Indian J. Genet., **55** (2): 166–169 (1995)

INFLUENCE OF NOBLE AND COMMERCIAL HYBRID CLONES ON ECONOMIC TRAITS IN MOBILIZATION OF *SACCHARUM* SPECIES

BAKSHI RAM* AND G. HEMAPRABHA

Crop Improvement Division, Sugarcane Breeding Institute, Coimbatore 641007

(Received: September 4, 1993; accepted January 19, 1995)

ABSTRACT

The effectiveness of *Saccharum officinarum* and commercial hybrid clones on three species, viz. *S. barberi*, *S. robustum* and *S. spontaneum*, during the second nobilization stage, was compared. Genotypic coefficients of variation of progenies of *S. officinarum* x N_1 in six mating groups were higher to their respective commercial x N_1 progenies. Inversely, the mean performances and heritability estimates, in general, of progenies of commercial x N_1 crosses were superior to the progenies involving noble clones. However, no such trend was observed for heterosis. Higher heterosis for all the three characters was observed only in (*S. officinarum* x *S. robustum*) x Hybrid mating group. As the heritability values were quite high for sucrose per cent in comparison with other two traits, selection for this trait would be effective while selecting the parents for future breeding programmes.

Key words: Variability, heterosis, heritability, nobilization, *Saccharum* spp.

The use of *S. officinarum* clones, as practised, is associated with certain difficulties [1]. As an alternative, the use of commercial hybrids was tried which resulted in better progenies during nobilisation [2–5]. But information on using a commercial clone as female, particularly in the early generations of nobilisation, as an alternative to using a noble clone is meagre. The present study aims to compare the effects of using commercial and noble clones for three economic attributes during second generation of nobilisation.

MATERIALS AND METHODS

Clones of three *Saccharum* species, viz., *S. barberi* (S), *S. robustum* (R) and *S. spontaneum* (S), were crossed with *S. officinarum* (O), and commercial hybrid (H) clones to produce the six first nobilization stage (N_1) hybrid groups (OB, OR, OS; HB, HR, HS, respectively). The resulting hybrid progenies from these six mating groups were backcrossed with noble cane

*Present address: Sugarcane Breeding Institute, Regional Centre, Post Box No. 52, Karnal 132001.

[(OB) O, (OR) O, (HB) O, (HR) O, (HS) O, respectively] and with commercial hybrids [(OB) H, (OR) H, (OS) H, (HB) H, (HR) H, (HS) H, respectively] to produce hybrids of second nobilisation (N_2) cycle. Thirty N_2 hybrids in each mating group were taken at random. Three hundred and sixty hybrids from 12 mating groups along with their parents were evaluated in compact family block design. Each progeny was grown in single-row plots of 3 m length with 90 cm spacing. Ten three-budded setts were planted at equal distance in each plot. The trial was harvested when 12 months old and data on stalk yield, estimated sugar yield, and sucrose per cent in juice were recorded. Genotypic coefficient of variation (GCV), heritability, heterosis over mean of parents (MP) and over mean of the N_1 hybrid parents used in the second cycle of hybridization (N_1P) were worked out using the standard formulae.

RESULTS AND DISCUSSION

Relative genetic variability as expressed by GCV of the *S. officinarum* x N_1 crosses was higher than their respective commercial hybrids x N_1 crosses for all the three traits (Table 1). Such high variability among (OB) O, (OR) O, (OS) O, (HB) O, (HR) O and (HS) O genotypes in comparison with the (OB) H, (OR) H, (OS) H, (OB) H, (HR) H and (HS) H genotypes, respectively, could be due to high frequency of unfavourable alleles as a result of heterozygosity in noble parents used in hybridization. The GCV of *S. robustum* progenies was higher than the variability observed in the progenies of the other two species for stalk yield and expected sugar yield, but was lower for sucrose per cent.

Heritability estimates from regression of offsprings on midparent were generally higher in the mating groups involving the commercial hybrids (Table 1). Among the characters analysed, high values for sucrose per cent indicated its effectiveness while selecting the parents for further hybridization, as also reported earlier [3, 6]. The variation observed in heritability values is expected due to differing degrees of genetic variability in the parents and the environmental and competitive ability variance in small plots [3].

Differences in character means were conspicuous between the mean performances of the progenies of the crosses *S. officinarum* x N_1 and commercial hybrids x N_1 (Table 2). The use of commercial hybrids resulted in significant improvement in all the six mating groups [(OB) H, (OR) H, (OS) H, (OB) H, (HR) H and (HS) H] over their respective progenies [(OB) O, (OR) O, (HB) O, (HR) O, (HS) O, respectively] involving *S. officinarum*. Maximum improvement for sugar yield was observed in the (OR) H progenies, followed by the (OS) H mating group. The improvement in sugar yield in (OR) H was due to increment in both stalk yield (56.8%) and sucrose content of juice (32.3%). Therefore, both stalk yield and sucrose content in juice of the commercial hybrids could be improved by incorporating the *S. robustum* genome which is absent in the present Indian commercial hybrids. Roach [3] and Barbados [7] also observed superiority of the commercial x F_1 crosses over noble x F_1 crosses.

Table 1. Genotypic coefficient of variation (GCV) and heritability (h^2) in twelve mating groups in sugarcane

Character	Parameter	(OB) O	(OB) H	(HB) O	(HB) H	(OR) O	(OR) H	(HR) O	(HR) H	(OS) O	(OS) H	(HS) O	(HS) H
Stalk yield	GCV	46.03	26.31	41.20	45.30	38.74	32.47	56.43	50.90	43.72	41.81	38.80	37.64
	h^2	0.30	0.41	0.30	0.39	0.11	0.12	0.31	0.55	0.16	0.23	0.22	0.15
Sugar yield	GCV	54.04	31.90	41.42	40.61	45.80	38.90	64.61	53.23	63.80	45.27	41.31	39.24
	h^2	0.39	0.42	0.31	0.30	0.11	0.12	0.17	0.66	0.36	0.45	0.20	0.21
Sucrose %	GCV	18.87	13.71	18.23	12.04	18.10	11.43	17.34	7.41	24.63	18.92	20.61	13.09
	h^2	0.18	0.50	0.54	0.72	0.17	0.25	0.35	0.38	0.58	0.61	0.54	0.57

B—*S. barberi*, S—*S. spontaneum*, *O*—*S. officinarum*, H—commercial hybrid R—*S. robustum*.

Table 2. Mean ($\bar{X}$), midparent (MP) heterosis, and heterosis over N_1 parents (N_1P) in sugarcane

Character	Parameter	(OB) O	(OB) H	(OS) O	(HB) H	(OR) O	(OR) H	(HR) O	(HR) H	(OS) O	(OS) H	(HS) O	(HS) H
Stalk yield	$\bar{X}$ (tonnes/ha)	82.2	95.9	72.6	98.9	86.7	135.9	81.5	98.5	63.3	95.9	80.0	83.7
	MP heterosis (%)	51.9	38.6	33.6	56.3	97.6	89.3	75.6	31.9	16.1	65.1	85.0	7.4
	N_1P heterosis (%)	9.2	28.1	115.7	107.8	95.8	104.9	37.1	59.6	13.9	56.4	46.2	13.4
Sugar yield	$\bar{X}$ (tonnes/ha)	7.8	11.1	6.3	10.0	7.0	14.4	8.5	11.5	6.3	10.0	7.8	9.6
	MP heterosis (%)	58.6	45.1	47.1	42.1	79.4	110.2	52.5	30.0	103.8	74.3	81.0	8.9
	N_1P heterosis (%)	27.9	69.1	70.1	101.4	142.7	182.7	22.8	54.3	55.8	64.9	26.0	18.4
Sucrose	$\bar{X}$ (%)	14.0	16.7	13.4	15.1	12.1	16.0	15.1	16.7	14.4	15.1	14.9	17.1
	MP heterosis (%)	–2.3	3.3	–5.4	–6.1	–9.9	7.6	–9.4	–1.3	12.9	–2.6	4.6	2.3
	N_1P heterosis (%)	6.3	15.2	–19.1	–3.9	–8.0	25.7	–16.7	–3.6	32.1	5.7	–14.0	–16.5

The influence of the noble and commercial clones on heterosis varied with respect to individual characters and also the mating groups (Table 2). For stalk yield, maximum heterosis was observed in (OR) O, followed by the (OR) H mating groups. For sugar yield, (OR) H followed by (OS) O, were the most heterotic groups. For sucrose per cent the (OS) O groups showed 12.9% heterosis, followed by 7.6% in (OR) H.

The appearance of commercial types in mating groups involving commercial hybrids at N_1 and N_2 stages implies that crossing of the species and N_1 clones with a commercial hybrid is a dependable and quick method of incorporation of new and varied germplasm into a genotype previously selected for adaptation to a particular environment. This also introduces in one step gone complexes from several sources of *S. officinarum* and *S. spontaneum*. The use of commercial hybrids in the crosses resulted in better progenies [2–5]. This may be due to superiority of the gametes contributed by the commercial hybrids, better chromosomal balance from noble cane and wild donors, and n + n transmission resulting in chromosome number within the range of 100–125 as generally found in the commercial hybrids [1]. Thus, further improvement in sugar yield could be brought about by crossing the selected clones with commercial hybrids and by disassortative mating among the clones from various mating groups.

REFERENCES

1. B. T. Roach. 1984. Conservation and use of genetic resources of sugarcane. Sugarcane, **2**: 7–11.

2. D. I. T. Walker. 1972. Utilization of noble and *S. spontaneum* germplasm in West Indies. Proc. Intern. Soc. Sug. Cane Technol., **14**: 224–232.

3. B. T. Roach. 1978. Utilization of *S. spontaneum* in sugarcane breeding. Proc. Intern. Soc. Sug. Cane Technol., **16**: 43–58.

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

5. Bakshi Ram and G. Hemaprabha. 1992. Genetic variability in interspecific progenies in sugarcane (*Saccharum* spp.). Indian J. Genet., **52**: 192–198.

6. D. M. Hogarth. 1971. Quantitative inheritance studies in sugarcane. I. Estimation of variance components. Aust. J. Agric. Res., **27**: 93–102.

7. Anonymous. 1972. Basic breeding programme. West Indies Central Sugarcane Breeding Station, 39th Ann. Rep.: 10–20.