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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., 100cm spaced 30cm wide single-row ditches (P_1), 100cm spaced 60cm wide double-row ditches (P_2), 100cm spaced 90cm wide triple-row ditches (P_3), 100cm spaced 100 x 100 cm^2 pits (P_4), 90cm spaced single-row strips (P_5), and 90cm spaced double-row strips 30/90cm (P_6). 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} was obtained from the variety Co-1148 planted in 100 cm spaced 100 x 100 cm^2 pits and significantly high commercial cane sugar (14.75%) was found in SPSG-26 planted in 90cm spaced double-row strips 30/90cm (P_6).

Key words: *Saccharnum officinanum*, 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 35° 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 1.056 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 (Shafi *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 agro-ecological 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 (P) viz., 100 cm spaced 30cm wide single-row ditches (P_1), 100 cm spaced 60cm wide double-row ditches (P_2), 100 cm spaced 90cm wide triple-row ditches (P_3), 100 cm spaced 100x100 cm^2 pits (P_4), 100 cm spaced single-row strips (P_5) and 90 cm spaced double-row strips 30/90 cm (P_6) by keeping genotypes in main plots, while the planting patterns were randomized in subplots. The net plot size was variable for each treatment; however, uniform area from each treatment was harvested for recording the yield data. Ditches were made 30 cm deep while pits were dug to a depth of 60 cm and then refilled to the level of 45 cm with the same soil along with 5 kg well rotten FYM per pit. The crop was fertilized @ 150-100-100 Kg NPK ha^{-1} in the form of urea, SOP and SSP, receptively. 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 m^2, cane length (m), 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, can 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 SPSG-26, Significantly higher stripped cane yield of 93.13 t ha^{-1} was obtained from the genotype Co-1148 as compared to the genotype SPSG-26 that produced 83.25 t ha^{-1} of stripped cane yield (Table 1). Anjum (1991) and Javed (1994) 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 100cm spaced 100 x 100 cm^2 pits (V_2 x P_4) produced maximum stripped cane yield (99.64 t ha^{-1}) and SPSG-26 planted in 100cm spaced 90cm wide triple-row ditches (G_1 x P_3) 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.

Table 1: Comparisons of means of yield and yield components of two varieties of sugarcane as effected by different planting patterns

Treatment	Stripped Cane yield (t ha^{-1})	Millable canes (m^2)	Cane length (m)	Inter-nodes/ cane	Inter-nodal length (cm)	Cane diameter (cm)	Weight/ stripped cane (Kg)	CCS (%)	Sucrose content (%)
Genotypes									
G_1	83.25b	09.65b	2.77a	25.62a	10.83a	2.38a	1.27a	14.90a	19.69a
G_2	93.13a	11.51a	2.41b	24.72a	09.80b	2.30a	1.12b	13.49b	18.53b
Planting patterns									
P_1	88.61b	10.10c	2.82a	25.32a	11.10a	2.30a	1.09d	12.79c	18.33c
P_2	83.17c	10.66b	2.58bc	24.12a	10.35b	2.41a	1.25b	14.00b	18.98b
P_3	83.87c	10.37bc	2.61b	24.88a	10.23b	2.37a	1.33a	14.58a	19.61a
P_4	97.60a	11.85a	2.60b	25.01a	10.32b	2.35a	1.24bc	14.59a	19.33ab
P_5	88.32b	10.31bc	2.51bc	25.31a	10.17b	2.25a	1.11d	14.46ab	19.11ab
P_6	87.55b	10.19bc	2.42c	24.92a	09.73b	2.36a	1.16cd	14.75a	19.20ab
Interaction (G x P)									
G_1P_1	78.68g	09.33efg	3.28a	27.82a	11.80a	2.30a	1.11dc	12.83f	17.61e
G_1P_2	79.10g	10.01de	2.78b	24.92bcd	10.27a	2.47a	1.40a	14.74bc	19.96a
G_1P_3	73.60h	08.87g	2.72bc	25.59bcde	10.58a	2.43a	1.44a	15.45ab	20.48a
G_1P_4	95.56bc	10.74cd	2.74bc	24.10cde	11.15a	2.40a	1.33ab	15.84a	20.42a
G_1P_5	87.78de	09.76ef	2.63bcd	25.50bc	10.82a	2.32a	1.15cde	15.06b	19.74ab
G_1P_6	84.78f	09.20fg	2.47de	23.78cde	10.37a	2.37a	1.21cd	15.47ab	19.94a
G_2P_1	98.54ab	10.87c	2.37e	22.81e	10.40a	2.29a	1.07e	12.75f	19.04bc
G_2P_2	87.24ef	11.31bc	2.39de	23.32de	10.43a	2.35a	1.10de	13.25ef	17.99de
G_2P_3	94.14cd	11.87b	2.50cde	25.18bc	09.99a	2.31a	1.22bc	13.70de	18.74cd
G_2P_4	99.64a	12.95a	2.46de	25.92b	09.49a	2.29a	1.15cde	13.35def	18.24cde
G_2P_5	88.86e	10.87c	2.39de	25.12bcd	09.52a	2.19a	1.07e	13.86de	18.48cd
G_2P_6	90.32e	11.17bc	2.37e	26.08ab	09.09a	2.34a	1.12cde	14.03cd	18.66cd

Any two means not sharing a common letter differ significantly at 5% probability level

It is evident from the Table 1 that genotypes differ significantly in sucrose content and the genotype SPSG-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. SPSG-26 planted in 100 cm spaced 90 cm wide triple-row ditches (G_1 x P_3) produced maximum sucrose content (20.48%), where as Co-1148 planted in 100cm spaced 60 cm wide double-row ditches (G_2 x P_2) produced minimum sucrose content (17.99%).

The results regarding commercial cane sugar indicated highly significant differences among two genotypes (Co-1148 and SPSG-26). Significantly higher commercial cane sugar (14.90%) was found in SPSG-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 SPSG-26 regarding quality parameters.

Different planting patterns showed highly significant differences with respect to number of millable canes, cane length, weight per stripped cane, stripped 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 100cm spaced 100x100 cm^2 pits produced highest stripped 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 60cm 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 100cm spaced 100 x 100 cm^2 wide pits (G_2 x P_4) produced maximum stripped cane yield of 99.64 t ha^{-1} (Table 1) and SPSG-26 planted in 100 cm spaced 90cm wide triple-row ditches (G_1 x P_3) produced minimum striped cane yield of (73.60 t ha^{-1}).

The results regarding number of millable cane (m^2) showed significant differences among different planting patterns. The highest number of millable canes (11.85 m^2) were obtained form the crop grown in 100 cm spaced 100 x100 cm^2 pits. On the contrary, the crop raised in 100cm spaced 30cm wide single-row ditches produced the lowest number of millable canes (10.10 m^2). Differential effect of different planting patterns on the number of millable canes m^2 might be attributed to the varying germination count and tillering. Ricaud and Cochran (1980) and Nazir *et al.* (1988) 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 cm^2 wide pits (G_2 x P_4) produced maximum number of millable canes of 12.95 m^2. While SPSG-26 planted in 90 cm spaced 60cm wide double-row strips (G_1 x P_6) produced minimum number of millable canes of 10.74m^2 (Table 1). As regard cane length the results also showed significant differences among planting patterns. The sugarcane planted in 100cm spaced 30cm 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 90cm spaced double–row strips. These findings are in agreement with those of Jatala (1976). Interaction between genotypes and planting patterns was also found to be significant, SPSG-26 planted in 100cm spaced 60 cm wide single-row ditches (G_1 x P_2) produced longer cane of 3.28 m, while Co-1148 planted in 90cm spaced double-row strips (G_2 x P_6) 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 SPSG-26 planted in 100 cm spaced 30 cm wide single-row ditches (G_1 x P_1) produced maximum number of inter-nodes per cane (27.82) where as Co-1148 planted in 100cm spaced 30cm wide single-row ditches (G_2 x P_1) produced minimum number of inter-nodes per cane (22.81). The data presented in Table 1 indicate that planting patterns had significant effect on inter-nodal length. The maximum inter-nodal length of 11.10 cm was recorded in the crop

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 produced cane of maximum weight of 1.33 Kg. The interaction between two factors was also found to be significant. The genotype SPSG-26 planted in 100-cm spaced 90cm wide triple-row ditches (G_1 x P_3) produced canes of maximum weight of 1.44 Kg (Table 1) where as Co-1148 when planted in 90cm spaced single-row strips (G_2 x P_5) produced canes 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 90cm spaced double-row strips. On the contrary the minimum C.C.S. (12.78%) was found in case of crop planted in 100cm spaced 30cm wide single row ditches. These findings are in agreement with Mali and Singh (1985). The interaction between genotypes planting patterns was highly significant. SPSG-26 planted in 100 x 100cm^2 pits (G_1 x P_4) produced high C.C.S of 15.48% (Table 1) and Co-1148 planted in 100cm spaced 30cm wide single-row ditches (V_2 x P_4) produced minimum C.C.S. of 12.75% (Table 1). In conclusion variety SPSG-26 perform better under Faislabad conditions regarding quality parameter and Co-1148 regarding stripped cane yield. In planting patterns pit plantation and 90cm spaced double-row strips were equally superior to other planting techniques under study, for harvesting the maximum sugar and cane yield per unit area.

References

Ahmad, I., 1990. Study on comparative ratooning performance of some new and old varieties of sugarcane. M.Sc. (Hons). Thesis, Dept. Agron., Univ. Agric., Faisalabad, Pakistan.

Akbar, M., 1984. Studies on inter cropping in autumn ratoon cane planted in different geometrical patterns. M.Sc. Thesis, Dept. Agron., Univ. Agric., Faisalabad, Pakistan.

Ali, D., 1994. A study on comparative ratooning performance of some new and old varieties of sugarcane. M.Sc. (Hons.) Thesis, Dept. Agron. Univ. Agric., Faisalabad, Pakistan.

Anjum, 1991. Ratooning potential of autumn sugarcane as affected by pits and flat planting. M.Sc. (Hons). Thesis, Dept. Agron. Univ. Agric., Faisalabad, Pakistan.

Anonymous, 1999. Agricultural Statistics of Pakistan. 1997-98. Govt. of Pakistan, Ministry of Food, Agriculture and Livestock, Economic Wing, Islamabad.

Gill, M. B., 1995. Physio-agronomic studies on flat versus pits plantation of autumn and spring sugarcane. Ph.D. Thesis, Dept. Agron. Univ. Agric., Faisalabad, Pakistan.

Hafeez, M. A., 1993. Ratooning potential of different cultivars of sugarcane in autumn. M.Sc. (Hons.) Thesis, Dept. Agron. Univ. Agric., Faisalabad, Pakistan.

Jatala, M. A., 1976. The effect of shape and size of nutritional area on the yield and quality of sugarcane. M.Sc. Thesis, Deptt. of Agron. Univ. Agric., Faisalabad, Pakistan.

Javed, M. S., 1994. A study on comparative ratooning performance of some sugarcane varieties. M.Sc. (Hons.) Thesis, Dept. Agron. Univ. Agric., Faisalabad, Pakistan.

Mali, A. L. and P. P. Singh, 1985. Quality of sugarcane as influenced by varieties in relation to varying row spacing. Indian sugar, 35: 451-456

Nazir, M. S., I. A. Faqeer, G. Ali, R. Ahmad and T. Mahmood, 1988. Studies on planting and intercropping in autumn sugarcane. Gomal Univ. Res. J., 8: 57-64.

Ricaud, R. and B. J. Cochran., 1980. Methods of planting sugarcane for sugar and biomass production in Louisiana. 17th Congress of Inter. Soc. of Sugarcane Tech., 1: 302-310.

Shafi, M., M. L. Shah, T. Mahmood, S. Afghan and S. H. Shah, 1990. Cane yield and quality of sugarcane as influenced by different planting patterns. Pak. Sugar. J., 4: 3-4.

Sharma, R. A., 1982. Effect of premonsoon irrigation and inter-row spacing on yield and quality of sugarcane. J. N. K. V. V. Res. J., 16:136-141

Steel, R. G. D. and J. H. Torrie., 1984. Principles and procedures of statistics. McGraw Hill Book Co. Inc. Singapore.

Yadav, R. L., 1992. Effect of set size and row arrangement on yield and quality of sugarcane. Cooperative Sugar, 23: 667-670.