MILITATING SELECTION INDICES IN SOME BREAD WHEAT CROSSES

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Abstract

This study was carried out at El-Giza Agric. Res. Station during four seasons from 2005/2006 to 2008/2009 to evaluate the effect of eight methods of selection indices on grain yield per plant , number of spikes per plant , number of kernels per spike and 100-kernel weight of three bread wheat crosses.

Selection indices were

1- Bulk method as a control, 2- Number of spikes per plant "$S.I_1$", 3- Number of kernels per spike "$S.I_2$", 4- 100-kernel weight "$S.I_3$" , 5- Number of spikes per plant and number of kernels per spike withholding 100 kernel weight "$S.I_{12.3}$" , 6-Number of spikes per plant and 100-kernel weight withholding number of kernels per spike "$S.I_{13.2}$" , 7- Number of kernels per spike and 100-kernel weight withholding number of spikes per plant "$S.I_{23.1}$", 8- Number of spikes per plant, number of kernels per spike and 100-kernel weight "$S.I_{123}$". After three cycles of selection in F2,F3 and F4, six genotypes from each selection indices were selected from each cross. A total number of 42 selected genotypes resulting from seven selection indices and six bulk populations were evaluated for grain yield and yield components. Single analysis of variance demonstrated significant differences between selection indices in all crosses. Genotypes significantly differed for all characters except number of spikes per plant, 100 kernel weight and kernel weight per spike in cross No. 1. The interaction between genotypes × indices had significantly effected all characters except 100-kernel weight in cross No.1 and 2 . Analysis of variance of selection indices "M", crosses "C" and genotypes or lines "G" showed significant differences except grain yield per plant. The interactions between (C × M) , (C × G) , (M × G) and (M × C ×G) had significant effect. Results also, showed that the best selection indices for number of spikes per plant was $S.I_{13.2}$, for number of kernels per spike was $S.I_{123}$, for 100 kernel weight $S.I_3$, for kernel weight spike $S.I_3$, and for grain yield per plant were $S.I_{123}$ and $S.I_1$. Results also showed that the three crosses significantly differed in all characters except grain yield per plant . Cross No.3 had the highest number of spikes per plant , cross No.2 had the highest number of kernels per spike, and cross No.1 had the highest 100 kernel weight , kernels spike weight and grain yield per plant .

INTRODUCTION

Wheat is the most important crop in terms of area and production and is the staple food for more than one third of the world population. Wheat contributes more calories and protein to the world diet than any other food crop. Low wheat production

in Egypt means failure to achieve self-sufficiency due to the high increase in population every year.

Therefore, efforts have been made to minimize the gap between production and consumption through expanding wheat cultivated area in both Nile Valley and New Reclaimed Areas and by improving productivity per unit area through breeding programs .

Breeding methods play major role in developing high yielding cultivars, resistant to diseases with better quality. Yield is a complex character controlled by a large number of genes because it is affected by several yield components i.e., number of spikes per plant , number of kernels per spike and 100-kernel weight .Therefore, wheat breeders have been concerned with the simultaneous improvement of more than one of these components . Each of these components may affect the practical value of any genotype in varying degrees according to its importance.

Selection index is used by plant breeders to improve yield in different crops. But selection indices have been criticized due the labor and time needed for computations, at a busy period of the year .

In order to make progress in selection for a complex character as yield in wheat, the breeder must know the total variation observed in segregating populations that is due to the genetic composition and the best method of selection. Such information for each of the yield components as well as the relationship between the components and yield would help in determining the type of selection program to follow to obtain high yielding wheat varieties.

Several investigators studied the type of selection effect in wheat genotypes . kumar et al (1972) found that selection increased grain yield and 100 grain weight by 16.9% and 16.7 %, respectively . Virk(1973) found that the expected genetic advance was 38.9 to 49.4 % for grain yield per plant and 5.2 to 19.9 % for number of kernel per spike for two wheat crosses .Also , Ketata et al (1976) , Mitkees (1976), Abo Elenein et al (1977), Chandrappa et al (1977), McNeal et al (1978), Ageez (1981) and Tammam (2004) reported that the expected genetic advance in grain yield and yield components of individual plant in wheat by using single or more character selection could improve wheat yield . Awad (1987), obtained genetic advance values ranging from 78.5 to 110.4% for grain yield per plant, 42.8 to 57.2 % for number of kernels per spike, 35.3 to 52 for 100-kernel weight , 59.6 to 75.8 % for spike grain weight and 26.6 to 13.6 % for number of productive tillers per plant . Hamada (1988) found that selection for yield and yield components in F2, F3 and F4 of wheat increased yield and yield components of the individual plant. El-Sayed (1996),(2006) showed that

restricted selection indices for number of spikes per plant , number of kernels per spike and 100 kernel weight were affective in improving grain yield in most crosses.

The main objective of this study was to determine the values of selection indices using different combinations of yield components to improve wheat grain yield .

MATERIALS AND METHODS

The breeding materials used in the present study were F2 population , F3 and F4 families and F5 lines of three bread wheat crosses drived from Sakha 8 × Sids 1 (Cross No. 1) , Sakha 69 × Bow"S"/ Crow"S" (Cross No. 2) and Giza 168 × Opata (Cross No.3). Sakha 8, Sids 1 , Sakha 69 and Giza 168 are local cultivars while Bow"S"/ Crow"s" and Opata were imported from CIMMYT. The three crosses were chosen from a diallel crosses made and evaluated for combining ability in F1 generation for several agronomic traits (El-Sayed 2004). The three crosses included the highest general combiners for grain yield and its components, i.e number of spikes / plant (X1), number of kernels/ spike (X2), 100-kernel weight (X3) and grain yield / plant (X4).

Data were recorded on four agronomic characters in the seven different selection indices (S.I) comparing with bulk method of selection. The selection indices used in the present study were :-

1- Bulk method (as a control).
2- Selection index for number of spikes / plant (S I1) .
3- Selection index for number of kernels / spike (S I2) .
4- Selection index for 100 kernel weight (S I3) .
5- Restricted Selection index for number of spikes / plant and number of kernels / spike withholding 100 kernel weight (S I12.3) .
6- Restricted Selection index for number of spikes / plant and 100-kernel weight withholding number of kernels/ spike (S I13.2) .
7- Restricted Selection index for number of kernels / spikeand 100 kernel weight withholding number of spikes / plant (S I23.1) .
8- Selection index for three components of yield in wheatnumber of spikes / plant , number of kernels/ spike and 100 kernel weight (S I123) .

From 2005/2006 through 2007/2008 F2 , F3 and F4 plants of the three crosses were grown at Giza Agricultural Research Station in a randomized complete block design experiment with four replications . Seeds were space –planted at 10 cm within rows spaced 30 cm. apart and four meters long. At harvest , grain yield per plant , number of spikes / plant , number of kernels / spike and 100-kernel weight were recorded . The remained F2, F3 and F4 plants of each cross were harvested in bulk . In 2008/ 2009 the selected genotypes of the eight indices were evaluated in F_5.

Derivation of optimum weighing coefficients

The formula used in the calculations of the various selection indices is the general index formula mentioned by Smith (1936) and Hazel (1943):-

$I = b_1x_1 + b_2x_2 + ...b_n x_n$

Where

I = the single index value of the individual unit on which selection is based .

X_1--- X_n = the phenotypic values of the traits

b s = weight to be given to the corresponding characters x, s .

The appropriate b s which maximizes the advance from selection are calculated by the following formulas :

1- For improving a single character :

$b = h^2a$, (Kempthorne 1957).

2- For improving two characters while holding the third constant, i.e restricted selection index:

$B = \{ I_m - P^{-1}Gc (CG. P^{-1}GC)^{-1}CG\}P^{-1}$ Gai, Kempthorne and Nordskog (1959).

3- For improving the three characters:

$b = P^{-1}$Gai, Smith (1936) and Hazel (1943).

Where,

I_m = the identity matrix.

P^{-1}= the inverse matrix of phenotypic variances and covariances.

G = the matrix of genotypic variances and covariances.

GC = the vector, from the G matrix , consisting the column of the character which wanted to be kept constant .

a_i = the vector of relative economic importance value of each character.

The relative economic value of each trait depends on the amount of profit expected to increase each unit of improvement in that trait. Good approximations to relative economic values often can be obtained from long time price average and cost-of- production figures, Hazel (1943). The most bothersome of statistics needed were the economic weight to be assigned to each trait. A considerable element of

arbitrariness had to be resorted to, in the choice of economic weight, first because they were impossible to determine accurately and second because they are not constant (Lerner 1961).

The prices of wheat per Ardab (one ardab = 150 Kg. of seed), in the last season of selection was 270 Egyptian pounds (Statistical Management, Department of Agricultural Economy, Ministry of Agriculture, A.R.E. 1990). The relative economic values for the different characters were estimated from data of F2 , F3 and F4 generations and prices as follows.

1- One plant of wheat is equal to 0.025 Egyptian pound.
2- Price of kernels per one spike is equal to 0.003 Egyptian pound.
3- 100 kernel weight is equal to 0.012 Egyptian pound.

Calculation of selection indices

The phenotypic value of the simple index value of a plant was estimated by using the formula outlined by Smith (1936) and Hazel (1943) as :-

$$I = {}^{n}\Sigma i = bi\ xi$$

Where ,bi is the weighing factor and xi is the phenotypic value for the traits.

Phenotypic and genotypic variance were calculated by the analysis of randomized complete blocks design as described by Miller et al (1958) and Steel and Torrie (1980) on plot mean basis .

Calculation of phenotypic and genotypic covariances generations between pairs of traits , followed the same form as variance analysis , as suggested by Handerson (1953) .

After three cycles of selection indices in the F2, F3, and F4, six lines were produced from the selection indices for cross. This genotypes were evaluated in F5.

In 2008/2009, 48 genotypes for each cross (42 lines from seven selection indices and six bulk population) were sown in a split–split plot experiment with four replications. Selection indices were allocated in the main plot , crosses were in the sub plots and genotypes were in sub-sub plots. Each line was planted in two rows with 3.0 m long, 30 cm apart and 10.0 cm between plants. At maturity, 20 guarded plants were harvested from every plot and data were recorded for number of spikes / plant, number of kernels / spike , 100- kernel weight, kernel spike weight and grain yield / plant . The other cultural practices were carried out as recommended for wheat production in the region .

Data were subjected to analysis of variances according to Snedecor and Cochran (1967). Also, single analysis for three crosses of the seven methods of selection indices were compared with bulk method as RCBD to compute the significance for genotypes, selection indices and their interaction.

The Least Significance differences (L.S.D.) test at 5% level of probability, was used to compare means according to Steel and Torrie (1980) .

RESULTS AND DISCUSSION

1- Analysis of variance

Results will be presented with regard to the performance of six F5 genotypes derived from three bread wheat crosses for each selection indices.

The performance of the F5 genotypes was evaluated in terms of the effectiveness of eight selection methods of phenotypic or visual selection for the five agronomic characters .

Single analysis for each cross, selection indices, F5 genotypes and their interaction are presented in Table 1.

Mean squares for indices of selection "M" differed significantly for all the five characters in all crosses.The differences among genotypes "G" in number of spikes per plant, number of kernels per spike , 100 kernel weight, kernels spike weight and grain yield per plant were significant except in cross No.1. On the other hand , the interaction between genotypes and selection indices "M×G" significant effect on all characters except 100 kernel weight in cross No. 2 .

Mean squares of overall analysis for the six lines derived from three bread wheat crosses and eight selection indices are presented in Table 2. Results showed highly significant differences were observed among the three crosses except for grain yield per plant, Also exhibited highly significance effect for the interaction between selection indices and crosses, selection indices and genotypes, crosses and lines and the selection indices , Indicating different response to selection indices according to the cross and the indices.

These results are in agreement with those obtained by Ageez (1981), Hamada (1988), El-Sayed (1996) and El-Sayed (2004).

2-Mean performance

2.1- Number of spikes per plant

Data in Table 3 indicated that the average number of spikes per plant ranged from 17.29 in cross No. 1 to 18.33 in cross No. 3 with an average of 26.41 in selection index No. 6 and from 13.2 to 11.95 in the index No.7 (S.I23.1) . The best genotype was No. 5 in the cross No. 1 with an average of 17.84 while cross No. 2 recorded the highest number of spikes per plant cross No. 3 and in over all mean with values of 19.28, 19.80 and 18.76 spikes per plant, respectively .

The best selection index was selection index No. 6 (S.I 13.2) in the crosses No. 1,2 and 3 with averages of 26.97 , 27.65 and 24.62, respectively. Meanwhile, selection

index No. 7 (S.I 23.1) had the lowest number of spikes per plant in the three crosses.These results are in line with those obtained by El-Sayed (1996) , (2006) and Tammam (2004).

2.2-Number of kernels per spike

Data for number of kernels per spike are presented in Table 4 . The data showed that the average values of the three crosses were 41.40, 43.65 and 43.27, respectively . The best selection index for number of kernels per spike was method No. 8 (S.I 123) with the value of 54.28 followed by No. 3 (S.I 1) and No.5(S.I12.3) with values of 52.93 and 50.66, respectively; On the other hand, the bulk selection method recorded the lowest number of kernels per spike .Genotypes No. 1 and 4 in cross No. 1, genotype No. 3 and 2 in cross No. 2, No. 3 and overall mean gave the highest number of kernel per spike . Generally indices No. 3 (S.I2), No. 5 (S.I 12.3) and No. 8 (S.I 123) produced the highest number of kernels per spike in all crosses and over all mean . These results are in agreement with those reported by Virk (1973), Mitkees (1976) , Abo.Elnein *et al* (1977) , Ageez (1981), Awad (1987), Hamada (1988), El-Sayed(1996) and (2006) and Tammam(2004).

2.3 - 100 kernel weight

Average of 100 kernel weight (Table 5) for the three crosses were 4.874 , 4.771,4.371 gm, respectively and it was 4.671 for over all crosses . The best genotypes in the three crosses were No. 1 and 5 with the values of 4.921 and 4.954 gm , in cross No. 1, genotypes No. 2 and 5 gave 4.970 and 4.789 gm. in cross No.2 , genotypes No. 1 and 2 with 4.42 and 4.486 gm. in the cross No. 3 genotypes No.1 and 2 with 4.704 and 4.761 gm.

On the other hand the best selection indices for cross No. 1 were 4 (S.I 3) , 3 (S.I 2) and 7 (S.I 23.1), for cross No. 2 were 4(S.I 3) , 3(S.I 2) ,6 (S.I 13.2) and 7 (S.I 32.1), for cross No. 3 were 3(S.I 2). 7 (S.I 23.1) and 8 (S.I 123) and over crosses were 4(S.I 3) ,3 (S.I2) , 6 (S.I 13.2) and 7 (S.I 23.1) , respectively. These results indicated that selection indices No. 4(S.I3) and No. 7 (S.I 23.1) were more effective in improving 100-kernel weight. Similar result were obtained by Kumar (1972), Ageeza (1981), Awad 1987), Hamada (1988), Tammam(2004) and EL-Sayed (2006) .

2.4- kernel weight /spike

Selection indices significantly affected kernel weight / spike of all cases. The highest kernel weights /spike were 1.549 gm. for selection index No. 3 (S.I 2),and 2.742 gm. for selection index No. 4 (S.I 3) .Also, selection indices No.4 (S.I 3) and No. 7 (S.I 23.1) existed in cross No.1 with the values of 2.795 and 2.822 gm., bulk method and selection index No.4 (S.I 3) existed in cross No. 2 with the values of

2.338 and 3.017 gm., respectively, and selection indices No. 4 (S.I 3) and No.7 (S.I 23.1) existed in cross No.3 with the values 2.413 and 2.318 gm., respectively .

On the other hand cross No.1 had a heavy kernel weight . Moreover, genotypes No. 2 and 6 in cross No. 1 , No. 2 and No. 3 in cross No. 2, No. 2 and 5 in cross No. 3 and over all mean were the highest in kernel weight/ spike . These results are in agreement with those obtained by Awad (1987), Hamada (1988), Tammam (2004) and EL-Sayed (1996) and (2006) .

2.5- Grain yield per plant

Regarding grain yield per plant Table 7, average of grain yield per plant were 55.12 , 54.78 and 55.09 gm. for the three crosses, respectively, with an over all mean of 54.99 gm. The best selection indices for grain yield per plant were No. 8 (S.I 123) and No. 2 (S.I1) with the values of 80.88 and 75.44 gm , respectively . Also selection indices No. 8 and No. 2 recorded the highest value of grain yield per plant in all crosses, while bulk method and selection index No.5 (S.I 12.3) were produced the lowest value of grain yield per plant in all crosses and overall mean .

The best genotypes which gave higher grain yield per plant were genotype No. 2 in cross No. 1 with 78.94 gm., No. 2 and 3 in cross No. 2 with 58.49 and 58.44 gm., No.2 and 6 in cross No. 3 with 58.9 and 56.28 gm. and No. 2 and 3 in the over all crosses with 56.99, 56.45 gm., respectively . These results are in line with those obtained by Ageeze (1981), Awad (1987) , Hamada (1988) , Tammam (2004) and EL-Sayed (1996) and (2006) .

Table 1. Mean squares for the studied characters in three bread wheat crosses using eight selection methods.

S.of V.	*d.f.*	*Cr1*	*Cr2*	*Cr3*
		No. of spikes /plant		
Replication	3	6.445	20.261	4.49
Methods "M"	7	602.178**	631.667**	455.975**
Genotypes "G"	5	5.035	22.112**	20.423**
M × G	35	3.630**	8.398**	8.485**
Error	141	1.958	2.904	3.852
		No. of Kernels /spike		
Replication	3	8.871	27.426	22.06
Methods "M"	7	1606.994**	3503.518**	2023.251**
Genotypes "G"	5	24.673**	52.595**	66.706**
M × G	35	36.149**	41.140**	70.848**
Error	141	4.384	8.353	18.411
		100 -kernel weight		
Replication	3	0.170	0.103	0.224
Methods "M"	7	3.752**	16.133**	6.415**
Genotypes "G"	5	0.084	0.396**	0.193**
M × G	35	0.055	0.107	0.143**
Error	141	0.053	0.089	0.044
		Kernels spike weight		
Replication	3	0.006	0.018	0.005
Methods "M"	7	6.047**	12.579**	5.368**
Genotypes "G"	5	0.139	0.221**	0.135**
M × G	35	0.094**	0.068**	0.091**
Error	141	0.051	0.014	0.021
		Grain yield / plant		
Replication	3	220.819	208.800	196.317
Methods "M"	7	4477.074**	5506.788**	7790.938**
Genotypes "G"	5	99.320**	388.198**	259.654**
M × G	35	45.851**	110.286**	48.120**
Error	141	21.190	23.859	19.586

* and ** significant at 0.05 and 0.01 probability levels , respectively

Table 2. Mean squares for yield and its components indices in three bread wheat crosses, selection indices and the interactions .

S.of V.	*d.f.*	**No. of spikes / plant**	**No. of kernels / spike**	**100-kernel weight**	**Kernel spike weight**	**Grain yield / plant**
Replication	3	23.704	25.420	0.273	0.007	557.451
index "M"	7	1587.449**	5959.057**	21.570**	21.543**	16848.140**
Error (a)	21	14.908	20.804	0.156	0.037	125.047
Crosses "C"	2	56.726**	276.864**	13.242**	2.189**	6.451
M × C	14	51.163**	587.353**	2.365**	1.225**	463.330**
Error (b)	48	3.563	18.066	0.112	0.038	51.314
Lines "L"	5	26.180**	51.599**	0.315**	0.289**	495.196**
M × L	35	9.135**	27.216**	0.118**	0.096**	140.045**
C × L	10	10.695**	46.203**	0.180**	0.103**	125.988**
M × C × L	70	5.689**	60.461**	0.093**	0.079**	32.106**
Error (c)	360	2.131	8.852	0.050	0.026	11.750

*, ** Significant at probability 5% and 1% respectively

Table 3. Mean performance for number of spikes / plant in six bread wheat families using eight selection indices.

Characters	selection indices	Genotypes						Overall mean
		1	2	3	4	5	6	
Cross 1	1	11.21	15.50	15.00	11.25	16.25	12.75	13.66
	2	22.45	21.70	22.36	21.76	21.88	20.64	21.80
	3	14.85	13.89	13.93	13.75	13.77	14.00	14.03
	4	16.17	16.96	17.36	17.21	17.40	16.65	16.96
	5	17.10	16.25	18.75	17.50	19.25	18.00	17.81
	6	26.67	26.66	27.37	27.64	26.69	26.80	26.97
	7	11.37	11.34	11.30	11.53	11.06	11.58	11.36
	8	11.54	15.30	15.73	16.73	16.39	14.90	15.76
	Mean	16.92	17.20	17.72	17.17	17.84	16.91	17.29
Cross 2	1	16.50	17.00	15.75	15.00	14.50	11.50	15.04
	2	24.07	25.57	27.37	21.23	23.75	23.74	24.29
	3	16.22	17.29	17.79	18.21	18.27	16.77	17.43
	4	14.38	15.00	14.40	1481	15.35	14.99	14.82
	5	16.25	23.00	17.50	13.25	15.75	16.25	17.00
	6	27.55	27.39	28.57	27.48	27.91	27.03	27.65
	7	13.10	13.08	13.57	11.79	12.77	12.90	12.87
	8	15.30	15.89	16.13	15.53	15.88	15.77	15.75
	Mean	17.92	19.28	18.88	17.16	18.02	17.37	18.11
Cross 3	1	15.00	23.00	14.50	18.50	15.75	14.75	16.92
	2	24.90	23.47	23.74	24.08	23.00	24.08	23.88
	3	13.80	15.34	14.60	13.91	14.98	14.63	14.46
	4	16.66	18.55	17.43	19.07	17.00	17.88	17.77
	5	17.25	22.25	19.75	16.25	17.00	17.75	18.38
	6	24.82	25.07	24.81	25.36	22.33	25.32	24.62
	7	12.27	11.64	11.57	10.98	12.16	11.13	11.62
	8	18.18	19.11	20.35	19.58	18.53	18.08	18.97
	Mean	17.86	19.80	18.34	18.47	17.53	17.95	18.33
Mean	1	14.24	18.50	15.08	14.92	15.50	13.00	15.21
	2	23.80	23.58	24.49	2236	22.88	22.82	23.32
	3	14.96	15.51	15.44	15.29	15.50	15.13	15.31
	4	15.74	16.84	16.40	17.03	16.58	16.51	16.52
	5	16.87	20.50	18.67	15.67	17.33	17.33	17.73
	6	26.34	26.37	26.92	26.83	25.64	26.38	26.41
	7	12.25	12.02	12.14	11.43	11.99	11.87	11.95
	8	16.34	16.76	17.40	17.28	16.93	16.25	16.83
	Mean	17.57	18.76	18.32	17.60	17.80	17.41	17.91
L.S.D at 5%	Indices M	Crosses C	Genotypes G	MxC	MxG	CxG	MxCxG	
	1.34	0.39	0.41	1.10	1.17	0.72	2.02	

Table 4. Mean performance for number of kernels / spike in six bread wheat families using eight selection indices.

Characters	selection indices	Genotypes						Overall mean
		1	*2*	*3*	*4*	*5*	*6*	
Cross 1	1	32.35	33.26	33.36	33.97	32.23	36.06	33.54
	2	41.26	42.46	35.86	39.82	39.52	41.11	40.00
	3	50.56	52.65	52.00	55.66	48.75	53.90	52.25
	4	37.33	36.96	36.20	35.02	36.38	35.81	36.28
	5	54.06	37.16	36.99	36.92	37.16	36.40	39.78
	6	39.24	41.56	42.93	42.46	39.54	41.76	41.25
	7	32.43	34.07	33.16	31.86	31.40	35.15	33.01
	8	53.99	55.76	55.95	52.66	56.83	55.46	55.11
	Mean	42.65	41.26	40.80	41.04	32.23	41.96	41.40
Cross 2	1	31.27	34.37	34.31	34.52	33.82	34.19	33.75
	2	47.08	45.26	45.40	44.50	48.00	51.56	46.97
	3	54.78	56.26	59.60	56.11	60.01	58.37	57.52
	4	32.70	32.84	34.26	37.46	38.11	29.97	34.22
	5	52.10	65.10	65.10	57.12	54.78	45.97	56.69
	6	30.95	31.57	32.28	32.01	31.03	30.35	31.36
	7	30.82	32.00	32.66	32.47	32.67	30.76	31.90
	8	54.63	56.99	58.74	58.29	53.34	58.66	56.78
	Mean	41.79	44.30	45.29	44.06	43.97	42.48	43.65
Cross 3	1	49.92	35.24	35.30	35.66	34.68	33.20	37.33
	2	43.71	57.79	60.56	48.18	45.24	50.59	51.01
	3	46.03	49.61	50.11	51.92	48.15	48.33	49.02
	4	33.25	35.07	32.93	33.08	34.55	33.90	33.80
	5	44.72	61.42	53.39	56.87	57.87	59.29	55.51
	6	30.56	34.31	35.36	32.65	36.16	32.91	33.65
	7	35.01	35.18	34.92	35.26	33.36	35.36	34.85
	8	48.55	53.57	54.59	45.82	50.63	52.51	50.95
	Mean	41.47	45.27	44.64	42.93	42.52	43.26	43.27
Mean	1	37.85	34.29	34.32	34.72	33.57	34.48	34.87
	2	44.02	48.50	47.27	44.16	44.25	47.75	45.99
	3	50.46	52.84	53.90	54.56	52.31	53.54	52.93
	4	34.43	34.96	34.47	35.19	36.35	33.23	34.77
	5	50.29	54.56	51.83	50.30	49.77	47.22	50.66
	6	33.58	35.81	36.85	35.71	35.57	35.01	35.42
	7	32.75	33.75	33.58	33.19	32.48	33.75	33.25
	8	52.39	55.44	56.43	52.26	53.60	55.54	54.28
	Mean	41.97	43.77	43.58	42.51	42.24	42.57	42.87
L.S.D at 5%	Indices M	Crosses C	Genotypes G	MxC	MxG	CxG	MxCxG	
	1.54	0.88	0.11	2.48	0.31	0.19	0.54	

Table 5. Mean performance for 100- kernel weight in six bread wheat families using eight selection indices .

Characters	selection indices	Genotypes						Overall mean
		1	*2*	*3*	*4*	*5*	*6*	
Cross 1	1	4.349	4.426	4.319	4.406	4.667	4.598	4.461
	2	4.457	4.459	4.496	4.490	4.594	4.555	4.524
	3	5.119	5.105	5.130	5.215	5.145	5.094	5.135
	4	5.443	5.071	5.421	5.488	5.421	5.540	5.398
	5	4.558	4.555	4.423	4.417	4.580	4.340	4.479
	6	5.298	5.079	4.996	5.107	5.200	4.980	5.110
	7	5.288	5.276	5.308	5.077	5.395	5.381	5.287
	8	4.858	4.548	4.662	4.540	4.630	4.352	4.598
	Mean	4.921	4.826	4.844	4.843	4.954	4.855	4.874
Cross 2	1	3.078	3.018	3.014	3.067	3.0505	2.992	3.029
	2	4.470	4.370	4.230	4.402	4.448	4.326	4.374
	3	5.295	5.393	5.350	5.250	5.491	5.359	5.356
	4	5.520	5.601	5.358	5.608	5.336	5.586	5.502
	5	4.647	5.047	4.535	4.323	4.431	4.215	4.533
	6	5.304	5.598	5.303	5.524	5.610	5.097	5.406
	7	5.171	5.335	5.077	5.262	5.151	5.151	5.191
	8	4.627	5.400	4.368	4.711	4.837	4.719	4.777
	Mean	4.764	4.970	4.654	4.768	4.789	4.681	4.771
Cross 3	1	3.145	3.341	3.092	3.212	3.061	3.172	3.170
	2	4.556	4.360	4.441	4.370	4.408	4.403	4.423
	3	4.822	4.666	4.574	4.861	4.912	4.653	4.748
	4	4.589	4.726	4.571	4.656	4.614	4.551	4.618
	5	4.207	4.676	4.129	4.290	4.186	4.309	4.300
	6	4.975	4.421	4.541	4.749	4.444	5.064	4.699
	7	4.818	4.742	4.621	4.761	4.605	4.677	4.704
	8	4.310	4.958	4.461	4.411	4.105	3.852	4.350
	Mean	4.428	4.486	4.304	4.414	4.292	4.335	4.371
Mean	1	3.524	3.595	3.475	3.562	3.578	3.587	3.553
	2	4.494	4.427	4.389	4.420	4.484	4.428	4.440
	3	5.079	5.054	5.018	5.109	5.183	5.035	5.080
	4	5.184	5.133	5.117	5.251	5.124	5.226	5.172
	5	4.471	4.760	4.362	4.343	4.399	4.288	4.433
	6	5.192	5.033	4.947	5.127	5.085	5.047	5.072
	7	5.092	5.118	5.002	5.033	5.050	5.070	5.061
	8	4.598	4.969	4.497	4.554	4.524	4.308	4.575
	Mean	4.704	4.761	4.601	4.675	4.678	4.624	4.671
L.S.D at 5%	indices M	Crosses C	Genotypes G	MxC	MxG	CxG	MxCxG	
	0.133	0.069	0.063	0.179	0.194	0.110	0.310	

Table 6. Mean performance for kernels weight / spike in six bread wheat families using eight selection indices.

Characters	selection indices	Genotypes						Overall mean
		1	*2*	*3*	*4*	*5*	*6*	
Cross 1	1	2.077	2.493	1.720	1.720	1.785	2.053	1.975
	2	2.017	2.027	1.944	1.899	1.954	1.993	1.973
	3	1.727	1.872	1.934	1.883	1.793	1.889	1.849
	4	2.726	2.813	2.831	2.718	2.899	2.785	2.795
	5	1.650	1.810	1.918	1.718	1.835	1.883	1.802
	6	1.674	1.700	1.644	1.350	1.600	1.741	1.618
	7	2.643	2.675	2.660	2.820	3.278	2.858	2.822
	8	1.410	1.477	1.438	1.505	1.453	1.666	1.491
	Mean	1.991	2.108	2.011	1.951	2.075	2.108	2.041
Cross 2	1	2.207	2.840	2.467	2.337	2.335	1.963	2.358
	2	1.761	1.794	1.793	1.597	1.875	1.623	1.740
	3	1.338	1.337	1.344	1.376	1.330	1.266	1.322
	4	2.876	3.046	3.113	3.023	2.929	3.117	3.017
	5	1.825	1.993	2.347	2.222	2.148	1.975	2.055
	6	1.633	1.786	1.734	1.791	1.820	1.599	1.727
	7	2.803	2.992	3.015	2.938	3.075	3.012	2.972
	8	0.965	1.028	1.028	1.045	1.007	1.015	1.012
	Mean	1.924	2.102	2.105	2.041	2.065	1.924	2.027
Cross 3	1	2.090	2.435	2.225	2.152	2.260	2.132	2.216
	2	1.543	1.688	1.518	1.569	1.723	1.564	1.601
	3	1.363	1.475	1.545	1.400	1.574	1.432	1.465
	4	2.319	2.477	2.474	2.308	2.480	2.423	2.413
	5	2.250	2.702	1.887	1.795	1.712	1.847	2.032
	6	1.720	1.562	1.598	1.756	1.702	1.801	1.690
	7	2.195	2.386	2.385	2.317	2.299	2.324	2.318
	8	1.020	1.086	1.087	1.120	1.056	0.984	1.059
	Mean	1.812	1.976	1.840	1.802	1.851	1.813	1.849
Mean	1	2.125	2.589	2.137	2.070	2.127	2.049	2.183
	2	1.774	1.836	1.752	1.688	1.851	1.727	1.771
	3	1.467	1.561	1.608	1.553	1.565	1.529	1.549
	4	2.639	2.779	2.806	2.683	2.769	2.775	2.742
	5	1.908	2.168	2.051	1.912	1.898	1.842	1.963
	6	1.675	1.683	1.659	1.632	1.708	1.713	1.678
	7	2.547	2.684	2.687	2.692	2.884	2.713	2.704
	8	1.129	1.197	1.183	1.223	1.172	1.222	1.188
	Mean	1.909	2.062	1.985	1.932	1.997	1.948	1.972
L.S.D at 5%	indices M	Crosses C	Genotypes G	MxC	MxG	CxG	MxCxG	
	0.066	0.040	0.166	0.114	0.130	0.079	0.225	

Table 7. Mean performance for grain yield / plant in six bread wheat families using eight selection indices.

Characters	selection indices	Genotypes						Overall mean
		1	2	3	4	5	6	
Cross 1	1	46.70	43.64	39.69	44.08	41.38	42.47	42.99
	2	58.77	65.87	67.58	70.23	71.14	68.96	67.09
	3	54.32	57.13	60.91	58.52	59.77	62.01	58.77
	4	48.19	41.88	49.23	47.86	47.96	45.08	46.70
	5	43.56	39.67	42.87	41.30	44.03	47.29	43.12
	6	45.75	45.66	43.02	42.37	43.13	46.26	44.36
	7	51.13	55.82	59.61	54.41	60.09	60.43	56.91
	8	70.06	78.94	87.90	86.00	82.80	80.13	80.97
	Mean	52.31	78.94	56.35	55.29	56.29	56.58	55.12
Cross 2	1	40.04	61.99	42.74	35.16	35.16	33.75	42.30
	2	61.82	72.35	81.72	72.64	72.64	77.29	74.01
	3	47.55	50.71	54.63	46.23	46.23	54.16	50.91
	4	44.84	47.40	50.60	45.69	45.69	46.68	46.65
	5	36.92	43.02	53.09	36.06	36.06	36.38	40.39
	6	46.73	48.47	48.18	46.35	46.35	46.93	46.92
	7	52.28	59.00	51.82	53.06	53.06	57.20	55.29
	8	65.64	85.00	85.44	85.61	85.61	84.86	81.80
	Mean	49.48	58.49	58.44	52.60	52.60	54.66	54.78
Cross 3	1	34.40	47.19	37.23	35.74	36.21	35.34	37.68
	2	72.73	85.38	88.45	90.41	87.20	87.14	85.22
	3	53.71	55.15	56.22	53.22	53.73	57.33	54.89
	4	48.06	50.65	46.16	48.96	50.43	49.17	48.90
	5	34.42	45.61	36.75	34.00	36.67	36.30	37.29
	6	46.16	47.67	46.13	47.97	46.24	48.73	47.15
	7	45.63	54.46	47.02	50.20	48.29	52.45	49.67
	8	66.31	85.07	77.75	82.89	83.39	83.82	79.87
	Mean	50.18	58.90	54.46	55.42	55.27	56.28	55.09
Mean	1	40.38	50.94	39.88	39.97	37.58	37.19	40.99
	2	64.44	74.53	79.25	79.63	76.99	77.80	75.44
	3	51.86	54.33	57.25	54.64	53.24	57.83	54.86
	4	47.05	46.64	48.66	47.16	48.03	46.98	47.42
	5	38.30	42.77	44.23	37.38	38.92	39.99	40.27
	6	46.21	47.27	45.78	45.07	45.24	47.31	46.15
	7	49.68	56.42	52.82	54.32	53.81	56.69	53.96
	8	67.34	83.00	83.70	84.39	83.93	82.94	80.88
	Mean	50.66	56.99	56.45	55.32	54.72	55.84	54.99
L.S.D at 5%	Indices M	Crosses C	Genotypes G	MxC	MxG	CxG	MxCxG	
	3.865	n.s.	0.967	4.167	2.735	1.675	4.737	

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تأثير دلائل الانتخاب فى بعض هجن القمح

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قسم بحوث القمح – معهد بحوث المحاصيل الحقلية- مركز البحوث الزراعية

أجريت هذه الدراسة فى محطة البحوث الزراعية بالجيزة فى الفترة من ٢٠٠٥/٢٠٠٦ حتى ٢٠٠٨/٢٠٠٩ .

واستخدم في هذا البحث ثمانية دلائل للانتخاب :-

١- طريقة الانتخاب التجميعي أو الاجمالى

٢- دليل الانتخاب لعدد السنابل في النبات

٣- دليل الانتخاب لعدد حبوب السنبلة

٤- دليل الانتخاب لوزن ١٠٠ حبه

٥- دليل الانتخاب لعدد السنابل في النبات وعدد حبوب السنبلة مع تثبيت وزن ١٠٠ حبة .

٦- دليل الانتخاب لعدد السنابل في النبات ووزن ١٠٠ حبة مع تثبيت عدد حبوب السنبلة .

٧- دليل الانتخاب لعدد حبوب السنبلة ووزن ١٠٠ حبة مع تثبيت عدد السنابل في النبات .

٨- دليل الانتخاب لعدد السنابل في النبات وعدد حبوب السنبلة ووزن ١٠٠ حبة .

أجريت ثلاث دورات للانتخاب على ثلاثة هجن من قمح الخبز في الجيل الثاني والثالث والرابع . عقب دورة الانتخاب الثالثة في الجيل الرابع كان هناك خمسة سلالات منتخبة من كل هجين بالإضافة إلى سلالة سادسة ناتجة من طريقة الانتخاب الاجمالى بمجموع ستة سلالات لكل طريقة انتخاب ومجموع عام ٤٨ سلالة لكل هجين وتم تقييم تلك السلالات كلها في الجيل الخامس . وأظهرت نتائج التحليل الفردي لكل هجين وجود فروق معنوية في طرق الانتخاب الثمانية لكل الصفات ووجود فروق معنوية بين السلالات المنتخبة لكل هجين لكل الصفات ما عدا عدد السنابل في النبات ووزن ١٠٠حبة ووزن حبوب السنبلة وذلك بالنسبة للهجين الأول . كما كان التفاعل بين طرق الانتخاب والسلالات المنتخبة معنويا لكل الصفات ما عدا صفة وزن ١٠٠ حبة في الهجين الأول والثاني . كما أوضح التحليل التجميعي للهجن ما عدا صفة محصول الحبوب في النبات ودلائل الانتخاب والسلالات المنتخبة وجود فروق معنوية وكذلك في جميع التفاعلات الثنائية أو الثلاثية فيما بينها . أظهرت نتائج التحليل أن أفضل دليل للانتخاب لعدد السنابل هو الدليل السادس ولعدد حبوب السنبلة الدليل الثاني والخامس ولوزن ١٠٠ حبة الدليل الرابع والثانية ولوزن حبوب السنبلة الدليل الرابع ولمحصول الحبوب في النبات الدليل الثامن والثاني . أوضحت النتائج اختلاف الهجن الثلاثة فيما بينها في متوسطات الصفات المدروسة وكان الهجين الثالث هو الأفضل في عدد السنابل على النبات والهجين الثاني هو الأفضل في عدد حبوب السنبلة والهجين الأول هو الأفضل في وزن ١٠٠ حبة ووزن حبوب السنبلة ومحصول الحبوب في النبات.