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GENETIC VARIABILITY AND CORRELATIONS IN SUGARCANE HYBRID CLONES

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Abstract: A field trial with selected sugarcane hybrid clones of the intervarietal cross Co 775 x Co 453 was conducted at the Sugarcane Research Station, Thiruvalla to study the different genetic parameters in the settling progeny. High heritability was observed for shoot count, total weight of cane, number of millable canes, length of internode, length and girth of cane and weight of single cane at harvest. Cane yield and its components displayed low coefficients of variation. Correlation studies indicated that cane yield has positive correlation with all major economic attributes except H.R. Brix. The closest association of cane yield with number of millable canes at harvest was well established with the present study. The study suggested that probabilities of varieties combining higher yield and quality attributes are remote.

INTRODUCTION

Variability in any population is a pre-requisite for selection. Creation of variability in vegetatively propagated crops involves innumerable problems unlike in seed propagated crops. Sugarcane being a vegetatively propagated crop which is amenable to seed production also, mitigates the problems posed in other vegetatively propagated crops. Being a highly polyploid hybrid by itself, inheritance of characters is more complex in sugarcane. Clear genetic stability is usually met with only in a few characters like stalk weight in this crop. Hence, this can be relied on as criterion of selection.

In Kerala, due to the nonavailability of high yielding cane varieties suited to local conditions, the area under this paramount sugar yielding crop has not registered any increasing trend in recent years. With the objective of evolving locally suited promising cane varieties with high yield potential coupled with other desirable attributes, a project was taken up at the Sugarcane Research Station, Thiruvalla in which the genetic variability, genetic advance, heritability and correlations among yield and its components in the settling progeny of the intervarietal cross Co 755 x Co 453 were estimated.

MATERIALS AND METHODS

Sixty five genotypes (settling progeny) from the cross Co 775 x Co 453 were selected after conducting a preliminary study on variability in 450 hybrid seedlings. The clones for the study were selected based on the economic attributes in the seedling population. The selected clones were tried in an RBD with three replications. Observations on thirteen economic attributes were recorded and coefficient of variation, correlation coefficients (phenotypic and genotypic), heritability in the broad sense and genetic advance were estimated.

RESULTS AND DISCUSSION

Statistical analysis revealed that significant differences existed among the clones, for all the characters studied. The range, mean, coefficients of variation, heritability in the broad sense and expected genetic advance under selection for the different characters are presented in Table 1.

Table 1. Genetic parameters of different characters in the clonal population

SI. No.	Characters	Range	Mean	Coefficient of variation		Heritability in the broad sense	Expected genetic advance under selection
				Phenotypic	Genotypic		
1	Germination (45 DAP)	25.02 - 83.40	57.13	29.21	13.37	20.96	7.205
2	Shoot count (90 DAP)	7.67 - 53.33	24.49	38.66	30.68	62.98	12.284
3	H.R.Brix (10th month)	12.80 - 21.80	17.91	16.12	9.17	32.66	1.925
4	Total weight of cane	4.41 - 18.33	9.43	40.00	29.75	55.29	4.297
5	No. of millable canes at harvest	4.00 - 30.67	16.18	32.56	25.02	59.02	6.407
6	No. of internodes at harvest	15.11 - 29.11	21.82	16.55	14.30	73.72	5.520
7	Length of internodes at harvest	6.55 - 12.30	9.63	13.32	8.43	40.08	1.059
8	Girth of area at harvest	6.20 - 8.56	7.31	9.72	6.37	42.84	0.627
9	Height of cane at harvest	134.61 - 232.47	182.10	13.09	9.87	56.85	27.919
10	Weight of single cane	441.67 - 1170.00	768.87	0.03	0.02	38.63	0.185
11	Grassy shoot counts (180 DAP)	0.00 - 23.67	6.48	119.77	68.54	32.75	5.241
12	No. of water shoots	2.67 - 21.33	9.36	49.56	27.64	31.10	2.972
13	Number of arrows	0.00 - 20.67	5.35	91.58	81.16	78.54	7.933

The maximum amount of phenotypic coefficient of variation was expressed by grassy shoot counts (119.77) followed by number of arrows (91.58). Weight of single cane displayed minimum phenotypic coefficient of variation of 0.03. As far as the genotypic coefficient of variation is concerned, the number of arrows recorded the maximum coefficient of variation (81.16) followed by grassy shoot counts (68.54). The minimum variation was displayed by the weight of single cane (0.02).

In general, the phenotypic coefficient of variation was greater than the genotypic coefficient of variation for all the characters studied. Cane yield and its components like number of millable canes, number and length of internode, girth and height of cane, manifested low coefficients of variation. In contrary to these observations, Singh *et al.* (1981) reported high variability for cane yield.

Maximum range was observed in weight of single cane while the range of girth of cane at harvest was minimum. Heritability manifested wide variation in all the thirteen characters studied and the values ranged from 20.96% to 78.54%. Shoot count (62.98%), total weight of cane (55.29%), number of millable canes at harvest (59.02%) and height of cane at harvest (56.85%) showed moderate heritability. Number of internodes at harvest and number of arrows showed high heritability values (73.72% and 78.54%) associated with low genetic advance. Eventhough all the characters showed relatively high degree of heritability, it was not always found to be accompanied by high genetic advance. Maximum genetic advance (27.92) was displayed by height of cane.

Moderate heritability combined with high genetic advance for height of cane indicated that the character can be improved by selection. High heritability with low genetic advance for characters such as shoot count, total weight of cane, number of millable canes at harvest, number of internodes at harvest and the number of arrows, suggests that selection for these characters will not be beneficial.

Table 2. Phenotypic and genotypic correlations among characters in the clonal population

Characters		Shoot count	H.R. Brix	Total weight of cane	Number of millable canes at harvest	Number of internodes at harvest	Length of internodes at harvest	Girth of cane at harvest	Height of cane at harvest	Weight of single cane
Germination	(P)	0.50**	-0.04	0.12	0.36"	0.02	0.05	-0.03	-0.002	-0.14
	(G)	0.79**	-0.17	0.23	0.47**	-0.01	0.02	0.03	0.09	-0.22
Shoot count	(P)		0.16	0.14	0.40**	-0.04	-0.02	-0.17	-0.05	-0.17
	(G)		-0.31*	0.07	0.43**	-0.07	-0.12	-0.35**	-0.06	-0.33**
H R Brix	(P)			0.02	-0.13	0.11	-0.01	0.04	0.06	0.16
	(G)			-0.13	-0.30*	0.13	-0.12	0.27*	-0.13	0.32*
Total weight of cane	(P)				0.67**	0.16	0.21	0.21	0.42**	0.29*
	(G)				0.76**	0.23*	0.28*	0.33**	0.59**	0.48**
No.of millable canes at harvest	(P)					-0.04	0.17	-0.07	0.12	-0.05
	(G)					0.01	0.24	-0.21	0.23	-0.10
No.of internodes at harvest	(P)						-0.05	0.13	0.58**	0.46**
	(G)						-0.06	0.15	0.61**	0.67**
Length of internodes at harvest	(P)							0.17	0.36**	0.16
	(G)							0.31*	0.49**	0.27
Girth of cane at harvest	(P)								0.20	0.54**
	(G)								0.21	0.67**
Height of cane at harvest	(P)									0.52**
	(G)									0.68**

P = Phenotypic
G = Genotypic

** Significant at 1 per cent level
* Significant at 5 per cent level

Correlation studies in the clonal population revealed that genotypic correlations were greater than phenotypic correlations (Table 2). The association between cane yield and its important components viz., number of millable canes, number of internodes, girth of cane, height of cane, weight of single cane and H.R. Brix were studied. Yield of cane recorded positive correlations with all the components except H.R.Brix. Yield had the maximum positive significant correlation with number of millable canes followed by height of cane and weight of single cane. The maximum contribution of number of millable canes to cane yield had been well established by the study. Gill (1949), James (1971), Mariotti (1971) and Bathila (1978) also recorded similar results. Number of millable canes registered negative nonsignificant correlation with girth of cane and weight of single cane.

Another important yield component viz., number of internodes was found to be inversely associated with length of internodes at harvest and it displayed positive significant association with height of cane at harvest and weight of single cane. This attribute expressed positive association with girth of cane at harvest though not significant. Similar is the case with number of millable canes. However, Singh *et al.* (1981) reported significant positive genotypic and phenotypic association between these two traits.

Length of internode at harvest was positively correlated with all the characters studied except shoot count, H.R.Brix and number of internodes. Girth, height and weight of single cane at harvest displayed positive and significant association with length of internode. Number and length of internode at harvest were found to be indirectly influencing the cane yield through cane height as these two traits had a positive bearing on the height of cane. Positive correlation of yield with number of internodes was emphasised by Singh and Sangha (1970).

Regarding the association of quality components with yield of cane, H.R.Brix was found to have negative correlation. The results were in conformity with the findings of Desorney (1950), who reported total absence of correlation between yield and quality. The present study also revealed that H.R.Brix had negative significant correlation with number of millable canes and positive significant correlation with girth of cane and weight of single cane. Negative correlations of yield with juice quality were already reported by Stevenson (1954) and Mariotti *et al.* (1971). Hence, it may be presumed that the probability of varieties combining high yield potential and quality attributes is remote.

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