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SELECTION INDICES IN INDIAN RAPESEED (*Brassica campestris*) AND MUSTARD [*B. juncea*]

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ABSTRACT

Different selection indices were constructed separately in 14 toria and 7 mustard genotypes on the basis of multiple regression analysis and discriminant functions to determine the relative importance of various component characters. Based on their genetic variance, heritability and direct effect components, five characters in toria and four in mustard were chosen to construct multiple regression equations. The multiple regression equation involving all the characters indicated that the characters included in the multiple regression equations in toria and mustard respectively could explain 84.17% and 95.42% variation in seed yield. Different discriminant functions were fitted for the characters on which yield showed significant partial regression co-efficients. It was observed that the indices involving seed yield, biological yield, siliquae on main inflorescence and secondary branches per plant in toria and seed yield, biological yield and 1000-seed weight in mustard were quite effective and efficient.

INTRODUCTION

Selection based on a single character may not always be effective. On the other hand, it is a very cumbersome process for a breeder to involve a large number of component traits simultaneously in a selection programme. Therefore, knowledge of major yield components is necessary for evolving an effective selection criterion. Selection indices provide the means for making use of correlated traits for higher efficiency in selection for yield (Smith, 1936). In the present investigation, different selection indices have been constructed on the basis of multiple regression analysis and discriminant functions.

MATERIALS AND METHODS

Fourteen toria and seven mustard genotypes were grown in a randomized block design with three replications. Each plot consisted of three rows of 4m lengths, with a spacing of 30cm X 10cm. Observations were recorded on ten random plants from each plot for thirteen characters related to crop duration and yield. Based on their genetic variance, heritability and direct effect components on yield, five characters viz. biological yield, plant height, length of main inflorescence, siliquae on main inflorescence and secondary branches per plant in toria and four characters viz. biological yield, plant height, seeds per siliqua and 1000-seed weight in mustard were chosen to fit multiple regression equations. Multiple regression equations were constructed with the help of partial regression co-efficient of yield on independent characters. The component characters on which yield showed significant partial regression were used to construct different selection indices following the method suggested by Goulden (1959).

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RESULTS AND DISCUSSION

The multiple regression equations with their efficiencies and partial regression co-efficients of the characters on yield in toria and mustard are presented in Table 1 and Table 2 respectively. Multiple regression equation in toria with all the five characters exhibited 84.17 per cent efficiency while that in mustard with all the four characters exhibited 95.42 per cent. Partial regressions of yield on length of main inflorescence in toria and on plant height in mustard were found to be non-significant. Therefore, two more multiple regression equations were constructed one in toria and another in mustard with the characters on which yield showed significant partial regressions and their efficiencies were estimated to be 78.97 per cent in toria and 93.86 per cent in mustard. The exclusion of length of main inflorescence in case of toria and plant height in case of mustard from the multiple regression equations resulted in the reduction of their efficiencies only by 5 per cent and 1.5 per cent respectively indicating that these are not important characters contributing to the total variation in seed yield in these two species.

Fifteen different selection indices were constructed in both toria and mustard in different combinations for the characters on which yield showed significant partial regression co-efficients. The efficiency of different indices was determined by calculating genetic advance and comparing it with straight selection for seed yield taken as 100 per cent. Different discriminant functions along with their genetic advance and relative efficiency for toria and mustard are presented in Table 3 and Table 4 respectively. The data revealed that the efficiency of the indices increased at a declining rate with the inclusion of additional characters. Similar results were also reported by Sidhu et al. (1995) in pigeon pea. Hazel and Lush (1942) stated that superiority of selection based on selection indices increased with an increase in the number of characters under selection.

In the present investigation straight selection for seed yield in both toria and mustard was found to be more efficient as compared to indirect selection for seed yield based on any single character except biological yield per plant which was equally efficient with straight selection. Considering two traits at a time, the combination of seed yield and biological yield per plant exhibited the highest efficiency in both toria and mustard. Among the three-factor indices in toria, two indices one with seed yield, biological yield and secondary branches per plant and another with seed yield, biological yield and siliquae on main inflorescence exhibited the maximum efficiencies of 160.82 per cent and 160.32 per cent respectively. Whereas, in case of mustard the index involving seed yield, biological yield and 1000-seed weight exhibited the maximum efficiency of 177.08 per cent which was about 19 per cent less as compared to the most efficient index involving all the four characters. The four-factor index constructed with seed yield, biological yield, siliquae on main inflorescence and secondary branches per plant in toria exhibited the highest relative efficiency of 174.04 per cent and it was at par with the index involving all the five characters. Thus, considering the difficulty in simultaneous selection, it can be concluded that the index involving four characters viz. seed yield, biological yield, siliquae on main inflorescence and secondary branches per plant in toria and the index involving three characters viz. seed yield, biological yield and 1000-seed weight in mustard are quite efficient. Choudhury et al. (1990) also reported that secondary branches and biological yield per plant are some of the important characters in different Brassica species.

REFERENCES

Choudhury, B. D.; Singh P. ; Singh D. P. and Kumar A. (1990). Association and interdependence of morph physiological characters under moisture stress in brassicas. *Beitrage zur Tropischen Landwirt shaft und. Veterinarmedizin.* **28 :** 43 - 47.

Goulden, C.H. (1959). Methods of Statistical Analysis. John Wiley and Sons. Inc., New York.

Hazel, L.N. and Lush, L. (1942). The efficiency of three methods of selection. *J. Heredity.* **33:** 393 - 399.

Sandhu, T.S.; Reddy, K.R. and Gumber, R.K. (1995). Relative efficiency of different selection indices for seed yield in pigeon pea (Cajanus cajan L.). *Indian J. Genet.* **55** : 384 - 388.
Smith, H.F. (1936). A discriminant function for plant selection. *Ann. Eugen.* **7**: 240 - 250.

Table 1. Partial regression co-efficients and corresponding standard errors (S.E.) for multiple regression equations along with their efficiency in *toria.*

Multiple regression equations	Efficiency (%)	Partial regression of yield on:	Partial regression co-efficients with S.E.
Ye= -7.132+0.1473 X_1		Biological yield per plant (b_1)	0.1473**±0.047
+0.0545 X_2		Plant height (b_2)	0.0545*±0.025
+0.0114 X_3		Length of main inflorescence (b_3)	0.0114*±0.013
+0.0951 X_4		Siliquae on main inflorescence (b_4)	0.0951*±0.051
-0.0858 X_5	84.17	Secondary branches per plant (b_5)	-0.0858*±0.057
Ye= -6.208+0.1384 X_1		Biological yield per plant (b_1)	0.1384**±0.044
+0.0534 X_2		Plant height (b_2)	0.0534*±0.018
+0.0875 X_4		Siliquae on main inflorescence (b_4)	0.0875*±0.039
-0.0427 X_5	78.97	Secondary branches per plant (b_5)	-0.0427±0.036

* Significant at p= 0.05

** Significant at p= 0.01

Table 2. Partial regression co-efficients and corresponding standard errors (S.E.) for multiple regression equations along with their efficiency in mustard.

Multiple regression equations	Efficiency (%)	Partial regression of yield on:	Partial regression co-efficients with S.E.
Ye= -3.052+0.0955 X_1		Biological yield per plant (b_1)	0.0955*±0.042
+0.0129 X_2		Plant height (b_2)	0.0129 ±0.015
+0.1381 X_3		Seeds per siliqua (b_3)	0.1381*±0.053
+0.8615 X_4	95.42	1000-seed weight (b_4)	0.8615*±0.289
Ye= -3.759+0.1195 X_1		Biological yield per plant (b_1)	0.1195*±0.031
+0.1613 X_3		Seeds per siliqua (b_3)	0.1613 ±0.091
+0.9307 X_4	93.86	1000-seed weight (b_4)	0.9307*±0.268

* Significant at p= 0.05

Table 3. Discriminant functions, Genetic advance and Relative efficiency of different functions in *toria*.

Sl. No.	Discriminant functions	Genetic advance	Relative efficiency (%)
1.	$0.1582\ X_1$	0.90	100.00
2.	$0.0434\ X_2$	0.90	99.85
3.	$0.0085\ X_3$	0.35	39.09
4.	$0.0215\ X_4$	0.53	58.51
5.	$0.1635\ X_5$	0.63	69.79
6.	$0.1492\ X_1+0.0519\ X_2$	1.32	146.08
7.	$0.1538\ X_1+0.0126\ X_3$	0.99	109.49
8.	$0.1623\ X_1+0.0031\ X_4$	0.94	103.72
9.	$0.1503\ X_1+0.1654\ X_5$	1.08	120.15
10.	$0.1471\ X_1+0.0500\ X_2+0.0140\ X_3$	1.38	152.60
11.	$0.1351\ X_1+0.0561\ X_2+0.0270\ X_4$	1.45	160.32
12.	$0.1381\ X_1+0.0531\ X_2+0.1630\ X_5$	1.45	160.55
13.	$0.1790\ X_1+0.0384\ X_2+0.0063\ X_3+0.1544\ X_5$	1.45	160.82
14.	$0.1238\ X_1+0.0580\ X_2+0.0273\ X_4+0.1615\ X_5$	1.57	174.04
15.	$0.1235\ X_1+0.0570\ X_2+0.0140\ X_3+0.0253\ X_4+0.1630\ X_5$	1.62	179.66

X_1= Seed yield per plant

X_2= Biological yield per plant

X_3= Plant height at maturity

X_4= Number of siliquae on main inflorescence

X_5= Number of secondary branches per plant

Table 4. Discriminant functions, Genetic advance and Relative efficiency of different functions in mustard.

Sl. No.	Discriminant functions	Genetic advance	Relative efficiency (%)
1.	$0.1151\ X_1$	0.572	100.00
2.	$0.0258\ X_2$	0.604	105.67
3.	$0.0608\ X_3$	0.431	75.35
4.	$0.2208\ X_4$	0.454	79.37
5.	$0.0858\ X_1+0.0378\ X_2$	0.883	154.38
6.	$0.1104\ X_1+0.0764\ X_3$	0.740	129.58
7.	$0.1023\ X_1+0.2720\ X_4$	0.738	129.04
8.	$0.0265\ X_2+0.0653\ X_3$	0.758	132.57
9.	$0.0262\ X_2+0.2289\ X_4$	0.765	133.72
10.	$0.0588\ X_3+0.2131\ X_4$	0.615	107.57
11.	$0.0821\ X_1+0.0371\ X_2+0.0760\ X_3$	0.996	174.08
12.	$0.0421\ X_1+0.0430\ X_2+0.3179\ X_4$	1.013	177.08
13.	$0.0891\ X_1+0.0831\ X_3+0.2879\ X_4$	0.881	154.01
14.	$0.0274\ X_2+0.0626\ X_3+0.2214\ X_4$	0.887	155.03
15.	$0.0229\ X_1+0.0433\ X_2+0.0875\ X_3+0.3410\ X_4$	1.125	196.59

X_1= Seed yield per plant

X_2= Biological yield per plant

X_3= Number of seeds per siliqua

X_4= 1000-seed weight