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Performance of new early genotypes of sugarcane (*Saccharum* spp. hybrid complex) as influenced by row spacing

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ABSTRACT

Field experiment was conducted during 2017-18 at Sugarcane Research Institute, Dr. Rajendra Prasad Central Agricultural University, Pusa, Samastipur, Bihar to study the effect of row spacing on yield and quality of early maturing sugarcane genotypes. Treatment included two row spacing (90 and 120 cm) and five genotypes *viz.,* 'CoLk 12207', 'CoP 12436', 'CoSe 12451', 'BO 130' and 'CoSe 95422'. Significantly higher plant population, leaf area index (4.18), drymatter accumulation (34.8 t/ ha) and millable canes (126, 200/ ha) were recorded with 90 cm row spacing gave significantly highest cane (96.2 t/ ha) and sugar yield (11.6 t/ ha). Results showed that genotype CoSe 95422 superseded other genotypes in growth and yield attributing characters. Maximum cane yield (104.4 t/ ha) was noticed due to the genotypes CoSe 95422. However, maximum brix (20.3%), pol (18.13%) and CCS percent (12.60%) were noted with the genotype CoLk 12207 which was statistically similar to BO 130. Significantly higher sugar yield (12.4 t/ha) was obtained with the genotype CoSe 95422 which was statistically comparable to CoLk 12207 and CoSe 12451.

Key words : *Growth, Row spacing, Sugarcane genotypes, Quality, Yield*

Introduction

Sugarcane is an important cash crop of India, which is cultivated in an area of about 4.02 million ha with an average cane yield of 71.1 t/ ha. The average productivity of sugarcane in Bihar has been around 61 t/ ha (ISMA, 2020). The main thrusts of sugar industry in India include improved crop production technologies as means of enhancing the sugar recovery through improved varieties and agronomic practices. Millable canes and single cane weight are the two important components of cane yield in sugarcane. The differences in these attributes among sugarcane genotypes is due to variation in genetic

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makeup and responses of particular genotype to different row spacing in which they were planted. Yield potential of varieties may vary under different set of agro climate and management practices. Varieties with high tillering capacity respond more to wider row spacing compared to low tillering varieties. Selection of genotypes for different maturity group is of great importance in achieving higher productivity and sugar recovery from sugarcane. The proper selection of genotype with its appropriate row arrangements in the field at the time of planting coupled with optimum plant population and agronomic management practices play an important role in sugarcane production. Ignorance in any one of the components in production system lead to sub-optimal productivity which in turn adversely affects the cane growers, sugarcane millers and economy of the nation as a whole. Wider row spacing has gained a lot of popularity recently because it helps mechanize a number of field operations, resulting in a low cost of production. The number of millable canes, however, may become a productivity-limiting factor as spacing increases (Kumar, 2020). The sugarcane productivity and sugar recovery of Bihar are low as compared to many Indian states due to lack of adequate number of high yielding and high sugared early maturing varieties and poor adoption of improved technologies. Keeping in view the importance of varietal need and its appropriate row arrangements in sugarcane production system, the present investigation was undertaken to compare the performance of different early maturing sugarcane genotypes to different row spacing on yield and quality of sugarcane.

Materials and Methods

The experiment was carried out at the field of Sugarcane Research Institute, Dr. Rajendra Prasad Central Agricultural University, Pusa, Bihar during the spring season of 2017 – 18. The soil was sandy loam in texture with low in organic carbon (0.47%), N (226 kg N/ ha), P (9.6 kg/ha) and available K (100.4 kg/ ha) content with pH 8.3. Ten treatments, comprising the combinations of 2 row spacing (90 and 120 cm) and 5 sugarcane genotypes ('CoLk 12207', 'CoP 12436', 'CoSe 12451', 'BO 130' and 'CoSe 95422') of early maturing group were laid out in factorial randomized block design with 3 replications. The recommended dose of fertilizer for the zone was 150 kg N, 37.1 kg P and 49.8 kg K/ha. Full dose of P and K and half of total N were applied as basal and remaining N in 2 splits, after completion of germination (45 DAP) and at maximum tillering stage (120 DAP). Other inputs and operation were adopted as per recommended packages and practice for raising the healthy crop. Crop was planted in first week of March and harvested in third week of December. The planting was done in furrow using three budded setts. The rainfall received during the crop season was 1016.2 mm in 59 rainy days. Whole cane samples were taken at the time of harvesting and cane juice was extracted with power crusher and juice quality was estimated as per method given by Spencer and Meade (1955). Sugar yield (Commercial cane sugar) was calculated as; sugar yield (t/ha) = [S – 0.4 (B - S) x 0.73] x cane yield (t/ha)/100; where, S and B are sucrose and brix per cent in cane juice respectively.

Results and Discussion

Growth and yield attributes

Germination counts were recorded at 30 and 45 days after planting of sugarcane. Row spacing had non-significant effect on germination and plant height of sugarcane (Table 1). Tiller population at 90 DAP (1, 69800/ ha) and 120 DAP (183, 600/ ha) was significantly higher at 90 cm row spacing over 120 cm row spacing due to optimum row spacing for growth of sugarcane crop at 90 cm under sub-tropical conditions. Higher tiller population at 90 cm row spacing over 120 cm row spacing under subtropical conditions has also been reported by Kumar (2020) and Chakrawal and Kumar (2013). The effect of row spacing was found more pronounced on leaf area index, drymatter accumulation and millable canes (Table 1). Planting of sugarcane at 90 cm row spacing recorded significantly higher LAI (4.18), drymatter accumulation (34.8 t/ ha) and millable canes (2, 62, 200/ ha) than planting sugarcane at 120 cm row spacing. These results also have conformity with results of Kumar (2020) and Chakrawal and Kumar (2014a).

Genotypes differed significantly for observation recorded on germination, tillers, LAI, drymatter accumulation and millable canes. Significantly higher germination per cent was recorded with the genotype CoSe 95422 (25.2 and 39.2%) at 30 and 45 DAP, respectively which was statistically comparable to BO 130 and CoP 12436 at 30 DAP and CoP 12436,

CoSe 12451, CoLk 12207 and BO 130 at 45 DAP. Results obtained in the present investigation are in accordance with those of Kumar *et al.* (2014) and Kumar *et al.* (2015). At 90 and 120 DAP, genotype CoSe 95422 (178500 and 1, 95100/ ha) recorded higher tillers count which was followed by CoSe 12451 (1, 65700 and 1, 79800/ ha) and CoLk 12207 (1, 57200 and 1, 69800/ ha) at 90 and 120 DAP, respectively (Table 1). The genotype CoSe 95422 noticed maximum LAI (4.21) which was significantly superior over CoP 12436 and at par with rest of the genotypes. Genotypes could not influence the plant height of sugarcane to any appreciable extent. Though comparatively higher plant height of 308.1 cm was obtained with CoSe 95422 and lowest (173.6 cm) with BO 130. Sugarcane genotype CoSe 95422 and CoSe 12451 being at par with each other produced higher drymatter accumulation (37.1 and 34.1 t/ ha) than rest of the genotypes.

Yield attributes and cane yield

Millable canes are the basis for optimizing cane yield at harvest. Planting of sugarcane at 90 cm row spacing recorded significantly higher millable canes (1, 26200/ ha), which was significantly higher over 120 cm row spacing (Table 1). The findings are in corroboration with the results of Tayade *et al.* (2017), Kumar (2020) and Chakrawal and Kumar (2014a). Yield is one of the most important considerations for sugarcane growers. Row spacing had significant impact on cane yield (Table 2). Sugarcane planted at 90 cm row spacing yielded 12.5% higher than that of planted at 120 cm row spacing. Millable canes was observed significantly higher (1, 34000/ ha) by the

Table 1. Growth and yield attributes of early maturing sugarcane genotypes as influenced by row spacing

Treatment	Germination (%)		Tillers (10^3/ha)		LAI at 210 DAP	Plant height at 240 DAP	Dry matter accumulation (t/ ha)	Millable canes (10^3/ha)
	30 DAP	45 DAP	90 DAP	120 DAP				
Row spacing (cm)								
90 cm	21.9	35.5	169.8	183.6	4.18	292.9	34.8	126.2
120 cm	23.3	36.3	137.2	150.9	3.72	281.1	30.6	111.1
SEm±	0.53	1.01	3.67	4.78	0.085	6.35	0.74	3.15
CD (P=0.05)	NS	NS	10.9	13.3	0.25	NS	2.2	9.4
Genotypes								
CoLk 12207	19.8	34.8	157.2	169.8	4.01	275.7	33.4	117.0
CoP 12436	22.9	38.3	145.9	159.1	3.28	275.9	30.7	113.5
CoSe 12451	21.6	35.6	165.7	179.8	4.16	301.7	34.1	128.0
BO 130 (std.)	23.5	31.7	120.2	132.5	4.09	273.6	28.2	100.7
CoSe 95422 (std.)	25.2	39.2	178.5	195.1	4.21	308.1	37.1	134.0
SEm±	0.84	1.59	5.81	7.08	0.135	10.03	1.16	4.98
CD (P=0.05)	2.5	4.7	17.2	29.7	0.40	NS	3.5	14.8

Table 2. Yield and quality of early maturing sugarcane genotypes as influenced by row spacing

Treatment	Cane yield (t/ha)	Brix (%)	Pol (%)	Purity (%)	CCS (%)	Sugar yield (t/ ha)
Row spacing (cm)						
90 cm	96.2	19.6	17.39	88.7	12.05	11.6
120 cm	85.5	19.8	17.64	89.1	12.24	10.5
SEm±	2.10	0.12	0.095	0.67	0.128	0.25
CD (P=0.05)	6.2	NS	NS	NS	NS	0.7
Genotypes						
CoLk 12207	91.8	20.3	18.13	89.3	12.60	11.6
CoP 12436	85.9	19.1	16.93	88.6	11.72	10.1
CoSe 12451	94.0	19.5	17.36	89.0	12.05	11.3
BO 130 (std.)	78.2	20.2	17.97	89.0	12.46	9.7
CoSe 95422 (std.)	104.4	19.4	17.19	88.6	11.90	12.4
SEm±	3.31	0.19	0.151	1.06	0.203	0.40
CD (P=0.05)	9.8	0.6	0.45	NS	0.60	1.2

genotype CoSe 95422 which was almost equal to CoSe 12451 (1, 28000/ ha) and significantly higher over rest of the genotypes. The higher millable canes of the genotype CoSe 95422 and CoSe 12451 were due to higher tiller population. Kumar *et al.* (2014) also reported significant variation in millable canes due to varieties. Cane yield also varied significantly with different varieties (Table 2). The genotype CoSe 95422 exhibited significantly higher cane yield (104.4 t/ha) and it was registered 11.1, 13.7, 21.5 and 33.1% higher cane yield over CoSe 12451, CoLk 12207, CoP 12436 and BO 130, respectively. Higher tiller population followed by higher number of millable canes is responsible for higher yield of the genotype CoSe 95422. Kumar *et al.* (2012) and Kumar (2018) also reported similar yield variation.

Quality and sugar yield

The quality parameter of sugarcane *viz*., brix, pol, purity and CCS percent did not undergo significant changes due to different row spacing (Table 2). Though comparatively higher values of brix (19.8%), pol (17.64%), purity (89.1%) and CCS percent (12.24%) were obtained with 120 cm row spacing. These results confirm the findings of Chakrawal and Kumar (2014) and Kumar (2020) who reported non-significant differences in juice quality due to different row spacing. Row spacing had significant impact on sugar yield. Sugarcane planted at 90 cm row spacing yielded 10.5% higher than that of planted at 120 cm row spacing. Since the CCS percent was not affected by row spacing, the significant impact on sugar yield was mainly due to cane yield on which the effect of row spacing was significant. Chakrawal and Kumar (2014) and Kumar (2020) obtained higher tonnage of sugar at closer spacing. Genotypes differ significantly among themselves for all the quality parameters except purity percent juice (Table 2). Significantly higher value of brix (20.3%), pol (18.13%) and CCS percent (12.60%) were recorded with CoLk 12207 which was statistically comparable to BO 130. However, minimum values of above parameters were noticed with CoP 12436. Genotype CoSe 95422 recorded the highest sugar yield (12.4 t/ ha), which was at par with CoLk 12207 (11.6 t/ ha) and CoSe 12451 (11.3 t/ ha), but significantly higher over CoP 12436 (10.1 t/ ha) and BO 130 (9.7 t/ ha).

Conclusion

From the results of present observations, it may be concluded that higher millable canes, cane and sugar yield was obtained with the genotype CoSe 95422 which was followed by CoSe 12451 and CoLk 12207 are suitable for cultivation under spring season at 90 cm row spacing in subtropical Indian conditions.

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