI,NewDelhi, A-77.

Patil, S. J. (1997). Agronomic investigation in baby corn at Arbhavi. Annual Progress Report, AICMIP, Directorate of Maize Research, New Delhi, A-58-59.

Raja, V. (2001). Effect of nitrogen and plant population on yield and quality of super sweet corn (*Zea mays*). *Indian J. Agron.,* **46** (2) : 246-249.

Sahoo, S. C. (1995). *Determination of optimum plant geometry for baby corn at Jashipur*. Annual Progress Report, AICMIP, Directorate of Maize Research, New Delhi, A-50.

Sahoo, S.C. and Mahapatra, P. K. (2004). Response of sweet corn (*Zea mays*) to nitrogen levels and plant population. *Indian J. Agric. Sci.,* **74** (6) : 337-338.

Singh, S.D. (2001). Effect of irrigation regimes and nitrogen levels on growth, yield and quality of baby corn, *Madras Agric. J.,* **88**: 371-374.

Thakur, D.R.(1997). *Studies on phosphorus and potassium requirements in baby corn at Bajaura*. Annual Progress Report, AICMIP, Directorate of Maize Research, New Delhi,A-54.

Thakur, D.R, Om Prakash, Khorwara, P.C. and Bhalla, S.K. (1997). Effect of nitrogen and plant spacing on growth, yield and economics of baby corn (*Zea mays*). *Indian J. Agron.,* **42** (3) : 479-483.

Thakur, D.R., Prakash, Om, Kharwara, P.C. and Bhalla, S.K. (1998). Effect of nitrogen and plant spacing on yield, nitrogen uptake and economics in baby corn (*Zea mays*). *Indian J. Agron.,* **43**: 668-671.