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GENETIC VARIABILITY AND CHARACTER ASSOCIATION IN INTERSPECIFIC HYBRIDS OF SUGARCANE

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ABSTRACT

In an interspecific hybrid population of 46 clones derived from crosses of various *Saccharum* spp., number of millable canes, sugar yield and single cane weight recorded high genotypic coefficient of variation. High heritability coupled with high genetic advance were recorded for CCS, sucrose content, and number of millable canes. Cane yield recorded low heritability and low genetic advance. Sucrose, brix, CCS and sugar yield were positively interrelated. Cane yield did not have significant positive association with any of the yield attributes except number of millable canes. The hybrids derived from the crosses involving commercial hybrids with *S. robustum* or *S. barberi* were superior to other hybrids.

Key words: *Saccharum*, variability, heritability, correlation, interspecific hybrids.

Sugarcane scientists all over the world have now recognized the problem of a restricted genetic base in sugarcane and are operating parallel basic breeding programmes to infuse new genetic material into the commercial cane breeding programme. The present study aims to assess the variability and relative importance of different characters with the help of genetic parameters like genotypic coefficient of variation (GCV), heritability (broad sense), genetic advance (GA) and the interrelationships among different yield and quality characters in a population derived from crosses utilizing various *Saccharum* species.

MATERIALS AND METHODS

The materials for the study consisted of 46 selected inter-specific hybrids derived from the crosses of various *Saccharum* species (Table 1). The trial was laid out in randomized block design with three replications at the Sugarcane Breeding Institute Research Centre, Jamkhandi in the crop season of 1990–91. Each clone was grown in a three-row plot with the row length 6 m and spacing 90 cm. Twenty four 3-budded setts were planted in a row

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at equal distance. The trial was harvested after 360 days and data on ten quantitative characters (Table 2) were recorded as per standard procedures.

Heritability (broad sense) was estimated according to Allard [1]. Phenotypic and genotypic coefficients of variation (PCV, GCV) were estimated as per Burton [2]. Genetic advance (GA) as per cent of mean was estimated according to Johnson et al. [3], and phenotypic and genotypic correlations were determined by the method of [4].

RESULTS AND DISCUSSION

The present study indicated substantial differences in GCV and PCV for the characters studied (Table 2). GCV and PCV were high for number of millable canes (NMC), sugar yield, and single cane weight (SC wt.). The difference between PCV and GCV was high for cane yield, indicating environmental factors influencing the characters. It was low for sucrose and brix, indicating that genetic factors were predominantly responsible for these characters. Heritability of all quality characters was high with high GA. Among yield components, NMC and SC wt. had high heritability and lower GA, as has been reported earlier [5, 6]. Since broad sense heritability includes both additive and epistatic effects, it will be reliable only when accompanied by high genetic advance [7]. Burton [2] suggested that the GCV together with heritability estimates gives the best picture of the advance expected by selection.

Table 1. Experimental material used for the study on interspecific hybrids of sugarcane

Cross	No. of clones
S. officinarum x *S. barberi*	16
S. officinarum x *S. robustum*	5
Commercial Hybrid x *S. barberi*	5
Commercial Hybrid x (*S. officinarum* x *S. robustum*)	2
(*S. officinarum* x Commercial Hybrid) x (*S. officinarum* x *S. robustum*)	1
Commercial Hybrid x (*S. officinarum* x *S. robustum*) x Commercial Hybrid	4
Commercial Hybrid x *S. spontaneum*	2
S. officinarum x *S. spontaneum*	3
Commercial Hybrid x (Commercial Hybrid x *S. robustum*)	3
(Commercial Hybrid x *S. barberi*) x (Commercial Hybrid x *S. robustum*)	1
S. officinarum x Commercial Hybrid	2
(Commercial Hybrid x *S. barberi*) x (*S. officinarum* x *S. robustum*)	1
Commercial Hybrid x *S. robustum*	1

The genotypic correlation coefficients were, in general, higher than the phenotypic correlation coefficients. This may be due to the effect of environment in modifying the total expression of the genotype, thus altering the phenotypic expression [8].

Table 2. Variability and other genetic parameters for different characters in interspecific hybrids of sugarcane

Character	Mean	Range	GCV	PCV	Herita-bility	Genetic advance
Sugar yield (kg/plot)	3.3**	1.4-6.6	27.4	39.9	47.1	38.8
Yield (kg/plot)	30.9**	17.7-50.0	15.2	30.1	25.5	15.5
CCS (%)	10.6**	5.3-13.6	20.1	22.9	77.4	36.5
Brix (%)	17.6**	12.5-22.9	11.7	13.4	76.3	21.0
Sucrose (%)	15.3**	8.8-19.8	17.4	19.7	77.9	31.6
NMC/plot	45.0**	22.0-110.7	33.8	39.6	72.7	59.4
SC wt. (kg)	0.8**	0.3-1.4	25.1	31.4	64.0	41.6
Cane length (m)	1.9**	1.4-2.2	7.1	15.1	22.2	6.9
Cane thickness (cm)	2.3**	1.7-3.2	13.9	16.3	72.7	24.6
No. of internodes	17.3**	13.3-22.0	10.0	16.5	36.6	12.4

**Significant at P = 0.01.

Sugar yield was positively associated with cane yield, commercial cane sugar (CCS), brix, and sucrose. The characters CCS, brix and sucrose content were positively correlated to each other. Single cane weight and cane thickness were positively and cane length negatively correlated with CCS and sucrose content. These associations show that sugar characters are not totally independent and have complex association with yield components, as demonstrated by Rao et al. [9].

Cane yield and NMC were positively correlated [5, 6]. Cane yield and number of internodes were negatively associated. Cane yield was not significantly associated with SC wt., cane thickness, cane length, CCS, brix and sucrose content. Single cane weight, was positively correlated with cane thickness, whereas cane length was negatively associated with cane weight and cane thickness. This may be due to inclusion of many immediate F_1 materials of various wild *Saccharum* species in the present investigation.

These results also show that direct selection for cane yield will not be rewarding as this character is influenced more by environment, whereas NMC which with high GCV, heritability and GA has greater breeding value for improving cane yield, as it was positively associated with cane yield. Sugar yield is a more dependable character due to its high GCV, moderate heritability, and high GA, and stronger association with the sugar characters which themselves recorded higher heritability and GA than the yield components.

Table 3. Superior interspecific hybrids selected for future breeding programmes

Clone	Cross	Sugar yield (kg/plot)	Yield (kg per plot)	Brix (%)	su-crose (%)	NMC per plot	SC wt. (kg)	Cane thick-ness (cm)
ISH 1	Commercial Hybrid x (*S. officinarum* x *S. robustum*)	4.7	34.1	21.0	19.8	38.0	0.9	2.4
ISH 282	Commercial Hybrid x *S. robustum*	3.5	26.0	22.9	19.8	40.7	0.6	2.1
ISH 284	*S. officinarum* x *S. spontaneum*	4.6	40.3	18.2	16.5	71.3	0.43	1.8
ISH 292	*S. barberi* x Commercial Hybrid	4.5	39.1	18.3	16.7	47.7	0.7	2.3
ISH 297	*S. barberi* x Commercial Hybrid	4.2	37.2	18.8	16.4	28.7	1.4	3.2
ISH 23	Commercial Hybrid x (*S. officinarum* x *S. robustum*) x Commercial Hybrid	4.8	38.6	18.4	17.1	64.0	0.6	2.1
ISH 25	Commercial Hybrid x (Commercial Hybrid x *S. robustum*)	6.6	50.0	19.5	18.5	55.3	1.0	2.0
ISH 118	*S.officinarum* x Commercial Hybrid	4.3	38.7	17.1	15.6	43.0	0.9	2.7

Out of four species used in crossing programme, the *S. robustum* types followed by *S. barberi* were particularly useful for improving NMC/plot, cane yield and cane diameter, keeping sucrose and other quality parameters towards higher side, as shown by [10] (Table 3). *S. spontaneum* improves NMC while there is decrease in yield and quality traits. Further, the results indicated that the hybrids derived from the crosses of *S. officinarum* and progeny of commercial hybrids crossed with *S. robustum* or *S. barberi*, were superior. On the contrary, the hybrids derived from the single crosses of *S. officinarum* with commercial hybrids or any species could not improve any particular trait.

REFERENCES

1. R. W. Allard. 1960. Principles of Plant Breeding. John Wiley & Sons, Inc, New York, U.S.A.: 75–108.

2. G. W. Burton. 1951. Quantitative inheritance in pearl millet (*Pennisetum glaucum*). Agron. J., **43**: 409–417.

3. H. W. Johnson, H. F. Robinson and R. E. Comstock. 1955. Estimates of genetic and environmental variability in soyabean. Agron. J., **47**: 314–318.

4. H. W. Johnson, H. F. Robinson and R. E. Comstock. 1955. Genotypic and phenotypic correlations in soyabean and other implications in selection. Agron. J., **47**: 477–483.

5. H. N. Singh, S. B. Singh, R. V. S. Chauhan and Viswakarma. 1983. Variability for yield and quality in sugarcane. Indian J. agric. Sci., **53**(9): 786–789.

6. C. R. Reddy and M. V. Reddy. 1986. Degree of genetic determination, correlation and genotypic and phenotypic path analysis of cane and sugar yield in sugarcane. Indian J. Genet., **46**(3): 550–557.

7. S. Ramanujam and D. K. Thirumalachar. 1967. Genetic variability of certain characters in red pepper (*Capsicum annuum* L.). Mysore J. agric. Sci., **1**: 30–36.

8. K. S. Nandpuri, Surjan Singh and Tarsemlal. 1973. Studies on genetic variability and correlation of economic characters in tomato. J. Res. PAU., **10**: 361–371.

9. P. N. Rao, M. F. Rahman and C. P. Rao. 1983. Genetic variability and character association in sugarcane progenies. Indian J. agric. Sci., **53**(2): 621–623.

10. Bakshi Ram and G. Hemaprabha. 1990. Variability pattern in cultivar x species progenies in sugarcane. Indian J. Genet., **50**(4): 400–406.