Relative efficiency of cane characters in selection for cane yield in sugarcane (*Saccharum* spp. hybrid)

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The present investigation was attempted to develop selection indices and to estimate the gains through discriminant function over direct selection for cane yield at 300 and 360 days. Similarly attempts were also made to construct simultaneous selection indices involving various combinations of characters and to estimate the genetic advance and relative efficiencies. The 28 genotypes of sugarcane representing the spectrum of variability in commercial sugarcane varieties released from Sugarcane Breeding Institute (ICAR), Coimbatore (TN) and clones selected by other Sugarcane Research Stations in the country were tested during 1995-96 at Sugarcane Breeding Institute, Coimbatore. These clones are complex allopolyploids with components of *Saccharum officinarum* L., *S. spontaneum* L., *S. barberi* L. and *S. sinense* L. genomes. The crop was sampled by harvesting half at the 300 and 360 days after planting. Data were recorded on number of millable canes per plot, cane thickness, cane length, internode length, internode number, single cane weight and cane yield per plot. Genotypic and phenotypic variance and covariance were used for the calculation of regression coefficients (bi values) using different character combinations, considering cane yield as dependent and its parameters as independent variables as suggested by Robinson [1] and Smith [2]. The means and variability for the parameters studied at 300 and 360 days are presented in Table 1. The existence of high variability for the parameters indicate the possibility of a higher response through selection.

Selection at 300 days: The expected genetic advance and relative efficiency of index selection over direct selection varied from 0.23 to 18.14 and 2.10 to 166.01%, respectively. Among the single characters studied, selection for cane yield resulted in the highest genetic advance of 10.93 with a relative efficiency of 100%, whereas, selection for number of millable canes resulted in a genetic advance of 10.88 with a relative efficiency of 99.57%. Selection for cane length resulted in a genetic advance of 6.90 with a relative efficiency of 63.17%. Among the two characters combinations,

cane length and cane yield resulted in the highest genetic advance of 15.8 and a relative efficiency of 144.66% followed by number of millable canes and cane yield (15.14 and 138.52 percent), single cane weight and cane yield (11.35 and 103.83%). When three characters combinations were considered, the average response was higher than that due to two characters combinations. The combination of number of millable canes, cane length and cane yield resulted in the highest genetic advance of 17.34 and a relative efficiency of 158.17 percent followed by the combinations of number of millable canes, cane thickness and cane yield. These results are in conformity with those reported by Miller *et al.* [3]. Among the four characters combinations, number of millable canes, internode number, cane length and cane yield resulted in the highest genetic advance of 17.74 and a relative efficiency of 162.37% followed by the combination of number of millable canes, cane thickness, cane length and cane yield. The five characters combinations *viz.*, number of millable canes, cane thickness, internode number, internode length and cane yield resulted in the highest genetic advance of 15.33 and a relative efficiency of 140.32%, whereas other combinations resulted in lower genetic advance and lower relative efficiency. Among the six characters combinations, the combination of number of millable canes, cane thickness, internode number, internode length, cane length and cane yield resulted highest genetic advance of 18.04 and a relative efficiency of 165.10%. Similar results were also reported by Lal and Sareena [4]. When the function was constructed on the basis of all the seven characters *viz.*, number of millable canes, cane thickness, internode number, internode length, cane length, single cane weight and cane yield it resulted in the highest genetic advance of 18.14 and a relative efficiency of 166.01%.

Selection at 360 days: The expected genetic advance and relative efficiency of index selection over direct selection varied from 0.21 to 18.44 and 2.47 to

Table 1. Means, genotypic coefficient of variability and gain through selection (5%)

Age of harvest (days)	Parameter	Number of millable canes per plot*	Mean cane thickness (cm)	Mean internode number per cane	Mean internode length (cm)	Mean cane length (cm)	Mean single cane weight (kg)	Mean cane yield per plot (kg)
300	MEAN	72.00	2.65	21.96	8.92	193.92	00.92	65.16
	GCV	17.84	10.75	7.57	6.34	5.72	27.26	21.35
	GS (5%)	28.05	18.55	6.82	4.67	5.64	47.59	29.81
360	MEAN	72.00	2.48	17.13	14.20	215.44	01.16	81.60
	GCV	17.84	10.61	4.46	0.00	5.87	22.98	17.26
	GS (5%)	28.05	17.73	2.42	0.00	6.67	31.97	16.21

*NMC recorded at 300 days only.

217.68%, respectively. Expected genetic advance and relative efficiency in direct selection for cane yield was 8.47 and 100.00%, respectively. When individual characters were considered it was observed that number of Millable canes and cane length gave genetic advances of 10.88 and 8.67 respectively with relative efficiencies of 128.45% and 102.39% over cane yield which had a genetic advance value of 8.47 with a relative efficiency of 100.00%. Among the two character combinations, number of millable canes and cane yield resulted in the highest genetic advance of 15.12 and the highest an relative efficiency of 178.46% followed by combinations of cane length and cane yield, number of millable canes and cane length and number of millable canes and single cane weight (10.91 and 128.78%). This finding is in agreement with Singh and Khan [5]. Among the three characters combinations, it was observed that number of millable canes, cane length and cane yield gave a genetic advance of 16.54 .with relative efficiency of 195.24% over the cane yield followed by number of millable canes, cane thickness and cane yield, number of millable canes, single cane weight and cane yield. These results are in conformity with those reported by Miller et al. [4]. When four characters were included in the discriminant function, it was observed that the combination viz., number of millable canes, cane length, single cane weight and cane yield resulted in the high genetic advance of 17.15 and an relative efficiency of 202.44% followed by number of millable canes, internode number, cane length and cane yield. Das et al. [6] also reported similar results. When five characters were included in the discriminant function, it was observed that the function including number of millable canes, cane thickness, internode number, cane length, and cane yield resulted in the highest genetic advance of 18.09 and relative efficiency of 213.53% followed by number of millable canes, cane thickness, internode number, cane length and single cane weight. The functions constructed on the basis of all the six characters viz., number of millable canes, cane thickness, internode

number, cane length, single cane weight and cane yield resulted in highest genetic advance of 18.44 and relative efficiency of 217.68% as compared to five characters combinations. When a compound character and its component characters i.e. cane yield with number of millable canes or cane yield with cane length or cane yield with mean single cane weight were included in a function, the selection gain as well as relative efficiency were greater, compared to the use of these parameters singly. This finding is in agreement with Doule and Balasundaram [7] and Bajpai et al. [8].

It is evident that, there was increase in genetic advance and relative efficiency when the number of characters in the discriminant functions increased. Application of simultaneous selection for cane yield and its components using discriminant function technique was found to provide better returns compared to selection for cane yield alone.

References

1. **Robinson H. F.** 1965. Quantitative genetics in relation to breeding on the centennial of mendelism. Indian J. Genet., **26A**: 171-187.

2. **Smith H. F.** 1936. A discriminant function for plant selection. Ann. Eugen., **7**: 240-250.

3. **Miller J. D., James N. I. and Iyrene P. M.** 1978. Selection indices in sugarcane. Crop Sci., **18**: 369-372.

4. **Lal K. and Sareena A. K.** 1992. New parameters for selection of early and mid-late maturing sugarcane varieties. National Academy Science Letters, **15**: 11-12.

5. **Singh S. E. and Khan A. Q.** 1995. Selection indices and path analysis for cane yield. Sugarcane, **3**: 9-11.

6. **Das P. K., Parida A. K., Nayak N., Mahapatra S. S. and Jena B. C.** 1997. Path coefficient, regression and discriminant function in sugarcane. Indian Sugar, **4**: 31-34.

7. **Doule R. B. and Balasundaram N.** 1999. Discriminant function-An efficient technique for selection in sugarcane. Proc. Int. Soc. Sugar Cane Technol., **23**: 440-447.

8. **Bajpai P. K. and Parbhakaran V. T.** 2000. A new procedure of simultaneous selection and stable crop genotypes. Indian J. Genet., **60**: 141-146.