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EFFECTIVENESS OF INDIVIDUAL PLANT SELECTION IN EARLY GENERATIONS OF BREAD WHEAT

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ABSTRACT

Reliability of individual plant selection was tested for grain yield, plant height, effective tillers, total dry matter, grain per spike, kernel weight and harvest index in five F_2 populations of bread wheat. Plants were selected for each of the seven characters in positive and negative directions in F_2 generation and selection response was measured in F_3 generation. Inter- generation correlation coefficients and realized heritability estimates were also computed for all the seven characters in the five F_2's. Individual plant selection for plant height and for kernel weight was found to be effective while, it was ineffective for the remaining characters.

Key words : *Triticum aestivum*, Early generation selection, realized heritability.

Early generation selection is desirable because a genotype possessing all the desirable genes in either the homozygous or heterozygous condition occurs most often in the F_2 generation, with its frequency declining in subsequent generations. Sneep [1] illustrated how the chances for the recovery of a plant with all the desired alleles for yield reduces with advanced generations. Although the percentage of homozygous genotypes increases considerably with advanced generations, the number of plants that are necessarily involved in the selection becomes so large that the size of the population grows beyond manageable limits.

Selection for yield and yield components in early generations has produced varying results [2, 3]. Therefore, the present investigation was undertaken to determine the reliability of individual plant selection in the F_2 generation for yield and its components.

MATERIALS AND METHODS

F_2 populations of five crosses namely CPAN 1992/Raj 3077 (population 1), HW 2002A/HUW 234 (population 2), HD 2403/WH 542 (population 3), PBW 138/HD 2481 (population 4) and UP 2121/CPAN 2063 (population 5) were planted at 23 x 10 cm spacing in 20 rows, each 5 m long during the *rabi* season of 1992-93 at Crop

Research Centre of this university. At maturity, 400 plants were harvested and threshed individually from each F_2 population. Data on individual plants were recorded for seven characters, namely, plant height (cm), number of effective tillers, total dry matter (g), grains/spike, grain yield(g), 200-kernel weight (g) and harvest index(%). Under each category, 10 highest scoring and 10 lowest scoring plants were selected. Performance of progenies of positive and negative selections for seven traits was evaluated in a split-plot design with two replications, keeping crosses as main-plots and selection groups as sub-plots during *rabi* 1993-94. F_3 seeds were space planted as in F_2 and all observations were recorded on 50 plants, selected at random from each selection group in each cross. Response to selection estimated in F_3 generation was the difference between the mean of the progenies of the positive and the mean of the progenies of the negative F_2 selection groups, for a character in each cross [4]. Inter-generation correlations between mean of selected plants in F_2 and mean of their progenies in F_3 were also computed. In the present study realized heritability estimates were computed following Alexander *et al.* [4].

RESULTS AND DISCUSSION

Analysis of variance revealed that all the F_2 crosses had significant differences for all the characters except harvest index. Different selection groups also showed significant differences for all the characters except grain yield. Presence of significant interaction between F_2 populations and selection groups for all the traits except grain yield indicated that response to selection varied from population to population for all the traits except grain yield.

The mean values of F_2 selection group progenies in F_3 generation under both positive and negative groups for all seven characters are presented in Table 1, and inter-generation correlation coefficients and realized heritability estimates in Table 2. Selection for tall plant height resulted in taller progenies and vice-versa in all the populations except population 1. The height differences between positive and negative groups were significant in populations 2, 4 and 5. Inter-generation correlation coefficients between F_2 and F_3 for plant height were also highly significant in these three populations. In addition, realized heritability estimates were also high in these three populations. Thus selection for plant height in the F_2 generation was effective in these three populations. For number of effective tillers, selection was effective in population 1 only. When the selection was applied for total dry matter, significant differences between positive and negative selections occurred in two populations, namely, population 1 and 2. Inter-generation correlation coefficients between F_2 and F_3 for total dry matter was non significant in all the populations and realized heritability estimates were low in all the populations except population 1.

Table 1. Mean values of F_3 progenies derived from positive (+) and negative (–) value F_2 plants

Population	Plant height (cm)		Effective tillers		Total dry matter (g)		Grains/spike		Grain yield (g)		200-kernel weight (g)		Harvest index(%)	
	+	–	+	–	+	–	+	–	+	–	+	–	+	–
1	83.13	88.64	15.21*	9.17	83.19*	42.42	42.78	40.26	16.51	15.43	7.48	7.02	35.14	33.08
2	107.15*	76.58	12.90	14.34	75.45*	51.32	38.92	36.11	20.99	19.74	8.41*	6.77	37.01	34.11
3	80.45	74.71	14.45	11.76	58.61	56.99	47.39*	37.94	22.44	23.34	7.76*	6.40	38.93	36.46
4	87.62*	62.68	11.72	9.32	54.31	40.79	37.29	36.62	16.29	13.30	9.26*	7.45	38.76	36.11
5	95.28*	77.46	8.59	7.08	55.91	56.78	43.85	39.91	18.34	17.35	8.28*	7.19	34.84	34.20
CD 5%	6.32		3.08		13.88		4.31		10.41		0.64		3.88	

*Significantly higher mean under + group over corresponding – group.

Table 2. Inter-generation (F_2/F_3) correlation coefficients (r) and realized heritability estimates (h^2) for yield and its components in five crosses of wheat

Character		Cross				
		1	2	3	4	5
Plant height	r	0.12	0.80**	–0.06	0.71**	0.72**
	h^2	–0.17	0.47	0.16	0.47	0.50
Tillers/plant	r	0.46	0.19	0.47	0.41	0.22
	h^2	0.43	–0.07	0.18	0.15	0.10
Total dry matter/plant	r	0.45	0.53	0.38	0.49	0.12
	h^2	0.66	0.32	0.02	0.23	–0.01
Grains/spike	r	0.29	0.30	0.23	0.04	0.36
	h^2	0.06	0.08	0.26	0.02	0.10
Grain yield	r	0.41	–0.24	–0.12	0.34	–0.12
	h^2	0.05	0.05	–0.04	0.12	0.04
Kernel weight	r	0.45	0.67**	0.54	0.71**	0.49
	h^2	0.06	0.34	0.33	0.30	0.21
Harvest index	r	0.08	0.53	0.53	0.49	0.03
	h^2	0.05	0.06	0.05	0.05	0.01

*, ** significant at 5% and 1% levels, respectively.

Number of grains/spike of F_3 generation progenies was higher in positive selection group than that in negative selection group in all the five populations. However, the difference was significant in population 3 only. Realized heritability estimates were low and inter-generation correlation coefficients were non-significant in all the five populations indicating that the selection based on number of grains/spike

was not effective in F_2 generation. Non-significant differences between positive and negative group progenies for grain yield, non-significant inter- generation correlation coefficients and very low realized heritability estimates in all the five populations proved that selection in F_2 generation using grain yield as a criterion was ineffective. Selection in F_2 generation, however, was effective on the basis of kernel weight as depicted by significantly higher kernel weight under positive group than that of negative group in four populations, namely, population 2, 3, 4 and 5. Significant inter-generation correlation coefficients and moderate realized heritability estimates were also observed in populations 2, 3 and 4. There were indications that selection on the basis of harvest index was ineffective.

To conclude selection was effective for plant height and kernal weight, and ineffective for grain yield, number of effective tillers, total dry matter, grains/spike and harvest index in F_2. Effectiveness of selection in early generation was reported earlier for grain weight [5] and for plant height and grain weight [6].

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