Response of Fourth Ratooning of Sugarcane to Different Patterns of Plantation and Seeding Densities

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Abstract: Planting pattern and density effects on various agronomic traits of the fourth ratoon of sugarcane genotype SPSG-394 were determined during 1998-99 at the University of Agriculture, Faisalabad (Pakistan). Plant crop was raised during 1993-94 in three planting patterns, i.e. 100-cm spaced 100×100 squarish pits, 100-cm spaced circular pits with a diameter of 1 m and 90-cm spaced 2-row strips (30/90 cm) flat sowing at seeding densities of 10, 15, 20 and 25 buds m⁻², using randomized complete block design. Ratoon of the crop planted in 90-cm spaced double-row strips (30/90 cm) gave significantly higher cane yield ha⁻¹ than pit plantation while the converse was true for the sucrose content. Planting densities used for the plant crop had little effect on striped cane yield but had significant effect on sucrose content. Ratoon of the crop planted at the lowest seeding density (10 buds m⁻²) produced juice with the maximum sucrose content against the minimum with a seeding density of 25 buds m⁻². Interactive effect of planting pattern and seeding density on striped cane yield, sucrose content and purity of juice was non-significant. The results suggest that sugarcane should be planted in 90-cm spaced double row strips at a seeding density of 25 buds m⁻² in order to maximize cane yield ha⁻¹ of the ratoon crop while pit plantation be preferred for improving sucrose content and purity of cane juice.

Key words: Seeding densities, ratooning of sugarcane

Introduction
Sugarcane (Saccharum officinarum L.) provides raw material for sugar industry which is second to the textile in Pakistan. It is cultivated on an area of 1056 thousand hectares with total annual production of 53104 thousand tonnes and average stripped cane yield of 50.3 t ha⁻¹ (Anonymous, 1999). However, this average yield is much lower compared to the production potential of the existing cane varieties. Ratoon crop occupies more than 50% of the total acreage under sugarcane in the Punjab, Pakistan (personal communication with Director, Sugarcane Research Institute, AARI, Faisalabad). However, production of ratoon crop is 6-30% less than the plant crop of sugarcane (Anonymous, 1991) because of low and different ratooning potential of cultivars and sub-optimal crop management. Thus it is imperative to evolve cane varieties with higher ratooning potential and develop appropriate agro-technology for raising of successful ratoon crop in order to optimize use of the land pre-occupied by ratoon of sugarcane. Since there is paucity of information pertaining to the effect of seeding density and planting pattern on the agro-biological performance of the ratoon sugarcane, the objective of this study was to determine the effects of different seeding densities and planting patterns on agrobiological performance of the ratoon crop of sugarcane genotype SPSG-394.

Materials and Methods
The research study was conducted at the agronomic research area, University of Agriculture, Faisalabad, on a sandy-clay loam soil during the year 1998-99. The experiment already laid out according to the randomized complete block design with split-plot arrangement for plant crop and subsequent three ratoons of sugarcane was selected. Fourth ratoon of sugarcane genotype SPSG-394 was used as the test crop. Treatments for the plant crop and subsequent ratoon crops comprised three planting techniques, i.e., 100-cm spaced 100 cm×100 cm squarish pits, 100-cm spaced circular pits with a diameter of 1 m, 90-cm spaced 2-row strips (30/90 cm) and four planting densities, i.e., 10 buds m⁻², 15 buds m⁻², 20 buds m⁻² and 25 buds m⁻².

Third ratoon of sugarcane genotype SPSG-394 was harvested at the end of February 1998. The test crop (4th ratoon) was fertilized at 200-170-170 kg N, P and K ha⁻¹. Weeds were removed manually and irrigation was applied when needed. Observations on millable canes m⁻², cane yield ha⁻¹, weight per cane, cane length, cane diameter, sucrose content and cane juice purity were recorded by using the standard procedures. The data obtained were analysed statistically by using the Fisher’s Analysis of Variance technique and treatment means were compared using the LSD test at 0.05 probability level (Steel and Torrie, 1984).

Results and Discussion
There were significant differences in cane yield ha⁻¹ (Table 1) among the various planting techniques and seeding densities. The maximum cane yield (69.76 t ha⁻¹) was produced by ratoon of the crop planted on flat at 90-cm spaced double row strips (Tj), while the minimum (55.19 t ha⁻¹) by that in the squarish pits which, in turn, did not differ significantly from the circular pit plantation. These results are contrary to those of Urgel (1966) and Irvine et al. (1980) who stated that pit plantation was significantly more productive than flat plantation at 2-row strips. This difference in ours and others findings may be due to: (a) we are reporting results of the fourth ratoon crop while they worked on the plant crops and (b) different climatic conditions of the experiments. Treatment combinations did not differ significantly with one another but gave cane yield between 54.17 and 74.64 t ha⁻¹. Planting technique and seeding density had significant effect on millable canes m⁻² (Table 1). The maximum millable canes m⁻² (12.47) were recorded in 90-cm spaced double-row strip plantation while the minimum (10.28) in 100-cm spaced 100×100 cm circular pits which was, however, statistically equal to 100-cm spaced 100×100 cm squarish pits.
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D, 60.60 10.48b 0.599a 1.702 2.115 15.83ab 87.22
D3 59.71 11.59a 0.538b 1.746 2.071 15.29bc 86.85
D, 60.33 11.36a 0.529b 1.630 2.032 15.43c 84.58
LSD (0.05) NS 0.76 0.031 NS NS NS 0.849 NS

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<th>Interaction (T × D)</th>
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NS = Non-significant at p = 0.05
T1 = 100-cm spaced 100 cm×100 cm squarish pits. T2 = 100-cm spaced circular pits with a diameter of 1 m, T3 = 90-cm spaced 2-row strips (30/90 cm).
D1 = 10 buds m⁻², D2 = 15 buds m⁻², D3 = 20 buds m⁻², D, = 25 buds m⁻²

(10.49 canes m⁻²). Different number of canes under various spatial arrangements have been reported by Kanwar and Sharma (1974). As regards seeding density, the maximum millable canes m⁻² (11.59) were recorded in 20 buds m⁻² which was, however, statistically on a par with D, and D1. While the minimum canes m⁻² (10.48) were recorded at a seeding density of 15 buds m⁻² which was statistically equal to 10 buds m⁻². Greater number of millable canes m⁻² at higher seeding density might be due to greater number of total tillers formed at higher seeding densities. Ahmad et al. (1995) also reported an increase in millable canes per unit area with an increase in planting density. Treatment combinations also differed significantly. The greatest number of millable canes m⁻² was produced by ratoon of the crop planted at 25 buds m⁻² in double-row strips (T1D,) that, however, did not differ significantly from T1D, and T1D,. On the contrary, the lowest number of millable canes m⁻² (9.29) was observed in ratoon of the crop planted at 20 buds m⁻² in 90-cm spaced 2-row strips (30/90 cm) on flat (T2D,). However, statistically on a par with T1D, T,D, and T,D,. Variability in cane diameter of ratoon of the crop planted in pits and on flat may be attributed to better cane growth in pits because of adequate supply of various agricultural inputs, i.e., water, fertilizer, etc. which were applied directly to the pits instead of mixing with the surface soil over the entire cropped area as is done in flat plantation. Main effects of planting technique and seeding density on cane length were non-significant while their interaction was significant. The maximum cane diameter (2.24 cm) was recorded in ratoon of the crop planted at 20 buds m⁻² in 100-cm spaced 100×100 cm circular pits (T,D,), which, however, did not differ significantly from treatment combinations of T,D, T,D, , T,D, and T,D,. Interaction (T×D) was non-significant. The maximum cane diameter (1.81 cm) was produced by ratoon of the crop planted at 20 buds m⁻² in 90-cm spaced 2-row strips (30/90 cm) on flat (T2D,). Cane length that varied from 0.561 to 0.566 kg (Table 1). The results concur with the findings of Irvine et al. (1980).

As regards planting density, the maximum weight per cane (0.599 kg) was found in ratoon of the crop planted at 15 buds m⁻² (D3), which was, however, statistically on a par with the planting density of 10 buds m⁻² (D2). While the Minimum weight per cane (0.467 kg) was produced by ratoon of the crop planted at 25 buds m⁻² (D,). Cane growth in pits because of adequate supply of various agricultural inputs, i.e., water, fertilizer, etc. which were applied directly to the pits instead of mixing with the surface soil over the entire cropped area as is done in flat plantation. Main effects of planting technique and seeding density on sucrose content of the cane juice were significant while interactive effect was non-significant. The maximum sucrose content (16.32%) was found in ratoon of the crop raised in 100-cm spaced 100×100 cm circular pits which, however, did not differ significantly from that in circular pits (Table 1). On the contrary, the minimum sucrose content (14.49%) was recorded in ratoon of the crop at 90-cm spaced 2-row strips but was statistically on a par with the circular pit plantation. As regards seeding
density, the maximum sucrose content (16.16%) was produced by ratoon of the crop planted at 10 buds m$^{-2}$ which, in turn, was statistically equal to that planted at 15 buds m$^{-2}$ (Table 1). Contrarily, the minimum sucrose content (14.53%) was found in ratoon of the crop planted at 25 buds m$^{-2}$ which, however, did not differ significantly from the D3. Crop at lower seeding density exhibited lower lodging that might have resulted in higher cane sucrose content than at high seeding density. These results conform to the findings of Kathiresan and Narayanasamy (1991) who observed that sugarcane seeded at 0.15 million buds ha$^{-1}$ gave the maximum poi per cent (14.11), while that at 0.2 million buds ha$^{-1}$ exhibited the minimum (13.82). In case of cane juice purity, both the main and interactive effects of planting technique and planting density on cane juice purity were not significant. However, among treatment combinations cane juice purity varied from 82.20 to 90.79% (Table 1). Above results suggests that sugarcane should be planted in 90-cm spaced double-row strips at a seeding density of 25 buds m$^{-2}$ to maximize cane yield ha$^{-1}$ of the ratoon crop while pit plantation be preferred for improving sucrose content and purity of cane juice.

References


