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EVALUATION OF SUGARCANE GENOTYPES FOR ASSOCIATION OF QUALITY CHARACTERS WITH CANE YIELD

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Abstract

The present investigation was carried out to study the association of quality traits with cane yield to establish an appropriate selection strategy based on quality characters. Ten sugarcane genotypes comprising three check cultivars were assessed during 2009-10 using RBD design with three replications. Data were collected on germination %,, number of shoots at 120 DAP and number of shoots at 240 DAP, number of millable canes, single cane weight, cane diameter, cane height, sucrose % , brix % and purity %, CCS % at10 and 12 months stage, , CCS (t/ha) and cane yield (t ha-1). Analysis of variance exhibited highly significant differences between crops for all parameters except brix (%). Among the genotypes highly significant differences were observed for all the yield and quality traits. Genotypes, CoSe05452 (69.43 t/ha), CoP05437 (66.89 t/ha) and Co05018 (65.87 t/ha) showed superiority for cane yield. Correlation analysis revealed that cane yield per plant exhibited highly significant positive association with number of millable canes and commercial cane sugar (t/ha) while, it showed significant positive association with germination at 45 DAP and number of shoots at 240 DAP. These traits should be taken in consideration while formulating selection program for evolving improved sugarcane genotypes. It is suggested that the quality parameters should be taken in to consideration in clonal selection program for evolving improved sugarcane genotypes. Moreover, the genotypes with high cane yield and sugar recovery should be evaluated further.

Key words : Sugarcane, Commercial Cane Sugar (CCS) and Correlation.

Sugarcane (*Saccharum spp*. complex) is world's largest crop with respect to total production and one of the important cash crop of India. India is the second largest producer of sugarcane in the world after Brazil. Across the world, 70 per cent sugar is manufactured from sugarcane and it is a major source of raw material for sugar industries and other allied group of by product industries. It is grown in 5.34 million hectare with total production of 345.6 million tones and productivity of 64.7 tonnes/ha. Cane yield and sugar recovery are two important characters. Cane yield is influenced by several quality characters. To increase cane and sugar yield through selection for yield attributing and quality characters, the knowledge of association of various characters is important. Therefore, the study of relationship of different characters with cane yield is essential, so that an appropriate and efficient selection strategy could be adopted for improvement. In Practice we need high yielding and high-quality varieties of sugarcane. Therefore, the knowledge about the associations that occur among the different quality traits and cane yield is important. Complex characters can be studied better by knowing the direct and indirect selection of interrelated components through path analysis. Suitable genotypes for a locality can be identified when selection criteria based on the characters having important contribution for the desired characters are made. Inter association of different yield and quality traits of sugarcane, their effect on cane yield and appropriate selection strategy based on quality traits were worked in the study. Similarly, the genotypes with high cane yield and quality traits were studied and selected for further investigation.

MATERIALS AND METHOD

The experiment was conducted at Sugarcane Research Institute, Pusa, Samastipur, Bihar, during 2009-10 cropping season in Randomized Block Design (RBD) with three replications. The experimental material for present investigation comprised of 10 diverse genotypes of sugarcane. The three budded setts of each genotype were planted in 6?m × 5.4?m size plot with row to row distance of 0.9?m. Setts were placed in the furrow following end to end method with a seed rate of 12 buds/eyes per meter. Data were recorded for eight yield and quality traits viz., germination%,, number of shoots at 120 DAP and number of shoots at 240 DAP, number of millable canes, single cane weight, cane diameter, cane height, sucrose %, brix % and purity v%, CCS % at10 and 12

months stage, CCS (t/ha) and cane yield (t/ha).. To test the significance of differences between treatments, analysis of variance was done as suggested Gomez and Gomez (1984). Correlation analysis was estimated as per Singh and Chaudhary (1979). Intercultural operations like weeding, earthen-up, mulching, and irrigation were done as per required schedule.

RESULTS AND DISCUSSION

The analysis of variance revealed highly significant differences among the genotypes for all yield and quality traits which indicated that considerable amount of variability were present in the genotypes included in the study. Hence, there is an ample scope for inclusion of promising genotypes in breeding programme for yield and its component characters.

On the basis of mean performance of the genotypes viz CoSe 05452, CoP 05437, Co 05018 and CoP 9301 were identified as the superior genotypes for yield and quality traits. The highest cane yield was given by the genotype CoSe 05452 (69.43 t/ha), followed by CoP 05437 (66.89 t/ha) and Co 05018 (65.87 t/ha) while, highest commercial cane sugar (t/ha) was recorded by CoP 9301 (8.18 t/ha) followed by Co 05020 (8.01 t/ha) and Co 05018 (7.95 t/ha).The highest number of millable canes was recorded by CoP 05437 (117.4) followed by CoP 9301 (114.1) and CoSe 05452 (113.8) whereas, highest single cane weight was exhibited by CoSe 05452 (0.65) followed by Co 05018 (0.62) and Co 05021 (0.60). The highest sucrose % at 10 months was given by the genotype CoP 9301 (17.98%) followed by CoSe 92423 (16.67%) and CoP 05437 (16.50%) while, the genotype CoP 9301 (18.39%), CoP 05437 (17.79%) and Co 05018 and Co 05020 (17.72%) recorded high sucrose % at 12 months stage The cane yield is the result of commercial cane sugar, number of millable canes, cane diameter, germination % at 45 DAP, number of shoots at 120 and 240 DAP, sucrose % and brix %. The highest brix % (20.20%) at 10 months stage was given by genotype CoP 9301 followed by CoP 05437 (18.93%) and CoBln0 5502 (18.87%0, while the genotype CoP 05437 (21.33%) recoeded highest brix % at 12 months followed by CoP 9301 (21.20%) and Co 05018 (20.73%). The highest CCS % (12.48%) at 10 months stage was given by CoP 9301 followed by CoSe 92423 (11.60 %) and CoP 05437 (11.57%) while, the genotype Co 05019 (12.78%), CoP 9301 (12.61) and Co 05020 (12.29) found to have high CCS % at 12 months stage.

According to Singh et al. 2003, it is very difficult to

Table-1 : Mean performance of genotypes different growth, yield and quality characters in sugarcane.

S.N.	Genotypes	Germination at 45 DAP	No. of shoots 120 DAP	No. of Shoots at 240 days	No. of millable canes	Single cane yield (kg)	Cane Diameter (cm)	Cane Height (m)	Brix% at 10 month	Sucrose % 10 month	Purity % at 10 month	Brix% at 12 month	Sucrose % at 12 month	Purity % at 12 months	CCS t/ha	CCS% at 10 month	Cane Yield (t/ha)
1.	Co05018	30.69	118.9	138.7	106.3	0.62	2.05	2.62	18.53	16.27	87.8	20.73	17.72	87.1	7.95	11.22	65.87
2.	Co05019	31.82	118.7	136.4	103.7	0.52	2.01	2.43	18.73	16.35	87.17	19.57	17.11	87.53	7.19	11.23	60.84
3.	Co05020	35.71	126.7	142.3	112.3	0.58	2.02	2.81	18.67	16.32	87.4	19.93	17.72	88.87	8.01	11.23	65.13
4.	Co05021	26.23	124.4	119.3	92.3	0.6	1.94	2.65	18.63	16.29	87.4	20.6	17.5	85.33	6.57	11.2	55.36
5.	CoP05437	36.2	144	168.9	117.4	0.57	2.11	2.43	18.93	16.5	88	21.33	17.79	83.4	8	11.51	66.89
6.	CoSe05452	34.61	134.7	155.8	113.8	0.65	2.22	2.58	18.2	16.2	88.9	19.27	16.71	85.6	7.85	11.24	69.43
7.	CoBln05502	27.83	135.4	161.2	109.6	0.57	2.2	3.25	18.87	15.6	86.6	18.13	15.96	87.4	6.85	10.73	62.51
8.	BO91	34.91	134.6	154	113.2	0.56	2.13	2.92	18.53	16.09	86.77	19.27	16.77	86.8	7.31	11.03	63.37
9.	CoP9301	32.54	137.2	156.2	114.1	0.57	2.2	2.68	20.2	17.98	89	21.2	18.39	86.77	8.19	12.48	65
10.	CoSe92423	31.96	136.1	149.6	107.3	0.56	2.14	2.58	18.6	16.67	89.63	19.7	17.07	86.67	7.21	11.6	60.07
	CD	4.04	26.8	21.7	15.6	0.03	0.16	3.39	0.95	0.8	2.04	1.14	1.16	2.93	0.77	0.57	8.6
	CV	7.3	11.9	8.5	8.3	3.71	4.46	7.34	2.96	2.82	1.36	3.33	3.91	1.97	5.96	2.92	7.9

Note : CCS – Commercial Cane Sugar.

Table-2 : Correlation coefficients between pairs of different yield and quality characters in sugarcane.

Characters	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10	X11	X12	X13	X14	X15	X16
X2	0.396NS															
X3	0.544NS	0.834**														
X4	0.809**	0.663*	0.896**													
X5	-0.035NS	-0.011NS	-0.060NS	0.009NS												
X6	0.279NS	0.709*	0.830**	0.708*	0.168NS											
X7	-0.305NS	0.143NS	0.199NS	0.085NS	-0.013NS	0.313NS										
X8	-0.028NS	0.303NS	0.253NS	0.234NS	-0.339NS	0.260NS	0.039NS									
X9	0.198NS	0.222NS	0.086NS	0.199NS	-0.133NS	0.175NS	-0.407NS	0.809**								
X10	0.234NS	0.346NS	0.187NS	0.208NS	0.272NS	0.383NS	-0.520NS	0.215NS	0.637*							
X11	0.184NS	0.033NS	-0.126NS	0.003NS	0.093NS	-0.312NS	-0.647*	0.449NS	0.671*	0.378NS						
X12	0.247NS	-0.074NS	-0.183NS	0.047NS	0.017NS	-0.315NS	-0.557NS	0.553NS	0.776**	0.377NS	0.936**					
X13	-0.083NS	-0.520NS	-0.278NS	-0.075NS	-0.238NS	-0.105NS	0.448NS	0.017NS	-0.082NS	-0.261NS	-0.448NS	-0.137NS				
X14	0.735*	0.221NS	0.441NS	0.728*	0.259NS	0.310NS	-0.326NS	0.326NS	0.514NS	0.415NS	0.509NS	0.604NS	-0.017NS			
X15	0.236NS	0.303NS	0.161NS	0.251NS	-0.094NS	0.231NS	-0.445NS	0.783**	0.991**	0.707*	0.684*	0.763*	-0.164NS	0.545NS		
X16	0.172NS	-0.425NS	-0.351NS	-0.108NS	-0.411NS	-0.473NS	-0.574NS	0.480NS	0.623NS	0.110NS	0.613NS	0.764*	0.211NS	0.376NS	0.569NS	
X17	0.714*	0.343NS	0.666*	0.845**	0.418NS	0.577NS	-0.080NS	0.018NS	0.092NS	0.230NS	0.079NS	0.101NS	-0.091NS	0.835**	0.145NS	-0.080NS

* & ** indicates significant at 5% and 1%, significantly.

Note – Details of the characters

X1	-	Germination 45DAP	X2	-	No. of shoots 120 DAP	X3	-	No. of Shoots 240 DAP	X4	-	No. of millable canes
X5	-	Single cane yield	X6	-	Cane Diameter	X7	-	Cane Height	X8	-	Brix% 10 month
X9	-	Sucrose% 10 month	X10	-	Purity % 10 month	X11	-	Brix% 12 month	X12	-	Sucrose% 12 month
X13	-	Purity % 12 month	X14	-	Commercial Cane Sugar	X15	-	Commercial Cane Sugar 10 month	X16	-	Commercial Cane Sugar 12 month
X17	-	Cane Yield									

achieve high cane yields and sugar recovery, in the same genotype. Most of the genotypes in the study performed better and the genotypes with high cane yield as well as quality traits are selected for further testing (Table-1).

Character Association

The study of inter-relationship among various characters in the form of correlation is one of the important aspects in selection programme for the breeder to make an effective selection based on the correlated and uncorrelated response. The table -2 represents the correlation coefficient between the characters .with grain yield per plant at the phenotypic levels. Correlation analysis revealed that cane yield per plant had exhibited highly significant positive association with number of millable canes and commercial cane sugar (t/ha) while, it showed significant positive association with germination at 45 DAP and number of shoots at 240 DAP. Germination at 45 DAP showed highly significant and positive correlation with number of millable canes and significant and positive association with commercial cane sugar (t/ha) and cane yield (t/ha) while it showed non-significant association with rest of the characters whereas, number of shoots at 120 DAP exhibited highly significant and positive correlation with number of shoots at 240 DAP and significant and positive association with number of millable canes and cane diameter. Number of shoots at 240 DAP showed significant and positive association with number of millable canes, cane diameter and cane yield while, number of millable canes exhibited significant and positive association with cane diameter, CCS% and cane yield. Cane height showed significant and positive association with brix% at 12 months whereas, cane diameter showed significant and positive association with sucrose % at 10 months and CCS% at 10 months. Sucrose % at 10 months exhibited highly significant and positive

association with sucrose % at 10 months, CCS% at 10 months, purity % at 10 months and brix % at 12 months, while, sucrose % at 12 months showed significant and positive association with CCS % at 10 months and CCS % at 12 months. CCS (t/ha) showed highly significant positive association with cane yield. However, purity % at 10 months exhibited positive and significant correlation with CCS % at 10 months. Brix % at 12 months showed significant and positive association with sucrose % at 12 months and CCS% at 10 months.

Most of the correlation of the yield attributing characters is seen to be positive or significant in association with each other. In our findings number of millable canes, commercial cane sugar, germination at 45 DAP and number of shoots at 240 DAP is found positive and significant with cane yield as compared with other yield and quality traits, which will help in development of better performing sugarcane variety in the materials tested. These findings are in accordance with the results of Verma et al. (1998), Singh et al. (2003), Chaudhary and Joshi (2005).

For plant breeders, yield in crops is one of the most important and complex traits. Continued improvement of yield remains the top priority in most breeding programs (Cox et al., 1996). CCS% and cane yield in sugarcane depends on various growth and component traits, which is the final outcome of a combination of different yield components, such as cane diameter, stalk number per stool, stalk weight and pol % (Olaoye, 1995).

CONCLUSION

The study showed that the genotypes i.e., CoSe 05452, CoP O5437, Co 05018 and CoP 9301 performed better for yield and quality traits and can be selected for further study. Most of the correlation of the yield attributing characters viz., number of millable canes, commercial cane sugar, germination at 45 DAP and number of shoots at 240 DAP is seen to be positive or significant in association with each other. These traits should be taken in consideration while formulating selection programme for evolving improved sugarcane genotypes. It is suggested that the quality parameters should be taken in to consideration in clonal selection programme for evolving improved sugarcane genotypes. Moreover, the genotypes with high cane yield and sugar recovery should be evaluated further.

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