INFLUENCE OF PLANTING TECHNIQUES ON GROWTH AND YIELD OF SPRING PLANTED SUGARCANE (*SACCHARUM OFFICINARUM* L.)

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Studies were undertaken to see the influence of five planting techniques viz; sowing in 45 and 60 cm apart furrows; 60, 90 and 120 cm apart trenches at Sugarcane Research Institute, Faisalabad during 2004 and 2005 by using sugarcane cultivar HSF-240 in R.C.B.D. with four repeats. Sugarcane germination percentage, tillers per m^2, plant height in meters, millable canes per m^2 and cane yield t ha^{-1} increased progressively with the increase in row spacing from 45 to 120 cm. On the basis of two years average, maximum germination percentage (54.73), tillers m^{-2} (15.92), plant height in meters (2.36), millable canes m^{-2} (13.51) and cane yield t ha^{-1} (104.4) were produced when the crop was planted in 120 cm apart trenches. While, sugarcane planted in 45 cm apart furrows showed minimum germination (47.75%), tillers (10.94 m^{-2}), plant height (1.96 m), the number of millable canes (12.31 m^2) and cane yield (95.39 t ha^{-1}).
Keywords: Planting techniques, germination, tillers, plant height, millable canes, yield

INTRODUCTION

Sugarcane is one of the major cash crops and plays a vital role in providing raw material, to second largest sugar industry in Pakistan, for the production of white sugar and *Gur*. Sugarcane share in value addition of agriculture and GDP is 3.4% and 0.7%, respectively. It contributes substantially to Pakistan's economy. Sugarcane is grown over the sub tropics (land surface of the earth) between latitude 30^o N and 35^o S (Nazir, 2000). It is grown in 74 countries of the world of which 12 are top cane producing ones. Pakistan ranks 5^{th} in acreage, 6^{th} in production and 11^{th} in yield per hectare. In Pakistan, during 2005-06, sugarcane was grown on an area of 907.3 thousand hectares with total production of 44.665 million tones. The national average yield remained 49.2 tones per hectare which is far below the yield potential of the existing sugarcane varieties and also less than the world average of 65.59 tonnes per hectare (Anonymous, 2005-06). There are many factors responsible for this low yield but one of the major causes of low cane yield is the sowing of sugarcane crop at narrow spacing with indigenous planting techniques. The cane yield increases with sowing of sugarcane at wider spacing and adopting of improved production techniques (Cheema *et al.*, 2002 and Gill, 1995).

Sugarcane germination increases progressively with the increase in the strip size from 45 to 120 cm (Khan *et al.*, 2002 and Sundara, 2003).

Higher number of tillers per plant is produced by planting sugarcane in wider row spacing than narrow spacing (Malik and Ali, 1990, Malik *et al.*, 1996).

More number of millable canes are possible with 90 cm inter-row spacing compared with 30 and 60 cm inter-row spacings (Raskar and Bhoi, 2003). The higher number of millable canes per unit area are produced by planting sugarcane in wider rows compared with closer rows (Cheema *et al.*, 2002).

The sugarcane plants attain more height at 120 cm apart row than 60 cm spaced ones because of proper orientation and establishment of plants in wider rows (Cheema *et al.*, 2002). Plant height increases with the increase in row spacing (Lal, 1988). Higher cane yield is possible with 120 cm row spacing compared with narrow rows (Nazir, 2000, Mahadevaswamy and Martin, 2002).

The proper planting technique of sugarcane is pre-requisite to enable the crop plants to fully utilize environmental conditions to exhibit their optimum potential. Densely populated sugarcane crop requires special attention for sowing at suitable distance with appropriate planting technique to increase cane yield. The present study, therefore, was designed to assess the yield of sugarcane under different spacings/ planting techniques.

MATERIALS AND METHODS

Studies were carried out to see the influence of different spacings/planting techniques on growth and yield of spring planted sugarcane at the Sugarcane Research Institute, Faisalabad during 2004 and 2005. The experiment was laid out in R.C.B.D. with 4 replications. The sugarcane cultivar HSF-240 was planted in plots measuring 3.6 m x 6.5 m in 45 and 60 cm apart furrows and 60, 90 and 120 cm apart trenches using seed @ 75,000 DBS per hectare on 13th and 15th February, 2004 and 2005, respectively. The crop was fertilized @ 168-112-112 kg NPK ha^{-1}. The crop was harvested manually on December 23 and 26 in 2004 and 2005, respectively.

The data on germination and tillering were recorded on plot basis at 45 and 90 days after planting in both the years. From each plot, 10 plants were randomly selected, their heights were measured and averaged. The number of millable canes and stripped cane yield were recorded from the whole plot at harvest.

The data were analysed statistically using Fisher's analysis of variance technique and least significant difference test at 5% probability level was employed to compare differences among the treatments means (Steel and Torrie, 1997).

RESULTS AND DISCUSSION

Germination percentage

The data (Table-1) revealed that average germination percentage was affected significantly. Germination increased progressively with the increase in spacing from 45 to 120 cm. Crop planted at 120 cm spacing (trenches) produced significantly the more number of germinants (54.73%) compared with all other planting techniques. The crop planted in furrows either at 45 or 60 cm apart, gave significantly lower germination compared with trench plantings of 60, 90 and 120 cm apart. However, the crop planted in 60 and 90 cm apart trenches gave statistically similar germination percentage. The increased germination percentage at wider row spacing is supported by Khan *et al.* (2002), Mahadevaswamy and Martin (2002) and Sundara (2003) they found that on an average germination increased progressively with the increase in strip size from 45 cm apart furrows to 120 cm apart trenches. Singh *et al.* (1987) and Dexi *et al.* (1990) found a slight improvement in germination of both autumn and spring sugarcane when grown in 80 cm spaced rows over that 60 cm spaced rows.

Table No. 1. Germination % of sugarcane as affected by different spacings/planting techniques

Treatments	Years		
	2004	2005	Mean
T_1 = Sowing in 45 cm apart furrows	49.50 D	50.00 D	49.75 D
T_2 = Sowing in 60 cm apart furrows	51.48 C	52.00 C	51.74 C
T_3 = Sowing in 60 cm apart trenches	52.47 B	53.00 B	52.74 B
T_4 = Sowing in 90 cm apart trenches	52.72 B	53.25 B	52.99 B
T_5 = Sowing in 120 cm apart trenches	54.45 A	55.00 A	54.73 A
LSD at 0.05%.	0.8578	0.004872	0.5783

Table No. 2. Number of tillers m^{-2} as affected by different planting techniques

Treatments	Years		
	2004	2005	Mean
T_1 = Sowing in 45 cm apart furrows	10.89 C	11.00 C	10.94 D
T_2 = Sowing in 60 cm apart furrows	12.87 B	13.00 B	12.93 C
T_3 = Sowing in 60 cm apart trenches	13.86 B	14.00 B	13.93 B
T_4 = Sowing in 90 cm apart trenches	15.46 A	15.61 A	15.53 A
T_5 = Sowing in 120 cm apart trenches	15. 84 A	16.00 A	15.92 A
LSD at 0.05%.	1.048	1.058	0.7052

Number of tillers m^{-2}

Tillering, an important yield contributing factor is controlled by genetic cum environmental factors. Data (Table-2) revealed that different planting techniques had significant effect on the no. of tillers m^{-2}. The average no. of tillers (15.92 and 15.93) were statistically similar in 120 and 90 cm apart trenches but significantly higher than other planting techniques. The average no. of tillers (13.93) were significantly higher in 60 cm apart trenches than 45 and 60 cm apart furrows. The 60 cm apart furrow planting also produced significantly more no. of tillers (12.93) than narrow spacing of 45 cm apart furrows with 10.94 tillers m^{-2}. These findings are in agreement with those of Malik and Ali (1990) and Malik *et al.* (1996). They reported higher no. of tillers per plant by planting sugarcane in wider row spacing than narrow row spacing.

Plant height (m)

Plant height in sugarcane is a combination of better crop growing conditions and varietal characteristics. It contributes considerably to increase crop biomass. On the basis of two years average data plant height was significantly affected by different planting techniques (Table-3). Planting of sugarcane in 120 and 90 cm apart trenches produced plants with similar height of 2.36 and 2.34 m but significantly more than other planting techniques. Crop sown at 60 cm apart trenches also produced plants with significantly more height (2.18 m) than sowing at 45 and 60 cm apart furrows with 1.96 and 2.08 m which were also significantly different from each other. Similar findings are reported by Lal (1988) who found that plant

Table 3. Plant height (m) as affected by different planting techniques

Treatments	Years		
	2004	2005	Mean
T_1 = Sowing in 45 cm apart furrows	1.95 D	1.97 D	1.96 D
T_2 = Sowing in 60 cm apart furrows	2.074 C	2.09 C	2.084 C
T_3 = Sowing in 60 cm apart trenches	2.18 B	2.20 B	2.23 B
T_4 = Sowing in 90 cm apart trenches	2.33 A	2.35 A	2.34 A
T_5 = Sowing in 120 cm apart trenches	2.34 A	2.37 A	2.36 A
LSD at 0.05%.	0.09744	0.09744	0.04615

height increased with increase in row spacing. Cheema *et al.* (2002) also reported significantly more plant height at 120 cm spaced rows than 60 cm spaced rows. More plant height in wider row spacing was probably due to proper orientation of plant in this spacing. On the other hand, Shih and Gascho (1980) found that stalks grown at 0.5 m row spacing were about 39 percent taller than those planted at 1.5 m row spacing. The taller plants in narrow row spacings can be due to more inter plant competition because of higher plant population than recommended.

No. of millable canes m^{-2}

Table4. No. of millable canes/m^{-2} as affected by different planting techniques

Treatments	Years		
	2004	2005	Mean
T_1 = Sowing in 45 cm apart furrows	12.25 B	12.38 B	12.31 B
T_2 = Sowing in 60 cm apart furrows	12.28 B	12.40 B	12.34 B
T_3 = Sowing in 60 cm apart trenches	12.61 B	12.74 B	12.68 B
T_4 = Sowing in 90 cm apart trenches	13.40 A	13.54 A	13.47 A
T_5 = Sowing in 120 cm apart trenches	13.44 A	13.58 A	13.51 A
LSD at 0.05%.	0.6482	0.6482	0.4366

Values followed by the same letter do not differ significantly at 0.05 P.

No. of millable canes per unit area is the major yield component of sugarcane. The data (Table-4) revealed that no. of millable canes was significantly affected by different planting techniques. On the basis of two years average data maximum no. of millable canes (13.51) were produced in sowing of 120 cm apart trenches followed by 90 cm apart trenches with 13.47 millable canes m^{-2} which were statistically similar with each other but significantly higher than 60 cm apart trenches, 60 and 45 cm apart furrows which were at par with one an other. More number of millable canes at wider row spacing can be due to more number of tillers m^{-2}. These results are in agreement with those of Raskar and Bhoi (2003). They reported significantly higher number of millable canes with a 90 cm intra row spacing compared with 30 or 60 cm intra row spacings.

Stripped cane yield (t ha^{-1})

The data given in Table-5 revealed that cane yield was significantly affected in different planting techniques. On the basis of two years average data, crop planted in 120 cm and 90 cm apart trenches produced statistically same yield (104.4 and 104.2 t ha^{-1}) but significantly higher than 60 cm apart trenches, 45 and 60 cm apart furrows. However, 60 cm apart trench planting also gave significantly higher cane yield (96.31 t ha^{-1}) than 45 and 60 cm furrow planting with 95.39 and 95.0 tonnes per hectare which were at par with each other. These results are in line with Dhoble and Khauspe (1983), Mahadevaswamy and Martin (2002) and Ahmad (2002). They found 120 cm optimum for higher cane and sugar yields. Cheema *et al.* (2002) and Rasker and Bhoi (2003) also recorded significantly higher cane yield with a 90 cm intra-row spacing compared with 60 cm intra row spacing.

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Table 5. Cane yield (t/ha) as affected by different planting techniques

Treatments	Years		
	2004	**2005**	**Mean**
T_1 = Sowing in 45 cm apart furrows	94.91 C	95.87 C	95.39 C
T_2 = Sowing in 60 cm apart furrows	95.00 C	95.57 C	95.09 C
T_3 = Sowing in 60 cm apart trenches	95.83 B	96.79 B	96.31 B
T_4 = Sowing in 90 cm apart trenches	103.60 A	104.70 A	104.2 A
T_5 = Sowing in 120 cm apart trenches	103.90 A	105.00 A	104.4 A
LSD at 0.05%.	0.6105	0.6163	0.4115

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