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COHERITABLE VARIATION AND DISCRIMINANT FUNCTION ANALYSIS FOR SEED YIELD IN LINSEED (*Linum usitatissimum* L.)*

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Coheritability of different pairs of characters and selection indices for seed yield were determined in 39 different strains of linseed. All characters were found to have higher coheritability value with yield per plant than the heritability of yield per plant except tillers per plant and plant height. Coheritability value was found high in seed yield with plant height while it showed decrease in seed yield with tillers per plant over the heritability of plant height and tillers per plant, respectively. Selection criteria on the basis of high coheritability value exhibited by a character pair involving yield was formed. The characters like days to flowering and maturity, seed weight, capsule length and breadth, seeds per capsule, capsules per plant and seed yield were suggested for yield improvement where as simultaneous selection for tillers per plant and plant height could lead to gain in yield. All single characters indices possessed low efficiency as compared to that of straight selection for seed yield. Two characters selection indices based on seed yield with seeds per capsule, tillers per plant, plant height, 1000 seed weight and capsule per plant showed increased efficiency over straight selection for seed yield. The selection indices based on three, four, five and six characters showed increase efficiency in sequence with the addition of each character over previous index except three characters index under study.

Phenotypic and genotypic correlations have been extensively used in predicting the effects of selection and in isolating desirable genotype from a breeding population. The genetic correlations might arise from linkages or pleiotropic effects of genes. It does not however take into consideration the environmental effects which are important components of the phenotypic variance on which selection is applied. Coheritability on the other hand is considered a more general genetic parameter for raising the efficiency of plant selection as it permits the study of changes in pairs of characters. Discriminant function helps in assessing genotypic value of yield from phenotypic observation on number of characters acting as its components. Yield is a quantitative character which always poses problem for the breeders when selecting a desired genotypes based on yield alone. Simultaneous selection on several characters has proved to be very useful in such situations in crop plants. Therefore, coheritability estimates of different pairs of characters are reported as compared correlation coefficients and discriminant function analysis was taken up for studying expected gain for seed yield in Linseed in this paper.

MATERIALS AND METHODS

The exprimental material consisted of 39 different strains of Linseed. These were grown in randomised block design with three replications in *Rabi* 1971-72 at exprimental field of Botany

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department, Punjabrao Krishi Vidyapeeth, Akola. Three rows of 6m. length was adopted for each entry. The specing was 60 x 30cm between and within rows. The usual cultural practices were followed. Data were recorded on days to followering and maturity, tillers per plant, plant height capsules per plant, seeds per capsule length and breadth, 1000 seed weight and seed yield per plant from five random plants in each plot. Coheritability was calculated by the formula suggested by Nei (1960). Six characters were used for the construction of selection indices on the basis of their genetic correlarion coefficients with yield in decending order. Phenotypic and genotypic variances and covariances were used fof the calculation of different discriminant function coefficients according to Smith (1936). The model suggested by Robinson *et al.*, (1951) was used for construction of selection indices and development of a required discriminant function.

RESULTS AND DISCUSSION

The heritability values estimated in bread sense based on phenotypic expression were moderate indicating effectiveness of selection in all characters except plant height (3.28% low). It was higher in character capsule length (32.09 %), followed by the characters 1000 seed weight (29.94 %), days to flowering (29.74 %), capsule breadth (29.0 %), seed yield per plant (24.18 %), seeds per capsule (22.68%), days to maturity (19.68 %), capsules per plant (16.07 %) and tillers per plant (14.27 %). The coheritability estimates were given in table 1 for different character pairs. The coheritability values of yield with other characters were higher than the heritability of yield except in seed yield with plant height (0.2262) and tillers per plant (0.0716). The association of seed yield with characters days to flowering (0.3645), capsule length (0.3568), 1000 seed weight (0.3512), days to maturity (0.3437), seeds per capsule (0.3387), capsule breadth (0.3154), and capsule per plant (0.2756) showed higher coheritability values than the heritability of seed yield per plant (24.18 %) and respective characters alone. The results are in line with Nei (1960). It revealed that inclusion of seed yield in combination of above characters in selection increased the genetic gain compared to selection based on either of the above characters alone. This fact emphasised the importance of seed yield in the selection programme alongwith other characters for higher genetic gian and the efficiency of selection for yield in improvement programme. Thus, the characters like days to flowering and maturity, seeds per capsule, capsule length and breadth, 1000 seed weight and capsules per plant can serve as indicatore for raising the efficiency of selection for yield and higher genetic gain when selection based on seed yield with each of the above characters. Seed yield with 1000 seed weight capsule length and breadth, capsules per plant had significant and possitive correlation coefficient while seed yield with days to flowering and maturity and seeds per capsule had negative and significant correlation coefficient at genotypic level. Seed yield with all other characters showed weak or less environmental correlation coefficient compare to phenotypic and genotypic correlation coefficients between these characters except in seed yield with tillers per plant (0. 4095). The euvironmental fluctuations were significant in character pairs seed yield with tillers per plant, capsule per plant, seeds per capsule and capsule length,

The seed yield with plant height (0.2262) showed higher coheritability than the heritability of plant height (3.28 %) alone but the coheritability in these characters pair was less compared to the heritability of seed yield alone. The lowest coheritability (0.0716) was observed in seed yield with tillers per plant over the heritability of either character alone. This might be due to significant environmental correlation coefficient (0 4095) in seed yield with tillers per plant. The lower coheritability values in seed yield with tillers per plant and plant height suggest that although it is possible to select for yield directly, yet there will be difficulties in the simultaneous improvement of these characters. The high *inter se* estimates of coheritability of days to flowering and maturity, capsules per plant, seeds per capsule, capsule length and breadth, 1000 seed weight and seed yield per plant indicated that good progress in yield improvement can be expected by basing selection on these characters. The low *inter se* estimates of coheritability with tillers per plant, plant height and capsules per plant indicated the absence of coheritable variation among these pairs of characters. Information on heritable variation is a pre-requisite in breeding programme and response to selection would also depend on characters association in inheritance. Coheritability which refer to the coheritance of different character pairs and indicated the genetic progress which would result from the joint selection for these characters is a better genetic parameter than genetic correlation as the latter does not take account of environmental variance which is also a component of phenotypic variance while selection is applied. The present study has clearly brought out some variable characters pair inheritance of importance and in conclusion it should be possible to visualize high yielding types based on a selection index involving days to flowering and maturity, capsules per plant, seeds per capsule, capsulelength and breadth, 1000 seed weight and seed yield per plant that could lead to gains in yield.

The indices for seed yield consist of single character and combination of two, three, four, five and six character (Table 2). Among the single character indices straight selection for seed yield per plant showed the highest genetic advance (17) followed by capsules per plant (15), 1000 seed weignt (14), plant height (6) and tillers per plant (1). The relative efficiencey of single character indices was less than straight selection for seed yield. The selection index based on single character viz., seeds per capsule and 1000 seed weight showed comparatively higher relative efficiency (88.3 and 79.9 per cent, respectively) while it was lower in selection index based on the characters plant height (32.5%) and tillers per plant (5.8%) in alone. When seed yield was included with each of the characters under study in two characters selection indices, maximum relative efficiency alongwith proportionate genetic gain was estimated in seed yield with seeds per capsule (186.6%) followed by seed yield with tillers per plant (185.7%), seed yield with plant height (177.6%) seed yield with 1000 seed weight (167.5%) and seed yield with

Table 1. Estimates of coheritability of different pairs of characters in Linseed.

Characters	Days to maturity	Tillers/ plant	Plant height	Capsules plant	Seeds/ capsule	Capsule length	Capsule breadth	1000 seed weight	Seed yield/ plant.
Days to flowring	0.2889**	0.0565	0.2239	0.4576	0.3413**	0.3547**	0.3287**	0.4962**	0.3645**
Days to maturity		-0.0624	0.2019	0.3905*	0.3821**	0.3165**	0.4396	0.3149**	0.3437**
Tillers per plant			0.1374	0.0186*	0.3931	0.3620	0.3152*	0.2722*	0.0716
Plant height				0.1256	0.2255**	0.2936	0.2874*	0.3388	0.2262**
Capsules per plant					0.3407**	0.3148*	0.2827	0.3419	0.2756**
Seeds per capsule						0.3418**	0.3588**	0.3181**	0.3386**
Capsule length							0.2952**	0.3199**	0.3568**
Capsule breadth								0.3231**	0.3154**
1000 seed weight									,3512**

*, ** indicate where phenotypic correlation coefficient were significant at 5 and 1% levels.

Table 2. Discriminant function, Excepted Genetic Advance in seed yield and Relative efficiency of different selection indices.

Selection Index	Discriminant function	Genetic Advance	Relative efficiency %
X_6 Seed yield	$0.2418X_6$	17.0774	100
X_1 Seeds per capsule	$1.4422X_1$	15.0940	88.38
X_2 Tillers per plant	$0.0343X_2$	0.9976	5.84
X_3 1000 weight	$0.5754X_3$	13.6582	79.98
X_4 Plant height	$0.0664X_4$	5.5420	32.45
X_5 Capsules per plant	$0.0149X_5$	13.8178	80.91
X_6X_1	$0.8204X_6 - 0.1677X_1$	31.8698	186.62
X_6X_2	$0.8374X_6 - 0.1351X_2$	31.7139	185.71
X_6X_3	$0.6795X_6 + 3.4547X_3$	28.6134	167.55
X_6X_4	$0.7852X_6 - 0.0573X_4$	30 3356	177.64
X_6X_5	$0.5163X_6 + 0\ 0071X_5$	26.7120	156.42
$X_6X_5X_4$	$0.4591X_6 + 0.0076X_5 - 0.0457X_4$	25.0949	146.95
$X_6X_5X_4X_3$	$0.2961X_6 - 0.0129X_5 - 0.0384X_4 + 2.6557X_3$	32.1710	188.38
$X_6X_5X_4X_3X_2$	$0.2910X_6 - 0.0138X_5 - 0.0364X_4 + 2.7827X_3 + 0.9119X_2$	32.9518	192.95
$X_6X_5X_4X_3X_2X_1$	$0\ 2691X_6 - 0.0149X_5 - 0.003X_4 + 2.2226X_3 + 0.9654X_2 - 1.3770X_1$	33.1590	194.17

capsules per plant (156.4%). It is interesting to note that with inclusion of yield in combination of each of yield components, the efficiency of new index increased considerably as compared to single characters index of each yield components. The results are in accordance with the findings of Chawghawe (1969). In three character selection index selection of plant height alongwith seed yield and capsules per plant was efficient. The efficiency of this index decreased by 9.5% as compared to previous two character index (i. e. seed yield and capsules per plant) but increased efficiency (47%) over straight selection for seed yield. It revealed the comparative unreliability of this character in increasing seed yield in the above given combination over two characters selection indices. In four character selection index, the character 1000 seed weight was assuming importance in addition to seed yield, capsules per plant and height with an increased efficiency of 41.4 per cent over previous three characters selection index and also on all two characters selection indices. The selection index based on seed yield per plant, capsules per plant, plant height, 1000 seed weight and tillers per plant (five characters) showed increased efficiency of 193.0 per cent while the six characters index based on seed yield, capsule per plant, plant height, 1000 seed weight, tillers per plant and seeds per capsules showed the highest relative efficiency of 194.2 per cent. Thus, the study revealed that the selection based on all yield components of seed yield gave the highest efficiency of 94.2 per cent over straight selection based on seed yield alone. However selection for high yield would be apparently based on the genetic advance in seed yield through appropriate indices. In the present study two characters selection indices based on seed yield with seeds per capsule and tillers per plant showed comparatively higher genetic advance values i. e. 31.86% and 31.71% respectively. There was no significant gain in genetic advance in three, four, five and six character indices. It revealed that two character selection indices based on seed yield with seeds per capsule or tillers per plant would be a better selection method than exerting pressure through seed yield per plant alone. These indies can be reframed as 17 times number of seeds per capsules substracted from 82 times seed yield per plant or 13 times tillers per plant substracted from 84 times seed yield per plant would be a better selection method for improvement of seed yield in Linseed.

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