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EFFECT OF PLANTING AND BUD PLACEMENT POSITION ON AGRONOMICAL AND PHYSIOLOGICAL TRAITS OF SUGARCANE (*SACCHARUM OFFICINARUM* L.)

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SUMMARY

Different planting techniques influence the quantitative and qualitative characteristics of sugarcane. This study focused on the hypothesis that altering sett spacing and bud placement position significantly improves sugarcane yield and quality. The experiment was conducted during the periods, 2016–2017 and 2017–2018, under field conditions at the Sugarcane Research Institute, Agriculture Research Centre, Tandojam, Sindh, Pakistan. The sugarcane variety, PSTJ-41, was used for the study in a randomized complete block design (RCBD) with three replications. Spacing between setts included S_1 = end to end, S_2 = 15 cm, S_3 = 22 cm, and S_4 = 30 cm. Bud placement position consisted of B_1= buds up and down, and B_2 = buds faced to ridge. Analysis revealed that sett spacings and bud placement positions significantly (P<0.05) affected almost all the studied agronomical, physiological, and qualitative sugarcane traits. Enhanced sugarcane sprouting (%), crop growth rate (gm^{-2}day^{-1}), leaf area index, cane length (cm), internodes cane^{-1}, millable canes (000 ha^{-1}), Brix (%), commercial cane sugar (CCS %), and cane yield (t ha^{-1}) were observed with setts plantation of a distance at 30 cm apart. In the case of bud position, B_2 showed maximum growth, yield, and best quality attributes. The highest and desirable mean values of the various parameters were documented in the interaction of 30 cm sett spacings × buds faced to ridges regarding interactive effects.

Keywords: Sugarcane, sett spacing, bud placement position, growth, millable canes, cane yield

Key findings: Sugarcane crop production relies heavily on sett spacing and bud location. Cane production and quality were improved by using 30 cm sett spacing and bud facing the ridge, as well as, their interaction.

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INTRODUCTION

Sugarcane is an essential industrial cash crop in the world, including Pakistan, and ranks fourth in hectarage after wheat, cotton, and rice (Rasool *et al*., 2011; Palachai *et al*., 2021). It is a perennial herb and belongs to the family Poaceae. This crop is mainly propagated by vegetative means with three buds each and a low multiplication rate (Roy and Kabir, 2007; Namwongsa *et al*., 2019; Songsri *et al*., 2019). It provides primary raw material input for the domestic sugar industry.

Sugarcane provides income to the grower and employment for numerous farm and industrial workers throughout the year (Ali, 2013; Singkham *et al*., 2016; Murianingrum *et al*., 2018). It is grown in 74 countries of the world, of which 12 are top cane-producing ones. Pakistan ranks fifth in hectarage, sixth in production, and 11th in yield per hectare in the world. In Pakistan, during 2020–2021, the crop was cultivated on 1.165 million ha, an increase of 12.0 % compared with last year's sown area of 1.04 million ha. Production increased by 22.0 % to 81.009 million t against 66.380 million t last year (GOP, 2020).

Improper row spacing is the most critical factor in reducing sugarcane yield in the country (Mahmood *et al*., 2007). It has been observed that the significant problem to increase output at farmer's fields is improper row spacing (Bashir *et al*., 2000; Mahmood *et al*., 2005). The economic yield is determined by the plant's capability to produce photosynthates and their distribution to economically valuable plant parts. To realize the full benefits of the land and environmental resources, it is necessary to place the plants over the field in such a pattern that there is less competition among them for essential growth.

There is a contradiction regarding the effect of row spacing on the quality parameters, such as, brix, sucrose content, juice extraction, and commercial cane sugar (Sharar *et al*., 2000; Asokan *et al*., 2005). However, Pawar *et al*. (2005) viewed that wider row spacing improved the sucrose content and commercial cane sugar percentage. El-Geddaway *et al*. (2002) obtained comparatively higher cane yield at a row spacing of 100 cm than 120 cm or 140 cm spacing.

Lack of sett rate knowledge declines sugarcane yield in Pakistan (Ameen *et al*., 2014). It was reported that a standard seed rate of 100% quantity recommended buds ha^{-1} had a significant impact on germination, the number of millable canes, and cane yield (commercial cane sugar) compared with a lower seed rate of 75% recommended buds ha^{-1} (Patel and Patel, 2014). They concluded that two and three-budded setts gave higher cane yield than single-budded setts. If a whole cane stalk is planted without being cut into setts, usually few buds at the top end germinate, and the lower end buds remain inactive due to leading dominance polarity (missing buds gaps). Therefore, the t study was designed to assess the yield of sugarcane under different sett spacings and bud placement positions.

MATERIALS AND METHODS

The study was conducted on clay loam soil for two consecutive years during autumn of 2016–2017 and 2017–2018 at the experimental fields of the Sugarcane Research Institute, Agriculture Research Centre, Tandojam, Sindh, Pakistan. According to the USDA system, the experimental area's ground is clay loam, which belongs to the Order *Aridisols* and Sub-group *TypicCamborthids*. Sugarcane variety PSTJ-41 was planted. An experiment was carried out in an RCBD with three replications. The net plot size was 13 m × 2.3 m (30 m^2). Before planting and after harvesting the crop, soil samples were taken with the help of a soil auger at a depth of 45 cm from five locations in the experimental area, and analyzed for the physical and chemical properties at Soil Fertility Institute, in Tandojam, Sindh, Pakistan. The details of the physico-chemical analysis of soil are given in Table 1. The land was prepared twice using a disc harrow, rinsed and dried to a workable condition, leveled, and finally, the seedbed was prepared by plowing with a cultivator. After intense tillage operations with the mouldboard plow and the crosswise disc harrow, rigorous smoothing was done successfully to bring the soil to the condition suitable for cultivation. Ridge was used for making furrows.

The crop was planted on 22 September 2016 and 25 September 2017, respectively. The experiment consisted of four spacing between setts (S_1 = end to end, S_2 = 15 cm, S_3 = 22 cm, and S_4 = 30 cm) and bud placement position included B_1 = buds up and down, and B_2 = buds faced to the ridge. Fertilizers viz., urea, DAP (diammonium phosphate), and SOP (Sulphate of potash) were applied as per recommended doses for sugarcane. The whole P and K, and one third of N were used at the time of sowing, while the

Table 1. Physico-chemical properties of the experimental soil during 2016–2017 and 2017–2018.

Soil Parameters	Values
Soil texture	
Sand (%)	19.5
Silt (%)	42.0
Clay (%)	38.5
Textural class	Silty clay loam
Soil chemical analysis	
EC (dS m^{-1})	0.23
Soil pH	8.20
Organic matter (%)	0.83
Total N (%)	0.09
Available P (mg kg^{-1})	8.80
Extractable K (mg kg^{-1})	0.88

other two thirds of N were added at first earthing-up (3.5 months after sowing) on 7 January 2017, and 9 January 2018, and in the next earthing-up (about 45 days after the initial earthing-up) on 23 February 2017 and 24 February 2018, respectively. All cultural practices, and insect pest, disease, and weed control measures were followed uniformly in all the treatments. The propagation material was taken from the upper two third portion of a stalk of an eight-month-old cane. Cane setts were soaked in Topsin-M at 150 g 100^{-1} L water to protect them from many cane diseases like sugarcane smut. A dry method of planting was adopted for growing canes with an ear-to-ear planting pattern. The cane setts were sown in furrows at 6–8 in depth and covered with 5–6 cm soil. Immediately after protecting the setts, water was let into the furrows. Irrigation was applied keeping in view the soil condition and crop needs as farmer practice. In summer (April-August) irrigation was used at the interval of 7–10 days, while in winter (November-March) at 10–15 days. All 28 irrigations were applied during the growing season (12 months). The herbicide, CLIO Combo pack at 3.75 kg ha^{-1}, was applied one month after planting when sufficient moisture was present in the soil. The insecticide, Lorsban at 5 L ha^{-1}, was applied at first irrigation to control termites. Trichogramma cards were stapled against the borers. Insecticide Furadan 3G (Carbofuran) was broadcasted at 30 kg ha^{-1} if the Trichogramma cards did not affect the borers. Harvesting was done when the crop was physiologically mature, i.e., ripening phase was completed, and brix was above 20%. The yield was harvested manually on 28 December 2017 and 31 December 2018, respectively.

Crop observations and measurement

The agronomic and physiological observations were recorded for parameters of economic importance, such as, seed germination (%), crop growth rate (g m^{-2} day^{-1}), leaf area index (LAI), cane length (cm), internodes $cane^{-1}$, millable canes (000 ha^{-1}), cane yield (t ha^{-1}), brix (%), and commercial cane sugar (%). The bud sprouting was calculated after 45 days of sowing using the formula:

$$\text{Germination percentage} = (\text{No. of germinated buds} \div \text{Total number of buds}) \times 100$$

Crop growth rate (g m^{-2} day^{-1}) was recorded from the tagged plants using the formula: $(W2 - W1) \div (T2 - T1)$ at peak vegetative growth. Leaf area index was measured at peak vegetative growth from randomly selected plants by the formula: Leaf area $plant^{-1}$ (cm^2) ÷ Ground area $plant^1$ (cm^2). Cane length (cm) was measured with the help of a measuring tape in centimeters from the soil's surface to the tip of the flag leaf. Internodes $cane^{-1}$ were counted at harvest, and internodes of randomly selected canes from each treatment were counted. After that, their average was taken. Millable canes (000 ha^{-1}) in each plot were counted at harvest and then converted into several billable canes per hectare. For cane yield (t ha^{-1}), the whole plot was manually harvested, leaves were removed, the cane was cut from the top, the cane per plot was weighed in kg by a spring balance, and then, the cane yield ha^{-1} was computed. For brix (%), cane juice samples were collected in a 500 ml beaker, and from the beaker, a drop of juice was taken with the help of a pipette and placed on the prism of the digital

Refractometer, where readings of the Brix% (Concentration of total soluble solids) were recorded. Commercial cane sugar (%) was calculated by the Australian commercial cane sugar (CCS) formula given by Meade and Chen (1977).

$$CCS\% = \frac{3P}{2}\frac{(1-F+5)}{100} - \frac{B}{2}\frac{(1-F+3)}{100}$$

where
*P = Pol. Percentage Reading
*B = Brix Percentage
*F = Fiber Percentage

Physico-chemical analysis of soil

Statistical analysis

The data were statistically analyzed following the ANOVA technique using the software Statistix version 8.1 (Statistix, 2006). The least significant difference (LSD) test was used at alpha 0.05 for comparing differences in treatments.

Meteorological data

The meteorological data of Tandojam during experimental seasons of both years (2016–2017 and 2017–2018) were obtained from the Meteorological Station, Tandojam. The details of the meteorological data are presented in Figures 1 and 2.

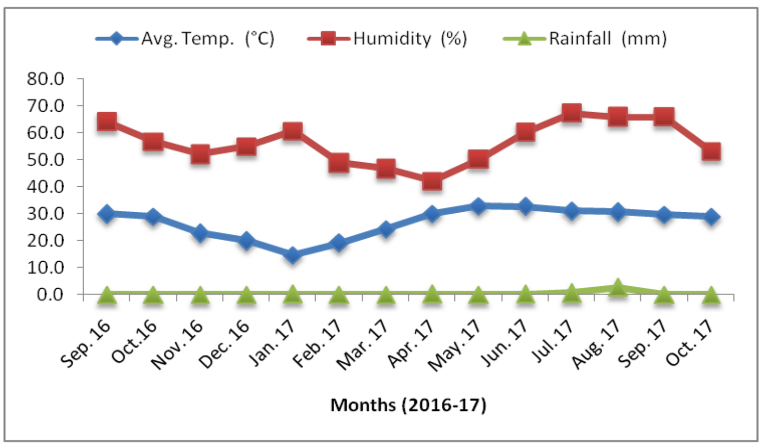

Figure 1. Weather data of experimental site of the Tandojam, Sindh, Pakistan during sugarcane growing season 2016–2017.

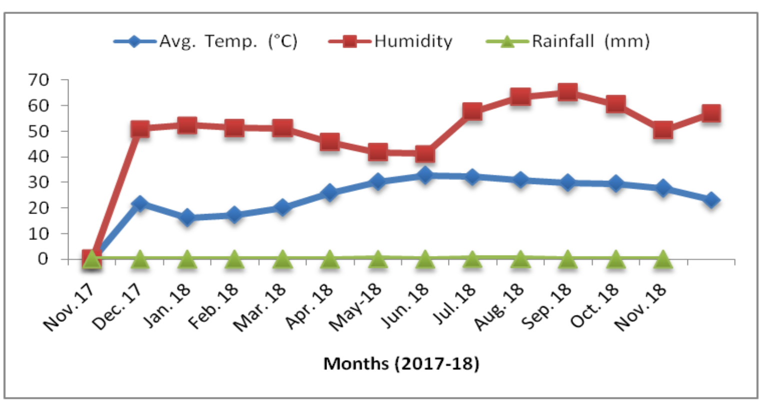

Figure 2. Weather data of experimental site of the Tandojam, Sindh, Pakistan during sugarcane growing season 2017–2018.

Table 2. Effect of sett spacing and bud placement position on bud sprouting and crop growth rate of sugarcane.

Spacings	Bud sprouting (%)			Crop growth rate (gm^{-2}day^{-1})		
	Bud placement position			Bud placement position		
	Buds up and down	Buds faced the ridge	Means	Buds up and down	Buds faced the ridge	Means
End to end	70.0	72.3	71.2 C	5.7	6.3	6.0 D
15 cm	73.7	76.7	75.2 BC	7.6	7.7	7.7 C
22 cm	79.7	81.0	80.3 AB	8.4	8.5	8.5 B
30 cm	81.7	90.0	85.8 A	9.6	9.8	9.7 A
Means	76.3	80.0	-	7.8	8.1	-
Variables	S.E.	P-value	$LSD_{0.05}$	S. E.	P-value	$LSD_{0.05}$
Spacing	3.9448	0.0127	8.4608	0.1892	0.0000	0.4058
Bud	2.7894	0.2002	-	0.1338	0.0740	-
S × B	5.5788	0.8143	-	0.2676	0.3976	-

RESULTS AND DISCUSSION

Bud sprouting

It was foreseen from the statistical analysis of data that a significant (P<0.05) effect was caused by sett spacing on bud sprouting (%), whereas non-significant (P>0.05) by bud placement position and their interaction (sett spacing × bud placement position) (Table 2). Thirty (30) cm sett spacing gave the highest bud sprouting (%), followed by 22 cm sett spacing having statistical equality with each other. In contrast, the lowest sprouting (%) was noticed in the end-to-end sett spacing. In the case of bud placement position, the bud's position faced to ridge resulted in the most excellent bud sprouting (%), followed by the up and down part of buds. The interaction of 30 cm sett spacing × buds faced to ridge produced enhanced bud sprouting (%), followed by 30 cm sett spacing × up and down bud placement position, whereas diminished results were recorded in the end to end spacing between setts × up and down bud placement position. These results align with Patel and Patel (2014), who reported that if the whole cane stalk is planted without being cut into setts, usually few buds at the top end sprout, and the lower end buds remain inactive due to ultimate dominance polarity (missing buds gaps). The effect of complete dominance is eliminated when the cane stalk is cut into pieces. Mahmood *et al*. (2005) also found that upward placement of three-budded setts of sugarcane gave the highest sprouting (58%), and good stand establishment leads to higher tonnage of the crop.

Crop growth rate

The crop growth rate (CGR) was affected significantly (P>0.05) by sett spacing. In contrast, bud placement position and their interaction (sett spacing × bud placement position) were non-significant (Table 2). The 30 cm sett spacing gave the highest CGR, followed by the 22 cm sett spacing having statistical equality with each other. In contrast, the lowest CGR was observed in the end-to-end sett spacing. Buds' position faced to ridge resulted in the highest CGR, followed by up and down part of buds. The interaction of 30 cm sett spacing × buds faced to ridge produced a better CGR compared with 30 cm sett spacing × up and down bud placement position. In contrast, the shortest CGR was recorded from the end to end spacing between setts × up and down bud placement position. The results showed a noticeable increase in the CGR in 30 cm sett spacing. The results are in agreement with Khan *et al*. (2007), who reported that maximum CGR, leaf area duration (LAD), and net assimilation rate (NAR) were observed in paired row strip planting pattern of 30/90 cm, followed by 75 cm and 60 cm spaced rows, while the minimum was noticed in 30/120 cm spaced paired row strip planting pattern.

Leaf area index

Leaf area index (LAI) responded significantly (P<0.05) to sett spacing, bud placement position, and their interaction (sett spacing × bud placement position) (Table 2). The 30 cm sett spacing gave a vibrant LAI, followed by 22

Table 3. Effect of sett spacing and bud placement position on leaf area index and cane length of sugarcane.

Spacings	Leaf area index			Cane length (cm)		
	Bud placement position			Bud placement position		
	Buds up and down	Buds faced the ridge	Means	Buds up and down	Buds faced the ridge	Means
End to end	5.4 f	6.8 e	6.1 D	196.7	203.3	200.0 C
15 cm	7.1 e	7.0 e	7.1 C	210.0	233.3	221.7 B
22 cm	8.1 d	8.7 c	8.4 B	260.0	266.7	263.3 A
30 cm	9.7 b	10.4 a	10.1 A	266.7	283.3	275.0 A
Means	7.6 B	8.2 A	-	233.3 B	246.7 A	-
Variables	S. E	P-value	$LSD_{0.05}$	S. E	P-value	$LSD_{0.05}$
Spacing	0.1371	0.0000	0.2940	7.8300	0.0000	16.794
Bud	0.0969	0.0000	0.2079	5.5367	0.0304	11.875
S × B	0.1939	0.0013	0.4158	11.073	0.6603	-

cm sett spacing having statistical impartiality with each other. In contrast, the lowest LAI was noticed in the end-to-end sett spacing. Among bud placement positions, the most remarkable LAI was recorded under buds position faced to a ridge as compared with the up and down buds placement position. The interaction of 30 cm sett spacing × buds faced to ridge produced superior leaf area, closely chased by 30 cm sett spacing × up and down bud placement position, whereas decreased results were recorded in end-to-end spacing between setts × up and down bud placement position. Similar results were found by Suggu *et al*. (2017), who studied that 120 cm row spaced planting significantly increased yield parameters like LAI, CGR, NAR, and cane yield; however, row spacing did not significantly influence the quality parameters like Pol%, Brix, and crystallizable cane sugar. The increased sugar yield was based on cane yield.

Cane length

Cane length was significantly ($P<0.05$) affected by sett spacing and bud placement position, but their interaction was found to be non-significant ($P>0.05$) (Table 2). The 30 cm sett spacing gave the highest cane length, followed by the 22 cm sett spacing having statistical equality with each other. In contrast, the lowest cane length was observed in end-to-end sett spacing. Bud's position faced to ridge resulted in the most significant cane length, followed by the up and down position of buds. The interaction of 30 cm sett spacing × buds faced to ridge improved cane length (cm), as well as, 30 cm sett spacing × up and down bud placement position. In contrast, reduced results were recorded in end-to-end spacing between setts × up and down bud placement position. Ehsanullah *et al*. (2011) also examined that 75,000 double budded setts ha^{-1} produced a maximum number of millable canes m^{-2} (7.65) and cane yield (92 t ha^{-1}) as compared with 60,000 and 90,000 double budded setts ha^{-1}, while 90 cm double row strip achieved higher cane length and yield. Chattha *et al*. (2007) also investigated that wider trenches and row spacing significantly increased germination percentage, tillers m^{-2}, plant height, millable canes m^{-2}, and cane yield t ha^{-1}, respectively.

Internodes per cane

Internodes $cane^{-1}$ responded significantly ($P<0.05$) to sett spacing and non-significantly ($P>0.05$) to bud placement position and their interaction (sett spacing × bud placement position) (Table 3). The 30 cm sett spacing gave dynamic internodes $cane^{-1}$, followed by 22 cm sett spacing. Invertly, the lowest internodes $cane^{-1}$ was noted under end-to-end sett spacing. In the case of bud placement position, buds position faced to ridge resulted in greatest internodes $cane^{-1}$, while the up and down position of buds came close at second. The interaction of 30 cm sett spacing × buds faced to ridge exposed improved internodes $cane^{-1}$ and likewise with 30 cm sett spacing × up and down bud placement position. At the same time, moderate results were recorded in end-to-end spacing between setts × up and down bud placement position. Results are in line with the findings of Bashir *et al*. (2000).

Table 4. Effect of sett spacing and bud placement position on internodes per cane and millable canes of sugarcane.

Spacings	Internodes $cane^{-1}$			Millable canes (000 ha^{-1})		
	Bud placement position			Bud placement position		
	Buds up and down	Buds faced the ridge	Means	Buds up and down	Buds faced the ridge	Means
End to end	22.7	23.3	23.0 B	105.0	105.0	105.0 B
15 cm	25.7	25.7	25.7 AB	113.0	114.0	113.5 AB
22 cm	26.0	26.0	26.0 AB	117.0	121.0	119.0 AB
30 cm	27.7	27.7	27.7 A	122.0	130.0	126.0 A
Mean	25.5	25.7	-	114.3	117.5	-
Variables	S. E	P-value	$LSD_{0.05}$	S. E	P-value	$LSD_{0.05}$
Spacing	1.5151	0.0539	3.2496	6.7876	0.0475	14.558
Bud	1.0714	0.8786	-	4.7996	0.5201	-
S × B	2.1427	0.9947	-	9.5991	0.9408	-

Millable canes

Millable canes responded significantly (*P* <0.05) to sett spacing and non-significantly (*P* >0.05) to bud placement position and their interaction (sett spacing × bud placement position) (Table 3). The 30 cm sett spacing gave the highest millable canes, followed by the 22 cm sett spacing having statistical consensus with each other. In contrast, the lowest millable canes were observed in end-to-end sett spacing, having no distance between the setts. Among bud placement positions, statistically, the greatest millable canes were recorded under buds faced to a ridge position, whereas buds placement positioned up and down registered most petite millable canes. The interaction of 30 cm sett spacing × buds faced to ridge confirmed superior millable canes, closely followed by 30 cm sett spacing × up and down bud placement position, whereas restrained results were recorded in end-to-end spacing between setts × up and down and buds faced to the ridge. These findings are in agreement with Pawar *et al*. (2005) who found that among four planting geometries, 90 cm row spacing had significantly increased millable canes (1,18,200 ha^{-1}), cane yield (91 t ha^{-1}), net returns (169 × 103 ha^{-1}), as compared with 150 cm row spacing. Suggu *et al*. (2010) and Arain *et al*. (2017) also investigated that planting patterns of 30/90 cm spaced paired row strips significantly affected millable canes, cane weight, and strip cane yield.

Cane yield

Cane yield was non-significant regarding sett spacing, bud placement position, and their interaction (sett spacing × bud placement position) (Table 4). The 30 cm sett spacing gave maximum cane yield, followed by 22 cm sett spacing having statistical impartiality with each other. In contrast, the lowest cane yield was noticed in the end-to-end sett spacing, where space was missing between the setts. The bud's position facing to ridge resulted in the most significant cane yield, followed by the up and down position of buds. The interaction of 30 cm sett spacing × buds faced to ridge improved cane yield, followed by 30 cm sett spacing × up and down bud placement position. In contrast, reduced results were recorded in end-to-end spacing between setts × up and down bud placement position. These results are in agreement with Raghu *et al*. (2006) who reported that 90 cm × 60 cm spacing in micropropagation significantly increased tillers' number, stalk length, internode length, and cane yield.

Brix

Analysis of variance indicated that a non-significant (*P*>0.05) effect was induced by sett spacing, bud placement position, and their interaction (sett spacing × bud placement position) (Table 5). The 30 cm sett spacing gave the most productive brix (%), followed by the 22 cm sett spacing having statistical parallelism with each other. In contrast, the lowest brix (%) was noticed in the end-to-end sett spacing. Buds position faced to ridge resulted in greatest brix (%) followed by the up and down position of buds. The interaction of 30 cm sett spacing × buds faced to ridge formed improved brix (%), where 30 cm sett spacing × up and down bud placement position

Table 5. Effect of sett spacing and bud placement position on cane yield of sugarcane.

Spacings	Cane yield (t ha^{-1})		
	Bud placement position		
	Buds up and down	Buds faced the ridge	Means
End to end	116.8	117.1	117.0
15 cm	120.7	122.3	121.5
22 cm	125.0	128.0	126.5
30 cm	129.0	130.0	129.5
Means	122.9	124.4	-
Variables	S. E	P-value	$LSD_{0.05}$
Spacing	6.5938	0.2727	-
Bud	4.6625	0.7684	-
S × B	9.3250	0.9968	-

Table 6. Effect of sett spacing and bud placement position on brix and commercial cane sugar of sugarcane.

Spacings	Brix (%)			CSS (%)		
	Bud placement position			Bud placement position		
	Buds up and down	Buds faced the ridge	Means	Buds up and down	Buds faced the ridge	Means
End to end	19.7	21.0	20.4	8.1	8.4	8.3 C
15 cm	20.2	20.7	20.5	9.2	9.7	9.5 B
22 cm	22.0	20.7	21.4	10.1	10.2	10.2 A
30 cm	22.5	22.7	22.6	10.2	10.5	10.4 A
Means	21.1	21.3	-	9.4 B	9.7 A	-
Variables	S. E	P-value	$LSD_{0.05}$	S. E	P-value	LSD (5%)
Spacing	0.8720	0.0730	-	0.1336	0.0000	0.2866
Bud	0.6166	0.7909	-	0.0945	0.0057	0.2027
S × B	1.2332	0.5063	-	0.1890	0.5379	-

come close. In contrast, reduced results were recorded in end-to-end spacing between setts × up and down bud placement position. These results agree with those of Shakoor-Ruk *et al*. (2014), who evaluated sett placement methods, i.e., 60, 75, and 90 cm apart row (set to set placement and alternate set placement) in two-row direction (north-south and east-west), significantly affected all agronomic parameters, while brix (%) and recovery (%) showed no significant effect.

Commercial cane sugar

The assessment of data showed that commercial cane sugar (%) was significantly ($P \leq 0.05$) affected by sett spacing and bud placement position, and non-significantly affected by their interaction (sett spacing × bud placement position) (Table 6). The 30 cm sett spacing gave the highest commercial cane sugar (%), followed by 22 cm sett spacing having statistical equality with each other. In contrast, the lowest commercial cane sugar (%) was noticed in end-to-end sett spacing. The bud's position faced to ridge resulted in the most incredible commercial cane sugar (%), followed by the up and down position of buds. The interaction of 30 cm sett spacing × buds faced to a ridge, created improved commercial cane sugar (%). Coming closewas 30 cm sett spacing × up and down bud placement position, whereas reduced results were recorded in end-to-end spacing between setts × up and down bud placement position. In line with our results, Soomro *et al*. (2009) also found different sett placement methods, i.e., overlapping, double setts, and row spacing, had a significant effect on millable canes, cane thickness, and several internodes plant^{-1}, cane weight, plant height, and CCS%. However, maximum cane yield and sugar content was obtained when sugarcane was planted at 1.25 m spaced rows with double sett placement.

CONCLUSIONS

The sugarcane's growth, yield, and quality characteristics were affected significantly by sett spacing, bud placement position, and their interaction. The 30 cm sett spacing produced better growth and quality parameters. Bud placement position faced to ridge resulted in enhanced leaf area index, cane length, and CCS %. Interaction of 30 cm sett spacing × buds faced to ridge established suitable set for improved yield and quality of sugarcane.

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