CORRELATION AND HERITABILITY STUDIES IN SUGARCANE

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ABSTRACT

Correlation and heritability study using 15 early maturing genotypes of sugarcane was carried out at Regional Sugarcane Research Station, Navsari Agricultural University, Navsari (Gujarat) during 2009-10. The experiment was laid out in randomized block design replicated thrice. The genotypic and phenotypic coefficient of variations were higher for Commercial Cane Sugar (CCS) (t/ha), cane yield (t/ha), number of millable canes / plot and single cane weight (kg). Also these characters showed high heritability coupled with high genetic advance. The genotypic correlation of number of millable canes/plot, single cane weight and CCS (t/ha) with cane yield was positive and highly significant. Therefore, due importance should be given to these characters while selecting early maturing sugarcane varieties for simultaneous improvement in cane yield.

KEY WORDS: Correlation, heritability, sugarcane

INTRODUCTION

Economic characters, mostly polygenically controlled and having complex type of inheritance are often influenced by the environment. Anshuman *et al.* (2002) stated that genetic variability and heritability are useful parameters that can help the breeding during different stages of crop improvement. The success of such program will depend upon largely on the extents of genetic variability available in the base population and heritability of the characters under improvement. Therefore, a clear understanding of genetic parameters is of paramount importance to develop a breeding strategy. Burton (1952) reported the study of genetic coefficient of variation along with heritability estimate as necessary to obtain the true picture of the heritable variations in the population handled. Furthermore, the most important function of heritability in genetic studies of quantitative traits is its prediction value that could be used as a guide to the breeding value, also estimation of heritability along with genetic advance expected by selection for yield and its contributing characters, seem to help designing an effective breeding programme and selecting superior clones for the on-going sugarcane industry. Keeping in view, this experiment was taken up to study the genetic variability and correlation coefficient among different traits in a set of 15 early maturing sugarcane varieties to understand the interrelationship among the traits and also to foresee the consequences of selection based on various components.

MATERIALS AND METHODS

A field experiment comprising 15 early maturing genotypes (12 diverse sugarcane genotypes *viz.*, Co 06001, Co

06002, Co 06010, Co 06021, Co 06022, Co 06023, Co 06024, Co 06082, CoSnk 06101, MS 06081, PI 06131, PI 06132 and three standards checks, Co 85004, Co 94008 and CoC 671 received under All India Co-ordinated Research Project on Sugarcane was laid out in a randomized block design replicated thrice at Regional Sugarcane Research Station, Navsari Agricultural University, Navsari (Gujarat) during 2009-10. The plot size was 6 rows of 6 meter length spaced at 90 cm between the rows. Two budded setts were used for planting @ 12 buds per meter length. The crop was grown with all the cultural practices and the entire recommended mannurial schedule followed. Ten canes were randomly selected from each plot for recording the observations on brix (%) at 300 days, Sucrose (%) at 300 days, Commercial Cane Sugar (%) at 300 days, pol (%) cane and single cane weight, while number of millable canes, cane yield and Commercial Cane Sugar (t/ha) were recorded per plot basis. All the genetic parameters i.e. phenotypic and genotypic coefficient of variation, heritability, genetic advance as per cent of mean and correlation coefficient were computed using the online OPSTAT software programme.

RESULTS AND DISCUSSION

The present study showed wide range of variation for the characters cane yield (89.63-132.22 t/ha), number of millable canes (88.52 - 122.41) and single cane weight (0.88-1.19 kg), while moderate range was observed for CCS (t/ha). The quality characters showed limited range of variation. Wide range of variations for number of millable canes was reported earlier by Ghosh and Singh (1996).

Among the variability parameters studied were genotypic coefficient of variance and phenotypic coefficient of variance, the first parameter indicated the magnitude of variations that exclusively due to the gene action, where as the latter indicated the total variations generated and was attributed to environmental component along with the genotypic variations. Higher values of genotypic and phenotypic coefficient of variation (GCV and PCV) were observed for commercial cane sugar (t/ha) and cane yield. The character number of millable canes and single cane weight showed moderate values of GCV and PCV, whereas all the quality characters registered low to very low values of GCV and PCV (Table 1). The closeness among GCV and PCV suggested that a major portion of total variation was due to genetic cause and so selection based on phenotypic performance would be effective for improvement in these traits. Similar results based on GCV and PCV had also been reported earlier by Ghosh and Singh (1996), Singh *et al*. (1996), Kumar and Singh (1999) and Kamat and Singh (2001).

The heritability estimates in broad sense (Table 1) were high for cane yield (t/ha), number of millable canes, CCS (t/ha) and single cane weight (kg), while rest of the characters showed moderate to low values of heritability. The genetic advance expressed as per cent of population mean was highest for cane yield (t/ha) followed by CCS (t/ha), number of millable canes and single cane weight (kg). Other characters showed moderate to low genetic advance. Similar results were earlier reported by Singh *et al*. (1996), Ghosh and Singh (1996) and Kamat and Singh (2001). On the basis of above discussion, it can be accomplished that direct selection based on CCS (t/ha) and cane yield having high estimates of GCV and PCV would be fruitful. High heritability coupled with high genetic advance reported in characters cane yield, number of millable canes, CCS (t/ha) and single cane weight, hence these characters may be utilized in future breeding programme for developing high yield varieties of sugarcane.

The genotypic and phenotypic

correlation coefficients among different characters in sugarcane are illustrated in Table 2. The results on correlation analysis indicated that genotypic and phenotypic correlations were found significantly correlated and the genotypic correlations were higher than the phenotypic correlations, in general. The cane yield was highly significant and positively correlated with number of millable canes followed by single cane weight and CCS (t/ha) at genotypic and phenotypic level. The CCS (t/ha) was positively and highly significantly correlated with number of millable canes and single cane weight at both genotypic and phenotypic level, while it was highly significantly and positively correlated with Pol (%) cane at phenotypic level. Pol (%) cane was significantly and positively correlated with Brix at 300 days, sucrose %, CCS % at both genotypic and phenotypic level and single cane weight at genotypic level. Single cane weight was highly significant and positively correlated with number of millable canes at genotypic correlation. CCS % was highly significant positive correlated with Brix at 300 days and sucrose % juice, whereas sucrose % juice was highly significantly correlated with Brix at 300 days at both genotypic as well as phenotypic level. It was observed from the results that Brix at 300 days, sucrose % juice and CCS % were negatively correlated with number of millable canes, whereas cane yield was negatively correlated with Brix at 300 days, sucrose % juice, CCS % and Pol % cane at genotypic level. Similar results were reported by Kundu and Gupta (1997), Sreekumar *et al.* (1994) and Murthy (2007).

CONCLUSION

From this study, it is evident that the high heritability coupled with high genetic advance reported in characters cane yield, number of millable canes, CCS (t/ha) and single cane weight. Hence, these characters may be utilized in future breeding programme. Also characters, number of millable canes followed by single cane weight and CCS (t/ha) were highly significant and positively correlated with cane yield at genotypic and phenotypic level and hence, these characters can be used as selection criteria for developing high yield varieties of sugarcane.

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Table 1: Range, mean, variability, heritability and genetic advance as per cent of mean for different characters in sugarcane

Characters	Range	Mean	Coefficient of Variation		Heritability (%)	Genetic Advance as Per Cent of Mean
			GCV	PCV		
Brix at 300 days	17.30-20.30	18.55	3.51	5.53	40.33	4.59
Sucrose (%)Juice at 300 Days	14.81-17.76	16.10	4.19	6.20	45.72	5.84
CCS (%) at 300 Days	10.12-12.26	11.08	4.50	6.57	46.95	6.36
Number of Millable Canes/Plot	88.52-122.41	108.56	8.79	10.41	71.39	15.31
Single Cane Weight (kg)	0.88-1.19	1.05	7.68	9.97	59.47	12.21
Pol (%) Cane	13.21-15.39	14.64	3.54	4.94	51.40	5.23
CCS (t/ha)	12.31-18.46	15.41	10.90	13.55	64.72	18.07
Cane Yield (t/ha)	89.63-132.22	114.48	10.57	12.12	76.05	18.98

Table 2: Genotypic and phenotypic correlations for different characters in sugarcane

Characters		Brix at 300 Days	Sucrose (%) Juice at 300 Days	CCS (%) at 300 Days	Number of Millable Canes/Plot	Single Cane Weight (kg)	Pol (%) Cane	CCS (t/ha)	Cane Yield (t/ha)
Brix 300 days	G	1.00							
	P	1.00							
Sucrose (%)Juice at 300 Days	G	1.001**	1.00						
	P	0.989**	1.00						
CCS (%) at 300 Days	G	1.001**	1.000**	1.00					
	P	0.980**	0.998**	1.00					
Number of Millable Canes/Plot	G	-0.150^{NS}	-0.176^{NS}	-0.199^{NS}	1.00				
	P	0.055^{NS}	0.016^{NS}	-0.007^{NS}	1.00				
Single Cane Weight (kg)	G	-0.185^{NS}	-0.194^{NS}	-0.190^{NS}	0.409**	1.00			
	P	-0.006^{NS}	-0.006^{NS}	-0.004^{NS}	0.232^{NS}	1.00			
Pol (%) Cane	G	0.784**	0.809**	0.821**	-0.260^{NS}	0.346*	1.00		
	P	0.304*	0.304*	0.309*	-0.076^{NS}	0.153^{NS}	1.00		
CCS (t/ha)	G	0.095^{NS}	0.095^{NS}	0.090^{NS}	0.766**	0.854**	0.288^{NS}	1.00	
	P	0.107^{NS}	0.069^{NS}	0.050^{NS}	0.712**	0.504**	0.456**	1.00	
Cane Yield (t/ha)	G	-0.247^{NS}	-0.256^{NS}	-0.266^{NS}	0.901**	0.756**	-0.112^{NS}	0.918**	1.00
	P	-0.059^{NS}	-0.104^{NS}	-0.128^{NS}	0.833**	0.490**	0.045^{NS}	0.906**	1.00

***,** significant at 5 per cent and 1 per cent levels of significance, respectively.* *G- Genotypic correlation* *P- Phenotypic correlation*

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