Response of Two Genotypes of Sugarcane to Different Planting Patterns

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Abstract: The study pertaining to response of two genotypes of sugarcane (Saccharum officinarum L.) to different planting patterns was conducted at the Agronomic Research Area of University of Agriculture, Faisalabad. Two sugarcane genotypes, SPSG-26 and Co-1148 were sown in six planting patterns, i.e., 100 cm spaced 30 cm wide single-row ditches (P1), 100 cm spaced 60 cm wide double-row ditches (P2), 100 cm spaced 90 cm wide triple-row ditches (P3), 100 cm spaced 100 x 100 cm² pits (P4), 90 cm spaced single-row strips (P5), and 90 cm spaced double-row strips 30/90 cm (P6). Sugarcane genotypes and planting patterns were differed significantly with respect to number of millable canes, cane length, inter-nodal length, weight per stripped cane, tops weight, stripped cane yield, sucrose content and commercial cane sugar (CCS%). The maximum yield of 99.64 t·ha⁻¹ canes obtained from the variety Co-1148 planted in 100 cm spaced 100 x 100 cm² pits and significantly high commercial cane sugar (14.75%) was found in SPSG-26 planted in 90 cm spaced double-row strips 30/90 cm (P5).

Key words: Saccharum officinarum, genotypes, planting patterns

Introduction
Sugarcane (Saccharum officinarum L.) is a prominent crop of family Poaceae. It is originally a crop of tropics but its cultivation has been extended rapidly over the subtropics between the latitude of 30° North and 25° South. Sugarcane is an important and highly valuable crop of Pakistan. It plays an important role in the economic uplift of the grower and the country at large. It supplies over 60% of world sugar requirement. In addition, it provides raw material for certain subsidiary products like chipboard, hardboard, paper, etc. In addition, its molasses is used in the preparation of animal feed and press-mud as manure. In Pakistan, sugarcane is cultivated on an area of about 1.066 million hectares with total annual production of 53.104 million tones canes, thus giving and average stripped cane yield of 50.3 t·ha⁻¹ (Anonymous, 1999), which is far below the potential yield of our existing cultivars. The main reasons for low yield are poor management practices, low yielding varieties and inappropriate planting methods.

In addition to other factors contributing to increased sugarcane production, use of high yielding varieties plays a remarkable role (Ahmad, 1990). Adoption of improved varieties not only increases cane tonnage per hectare but also enhances sugar production. Since yield potential of varieties in hand is deteriorating day by day due to segregation, susceptibility to diseases, insects admixture and changes in edaphic and climatic environments, it is essential to select the varieties with high yield potential and wide range of adaptability. Planting pattern is the key component of sugarcane agro-technology because it is the primary determinant of plant density of the crop. Conventional method of planting sugarcane in 60-cm spaced single-row restricts sugarcane yield to a considerable extent (Ghafi et al., 1990). Some preliminary studies have indicated that crop planted in pits or two-row strips gives better yield than that raised by conventional planting of sugarcane in closely-spaced single-row on flat (Gill, 1995). Pit and ditch plantations of sugarcane not only facilitate inter tillage practices and effective light penetration into the crop canopy but are also helpful in maintaining the desired plant density. These newly developed patterns have been reported to give substantial increase in cane yield (Yadav, 1992). Since there is a paucity of information pertaining to the performance of different genotypes of sugarcane crop to the newly developed plantation techniques, this study was planned to investigate the response of two genotypes of sugarcane to different planting patterns under the agronomic conditions of Faisalabad.

Materials and Methods
The proposed study was conducted on a sandy-clay loam soil at the Agronomic Research Area of University of Agriculture, Faisalabad, during the year 1998-99. The experiment was laid out according to the Randomized Complete Block Design (RCBD) with split plot arrangement. The sugarcane genotypes (Co-1148 and SPSG-26) were sown in six planting patterns viz., 100 cm spaced 30 cm wide single-row ditches (P1), 100 cm spaced 60 cm wide double-row ditches (P2), 100 cm spaced 90 cm wide triple-row ditches (P3), 100 cm spaced 100 x 100 cm² pits (P4), 90 cm spaced single-row strips (P5) and 90 cm spaced double-row strips 30/90 cm (P6). The crop was fertilized with 150-100-100 Kg NPK ha⁻¹ in the form of urea, SOP and SSP, respectively. The all quantity of phosphorus, potash and half nitrogen was applied at the sowing, while the remaining half dose of nitrogen was applied at the completion of tillers.

All other agronomic practices were kept uniform for all the treatments throughout the growing period. For data collection, 10 normal plants from each treatment were selected for various parameters, number of millable canes, cane length (cm), cane diameter (cm), number of inter-nodes per cane, inter-nodal length (cm) weight per stripped cane (Kg), yield (t·ha⁻¹) and sucrose content (%) were recorded. The data collected was analyzed statistically by using Fisher’s analysis of variance technique and treatment means was compared by using LSD test at 0.05 probability level (Steel and Torrie, 1984).

Results and Discussion
The sugarcane genotypes differed significantly with respect to number of millable canes, cane length, inter-nodal length, weight per stripped cane, stripped cane yield, and commercial cane sugar. However, cane diameter and number of inter-nodes per cane showed non-significant differences (Table 1).

The genotype Co-1148 performed better regarding cane yield as compared to the variety SPSCG-26. Significantly higher stripped cane yield of 93.13 t·ha⁻¹ was obtained from the genotype Co-1148 as compared to the genotype SPSCG-26 that produced 83.26 t·ha⁻¹ of stripped cane yield (Table 1). Anjum (1981) and Gill (1995) have also reported differences in cane yield among varieties. Similarly the interaction between two factors was also found to be highly significant. Co-1148 planted in 100 cm spaced 100 x 100 cm² pits produced maximum stripped cane yield (99.64 t·ha⁻¹) and SPSG-26 planted in 100 cm spaced 90 cm wide triple-row ditches (P6) produced minimum stripped cane yield of 73.60 t·ha⁻¹ (Table 1). On the other hand genotype SPSG-26 showed excellent performance in quality parameters.
It is evident from the Table 1 that genotypes differ significantly in sucrose content and the genotype SPSS-26 produced canes of maximum sucrose content (19.69 %) than Co-1148, which produced sucrose content (18.53%). These results are in agreement with Anjum (1991). The interaction between varieties and planting patterns was significant. SPSS-26 planted in 100 cm spaced 90 cm wide double-row ditches (G1 x P1) produced maximum sucrose content (20.45%), whereas as Co-1148 planted in 100 cm spaced 60 cm wide double-row ditches (G2 x P2) produced minimum sucrose content (17.99%).

The results regarding commercial cane sugar indicated highly significant differences among two genotypes (Co-1148 and SPSS-26). Significantly higher commercial cane sugar (14.90%) was found in SPSS-26 than Co-1148, which gave 13.49% commercial cane sugar (Table 1). These results are in conformity with those of Hafeez (1993) and Ali (1994), who also observed different commercial cane sugar in various varieties. It is obvious from the results that genotypes Co-1148 showed excellent performance regarding quantity parameters while SPSS-26 regarding quality parameters.

Different planting patterns showed highly significant differences with respect to number of millable canes, cane length, weight per stripened cane, stripened cane yield, inter-nodal length and commercial cane sugar (Table 1). There were highly significant differences among different planting patterns with respect to yield Kg ha⁻¹. Sugarcane planted in 100 cm spaced 100 x 100 cm² pits produced highest stripened cane yield of 97.60 t ha⁻¹ as compared to the other planting patterns (Table 1). On the contrary the lowest cane yield of 83.16 t ha⁻¹ was produced in 100 cm spaced 60 cm wide double-row ditches. Above results concur with the findings of Sharma (1982) and Yadav (1992). The interaction between varieties and planting patterns was found to be significant and Co-1148 raised in 100 cm spaced 60 x 100 cm² wide pits (G1 x P1) produced maximum stripened cane yield of 99.64 t ha⁻¹ (Table 1) and SPSS-26 planted in 100 cm spaced 90 cm wide triple-row ditches (G2 x P2) produced minimum stripened cane yield of (73.60 t ha⁻¹).

The results regarding number of millable cane (m) showed significant differences among different planting patterns. The highest number of millable canes (11.85 m²) were obtained from the crop grown in 100 cm spaced 100 x 100 cm² pits. On the contrary, the crop raised in 100 cm spaced 30 cm wide single-row ditches produced the lowest number of millable canes (10.10 m). Differential effect of different planting patterns on the number of millable canes m² might be attributed to the varying germination count and tillering. Ricardo and Cochran (1980) and Nazir et al. (1989) have also reported different number of canes per unit area at different planting patterns. The interaction between genotypes and planting patterns was found to be significant and Co-1148 raised in 100 cm spaced 100 x 100 cm² wide pits (G1 x P1) produced maximum number of millable canes of 12.95 m. While SPSS-26 planted in 90 cm spaced 60 cm wide double-row strips (G2 x P2) produced minimum number of millable canes of 10.74 m² (Table 1). As regard cane length the results also showed significant differences among planting patterns. The sugarcane planted in 100 cm spaced 30 cm wide single-row ditches produced longer canes measuring 2.82 m. In contrast the shortest canes of 2.42 m were produced by crop raised in 90 cm spaced double-row strips. These findings are in agreement with those of Jata (1976). Interaction between genotypes and planting patterns was also found to be significant. SPSS-26 planted in 100 cm spaced 60 cm wide single-row ditches (G2 x P2) produced longer cane of 3.28 m, while Co-1148 planted in 90 cm spaced double-row strips (G1 x P1) produced smaller canes of 2.37 m (Table 1).

The results regarding cane diameter showed non-significant differences among different planting patterns. These results concur with the findings of Akbar (1984), that reported that different row spacing had no significant effect on cane diameter. Similarly interaction between genotypes and planting patterns was also found to be non-significant (Table 1). The results of number of inter-nodes per cane had non-significant differences among different planting patterns. Interaction between two factors was found to be highly significant. The genotype SPSS-26 planted in 100 cm spaced 30 cm wide single-row ditches (G2 x P2) produced maximum number of inter-nodes per cane (27.82) whereas Co-1148 planted in 100 cm spaced 30 cm wide single-row ditches (G1 x P1) produced minimum number of inter-nodes per cane (22.81).
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raised in 100 cm spaced 30 cm wide single-row ditches. While the crop raised in all other planting patterns remains at par with one another. The interaction between two factors was also found to be non-significant (Table 1).

The data of weight per stripped cane revealed that there were highly significant differences among the various planting patterns. The crop planted in 100 cm spaced 90 cm wide triple-row ditches (G, x P,) produced cane of maximum weight of 1.33 Kg. The interaction between two factors was also found to be significant. The genotype DPSG-26 planted in 100 cm spaced 90 cm wide triple-row ditches (G, x P,) produced cane of maximum weight of 1.44 Kg (Table 1) where as Co-1148 when planted in 90 cm spaced single-row strips (G, x P,) produced cane of minimum weight (1.07 Kg). The results regarding C.C.S.% showed significant differences among various planting patterns. The maximum C.C.S. of 14.75% was obtained from crop planted in 90 cm spaced double-row strips. On the contrary the minimum C.C.S. (12.78%) was found in case of crop planted in 100 cm spaced 30 cm wide single row ditches. These findings are in agreement with Mali and Singh (1985). The interaction between genotypes planting patterns was highly significant. DPSG-26 planted in 100 x 100 cm² pits (G, x P,) produced high C.C.S. of 15.48% (Table 1) and Co-1148 planted in 100 cm spaced 30 cm wide single-row ditches (V, x P,) produced minimum C.C.S. of 12.76% (Table 1). In conclusion variety DPSG-26 perform better under Faisalabad conditions regarding quality parameter and Co-1148 regarding stripped cane yield. In planting patterns pit plantation and 90 cm spaced double-row strips were equally superior to other planting techniques under study, for harvesting the maximum sugar and cane yield per unit area.

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