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Classical Selection Indices in Sugarcane (*Saccharum officinarum* L.)

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ABSTRACT

Selection indices studies in 12 genotypes of sugarcane using discriminant function technique revealed that the function including cane yield as one of the components recorded high expected genetic advance and relative efficiency. The index in which all the nine characters were included showed maximum genetic advance and relative efficiency suggesting that simultaneous selection for all these characters would be better over straight selection for cane and CCS yield.

Key words : Genetic Advance, Selection Indices, Sugarcane

Considerable emphasis is currently being placed upon the improvement of yield through simultaneous selection for various yield attributes. The discriminant function affords an efficient method for simultaneous selection (Smith, 1936). So attempts are made in this investigation to assess the relative efficiency of different selection indices formulated through the use of discriminant function technique in sugarcane.

MATERIAL AND METHODS

The present investigation was conducted at Sugarcane Research Station, Vuyyur during 2007-08 crop season. The experimental material consisted of twelve sugarcane genotypes which were grown in randomized block design with three replications. Each clone was accommodated in plots having 8 rows of 8 meter length of 80 cm apart. Observations on various traits like length of millable cane, diameter of cane, single cane weight, number of internodes cane^{-1}, number of millable canes, brix per cent, per cent juice sucrose, cane yield and CCS yield were recorded from each replication in each genotype.

The mean values were used to construct selection indices based on the Fisher's (1936) discriminant function. The expected genetic advance and relative efficiency in percentage were computed according to Brim *et al.,* (1959).

RESULTS AND DISCUSSION

The economic weight (ai) values allotted for each character along with weighing coefficient (bi) values are presented in Table 1. Inverse of mean value for respective character were considered as allotted weight. Among the characters single cane weight got the highest weightage (0.580) followed by diameter of cane (0.390), CCS per cent (0.080) and per cent juice sucrose (0.060). In weighing coefficient values, per cent juice sucrose showed high bi value (0.5331) followed by single cane weight (0.4424) and CCS yield (0.1108).

Selection indices comprising various combinations of characters along with their genetic advance and relative efficiency are presented in Table 2. Among the two component character indices, combination of cane yield and length of millable cane showed highest genetic advance (1.06) with a relative efficiency of (278.94%, 460.86% and 331.25%) over cane yield plot^{-1}, CCS yield plot^{-1} and per cent juice sucrose, respectively. Likewise, three character combinations showed still higher genetic advance. The maximum genetic advance of (1.31) and relative efficiency of (344.74%, 569.56% and 409.38%) over cane yield plot^{-1}, CCS yield plot^{-1} and per cent juice sucrose respectively, were shown when all the nine characters *i.e.,* length of millable cane, diameter of cane, single cane weight, number of internodes cane^{-1}, number of millable canes, brix per cent, per cent juice sucrose, cane yield and CCS yield were included in the function. The other indices with different combinations involving, eight (1.30), seven (1.28), six (1.26) and five (1.25) characters gave values of genetic advance and relative efficiency in a relatively descending order.

The selection criteria for the 12 genotypes of sugarcane are given in Table 3. Higher values of selection criteria were observed for the genotypes Co 6907 (21.771) followed by 2003 V 3 (21.415), 2003 V 95 (21.402), while the lowest value was observed for the genotype 2003 V 46 (20.499).

From the results, it can be concluded that the function including all the nine characters under study *viz.,* length of millable cane, diameter of cane,

Table 1. Weighing coefficients (bi) and economic weights (ai) for different characters in sugarcane (*Saccharum officinarum* L.).

Character	bi value	ai value
Shoot population at 120 DAP	0.0019	0.001
Stalk population at 240 DAP	0.0022	0.003
Stalk population at 270 DAP	-0.0050	0.003
Length of millable cane (cm)	-0.0053	0.003
Diameter of cane (cm)	-0.2609	0.390
Single cane weight (kg)	0.4424	0.580
Number of internodes cane^{-1}	0.0084	0.030
Number of millable canes plot^{-1}	0.0014	0.003
Brix per cent at 300 days	-0.7957	0.050
Sucrose per cent at 300 days	0.5331	0.060
Per cent purity at 300 days	-0.1816	0.010
CCS per cent at 300 days	-0.0217	0.080
Cane yield (kg plot^{-1})	-0.0091	0.002
CCS yield (kg plot^{-1})	0.1108	0.020

Table 1. Selection indices for different character combinations in sugarcane (*Saccharum officinarum* L.).

Character combination	Genetic advance	Relative efficiency (%) over		
		Cane yield	CCS yield	Per cent juice sucrose
Length of millable cane (cm)(x_1)	0.21	55.26	91.30	65.63
Diameter of cane (cm) (x_2)	0.24	63.15	104.34	75.00
Single cane weight (kg) (x_3)	0.42	110.52	182.60	131.25
Number of internodes cane^{-1} (x_4)	0.16	42.10	69.56	50.00
Number of millable canes plot^{-1} (x_5)	0.19	50.00	82.60	59.38
Brix per cent at 300 days (x_6)	0.17	47.73	73.91	53.13
Per cent juice sucrose at 300 days (x_7)	0.32	84.21	139.13	100.00
Cane yield (kg plot^{-1}) (x_8)	0.38	100.00	165.21	118.75
CCS yield (kg plot^{-1}) (x_9)	0.23	60.52	100.00	71.88
$X_8 + x_1$	1.06	278.94	460.86	331.25
$X_8 + x_2$	0.89	234.21	386.95	278.13
$X_8 + x_3$	0.92	242.10	400.00	287.50
$X_8 + x_4$	0.88	231.58	382.60	275.00
$X_8 + x_5$	0.96	252.63	417.39	30.00
$X_8 + x_6$	0.88	231.58	382.61	275.00
$X_8 + x_7$	0.87	228.95	378.26	271.87
$X_8 + x_9$	0.99	260.53	430.43	309.38
$X_8 + x_1 + x_9$	1.17	307.89	508.69	365.63
$X_8 + x_1 + x_3 + x_9$	1.22	321.05	530.43	381.25
$X_8 + x_1 + x_3 + x_5 + x_9$	1.25	328.95	543.47	390.63
$X_8 + x_1 + x_3 + x_5 + x_7 + x_9$	1.26	331.58	547.83	393.75
$X_8 + x_1 + x_3 + x_4 + x_5 + x_7 + x_9$	1.28	336.84	556.52	400.00
$X_8 + x_1 + x_3 + x_4 + x_5 + x_6 + x_7 + x_9$	1.30	342.10	565.21	406.25
$X_8 + x_1 + x_2 + x_3 + x_4 + x_5 + x_6 + x_7 + x_9$	1.31	344.74	569.56	409.38

Table 3. Selection criterion values for 12 genotypes of sugarcane (*Saccharum officinarum* L.) in classical selection indices

Genotype	Selection criteria
2003 V 3	21.415
2003 V 46	20.499
2003 V 42	20.884
2003 V 16	20.950
2003 V 95	21.402
2003 V 23	21.063
2003 V 18	20.933
2003 V 27	20.820
2003 V 12	21.049
2003 V 38	20.650
2002 V 48	20.815
Co 6907 (Check)	21.771

single cane weight, number of internodes cane^{-1}, number of millable canes, brix per cent, per cent juice sucrose, cane yield and CCS yield plot^{-1} had highest genetic advance and relative efficiency suggesting that simultaneous selection for all these characters would be better over straight selection for yield. Sabitha (2007) observed a linear increase in genetic advance and relative efficiency with the inclusion of more number of characters in the index along with cane yield plot^{-1}. Hence, it can be concluded that the inclusion of characters one by one in the function resulted in the increased efficiency of selection.

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