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Morpho-qualitative Traits of Sugarcane (*Saccharum officinarum* L.) Varieties as Influenced by Seeding Density

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Abstract: Response of two varieties of sugarcane namely SPSG-26 and SPSG-394 to seeding densities of 75,000, 100,000, 125,000 and 150,000 sets ha^{-1} was studied under field conditions. SPSG-394 produced higher cane yield (64.80 t ha^{-1}) than SPSG-26 (52.64 t ha^{-1}) due to higher cane density, cane length and weight $cane^{-1}$. However, SPSG-26 gave higher sucrose content and commercial *cane* sugar (C.C.S.) percentage. Seeding densities also affected significantly cane density, cane length, weight $cane^{-1}$, cane yield, sucrose content and C.C.S. percentage. A significant decrease in cane yield was observed when crop was sown with seeding densities higher than 75,000 sets ha^{-1}. Therefore, seeding density of 75,000 sets ha^{-1} seems to be optimum for obtaining higher yield of sugarcane. However, maximum sucrose content (17.45%) and C.C.S. (11.87%) were obtained when crop was sown at a seeding density of 100,000 sets ha^{-1}.

Key words: Morpho-qualitative traits, sugarcane, varieties, seeding density

Introduction

Sugarcane supplies over 80% of the world sugar and plays a remarkable role in the economic uplift of the growers and the country by earning foreign exchange and providing employment to millions of people. The average cane yield in Pakistan (50.28 t ha^{-1}) is far below than the yield obtained in many other cane growing countries of the world like Peru (136.51 t ha^{-1}), Egypt (110.80 t ha^{-1}), Guatemala (101.05 t ha^{-1}), Australia (100.35 t ha^{-1}), Burkina Faso (100 t ha^{-1}) and Kenya (84.48 t ha^{-1}) (Anonymous, 1998). Among the various factors responsible for low yield of sugarcane, the use of low yielding varieties is considered the major one (Ahmad, 1988). The yield potential of our existing varieties is rapidly deteriorating due to changes in edaphic and climatic factors as well as their susceptibility to diseases and insect attack (Malik, 1990). Cultivars may vary greatly in yield, quality and resistance to insect attack and diseases. Tew *et al*. (1992) reported that sugarcane variety 11-78-0292 was adapted to a wide range of irrigated environments and produced 16% more cane and 20% more sugar yield than standard variety H-74-1715. H-78-0292 was also more resistant to pest damage and fungal diseases than H-74-1715 and H-70-0144. Rehman (1996) reported that varieties CPM-13 and CO-1321 produced the highest cane yield and C.C.S. percentage while CP-72/2083, CP-72/2086 and CP-75/1091 showed the least performance for these characters. Varietal differences with respect to number of minable canes, cane length, cane yield, cane sucrose content and commercial cane sugar percentage have also been reported by Sharar *et al*. (1998). The use of inadequate seed rate is another important factor responsible for low yield of sugarcane. About 70-80% of the sugarcane yield le contributed by cane number (Khalid, 1979). Bashir (1997) reported an increase in stripped cane yield with an increase in seeding density. However, sucrose content and C.C.S. percentage were not affected significantly by the seeding densities. Whereas, Nazir *et al*. (1999) reported that cane density m^{-2}, weight $cane^{-1}$, cane yield, harvest index, sucrose content and C.C.S. percentage were not affected significantly by seeding densities of either 50,000 or 100,000 two budded sets ha^{-1}. Consequently the present study was planned to see the effect of different seeding densities on the growth, yield and sucrose contents of two sugarcane varieties.

Materials and Methods

The growth and yield behaviour of two varieties of sugarcane as influenced by different seeding densities were carried out at Postgraduate Agricultural Research Station (PARS), University of Agriculture, Faisalabad. Two varieties of sugarcane namely SPSG-26 and SPSG-394 were planted at seeding densities of 75,000, 100,000, 125,000 and 150,000 ha^{-1} on February 5, 1994. The experiment was laid out in split plot design with four replications measuring a sub-plot size of 4.8 m × 7 m. Varieties were kept in main plot while seeding densities were randomized in sub-plots. The varieties were sown in 90 cm apart double row strips with 30 cm distance between the rows (30/90 cm) on a well prepared seed bed using two budded sets. The crop was fertilized at a rate of 150 kg N + 100 kg P_2O_5 + 100 kg K_2O ha^{-1}. Whole of phosphorus and potash along with half of nitrogen was applied at sowing time, while the remaining half of nitrogen was applied 90 days after sowing. All other agronomic practices were kept normal and uniform for all the plots. The crop was harvested on January 18, 1995. Observations on desired parameters were recorded using standard procedures. Sucrose percentage in cane juice was determined by Horn's dry lead acetate method of sugar analysis. Commercial cane sugar percentage was computed by using the formula. The data collected were analysed statistically using Fisher's analysis of variance technique and differences among treatment means were compared using LSE) test at 0.05 probability level (Steel and Torrie, 1984).

Results and Discussion

The data given in Table 1 indicated that SPSG-394 produced significantly higher number of canes $IT1^{-2}$ than SPSG-26. The difference in cane density between the two varieties might be due to their different genetic potential. Significant differences among the varieties for cane density have also been reported by Sharar *et al*. (1998). The number of canes m^{-2} were also influenced significantly by seeding density. The highest number of canes m^{-2} (8.35) was obtained from the plots planted at the rate of 100,000 sets ha^{-1} which did not differ significantly from plots planted at seed rate of 75,000 sets ha^{-1}. The differences between seeding densities of 75,030 and 125,000 ha^{-1} were also not significant. The lowest cane

Table 1: Agronomic traits and sucrose content in cane juice of two s arcane varieties as affected by seeding density

Treatment	Cane density (m^2)	Cane length (m)	Weight cane (kg)	Cane yield sucrose (t ha^{-1})	Content (%)	Commercial cane sugar (%)
Varieties (V)						
SPSG-26	6.61 b	1.88 b	1.27 b	52.64 b	16.78 a	11.52 a
SPSG-394	9.16 a	2.12 a	1.43 a	64.80 a	15.63 b	10.33 b
Seeding density (S) (Two-budded sets ha^{-1})						
75,000	8.09 ab	1.70 c	1.49 a	66.29 a	16.78 ab	10.83 b
100,000	8.35 a	1.82 b	1.33 b	59.93 b	17.45 a	11.87 a
125,000	7.77 b	2.22 a	1.31 b	59.81 b	16.31 b	10.54 b
150,000	7.34 c	2.27 a	1.27 b	48.84 c	16.27 b	10.47 b
Interaction						
V × S	**	NS	*	NS	NS	NS

Any two means in a column not sharing a letter in common differ significantly at 5% probability level.
** = Highly significant * = Significant NS = Non Significant

density was obtained at the highest seeding density. The results are contradictory to those of Nazir *et al*. (1999) who reported non significant effect of seeding densities on number of canes m^{-2}. SPSG-394 produced significantly taller plants than SPSG-26 (Table 1). The differences in plant height among the sugarcane varieties have also been reported by Sharar *et al.* (1998). Seeding densities of 125,000 and 150,000 sets ha^{-1} produced canes of statistically similar height but significantly taller than those of 100,000 and 75,000 sets ha^{-1}. The lowest plant height (1.70 cm) was obtained at the lowest seeding density. The increase in plant height with the increase in seed rate might have been due to competition among plants for light. Khalid (1979) has also reported increase in plant height with an increase in seeding density. SPSG-394 produced significantly heavier canes than SPSG-26. This difference in cane weight between the two varieties might be due to differences in genetic traits of crop plants. Ahmad (1988) has also reported significant differences among cultivars for weight cane. A consistent decrease in cane weight had been observed with a successive increase in seeding rate. Seeding density of 75,000 sets ha^{-1} produced significantly heavier canes than all other seeding densities. The weight $cane^{-1}$ produced by the seeding densities of 100,000, 125,000 and 150,000 sets ha^{-1} did not differ significantly from each other. These results are not in consonance with those of Nazir *et al*. (1999) who reported a non-significant effect of seeding density on weight $cane^{-1}$. The contradictory results might have been due to differences in genetic make up of the variety, climate or soil fertility. Cane yields produced by the two varieties were significantly different from each other. SPSG-394 produced significantly higher cane yield (64.80 t ha^{-1}) than SPSG-26 due to more cane density, cane length and weight $cane^{-1}$. Cane yield differences among the varieties have also been reported by Sharar *et al*. (1998). Cane yield was also influenced significantly by the seeding densities. There was a consistent decrease in cane yield with the subsequent increase in seeding density. The lowest seeding density of 75,000 sets ha^{-1} produced significantly greater cane yield than other seeding densities. The cane yields produced by 100,000 and 125,000 sets ha^{-1} were statistically similar. The highest seeding density of 150,000 sets ha^{-1} produced the least cane yield (48.84 t ha^{-1}). These results are in line with those of Bashir (1997) who obtained higher cane yield with higher seeding rate. The level of sucrose percentage in the juice determines the maturity and quality of cane crop. The two varieties produced significantly different sucrose content. SPSG-26 produced higher sucrose content than SPSG-394. These results are in line with those of Ahmad (1988) and Sharar *et al*. (1998) who also reported that varieties had different potentials for sucrose content. Sucrose content in juice was also affected by seeding density. The crop planted at a seeding density of 100,000 sets ha^{-1} gave higher sucrose content (17.45%) but did not differ significantly from the seeding density of 75,000 sets ha^{-1}. The differences between seeding densities of 75,000, 125,000 and 150,000 sets ha^{-1} were not significant. The least sucrose content (16.27%) was produced when crop was sown at the highest seeding density. These results are not in conformity with those of Nazir *et al*. (1999) who reported a non-significant effect of seeding density on sucrose content in juice. Commercial cane sugar (C.C.S) percentage which indicates the magnitude of sugar recovery was significantly different between the varieties. SPSG-94 produced higher C.C.S. percentage than SPSG-394 which agree with the findings of Sharar *et al*. (1998) who reported significant differences among the varieties for C.C.S. percentage. Commercial cane sugar was also influenced significantly by different seeding densities. Maximum C.C.S. percentage (11.87%) was recorded at seeding density of 100,000 sets ha^{-1}. The seeding densities of 75,000, 125,000 and 150,000 sets ha^{-1} produced statistically similar C.C.S. percentage but significantly lower than that of 100,000 sets ha^{-1}. These results are not in accordance with the findings of Bashir (1997) who reported that C.C.S. percentage was not influenced by seeding densities. The contradictory results might have been due to differences in genetic traits of crop plants.

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