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SELECTION CRITERIA FOR HIGH YIELDING GENOTYPES IN EARLY F_2 GENERATION OF TWELVE INTER VARIETAL CROSSES OF *Brassica rapa*

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ABSTRACT

An experiment was conducted at Sher-e-Bangla Agricultural University during November 2005-March 2006 to find out the selection criteria for selecting high yielding genotypes in early F_2 segregating population by estimating both correlation coefficient and path analysis between yield and its main economic traits in F_2 generation of twelve inter varietal crosses in *Brassica rapa*. The result of correlation analysis revealed that yield/plant had no significant positive association with plant height, number of secondary branches/plant, days to 50% flowering, length of siliqua, number of siliquae/plant and number of seeds/siliqua. Path coefficient analysis also confirmed that number of seeds/siliqua was important yield determinants followed by plant height, number of secondary branches/plant and number of siliquae/plant. Based on the correlation and path coefficients, it may be inferred that number of seeds/siliqua and plant height must be used as selection criteria in early F_2 generation of twelve inter varietal crosses of *Brassica rapa*.

Key words: Segregating population, F_2 generation, Correlation coefficient, Path analysis, Inter varietal crosses

INTRODUCTION

The *Brassica* genus contains many agronomically important crop species with a range of adaptation for cultivation under varied agroclimatic conditions. It is a highly diverse genus of plants belonging the family Brassicaceae or the mustard or cabbage family. It contains species that are of great economic importance since most species are some of the world's oilseed, forage, ornamental and vegetable crops. Almost all parts of many species have been developed to be edible including roots, stems, buds, leaves, flowers and seeds (AVRDC, 2000).

Most agronomical important traits including grain yield have complex genetic inheritance and require the use of relatively large populations for efficient plant breeding programme. In early stage of breeding programme, the direct estimates of yield are quite difficult. Plant breeders are commonly selecting for yield components which indirectly increase yield. Thus, yield components breeding to increase grain yield would be most effective if components involved were highly heritable and genetically independent or positively correlated in early generations. The relationship between yield and its main economic components in segregating population has been extensively studied. In *Brassica rapa* visual selection would be effective for yield and its component traits due to the positive association of number seeds/siliqua and 1000 seed weight with yield/plant. Similarly Nasim *et al.* (1994) and Kumar *et al.* (1984) found positive and significant correlation between yield/plant and 1000 seed weight in *Brassica rapa* in F_2. Besides these, the information on direct and indirect relative contribution of each component character towards yield will help the breeders to formulate the effective selection criteria in selecting desirable genotypes in early segregating populations. In this view, the present study was planned to determine the correlation and path analysis for yield and important yield components by using F_2 generation of twelve inter varietal crosses of *Brassica rapa*.

MATERIALS AND METHODS

The experiment was undertaken in the experimental farm, Sher-e-Bangla Agricultural University (SAU), Dhaka during November 2005-March 2006. The experiment was set up in a RCBD design with three replications, following 30 cm x 10 cm spacing. The unit plot size was 5 m×25 m and block to

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block distance was 1.5 m. The plot was fertilized with 250,170, 85, 150, 5 Kg/ha Urea, TSP, MP, Gypsum and Borax, respectively. Standard agronomic practices were carried out to raise healthy crop. Data were recorded on plant height, number of primary branches/plant, number of secondary branches/plant, length of siliqua, number of seeds/siliqua, number of siliquae/plant, days to 50% flowering, days to maturity, 1000 seed weight and yield/plant from ten plants selected at random from each line in each replication. Correlation and path coefficient values were calculated as explained by Singh and Chaudhary (1985) where yield/plant was kept as resultant variable and other yield component character as causal variables.

RESULTS AND DISCUSSION

Plant height showed highly significant positive association with days to 50% flowering and significant positive association with length of siliqua (Table 1). The results revealed that the tallest plant should be selected for length of siliqua. Plant height had non significant negative association with number of primary branches/plant, number of siliquae/plant and thousand seed weight. Number of seeds/siliqua and yield/plant had non significant correlation with plant height. Positive correlation of plant height with number of seeds/siliqua, number of siliquae/plant and negative correlation with 1000 seed weight were reported by Chaudhary and Prasad (1987).

Number of Seeds/siliqua showed non significant positive correlation with number of siliquae/plant and yield/plant but non significant negative association with thousand seed weight. Number of siliquae/plant had non significant positive association with yield/plant. Thousand seed weight showed non significant negative correlation with number of siliquae/plant and yield/plant.Number of primary branches/plant had significant positive correlation with number of siliquae/plant but non significant positive correlation with number of secondary branches/plant and 1000 seed weight. But number of primary branches/plant had non significant negative correlation with days to 50% flowering, length of siliqua, number of seeds/siliqua and yield/plant. Singh *et al.* (1969) found the similar findings earlier in his experiment. Number of secondary branches/plant showed negative correlation with length of siliqua and number of seeds/siliqua. Days to 50% flowering showed highly significant positive association with length of siliqua and non significant negative association with number of siliquae/plant and 1000 seed weight. The results revealed that number secondary branches/plant might not be considered for the selection of number of seeds/siliqua but early flowering type genotype might be selected for length of siliqua. Positive significant and non significant association of length of siliqua with number of seeds/siliqua and yield/plant with number of siliquae/plant respectively Chaudhary *et al.* (1993) found that seed yield was positively correlated with siliqua length which was agreed with the present findings. Correlation co-efficient might not provide an exact picture of the relative importance of direct and indirect influence of each of yield components on seed yield per plant. As a matter of fact, in order to find out a clear picture of the interrelationship between seed yield per plant and other yield attributes, direct and indirect effects were worked out using path analysis which also measured the relative importance of each component. The results of path co-efficient analysis using F_2 materials of *Brassica rapa* were presented in Table 2. Plant height showed positive direct effect on yield/plant and positive indirect effects through number of primary branches/plant and number of seeds/siliqua. On the other hand, plant height had negative indirect effect on number of secondary branches/plant, days to 50% flowering, length of siliqua, number of siliquae/plant and thousand seed weight. Han (1990) working with *Brassica napus*, observed negative direct effect of number of siliquae/plant and positive direct effect of number of seeds/siliqua and plant height on seed yield. There was disagreement of the present findings with that of Han (1990). Path analysis showed that number of primary branches/plant had negative direct effect on yield/plant and negative indirect effect with plant height, number of seeds/siliqua and thousand seed weight. Number of primary branches/plant showed positive indirect effect through number of secondary branches/plant, days to 50% flowering, length of siliqua and number of siliquae/plant. Kakroo and Kumar (1991) found that 1000 seed weight had positive direct effect but number of branches/plant had negative indirect effect via number of seed/siliqua on seed

Table 1. Correlation co-efficient among different characters of the F_2 materials of the *Brassica rapa*

Characters	Plant height (cm)	No. of primary branches/ plant	No. of secondary branches/ plant	Days to 50% flowering	Length of siliqua (cm)	Seeds/ siliqua (no.)	Siliquae/ plant (no.)	1000 seed weight (g)	Yield/ plant (g)
Plant height (cm)	**1.000**	-0.315	-0.529**	0.680**	0.396*	0.173	-0.242	-0.239	0.255
No. of primary branches/plant		**1.000**	0.225	-0.114	-0.144	-0.104	0.381*	0.136	-0.204
No. of secondary branches/plant			**1.000**	-0.429**	-0.239	-0.247	0.414*	0.207	0.167
Days to 50% Flowering				**1.000**	0.355*	0.319	-0.118	-0.021	0.060
Length of siliqua (cm)					**1.000**	0.360*	0.099	-0.319	0.243
Seeds/ siliqua (no.)						**1.000**	0.105	-0.208	0.042
Siliquae/plant (no.)							**1.000**	-0.058	0.236
1000 seed weight (g)								**1.000**	-0.072

**, Significant at the 0.01 level; *, Significant at the 0.05 level

Table 2. Partitioning of genotypic correlation with seed yield per plant into direct and indirect components of F_2 materials of *Brassica rapa*

Characters	Plant height (cm)	No. of primary branches/ plant	No. of secondary branches/ plant	Days to 50% flowering	Length of siliqua (cm)	Seeds/ siliqua (no.)	Siliquae/ plant (no.)	1000 seed weight(g)	Yield/ plant (g)
Plant height (cm)	**0.766**	4.485	-0.245	-0.174	-2.735	9.526	-5.700	-7.778	0.255
No. of primary branches/plant	-0.241	**-0.142**	0.104	2.910	9.947	-5.726	8.974	-4.426	-0.204
No. of secondary branches/plant	-0.405	-3.204	**0.463**	0.110	1.651	-0.000	9.752	-0.067	0.167
Days to 50% flowering	0.521	1.623	-0.199	**-0.255**	-2.453	1.756	-2.780	6.833	0.06
Length of siliqua (cm)	0.303	2.050	-0.111	-9.063	**-6.908**	1.982	2.332	0.104	0.243
Seeds/ siliqua (no.)	0.132	1.480	-0.114	-0.081	-2.487	**5.506**	2.473	0.068	0.042
Siliquae/plant (no.)	-0.185	-5.425	0.192	3.013	-6.839	5.781	**0.236**	0.019	0.236
1000 seed weight (g)	0.183	-0.019	9.587	5.361	2.203	-1.145	-1.366	**-0.325**	-0.072

Residual effect: 0.63; Bold figures indicate direct effects

yield. Number of secondary branches/plant had positive direct effect on yield/plant and negative indirect effects through plant height, number of primary branches/plant, number of seeds/siliqua and thousand seed weight. On the other hand, number of secondary branches/plant had positive contribution on days to 50% flowering, length of siliqua and number of siliquae/plant. Days to 50% flowering had negative direct effect on yield/plant and positive indirect effects through plant height, number of primary branches/plant, number of seeds/siliqua and 1000 seed weight. Chauhan and Singh (1985) observed high positive direct effect of days to 50% flowering, plant height, primary branching, siliqua/plant, seeds/siliqua on yield. Length of siliqua had negative direct effect on yield/plant but positive contribution via plant height, number of primary branches/plant, number of seeds/siliqua, number of siliquae/plant and 1000 seed weight. Kumar *et al.* (1984) and Chen *et al.* (1983) found siliqua length had negative effect on plant height and days to maturity. Number of seeds/siliqua and siliquae/plant had positive direct effect on yield/plant. Chen *et al.* (1983), Chauhan and Singh (1985) and Han (1990) found substantial direct effect of number of seeds/siliqua and number of siliquae/plant on seed yield.

It was evident that the correlations between yield and the various characters have been portioned into direct and indirect effect. Though the correlation coefficient was positive but the direct effect was negative as seen for days to 50% flowering and length of siliqua. Therefore, the indirect effects seemed to be the cause of correlation. In such situation the indirect causal factors were to be considered simultaneously. When correlation coefficient was negative and the direct effect was positive and high, though such situation was not noticed in the study, a restricted simultaneous selection model is to be followed, i.e. restrictions are to be imposed to nullify the undesirable indirect effects in order to make use of the direct effect (Singh and Kakar, 1977).The residual effect was 0.63, indicated that about 37% of the variability was contributed by eight quantitative characters studied in path analysis. This high residual effect might be due to characters not studied, environmental factors, sampling error etc.

In correlation and path coefficients analysis, it was observed that number of seeds/siliqua and plant heights were the most important yield components in *Brassica rapa*. Therefore, the results suggested that these yield attributing characters must be used as selection criteria in early F_2 generation of twelve inter varietal crosses of *Brassica rapa* and priority should be given to these characters in breeding program for higher seed yield.

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