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Variability pattern in cultivar x species progenies of sugarcane

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SUMMARY

Variability pattern of the progenies (30 per mating group) of the Indian commercial hybrids crossed with *Narenga, Erianthus* and *Saccharum spontaneum* were studied. The *Erianthus* genotypes were superior for cane yield and quality characters except number of millable canes. The *Erianthus* mating group had clean advantage over *Narenga* and *spontaneum* for both cane yield and quality traits. The maximum genetic variability was observed among the *S. spontaneum* progenies for all the characters except cane yield. The *Erianthus* mating group was found to have advantages for obtaining promising clones compared to other groups. It is suggested that a more extensive use of advanced breeding material could be made in a deliberate breeding programme of bridging crosses among the progenies of three mating groups for the genetic base broadening among the existing genotypes.

Key words : Variability, Mating groups, Genetic base broadening

Crossing of clones of closely related genera and *Saccharum* species to a commercial hybrid forms a dependable and quick method of incorporation of new and varied germplasm into a genotype selected for adaptation to a particular environment. More over, this practice hastens the gain in performance and steps up the variance among commercial hybrids which at present is diminishing to that of experimental error level in the commonly adapted inter varietal crossing programme. Little Published information was available to understand the variability existed in crossing commercial hybrids with closely related genera and *Saccharum species* for various quality and quantitative characters. This work was a long felt need by many workers (Daniels, 1965, Walker, 1972, Ethirajan, 1987, Heinz, 1987 and Krishnamurthi *et al*., 2006) to design a new cycle of nobilisation using diverse clones of *S. spontaneum* and wild relatives *viz., Erianthus* and *Narenga*.

MATERIALS AND METHODS

The present study had been under taken at M/s E.I.D Parry (India) Ltd., Sugar factory, R and D farm Nellikuppam, Cuddalore District, Tamil Nadu, during the month of March 2007. The experimental material comprised F_1 progenies from crosses involving commercial hybrids and *Erianthus, Narenga* and *S. spontaneum*. Eight clones each of *Erianthus, Narenga* and *S. spontaneum* were used in hybridization. The progenies at seedling stage were subjected to selection pressure, so as to surpass the threshold limits set up for each group for number of millable canes for *S. spontaneum,* cane diameter, single cane weight and quality characters in the *Erianthus* mating group to bring down the number to a manageable level. Hybridity of the progenies was ensured by the distinct economic characteristic of each type. Thirty progenies in each mating group were taken at random. The progenies along with two Checks, *viz.*, Co 86032 and COC 671 were evaluated in randomized block design with three replications. Each F_1 clone was grown in a single row plot, 6 meter long spaced at 90 cm. Seventy two, two budded setts were planted in a plot at equal distance. The trial was harvested after 360 days and the data on nine characters were recorded.

The genotypic and phenotypic coefficient of variation (GCV and PCV) (Burton, 1952), broad sense heritability (Hanson, 1963) and genetic advance (Allard, 1960) were computed.

RESULTS AND DISCUSSION

The analysis of F_1 genotypes showed significant differences between genotypes for all the traits (Table1). Significant differences were also observed between mating groups for all the characters. This indicated the potential of certain parents involved in the crosses to produce better genotypes. A comparison was made between mating groups. The genotypes derived from *Erianthus* mating group significantly differed from *S. spontaneum* genotypes and genotypes of *Narenga* differ significantly from *S. spontaneum*. Whereas, the genotypes

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Table 1 : Analysis of variance of genotypes derived from three mating groups in sugarcane

Sources	D.f.	Internodal length	Number of millable canes	Cane diameter	Cane length	Single cane weight	Cane yield	Sucrose %	Purity co efficient	CCS %
Genotypes	89	1059.5**	5162.5**	0.52**	2087.8**	0.59**	1081.7**	17.5**	77.6**	10.8**
Genotypes / *Erianthus*	29	681.2**	1028.5**	0.38**	1239.5**	0.45**	1377.5**	18.0**	81.5**	11.1**
Genotypes / *Narenga*	29	1362.5**	365.8**	0.25**	1519.0**	0.25**	1235.8**	18.9**	88.5**	12.5**
Genotypes / *S. spontaneum*	29	638.7**	8421.7**	0.61**	2892.5**	0.18**	842.5**	12.5**	46.8**	8.5**
Mating groups	2	4238.5**	22081.8**	0.25**	1382.6**	6.25**	325.5**	58.5**	325.9**	31.5**
Erianthus Vs *Narenga*	1	15642.7**	132821.9**	10.25**	9931.3**	12.31**	11.6**	0.10	9.8*	0.10
Erianthus Vs *S. spontaneum*	1	1082.8**	9288.4**	1.50**	18235.0**	3.96*	598.5**	96.5**	410.9**	46.5**
Narenga Vs *S. spontaneum*	1	4547.5**	62386.6**	6.55**	3562.1**	2.58*	439.5**	99.5**	546.8**	48.2**
Check Vs genotypes	1	724.3**	10821.8**	1.08**	731.8**	0.76**	1192.5**	92.5**	372.1**	64.5**
Error	184	32.10	12.15	0.08	158.39	0.09	120.8	3.20	16.41	1.9
C.D. for (group mean)	-	2.52	1.97	0.12	7.25	0.21	9.54	0.48	1.92	0.62

* and ** indicates significance of values at P =0.05 and P=0.001, respectively

of *Erianthus* differ significantly from the genotypes of *Narenga*, for all the characters except sugar yield and CCS per cent.

Differences were also significant between genotypes within each mating group. While comparing the magnitude of mean squares among the genotypes with in the mating groups, it was evident that the variation was highly significant indicating high frequency of distantly related alleles.

The genotypic coefficient of variation in *S. spontaneum* genotypes was higher than that of *Erianthus* and *Narenga* groups for almost all the characters studied (Table 2). The high variability among progenies of *S. spontaneum* mating group revealed that the *S. spontaneum* genotypes were not able to utilize effectively the existing environment. The relative genetic variability appeared to be the same. Comparison between genotypic and phenotypic coefficient of variation revealed that single cane weight and cane length in *Erianthus* and *Narenga* mating groups are largely influenced by environment.

The differences were evident among three mating groups for contributing attributes of cane yield (Table 2). The mean of *Erianthus* genotypes exceeds the means of *Narenga* and *S. spontaneum* genotypes for cane yield except number of millable canes and its attributing characters. Similar results were obtained by Krishnamurthy *et al.* (2006) in their study on nobilisation of *Erianthus* and *Saccharum spontaneum*. The *Erianthus* genotypes also recorded high mean for quality traits when compared to other two. The negative effect of number of millable canes in *Erianthus* group in comparison with *S. spontaneum* group was compensated by the positive effect of other component traits of cane yield, resulting in similar results in the two mating groups.

The heritability (broad sense) estimates provide a measure of the potential effectiveness of selection among the parents prior to hybridization. The heritability estimates for all the characters were significantly high in all the three groups for internode length, number of millable canes, cane diameter and cane yield. It seems that environment played a major role in sugar accumulation in these early generation (F_1) genotypes. In other words, selection for component characters of cane yield will be more reliable than the quality characters while selecting the parent for further hybridization keeping sucrose content at the economic threshold. Variation in heritability values is expected due to differing degrees of genetic variability in the parents and the environmental and

Table 2 : Mean, range, GCV, PCV, heritability (broad sense) and expected genetic advance (GA) in F_1 progenies of three mating groups of sugarcane

Character	Mating group	Mean	Range	GCV (%)	PCV(%)	Heritability (%)	GA as% of mean
Internode length	*Erianthus*	22.68a	22.00-25.00	2.68	3.32	93.06	20.75
	Narenga	12.75b	12.00-14.00	4.86	6.04	64.70	8.06
	S. Spontaneum	13.70b	11.00-14.20	10.44	10.82	65.11	4.45
NMC (number of	*Erianthus*	66.00a	60-72.00	12.45	12.54	98.51	25.45
millable canes)	*Narenga*	70.50b	58-82.00	17.24	18.46	87.20	33.16
	S. Spontaneum	135.00c	130-147.00	23.31	24.22	92.61	46.20
Cane diameter	*Erianthus*	2.70a	2.50-3.00	5.58	5.84	91.29	23.01
	Narenga	1.80b	1.60-2.00	6.46	6.61	95.40	13.00
	S. Spontaneum	2.00c	1.80-2.20	11.38	11.60	96.34	10.99
Cane length	*Erianthus*	290.50a	240.00-310.30	7.50	13.50	55.55	44.3
	Narenga	259.25b	242.00-276.20	6.90	12.00	57.75	16.3
	S. Spontaneum	299.70c	286.00-314.50	12.50	16.00	78.13	11.5
Single cane	*Erianthus*	3.64 a	3.00-3.72	1.16	1.96	35.00	13.81
weight	*Narenga*	2.09b	1.47-2.62	2.21	2.98	55.30	3.30
	S. Spontaneum	3.37c	3.11-3.57	6.83	6.96	96.36	1.41
Cane yield	*Erianthus*	68.50a	140.0-172.0	20.26	20.56	97.13	41.13
	Narenga	135.50b	103.0-160.00	11.41	11.55	97.63	23.23
	S. Spontaneum	159.25a	41.2-168.00	23.00	23.16	99.30	47.71
Sucrose %	*Erianthus*	15.90a	15.10-17.30	20.86	43.85	47.57	42.32
	Narenga	12.23b	11.25-12.93	11.66	27.25	42.78	23.76
	S. Spontaneum	15.43a	15.16-17.30	27.41	51.73	52.98	56.81
Purity %	*Erianthus*	84.59a	81.23-87.50	1.89	3.25	58.15	3.82
	Narenga	65.72b	61.50-68.33	0.55	0.93	35.69	0.68
	S. Spontaneum	81.50c	79.50-84.50	1.77	2.97	59.95	3.48
CCS %	*Erianthus*	10.75a	10.00-11.88	5.74	12.25	46.85	11.79
	Narenga	7.05b	6.16-7.64	1.45	3.96	36.61	2.94
	S. Spontaneum	10.31a	9.76-10.96	8.77	16.93	51.80	18.07

* indicates significance of value at P=0.05.

competitional variance in small plots which has to be used in these experiments (Roach, 1978). The genetic advance as per cent of mean was high in all the *Erianthus* mating group which indicated that the heritability is due to additive gene effects and selection may be effective in this group for further advancement of both quantitative and quality characters.

The occurrence of promising genotypes among the progenies of all the three mating groups is remarkable. It may be mainly due to the use of the commercial hybrids, resulting into better progenies (Walker, 1972; Roach, 1978 and Shang *et al*., 1968). According to Roach (1984) this may be due to the superiority of the gametes contributed by the commercial hybrids, better balance of cultivated (Noble) and wild chromosomes and may be due to n+n chromosome transmission (Kandasami, 1961).

Thus, the present study indicated that *Erianthus* mating group was found to be superior than *Narenga* and *S. spontaneum* in both cane yield and quality characters except number of millable canes. The maximum genetic variability was observed among the *S. spontaneum* genotypes. From this study it is observed that, for improvement of sugar yield, the average cane yield should be increased, however, maintaining the threshold and economic level of sucrose content of the genotypes. To make effective use of selected germplasm, a deliberate programme for bridging crosses among the three groups seems desirable. It is suggested that a more extensive use of advanced breeding material could profitably be made in the interest of a broader genetic base and to exploit the accumulated effects of specific selection pressure.

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