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# RELATIVE EFFICIENCY OF SELECTION INDICES FOR GRAIN YIELD IN BREAD WHEAT (*Triticum aestivum* L.)

N.K.Yousif
Dept .of biology,College of Sci.Mosul Univ.Iraq

## ABSTRACT

Six traits of bread wheat in 15 F2 generation of crosses from 6×6 diallel mating system with their parents were studied. The relative efficiency over grain yield from selection based on several indices were calculated . The results indicated that there was an increase in efficiency of selection for yield from 12.986 to 122.372% in various indices, which indicated that a selection index based on combination of traits, including number of spikes , spike length, 100 grains weight and number of grains per spike was superior to all selection indices, therefore the selection based on these four traits is recommended.

## INTRODUCTION

A breeder is always concerned with the selection of superior genotypes which performance is dependent on the phenotypic expression. Often selection based on pheno- typic performance does not lead to expected genetic advance mainly due to the presence of genotype-environment interactions as well as due to undesirable association between the component traits at the genotypic level .Thus a knowledge of correlation between complex traits like grain yield in wheat and its component traits, which show susceptibility to environmental conditions, therefore, capable of being measured with great precision, can obviously be of considerable use for a rational approach to the improvement of grain yield .So correlated response which reflect the expected change in yield resulting from selection for other components was reported by Smocek (1977), Whan *et al*. (1982) and May and van-Sanford (1992) in wheat and by Yousif (2004) in barley furthermore discriminant function, development by Fisher 1936and first applied by Smith 1936 for plant improvement (Sharma *et al*., 1973), offers an effective method for the simultaneous improvement of two or more traits by selection . This has been adopted in wheat by Simlote (1947),Sikka and Jain (1958), Ahmad and Hamdo (2000) and Ahmad (2003).

The present investigation was undertaken to analyze the nature and degree of interrelationship between different traits and also to test the suitability of various selection indices to find a simple and useful in wheat breeding.

## MATERIALS AND METHODS

The genetic materials used in this study were fifteen F2 populations derived from a set of diallel crosses, involving six bread wheat parents, namely, Gemeney, Saberbeg, Pandas, 69-S3, 35-S6 and Kvz / cgn. The parents and their F2 hybrid seeds were grown at Research Station, College of Education, Mosul University during the growing season (2002-2003), under natural dry - farming condition.

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The experiment was laid out in a randomized complete block design with four replications. One row were allotted to each parent and F2 per replication. The sowing were done by dibbling the seed at a distance of 15 cm. in the rows of 3 m length with a row to row spacing of 30 cm. Recommended cultural practices were followed to raise a good crop. Fifteen effective plants of each row in each replication, were selected at random for recording data on: grain yield per plant (g), number of spikes per plant, spike length (mm), 100 grain weight (g) and number of grains per spike. The estimates of phenotypic and genotypic variances and co-variances were obtained from the analysis of variance and co-variance diallel tables from the row means. The additive genotypic and phenotypic correlations were worked as per procedure proposed by Al-Rawi and Ahmed (1984). Heritability in narrow sense for each trait was calculated using the Bhatia *et al*. (1978) equations which depend on the general and specific combining ability estimates according to method-2 model-1 of Griffing (1956) . The genetic advance, correlated response and relative selection efficiency were worked out using the procedures suggested by Searle (1965). Fifty eight different indices were computed by Miller *et al*.(1958) method and compared in this study, thirty three of them included yield and the remainder excluded it, the expected genetic advance of these indices were expressed as percent of genetic advance expected from selection on the bases of grain yield alone.

## RESULTS AND DISCUSSION

The estimates of additive genotypic and phenotypic correlations between the studied characters in wheat are shown in Table (1).In general, the correlation at the genotypic and phenotypic level shown the same trend and genotypic correlations were of greater magnitude.The phenotypic and genotypic correlation coeffient of yield was positive and significant with spike length , 100 grains weight and number of grains per spike and negative and significant with plant height , this indicates that the effect of genes on grain yield with spike length , 100 grains weight and number of grains per spike are synergistic , but the effect of genes on grain yield with plant height are Antagonistic.

The estimates of narrow sense heritability and expected genetic advance with respect to the character used as the criterion of selection are given in Table (2). In general, narrow sense heritability estimates were high for all characters. The results showed high values of genetic advance for grain yield , short plant height and spike length and moderate values for other traits.

Table(3) was shown that the correlation response for grain yield if selection were for spike length, at a selection intensity 5%, would be 3.635 grains which represent a change of 15.494% of the original mean. Selection for number of grains per spike result a change of 10.083% of the original mean.This indirect selection is very important when the primary traits is difficult to evaluate, and the secondary traits has a high heritability and genetically highly correlated with the desired character. Selection indices for grain yield were constructed and different combinations were

examined in an attempt to identify those character which may be of help during selection .The result of Table (4) indicate that:out of two Fifty eight possible function only six are considered since they indicate superiority. In indices based on two characters combination the increase in efficiency was of the order of 13-74%,93-102% in three characters combination and 122%with four character combination .spike length is common attributes in all indices indicating its influence on yield .Plant height and number of grains per spike are also important

| Traits | $X_1$ | $X_2$ | $X_3$ | $X_4$ | $X_5$ | $X_6$ |
|---|---|---|---|---|---|---|
| $X_1$ | | ** -0.896 | ** 0.395 | ** 0604 | ** 0.442 | ** O.886 |
| $X_2$ | ** -0.540 | | 0.301 | ** 0.497 | ** 0.833 | ** -0.601 |
| $X_3$ | 0.131 | 0.212 | | ** -0.385 | ** -0.728 | ** -0.698 |
| $X_4$ | ** 0.515 | ** 0.426 | -0.276 | | ** -0.576 | ** 0.710 |
| $X_5$ | ** 0.473 | ** -0.672 | ** -0.522 | ** -0.443 | | -0.297 |
| $X_6$ | ** 0.715 | * -0.391 | ** -0.564 | ** 0.630 | -0.212 | |

Table(1): Values of additive genotypic (upper right) and phenotypic (lower left) correlations between all pairs of studied traits in wheat

$X_1$;X2;X3;X4;X5 and $X_6$ are grain yield per plant (g);plant height (cm); number of spike per plant; spike length (mm); 100 grains weight(g) and number of grains per spike respectively. *,**significant at 5% and 1% level, respectively.

Table (2):Estimates of narrow sense heritability ($h^2$),expected genetic advance ($\Delta G$)and expected genetic advance in percent of the mean($\Delta G\%$) for studied characters of wheat.

| Characters | Mean | $h^2$ | $\Delta G$ | $\Delta G\%$ |
|---|---|---|---|---|
| $X_1$ | 23.46 | 0.517 | 7.214 | 30.748 |
| $X_2$ | 76.93 | 0.516 | 6.554 | 8.519 |
| $X_3$ | 15.16 | 0.533 | 2.086 | 13.763 |
| $X_4$ | 83.40 | 0.723 | 7.117 | 8.533 |
| $X_5$ | 4.20 | 0.583 | 1.539 | 36.653 |
| $X_6$ | 37.99 | 0.533 | 2.711 | 7.136 |

Table (3): Expected charge in yield resulting from selection for other character as percentage of the mean yield.

| character selected | Expected change | Expected change in % mean of yield |
|---|---|---|
| $X_2$ | -5.878 | -25.055 |

| | | |
|---|---|---|
| $X_3$ | 0.812 | 3.460 |
| $X_4$ | 3.635 | 15.494 |
| $X_5$ | 0.641 | 2.731 |
| $X_6$ | 2.366 | 10.083 |

Table (4): Six superiority selection indices, expected genetic advance (ΔG) and relative efficiency over grain yield(RE%)

| Selection index | ΔG | RE% |
|---|---|---|
| $X_1$ | 7.214 | |
| $X_4$ and $X_5$ | 8.151 | 12.986 |
| $X_3$ and $X_6$ | 12.576 | 74.330 |
| $X_2$ , $X_3$ and $X_4$ | 13.961 | 93.533 |
| $X_1$, $X_2$ and $X_4$ | 14.580 | 102.099 |
| $X_3$ ,$X_4$,$X_5$ and $X_6$ | 16.042 | 122.372 |

**الكفاءة ألنسبية لأدلة إنتخاب حاصـل الحبوب في حنطة الخبز (*Triticum aestivum* L.)**

نجيب قاقوس يوسف
قسم علوم الحياة /كلية العلوم /جامعة الموصل

**الخلاصة**

درست ست صفات لحنطة الخبز في خمسة عشر من الأجيال الثانية للتهجينات التبادلية بين ستة أصناف مع آبائها. حسبت الكفاءة النسبية لعدة أدلة لإنتخاب الحاصل العالي . بينت النتائج وجود زيادة في كفاءة الأنتخاب للحاصل تراوحت بين(١٢,٩٨٦–١٢٢,٣٧٢٪)في الادلة المختلفة وان الدليل الأنتخابي الذي يتضمن صفات عدد السنابل وطول السنبلة ووزن ١٠٠ حبة وعدد الحبوب بالسنبلة تفوق على جميع الأدلة الاخرى ويوصى به في هذه الدراسة.

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