

Effect of spacing, seed rate and nitrogen on growth yield and quality of sugarcane (*Saccharum officinarum*)

S. K. P. SINGH, S. S. SINGH, U. P. SINHA AND A. K. SINGH

Department of Agronomy, Rajendra Agricultural University, Pusa, Bihar 848 125

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ABSTRACT

A field experiment was conducted during 1990–91 to 1992–93 to study the effect of 6 different row spacings-cum-seed rate and 3 nitrogen levels (75, 150 and 225 kg N/ha) on the growth, yield and quality of sugarcane (*Saccharum officinarum* L.). At narrow spacing (30 : 60 cm) cane yield (765.07 q/ha) increased significantly. Tiller production, plant height, millable canes, length of internodes, cane height/plant, girth were also significantly increased with same treatments (30 : 60 cm + 80,000 three-budded setts/ha). Although seed rate-cum-spacing did not affect quality of cane juice, but maximum sucrose (%) in juice was observed at 30 : 60 cm row spacing. Sugar (%) as well as yield were also maximum with the same treatments. The growth, yield and yield attributes were significantly influenced by varying levels of nitrogen. Application of 225 kg N/ha gave maximum cane yield (751.93 q/ha) and sugar (86.08 q/ha). Sucrose and commercial cane sugar (%) decreased with every increase of nitrogen levels, whereas sugar yield increased with increasing levels of nitrogen.

Though India has large area (3.5 million ha) under sugarcane (*Saccharum officinarum* L.), its cultivation is most neglected, resulting in very low average productivity. However, sugarcane yield may be increased with fertilizer use, cultivation of fertilizer-responsive varieties and high seed rate. The population per unit area and the distance between cane rows play a significant role in influencing the yield. Therefore, this study was conducted to determine the effect of different spacing, seed rate and nitrogen on the growth, yield and quality of sugarcane.

MATERIALS AND METHODS

A field experiment was conducted from 1990–91 to 1992–93 at Rajendra Agricultural University, Pusa (Bihar). The soil was sandy loam (Calciorrhents) with pH (8.2),

containing 0.372% organic carbon, 27.65 and 139.61 kg available P_2O_5 and K_2O /ha respectively. The treatment consisted of 6 spacing-cum-seed rates, viz T_1 , 90 cm spacing with normal seed rate (40,000 three-budded setts/ha); T_2 , 90 cm spacing with double seed rate (80,000 three-budded setts/ha); T_3 , 30 : 60 cm + 80,000 three-budded setts/ha; T_4 , 45 : 45 cm + 80,000 three-budded setts/ha; T_5 , 45 : 75 cm + 60,000 three-budded setts/ha and T_6 , 30 : 90 cm + 60,000 three-budded setts/ha as main-plot treatments and 3 levels of nitrogen (T_7 , 75 kg N/ha; T_8 , 150 kg N/ha; and T_9 , 225 kg N/ha) as subplot treatment. The experiment was laid out in split-plot design, replicated thrice having net plot size of 9.22 m x 7.20 m. The variety was 'BO 120' and planting was done in the second fortnight of February. Treated with 6% emisan (@ 500 g/ha in 500 litres of

water) 3-budded 32 setts of cane were planted in a row as per treatments. The sets were sprayed with 0.02% solution of gamma-BHC (20 EC) @ 1 kg ai/ha. Half dose of nitrogen as per treatments and full quantity of phosphorus (85 kg P_2O_5) and potash (60 kg K_2O /ha) were applied at planting. Remaining half nitrogen was applied in 2 splits at 2 months after planting (just after first irrigation) and at earthing up. The harvesting was done in the last week of January. The sugar yield was obtained by multiplying the sugar (%) in cane with yield.

RESULTS AND DISCUSSION

Effect of spacing

The treatment 30 : 60 cm inter-row spacing significantly gave higher cane yield (765.07 q/ha) over other treatments. Other row spacings in descending order were 45 : 45 cm (737.29 q/ha) and 90 cm row spacing

(731.26 q/ha) with double seed rate. Lowest yield (618.45 q/ha) was recorded in 90 cm spacing with recommended seed rate. Because the yield attributes like cane height, number of tillers, length of internodes and number of millable canes were maximum in 30 : 60 cm row spacing (Table 1). Similar results were obtained by Phogat *et al.* (1989) and Singh *et al.* (1991). Increase in row spacing increased the cane girth and weight significantly. Row spacing of 90 cm with conventional seed rate was superior in girth and cane weight over other treatments. Sugarcane in row spacing of 30 : 60 cm produced higher sugar (93.00 q/ha), followed by 90 cm (87.21 q/ha) and 45 : 45 cm row spacing with double seed rate (86.70 q/ha), while latter 2 treatments were similar (Table 2). Further increase in row spacing decreased the yield. Similar observations were recorded by Gamal *et al.* (1986).

Table 1. Effect of spacing-cum-seed rate and nitrogen levels on cane yield, and yield attributes (average data of 3 years)

Treatment	Germination (%) at 60 DAP	Tillers ('000/ha) at 180 days	Millable canes ('000/ha)	Cane grith at harvest	Length of of inter- nodes (cm) at harvest	Cane length (cm) at 210 days	Weight cane (g)	Cane yield (q/ha)
T ₁	36.96	126.75	92.24	2.39	9.08	175.33	524.78	618.45
T ₂	36.46	186.14	104.65	2.11	9.93	188.33	473.11	731.26
T ₃	38.90	224.06	106.54	2.19	10.28	193.33	491.56	765.07
T ₄	38.03	207.21	106.23	2.14	10.25	191.66	482.89	737.29
T ₅	37.46	160.34	101.16	2.24	9.83	188.00	500.56	681.72
T ₆	38.40	160.85	99.36	2.31	9.56	185.33	518.00	658.62
CD (P = 0.05)	NS	34.45	7.346	0.04	0.18	8.247	29.58	30.83
T ₇	37.56	167.19	96.56	2.14	9.16	178.66	477.39	631.67
T ₈	37.66	178.39	102.33	2.22	9.85	188.16	502.50	712.52
T ₉	37.88	190.09	106.20	2.32	10.36	194.16	515.56	751.93
CD (P = 0.05)	NS	13.94	5.647	0.03	0.19	8.125	7.75	18.79

Details of treatments are given in text

Table 2. Sugarcane quality as affected by spacing-cum-seed rate and nitrogen (average data of 3 years)

Treatment	Brix juice (%)	Sucrose juice (%)	Commercial cane sugar yield (q/ha)
T ₁	19.46	16.99	74.06
T ₂	19.46	16.95	87.21
T ₃	19.59	17.18	93.00
T ₄	19.51	16.79	86.70
T ₅	18.92	16.26	77.55
T ₆	19.17	16.63	77.06
CD (P = 0.05)	NS	NS	6.29
T ₇	19.05	17.06	77.11
T ₈	19.36	16.84	84.60
T ₉	19.65	16.50	86.08
CD (P = 0.05)	0.13	0.354	3.81

Details of treatments are given in text

Effect of nitrogen

Increase in nitrogen level from 75 to 225 kg/ha significantly increased number of tillers, number of millable cane, cane length, length of internodes, girth, and weight/cane weight (Table 1). Results are in conformity with those reported by Mali *et al.* (1982), and Mishra and Mathur (1991). Application of nitrogen increased cane yield, brix content in juice and sugar yield. However, on the contrary, sucrose content in juice decreased appreciably with increase in nitrogen levels from 75 to 225 kg/ha. Commercial cane sugar yield increased significantly with increase in nitrogen up to 150 kg N/ha because decrease in sucrose (%) was nullified by higher cane yield at 225 kg N/ha (Table 2). Interaction effect of spacing-cum-seed rate and nitrogen were non-significant in all the growth parameters

and yield.

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