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Selection Indices in Rice (*Oryza sativa* L.)

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ABSTRACT

Seventy six rice genotypes were evaluated to formulate selection indices based on seventeen characters. Selection indices were constructed adapting discriminant function which indicated that the maximum genetic advance and relative efficiency can be obtained when grain yield was included as one of the component character. The function including the nine characters viz., grain yield plant^{-1}, days to 50% flowering, plant height, ear bearing tillers plant^{-1}, panicle length, filled grains panicle^{-1}, milling percentage, head rice recovery, L/B ratio recorded highest genetic advance with a high relative efficiency over grain yield plant^{-1}.

Key words : Indices, Rice.

Yield is subjected to large environmental fluctuations and the performance of an individual plant is consequently not a very reliable index of the genotype (Panse, 1949). Hence, direct selection for yield alone does not result in expected gains. In such situations the success of selection could be enhanced with the use of selection technique as it facilitates the simultaneous improvement of a number of characters (Sood *et al*., 2006). Selection index is the most widely used method for selection which can be used for more than one trait. The superiority of index increases with increasing number of traits under selection but decreases with increasing differences in relative importance. The superiority of the selection index is maximal when the traits considered are equally important.

MATERIAL AND METHODS

The material for study consisted of seventy six genotypes obtained from Rice Research Unit (RRU), Bapatla, Andhra Pradesh. The material was grown in a randomized block design with two replications during *kharif* 2010 at Agricultural College Farm, Bapatla. The observations were recorded on ten random plants from each replication for days to 50% flowering, plant height (cm), No. of ear bearing tillers plant^{-1}, filled grains panicle^{-1}, panicle length (cm), test weight (g), grain yield plant^{-1} (g), milling percentage, hulling percentage, head rice recovery percentage, grain length (mm), grain breadth (mm), L/B ratio, kernel length after cooking (mm), protein percentage, amylose content and alkali digestion value. The mean data were subjected to the analysis of variance and selection indices were formulated. The expected genetic advance from different selection indices at 5% selection intensity and relative efficiency of each function over straight selection was also calculated.

The reciprocals of means of each character were used as relative weights (a_i)of corresponding character by Rama Kumar *et al.* (1981).The expected genetic advance, by constructing different discriminant functions was calculated and relative efficiency of each discriminant function was estimated as per Brim *et al.*,(1959).

The relative efficiency of the discriminant function which includes yield per plant alone was taken as 100% and the relative efficiencies of other functions were estimated with reference to this.

RESULTS AND DISCUSSION

The reciprocal of the mean value of respective character was considered as the allotted economic weight (Table 1). This reduced the wide disparity observed between the characters. Among the characters, grain length obtained the highest weightage of 0.3906, followed by grain breadth (0.2915) and alkali digestion value (0.2293). The weighing coefficients (bi values) for seventeen characters are also given in table1. Grain length had a high bi value (0.5455), followed by grain

Table.1 Weighing coefficients (b_i) and economic weights (a_i) for different characters in rice in classical selection indices.

Character	b_i	a_i
Days to 50% flowering	0.0022	0.0083
Plant height (cm)	0.0071	0.0093
No. of ear bearing tillers plant^{-1}	0.0747	0.0935
Panicle length (cm)	0.0342	0.0417
Filled grains panicle^{-1}	0.0073	0.0074
Grain yield plant^{-1}(g)	0.0486	0.0514
Test weight (g)	0.0136	0.0479
Milling percentage	0.0086	0.0155
Hulling percentage	0.0143	0.0135
Head rice recovery percentage	0.0229	0.0204
Grain length (mm)	0.5455	0.3906
Grain breadth (mm)	0.4857	0.2915
L/B ratio	-0.0245	0.0990
Kernel length after cooking (mm)	0.0811	0.1153
Protein percentage	0.1374	0.1364
Amylose content	-0.0326	0.0407
Alkali digestion value	0.2301	0.2293

Table 2. Selection indices along with their genetic advance and relative efficiency in rice.

Discriminant function	Genetic Advance	Relative efficiency over grain yield plant^{-1}
Grain yield plant^{-1} (X_1)	0.384	100.000
Days to 50% flowering (X_2)	0.057	14.802
Plant height (X_3)	0.126	32.969
Ear bearing tillers plant^{-1} (X_4)	0.156	40.695
Panicle length (X_5)	0.120	31.262
Filled grains panicle^{-1} (X_6)	0.332	86.616
Test weight (X_7)	0.133	34.670
Milling percentage (X_8)	0.072	18.703
Head rice recovery (X_9)	0.198	51.660
L/B ratio (X_{10})	0.152	39.504
X_1+X_6	0.571	148.736
$X_1+X_4+X_6$	0.622	162.056
$X_1+X_4+X_6+X_{10}$	0.663	172.950
$X_1+X_4+X_6+X_9+X_{10}$	0.698	181.970
$X_1+X_4+X_6+X_8+X_9+X_{10}$	0.729	189.970
$X_1+X_2+X_4+X_6+X_8+X_9+X_{10}$	0.735	191.475
$X_1+X_3+X_4+X_5+X_6+X_8+X_9+X_{10}$	0.730	190.408
$X_1+X_2+X_3+X_4+X_5+X_6+X_8+X_9+X_{10}$	0.737	192.022
$X_1+X_2+X_3+X_4+X_5+X_6+X_7+X_8+X_9+X_{10}$	0.694	180.918

breadth (0.4857) and the least value was obtained by amylose content (-0.0326).

Discriminant function with index of genetic advance as well as relative efficiency over grain yield plant^{-1} was computed for ten characters viz., grain yield plant^{-1}(X_1), days to 50% flowering (X_2), plant height (X_3), ear bearing tillers plant^{-1}(X_4), panicle length (X_5), filled grains panicle^{-1}(X_6), test weight (X_7), milling percentage (X_8), head rice recovery percentage (X_9), and L/B ratio (X_{10}) (Table 2).

Hazel and Lush (1943) stated that the superiority of selection based on selection index increased with an increase in the number of charcters under selection. In the present study also, the relative efficiencies of selection indices based on single character were lower than those resulting from the use of selection index comprising a combination of two or more characters. Inclusion of character one by one in the function resulted in the increased efficiency of selection until the inclusion of nine characters. But when all the ten characters were included the genetic advance reduced.

Among the two character combination, grain yield with filled grains panicle^{-1} showed highest genetic advance (0.571) with a relative efficiency of 148.736% over grain yield plant^{-1}. When three characters were considered the function with characters grain yield plant^{-1}, ear bearing tillers plant^{-1}, filled grains panicle^{-1} gave highest genetic advance (0.622) with a relative efficiency of 162.056% over grain yield plant^{-1}. Among the four character combinations the function with characters grain yield plant^{-1}, ear bearing tillers plant^{-1}, filled grains panicle^{-1}, L/B ratio gave highest genetic advance (0.663) with a relative efficiency of 172.950% over grain yield plant^{-1}. The function which includes five characters viz., grain yield plant^{-1}, ear bearing tillers plant^{-1}, filled grains panicle^{-1}, head rice recovery percentage, L/B ratio recorded highest genetic advance (0.698) with a relative efficiency of 181.970% over grain yield plant^{-1}. The function which includes six characters viz., grain yield plant^{-1}, ear bearing tillers plant^{-1}, filled grains panicle^{-1}, milling percentage, head rice recovery percentage, L/B ratio recorded highest genetic advance (0.729) with a relative efficiency of 189.970% over grain yield plant^{-1}. Among the seven character combinations the function with characters viz., grain yield plant^{-1}, days to 50% flowering, ear bearing tillers plant^{-1}, filled grains panicle^{-1}, milling percentage, head rice recovery percentage, L/B ratio recorded highest genetic advance (0.735) with a relative efficiency of 191.475% over grain yield plant^{-1}. The function which includes eight characters viz., grain yield plant^{-1}, plant height, ear bearing tillers plant^{-1},panicle length, filled grains panicle^{-1}, milling percentage, head rice recovery percentage, L/B ratio recorded highest genetic advance (0.730) with a relative efficiency of 190.408% over grain yield plant^{-1}.

A function involving characters like grain yield plant^{-1}, days to 50% flowering, plant height, ear bearing tillers plant^{-1}, panicle length, filled grains panicle^{-1}, milling percentage, head rice recovery percentage, L/B ratio recorded highest genetic advance with a high relative efficiency over grain yield plant^{-1}. Hence, the index with these characters might be useful for simultaneous improvement of these characters. This is in accordance with the findings of Abraham *et al*. (1954), that the discriminant function may be useful for simultaneous improvement of character.

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