PEDIGREE SELECTION FOR EARLINESS, SPIKES NUMBER AND GRAIN WEIGHT IN TWO SEGREGATING POPULATIONS OF BARLEY (*Hordium vulgare* L.)

El-Seidy, E. H.
Agronomy Dept., Faculty of Agriculture, Tanta University, Tanta

ABSTRACT

Two cycles of pedigree selection were applied to the F_3 generation of two barley crosses. The objective of this investigation was to improve grain weight, spikes number/plant and days to heading using the pedigree selection.

Highly significant differences among the F_3 families and sufficient genotypic coefficient of variability were detected for days to heading, spike length, number of spikes/plant, number of kernels/spike, 1000- kernel weight and grain weight/plant in both populations. Broad sense heritabilities were high for days to heading and moderate for number of spikes/plant and grain weight of both populations.

Heritability and predicted genetic gain upon selection decreased from F_3 to F_5 generation for the three selection criteria of both populations. The realized gains showed that days to heading was earlier by 4.16% in the first population and 2.76 % in the second one after two cycles compared to the bulk sample. Selection for more spikes/plant after two cycles increased the merit of selection by 10.88% in the first population and 5.07 % in the second population compared to the bulk of F_3 families. Direct selection for grain weight /plant showed realized response to selection reached to 7.57% and 7.60% from the bulk sample and accounted 6.59 and 2.41% from the best parent in population 1 and 2 , respectively. Family No. 66 in the first population yielded 13.07 % more than the bulk and was earlier than it by 5.58 % and family No. 92 in the second population could be considered the best selected family which had 6.45% increase in grain weight and was earlier than the bulk sample by 5.88%. Pedigree selection was an efficient selection procedure for increasing the mean of the character under selection and affected the other related characters.

Keywords: *Barley, Heritability, Predicted genetic advance-Realized gain.*

INTRODUCTION

Barley is mainly used for animal feeding in Egypt. However, interest in using the crop for human consumption has recently renewed. Barley is the main cereal crop grown in the rainfed areas of Egypt. It occupies about 126,000 ha in the Northwest Coast and about 21,000 ha in North Sinai. Breeding for drought resistance through developing short season cultivars is nowadays widely adopted in different regions of the world where water supply is limited. When breeding for high productivity, the breeder is faced with three major decisions. The first is to identify the desirable germplasm which posses the des.ired attributes. Secondly, the breeder must determine the most efficient breeding method which could be adopted in handle the basic breeding populations.

In a breeding program, information on efficiency of early selection for superior yielding genotypes is especially important in making decisions dealing with population size and possible selection pressure. Löffler and

Busch (1982) reported that no other selection criteria was effective in increasing grain yield as grain yield itself. In wheat, Mahdy (1988) found that selection based on grain yield *per se* was effective in improving grain yield itself and was accompanied by a sizeable significant increase in spike length, number of spikes/plant and grain numbers/spike. Kheiralla (1993) showed that direct selection for spike length, grain weight, grains/spike and spikes/plant was accompanied by an increase in grain yield which accounted 5.6, 5.9, 6.9 and 7.5 %, respectively, after two cycles of selection calculated as a deviation from mean of the best parent.

Therefore, the objective of this study was to compute the relative predicted genetic gain upon selection in two barley populations for two cycles started in the F_3 using the pedigree selection procedure in improving earliness, number of spikes/plant and grain weight and to measure direct and indirect response to selection for these traits.

MATERIALS AND METHODS

This investigation was carried out during the three successive growing seasons, 1997/98 and 2001/02 at the Exp. Farm, Fac. of Agric., Tanta, Tanta University and 2002/03 at El- Eslahe, Nawag, Tanta, El-Gharbia Governorate, Egypt.

The breeding materials used in this study were 100 F_3- families traced back to a random sample from F_2 single plants originated from each cross of:

(1) Giza 124 (Local) x ICRI (Hungary) (2) Plaisant (France) x ICRI.
The 100-F_3 families with the original parents along with F_3 bulked random sample were sown in 1997/98 season in separate experiments for each population in a randomized complete block design of three replications. Each plot was a single row 3 m long, 30 cm apart and 5 cm between plants within row. Days to heading was recorded on a plot mean basis as days from sowing to 50% of the heads extruded from the flag leaf sheath. The earliest plant of each plot was labeled. At maturity, individual plants data were recorded on ten random plants from the middle portion of each plot.
Data were collected on each plant as follows:
   1- Spike length of the main culm (cm).
   2- Number of spikes /plant.
   3- Number of kernels/spike.
   4- 1000-Kernel weight (g).
   5- Grain weight/plant (g).
Genotypic and phenotypic coefficients of variation were calculated on a plot mean basis as outlined by Miller *et al.* (1958). The best 20 plants from the best families from each population were selected for each of the selection criteria i.e., days to heading, number of spikes/plant and grain weight/plant and saved to give the F_4 family seeds (Family selection, C_1).

In 2001/02 season, the best 20 F_4 families of both populations (C_1), F_3 bulk families (C_0) and parents were individually evaluated for the three traits as have been carried out in 1997/98 season. At harvest, the best ten

plants from the best 10 families were selected for each of the three traits in 1997/98 season to give the F_2 family seeds (Family selection, C_2).

In 2002/03 season, the F_3 bulk families (C_0), parents and the ten selected families (C_2) were sown. The data of the two experiments for the two populations were recorded as in the first season.

The analysis of variance, the expected mean squares and heritability in broad sense were calculated as outlined by Miller *et al.*(1958). The realized gain from selection as a deviation percentage from the bulk sample and the best parent for the selection criteria and the correlated traits were also calculated. Expected genetic advance (G_a) upon selection assuming a selection intensity of 10 % (K=1.76) and predicted genetic advance (G_a%) were calculated according to Allard (1960) as follows:

G_a %= [1.76 (σph)(H^2/x) x100

RESULTS AND DISCUSSION

The analysis of variance (Table 1) indicate highly significant differences among F_3 families (base population) in both cross populations for days to heading, spike length, number of spikes/plant, number of kernels/spike, 1000-kerenl weight and grain weight/plant.

Estimates of the phenotypic and genotypic coefficents of variation indicate the presence of sufficient variability for most studied traits. The obtained variabilities suggest that selection among F_3 families would be effective changes in the two populations. The genetic variability was sufficient for effective selection in the base population for the three selection criteria i.e., days to heading, number of spikes/plant and grain weight/plant in both populations. In addition great response to selection can be achieved from selection in both populations having a large amount of phenotypic and genotypic variance. Similar results were obtained by Kheiralla (1993) and Ismail (1995) in wheat.

The genetic components of variance, genotypic (G.C.V.%) and phenotypic (P.C.V.%) coefficients of variability, heritability in broad sense and predicted genetic gain upon selection for the two cycles of selection in both populations are shown in Table 2. It appears that the F_3 families possessed considerable amount of genetic variability more than the F_4 families (C_1) for the three selection criteria in both populations. O'Brien *et al.* (1978) stated that although response to selection will be greater in populations with great genetic variance, the highest yielding lines may be derived from populations with less genetic variance but with a higher initial mean yield. Both P.C.V % and G.C.V.% decreased rapidly after two cycles of selection for the three selection criteria in both populations. Consequently, small genetic variance, low heritability and small selection progress could be expected after the second cycle. Predicted genetic gain upon selection (G_a%) was relatively high to moderate for all the studied traits except, days to heading of both populations (Table 1).

Table 1: Means, mean squares, genotypic (GCV%) and phenotypic (PCV%) coefficients of variability, broad Sense heritabilities and predicted genetic gain upon selection (Ga%) of the six traits studied in the F_3 families and their parents in the two barley populations.

| Trait | Pop. 1 | | | | | | | | | Pop. 2 | | | | | | | | |
| | Mean | | | Mean Squares | | Statistics | | | | Mean | | | Mean squares | | Statistics | | | |
	F_3 Families	Giza 124	ICRI	Families	Error	GCV%	PCV%	H^2	G_a%	F_3 Families	Plaisant	ICRI	Families	Error	GCV%	PCV%	H^2	G_a%
Days to heading	87.7	85.2	93.0	39.79**	4.86	3.89	4.15	0.88	5.33	89.6	88.2	93.0	35.97**	5.4	3.56	3.86	0.85	4.79
Spike length (cm)	8.3	7.5	8.8	4.38**	0.62	13.49	14.56	0.86	18.25	8.9	8.5	8.8	3.47**	0.81	10.58	12.08	0.77	13.57
No.of spikes/plant	11.6	10.4	12.3	7.38**	2.36	11.15	13.52	0.68	13.41	14.1	14.4	12.3	6.87**	2.92	8.14	10.73	0.57	8.92
No.of kernels / spike	58.7	56.3	62.4	170.4**	37.6	11.33	12.84	0.78	14.60	63.9	66.1	62.4	160.8**	44.2	9.76	11.46	0.73	12.19
1000-kernel weight (g)	45.9	48.1	43.3	39.52**	9.73	6.87	7.91	0.75	8.65	42.6	41.3	43.3	82.4**	12.53	11.33	12.30	0.85	15.25
Grain weight/plant (g)	40.8	38.7	42.4	593.6**	267.4	25.56	34.48	0.55	27.65	45.2	47.6	42.4	200.2**	100.4	12.76	18.07	0.50	13.18

*, ** Significant at 0.05 and 0.01 level of probability, respectively.

Also, predicted genetic gain upon selection ($G_a\%$) and the heritability estimates decreased rapidly after two cycles of selection for the three selection criterion in population 1 and 2 and decreased from F_3 to F_5 generation (Table 2). Broad sense heritabilities for all traits studied were high to moderate of both populations except, grain weight/plant of both populations and number of spikes/plant in the second population. Higher values of genetic advance under selection along with high estimates of heritability indicate that these characters were largely controlled by the additive gene effects and the improvement of such traits could be achieved through phenotypic selection. Johanson et al. (1955) suggested that heritability estimates along with genetic advance are normally more helpful in predicting gain under phenotypic selection than the use of heritability estimates alone. These results indicate that two cycles of selection for these traits were enough to identify the performance of the promising genotypes. It is clear that phenotypic coefficient of variation decreased from the base population as homogeneity increased from cycle to cycle (Table 2).

Table 2: Genotypic (σ^2_G) and phenotypic (σ^2_P) variances and their coefficients of variability and heritability in broad sense (H^2) of the three selected traits in F_3 before and after two cycles of selection in both populations of barley.

Traits	Selection cycle	Pop. 1						Pop. 2					
		σ^2_G	GCV %	σ^2_P	PCV%	H^2	$G_a\%$	σ^2_G	GCV %	σ^2_P	PCV%	H^2	$G_a\%$
Days to heading	Base pop. (F_3)	11.64	3.89	13.26	4.15	0.88	5.33	10.19	3.56	11.99	3.86	0.85	4.79
	C_1	3.11	2.13	4.84	2.65	0.64	2.48	4.62	2.59	5.98	2.95	0.77	3.31
	C_2	1.42	1.48	2.97	2.14	0.48	1.49	1.81	1.66	3.22	2.21	0.56	1.81
No.of Spikes/plant	Base pop. (F_3)	1.67	11.14	2.46	13.52	0.68	13.41	1.32	8.15	2.29	10.73	0.58	9.08
	C_1	0.41	4.05	0.86	5.87	0.48	4.11	0.22	3.40	0.53	5.28	0.42	3.23
	C_2	0.19	2.67	0.43	4.02	0.44	2.58	0.12	2.39	0.30	3.78	0.40	2.20
Grain weight /plant	Base pop. (F_3)	108.73	25.56	197.86	34.48	0.55	27.65	33.27	12.76	66.74	18.07	0.50	13.18
	C_1	11.73	7.64	23.84	10.90	0.49	7.79	10.02	7.08	24.97	11.18	0.40	6.52
	C_2	5.07	4.80	10.98	7.07	0.46	4.74	4.13	4.35	11.41	7.23	0.36	3.80

Falconer (1989) found that selection reduces the variance. High estimates of broad sense heritability indicate that the environmental effects were small compared to the genetic effects. High heritability were found for days to heading of both populations and moderate for number of spikes/plant in the first population compared with those obtained for grain weight/plant of both populations and number of spikes/plant of the second population. Several investigators reported high estimates of heritability for days to heading, such as El-Seidy and Hamada (1997), Moustafa et al. (1998), Awaad (2001), Kheiralla et al. (2001), Abd El-Aty and Katta (2002) and El-Seidy (2003). On the other hand, grain yield/plant has been extensively reported by many workers to be highly affected by environmental conditions as low heritability values were detected, of those; Kheiralla and Sherif (1992), El-Seidy and Hamada (1997), Moustafa et al. (1998), Kheiralla et al. (2001) and El-Seidy (2002). It is of interest to note that heritability estimates decreased from F_3 (base population) to F_5 (C_2) generation for the three

selection criteria at both populations. The reduction of heritability is due to the decrease in the amount of genetic variability. These results are in line with those reported by Kheiralla (1993) and Ismail (1995).

Means of three selection criteria over the selected families in two cycles (C_1 and C_2) and the best parents for population 1 and 2 presented in Table 3. The overall family means for cycle 1 and cycle 2 selection exceeded the mean of the F_3 families and the best parent for the three selection criteria at both populations. The response to selection was coined by Falconer (1989) as the difference between mean phenotypic values of the offspring of the selected parents and the generation mean of these parents. The bulk sample mean could be considered as the parent generation mean before selection. As well as, in the additive genetic model, the parental mean equals the generation mean before selection.

Table 3: Means of days to heading, number of spikes/plant and grain weight/ plant over all selected families in the C_1 and C_2 of selection.

Item	Pop. 1			Pop.2		
	Days to heading	Number of spikes /plant	Grain weight /plant	Days to heading	Number of spikes /plant	Grain weight /plant
First Cycle (C_1)	82.9	15.8	44.8	83.0	13.8	44.7
F_3 Bulk (C_0)	85.2	13.7	42.6	84.9	13.2	41.0
Best parent	85.0	13.8	43.0	84.3	13.4	42.2
Second Cycle (C_2)	80.7	16.3	46.9	81.1	14.5	46.7
F_3 Bulk (C_0)	84.2	14.7	43.6	83.4	13.8	43.4
Best parent	83.9	14.9	44.0	82.9	14.2	45.6

Realized gain from direct selection for the three selection criteria and correlated response with the other correlated traits in both populations measured as the deviation percentage of the overall cycle mean from the bulk sample and the best parent are shown in Tables 4 and 5. The results indicate that direct selection for early heading resulted in earlier families. Days to heading was earlier by 2.3 and 3.5 days from the bulk of F_3 families which were 2.7 % and 4.16 % earlier than the base population (C_0) in the first population after C_1 and C_2, respecively, and 1.9 and 2.3 days which equivalent 2.24 % and 2.76 % in the second population after C_1 and C_2, respectively. Likewise, the reduction in heading time reached 2.1 and 3.2 days in the first cross and 1.3 and 1.8 days in the second cross after C_1 and C_2 selection as compared to the earliest parent,respectively.

However, deleterious effects on the other correlated traits accompanied earliness after two cycles of selection, and accounted -8.99,-4.76,-1.29,-2.08 and -2.98 % relative to the base population (C_0) in the first population for spike length, number of spikes/plant, number of kernels/spike, 1000-kernel weight and grain weight /plant, respectively, and –3.33, -0.32 and –2.53 % in the second population for spike length, number of kernels/spike and grain weight/plant, respectively.

Table 4: Direct and correlated gains from pedigree selection for days to heading, number of spikes/plant and grain weight/ plant after the two cycles of selection in the first population as precent of F_3 means of bulk samples and best parent.

Selection criterion		Item	Days to heading		Spike length		No.of spikes/plant		No.of kernels/spike		1000-kernel weight		Grain weight/plant	
			Units	%	Units	%	Units	%	Units	%	Units	%	Units	%
Days to heading (days)	C_1	Bulk sample	-2.3	-2.70	-0.6	-6.98	-0.5	-3.65	-1.6	-2.59	-1.5	-2.89	-3.6	-8.45
	C_1	Best parent	-2.1	-2.47	-0.2	-2.44	-0.6	-4.35	-1.9	-3.06	-1.9	-3.63	-4.0	-9.30
	C_2	Bulk sample	-3.5	-4.16	-0.8	-8.99	-0.7	-4.76	-0.8	-1.29	-1.1	-2.08	-1.3	-2.98
	C_2	Best parent	-3.2	-3.81	-0.6	-6.90	-0.9	-6.04	-1.7	-2.71	-1.3	-2.45	-1.7	-3.86
Number of spikes/plant (spike)	C_1	Bulk sample	0.1	0.12	0.3	3.49	2.1	15.33	-2.0	-3.24	-1.1	-2.12	1.3	3.05
	C_1	Best parent	0.3	0.35	0.7	8.54	2.0	14.49	-2.3	-3.71	-1.5	-2.87	0.9	2.09
	C_2	Bulk sample	1.7	2.02	0.4	4.49	1.6	10.88	0.7	1.13	-2.0	-3.78	1.2	2.75
	C_2	Best parent	2.0	2.38	0.6	6.90	1.4	9.40	-0.2	-0.32	-2.2	-4.14	0.8	1.82
Grain weight/plant (g)	C_1	Bulk sample	1.7	2.0	1.1	12.79	0.8	5.84	2.7	4.38	1.5	2.89	2.2	5.16
	C_1	Best parent	1.9	2.24	1.5	18.29	0.7	5.07	2.4	3.87	1.1	2.10	1.8	4.19
	C_2	Bulk sample	1.6	1.90	0.9	10.11	1.3	8.84	3.1	5.02	3.5	6.62	3.3	7.57
	C_2	Best parent	1.9	2.26	1.1	12.64	1.1	7.38	2.2	3.51	3.3	6.21	2.9	6.59

Table 5: Direct and correlated gains from pedigree selection for days to heading, number of spikes/plant and grain weight/ plant after the two cycles of selection in the second population as percent of F_3 means of bulk samples and best parent.

Selection criterion		Item	Days to heading		Spike length		No.of spikes/plant		No.of kernels/spike		1000-kernel weight		Grain weight/plant	
			Units	%	Units	%	Units	%	Units	%	Units	%	Units	%
Days to heading (days)	C_1	Bulk sample	-1.9	-2.24	-0.5	-5.62	0.4	3.03	-1.7	-2.77	-0.8	-1.57	-0.5	-1.22
	C_1	Best parent	-1.3	-1.54	-0.4	-4.55	0.2	1.49	-2.2	-3.56	-1.1	-2.15	-1.7	-4.03
	C_2	Bulk sample	-2.3	-2.76	-0.3	-3.33	0.2	1.45	-0.2	-0.32	0.5	0.98	-1.1	-2.53
	C_2	Best parent	-1.8	-2.17	-0.5	-5.43	-0.2	-1.41	-0.7	-1.12	-0.2	-0.39	-3.3	-7.24
Number of spikes/plant (spike)	C_1	Bulk sample	-0.1	-0.12	0.6	6.74	0.6	4.55	1.6	2.61	1.0	1.97	2.9	7.07
	C_1	Best parent	0.5	0.59	0.7	7.95	0.4	2.99	1.1	1.78	0.7	1.37	1.7	4.03
	C_2	Bulk sample	-1.5	-1.80	0.8	8.89	0.7	5.07	3.6	5.82	2.3	4.50	2.9	6.68
	C_2	Best parent	-1.0	-1.21	0.6	6.52	0.3	2.11	3.1	4.97	1.6	3.09	0.7	1.54
Grain weight/plant (g)	C_1	Bulk sample	1.4	1.65	0.7	7.87	0.8	6.06	7.0	11.42	2.8	5.51	3.7	9.02
	C_1	Best parent	2.0	2.37	0.8	9.09	0.6	4.48	6.5	10.52	2.5	4.89	2.5	5.92
	C_2	Bulk sample	1.4	1.68	0.9	10.0	1.0	7.25	8.0	12.92	4.7	9.20	3.3	7.60
	C_2	Best parent	1.9	2.29	0.7	7.61	0.6	4.23	7.5	12.02	4.0	7.72	1.1	2.41

However, the percentages of reduction ranged from −2.45 % for 1000-kernel weight to − 6.9% for spike length in the first population and ranged from −0.39 for 1000-kernel weight to −7.24 % for grain weight/plant in the second population compared to the best parent after two cycles of selection.

Selection for more spikes/plant after the two cycles of pedigree selection increased the mean by 10.88 and 5.07 % in the first and second population after two cycles of selection compared to the bulk F_3 families and increased by 9.4 and 2.11% in the first and the second population after two cycles of selection over the best parent. Such increase in number of spikes caused increment in grain weight/plant in both populations with values of 2.75 and 6.68% compared to the bulk F_3 families and 1.82 and 1.54 % over the best parent after two cycles of selection in both populations, respectively. The other correlated traits behaved differently in the two cycles and populations. Afiah (1999), Afiah and Abdel-Hakim (1999) and Afiah and Darwish (2003) demonstrated that number of spikes/plant and number of grains/spike had the most prominent indirect positive effects on grain weight/plant. Positive values were detected between number of spikes/plant and grain weight/plant. This finding under present study, indicates that selection for number of spikes/plant would be accompanied by high yielding ability. El-Seidy (1997) in barley and El-Seidy (2002) in wheat found that spikes number/plant was good charcter for indirect selection for yield improvement, whereas the other yield components were intermediate.

Direct selection for grain weight/plant showed realized response to selection reached 7.57 and 7.60% compared to the bulk sample and accounted 6.59 and 2.41% from the best parent in population 1 and 2, respectively after two cycles of selection.

The correlated traits caused increment in all traits studied in both populations, except days to heading which had positive values towards lateness compared to mean of the bulk F_3 families (C_0) and the earliest parent and differed in magnitude from one trait to another and from one population to another. This could be indicate that response and correlated response to selection depend upon gene pool. Kheiralla (1993) and Ismail (1995) reported that selection based on grain yield *per se* was the most effective for improving such complicated trait. In pedigree selection, the breeder concerned with the performance of individual selected families. This could be due to that the overall mean masked the individual family means.

The results in Tables 6 and 7 show that the effect of pedigree selection for early heading was found in family No. 66 for the first population which was earlier than the bulk sample and better parent by 5.58 and 5.24% and was higher in grain weight by 13.07 and 12.05 %, respectively after the second cycle in the first population. For the second population, family No. 92 was earlier than the bulk by 5.88 and outyielded it by 6.45% after the second cycle. As well as, more spikes/plant resulted in families 50 and 63 which increased by 27.89 and 34.69% relative to C_0 after C_2 and the former outyielded the bulk sample by 3.21 and 12.61%, respectively, in the first population. For the second population, No. 6 had more spikes than the F_3 bulk by 29.71% and also outyielded it by 11.06% after the second cycle.

Table 6: Means of ten selected families for three selection criteria in the first and second cycles of selection in the first population.

Selection criterion	C_2 Fam.		Days to heading		Spike length		No.of spikes/plant		No.of kernels/spike		1000-kernel weight		Grain weight/plant	
			C_1	C_2	C_1	C_2	C_1	C_2	C_1	C_2	C_1	C_2	C_1	C_2
		Bulk sample	85.2	84.2	8.6	8.9	13.7	14.7	61.7	61.8	51.9	52.9	42.6	43.6
		Best parent	85.0	83.9	8.2	8.7	13.8	14.9	62.0	62.7	52.3	53.1	43.0	44.0
Days to heading (days)	3		81.7	81.9	10.2	6.3	14.0	13.4	65.8	60.4	51.9	53.6	46.6	41.7
	18		81.6	80.8	8.8	8.7	14.0	14.8	60.0	58.4	50.2	50.8	41.7	42.7
	22		84.3	79.7	6.5	10.0	11.6	9.9	58.4	60.7	49.8	51.4	32.8	30.6
	36		83.4	82.9	7.9	9.5	15.4	12.4	59.2	62.8	48.2	53.2	43.2	40.8
	39		84.7	79.8	8.2	8.0	12.0	13.9	60.0	65.3	52.4	52.8	37.3	42.1
	45		82.9	79.9	6.0	6.7	12.2	15.8	64.1	61.2	53.8	50.2	40.4	46.0
	66		83.9	79.5	7.7	8.4	15.5	16.7	58.1	60.0	44.6	49.3	38.0	49.3
	73		82.8	82.4	8.4	7.9	14.1	13.8	59.6	62.4	52.0	51.4	43.8	44.3
	85		82.8	78.4	7.9	9.0	10.0	15.3	64.6	60.0	51.2	51.1	32.4	46.7
	93		80.9	81.7	8.4	6.5	13.2	14.0	51.2	58.8	49.9	54.2	33.8	38.8
		Average	82.9	80.7	8.0	8.1	13.2	14.0	60.1	61.0	50.4	51.8	39.0	42.3
		LSD $_{0.05}$	2.02	2.1	1.6	1.7	2.2	2.1	2.4	2.5	1.8	1.7	3.5	3.3
Number of spikes/plant (spike)	11		84.6	84.3	9.6	9.7	15.0	15.7	61.3	65.4	50.4	51.7	45.3	45.3
	17		86.2	85.9	9.0	8.9	17.0	14.2	60.3	66.3	50.7	51.2	47.2	41.8
	33		85.4	83.0	9.4	10.8	15.2	17.2	58.4	58.4	53.7	48.6	46.3	48.6
	41		85.6	86.7	8.8	9.5	16.6	16.3	63.4	62.8	49.8	51.1	47.0	40.2
	46		83.7	87.3	10.3	9.9	15.2	17.1	56.7	57.3	52.8	48.9	40.6	47.5
	50		87.0	84.8	7.9	8.7	14.0	18.8	56.8	59.7	49.0	50.4	38.2	45.0
	63		85.4	86.7	8.4	7.8	13.1	19.8	63.7	61.4	50.2	48.8	40.8	49.1
	72		86.3	87.3	8.2	9.6	16.8	15.7	58.2	63.1	50.9	55.6	49.3	48.2
	83		86.8	85.4	7.6	8.3	17.4	11.8	61.0	65.2	50.1	50.4	44.0	38.3
	87		82.0	87.6	9.8	9.8	17.7	16.4	57.2	65.4	50.4	52.3	40.3	44.0
		Average	85.3	85.9	8.9	9.3	15.8	16.3	59.7	62.5	50.8	50.9	43.9	44.8
		L.S.D. $_{0.05}$	1.8	1.4	1.4	1.2	1.9	1.7	2.0	1.8	1.9	1.6	3.6	3.7
Grain weight/plant (g)	8		87.1	83.7	9.8	9.9	11.7	16.0	65.4	68.7	53.1	57.7	40.3	41.7
	12		86.2	85.7	10.4	9.9	12.9	14.3	64.2	65.8	54.3	58.8	42.3	46.6
	21		85.0	89.4	10.7	9.4	14.3	17.2	65.0	64.8	55.4	56.6	43.6	47.7
	36		85.3	82.6	8.3	9.5	15.7	18.3	65.8	62.3	54.4	55.3	48.8	49.7
	40		87.7	89.4	9.8	10.8	13.8	17.6	69.2	65.5	55.2	58.6	45.8	41.6
	53		88.9	86.0	9.7	7.3	15.9	14.7	60.4	62.7	52.8	58.2	44.0	49.7
	60		85.3	86.3	7.8	10.3	14.7	17.0	64.3	65.6	52.9	52.4	48.9	52.9
	62		89.8	88.8	9.5	10.6	16.3	14.6	65.2	66.9	52.2	56.3	50.2	49.8
	73		86.7	83.9	10.5	11.0	13.8	14.9	64.1	64.9	50.0	54.2	40.7	46.7
	97		87.0	82.2	10.5	9.3	15.9	15.4	60.4	61.8	53.7	55.9	43.4	42.6
		Average	86.9	85.8	9.7	9.8	14.5	16.0	64.4	64.9	53.4	56.4	44.8	46.9
		LSD $_{0.05}$	1.4	1.7	1.6	2.1	2.4	2.3	2.1	2.3	1.7	1.4	2.9	3.1
			3.1	2.9	2.3	2.1	3.0	2.3	3.8	3.6	2.4	2.2	4.5	4.3

Table 7: Means of ten selected families for three selection criteria in the first and the second cycles of selection in the second population.

Selection criterion	C₂.Fam.		Days to heading		Spike length		No.of. spikes/plant		No.of kernels/spike		1000-kernel weight		Grain weight/plant	
			C₁	C₂	C₁	C₂	C₁	C₂	C₁	C₂	C₁	C₂	C₁	C₂
		Bulk sample	84.9	83.4	8.9	9.0	13.2	13.8	61.3	61.9	50.8	51.1	41.0	43.4
		test parent	84.3	82.9	8.8	9.2	13.4	14.2	61.8	62.4	51.1	51.8	42.2	45.6
Days to heading (days)	15		81.6	80.4	8.6	8.3	14.0	12.7	59.9	61.4	54.3	54.3	46.2	40.7
	23		83.9	79.8	8.2	6.1	12.7	15.0	68.3	55.2	50.7	49.8	43.7	41.2
	35		82.7	80.5	7.7	10.7	16.3	16.0	62.9	58.4	51.1	51.4	51.3	47.9
	39		83.6	80.0	8.0	8.8	11.4	13.6	53.5	59.8	50.0	48.2	30.4	41.4
	46		85.8	79.7	9.0	9.1	11.0	11.7	56.2	68.2	49.8	55.8	30.3	42.3
	62		82.7	83.2	11.0	11.5	11.0	10.9	56.8	69.7	51.8	51.6	32.8	38.3
	71		84.3	80.7	7.5	6.8	16.9	14.8	58.4	56.0	44.8	53.3	44.9	40.9
	75		81.9	82.4	9.3	8.7	12.9	16.3	67.2	60.6	50.4	53.4	43.7	45.8
	81		81.6	85.8	6.2	10.7	14.5	14.2	54.1	59.8	46.8	48.0	37.3	38.3
	92		81.9	78.5	8.5	6.3	15.3	14.8	58.7	67.9	50.3	50.2	44.4	46.2
		Average	83.0	81.1	8.4	8.7	13.6	14.0	59.6	61.7	50.0	51.6	40.5	42.3
		LSD 0.05	1.8	2.03	1.6	2.0	1.9	2.1	2.2	2.5	1.4	1.5	2.3	2.5
No.of spikes/ plant (spike)	6		84.9	80.7	9.4	10.8	11.7	17.9	63.7	61.4	55.0	49.6	40.2	48.2
	9		85.3	79.4	7.8	9.5	13.6	16.9	61.7	66.0	53.6	50.2	44.3	47.1
	14		86.4	85.0	8.7	11.7	14.0	15.2	60.6	64.8	48.6	51.6	40.0	46.4
	17		86.1	80.1	11.0	11.5	14.1	14.4	58.4	58.9	53.2	54.8	43.7	45.7
	22		87.6	86.3	10.1	8.9	14.1	13.3	64.3	65.7	54.4	55.7	48.3	48.9
	30		83.7	80.1	9.3	9.5	14.7	16.6	56.1	65.2	51.6	56.1	40.9	46.3
	39		83.2	80.7	9.9	9.3	13.4	12.6	68.7	69.5	47.9	53.3	43.3	46.2
	62		86.3	79.6	10.3	8.6	12.2	12.2	65.2	69.4	55.0	56.4	41.9	45.8
	75		82.8	86.5	9.6	8.7	13.5	12.7	69.3	66.3	50.1	56.1	47.0	44.3
	84		81.7	80.6	8.9	9.5	16.7	13.2	61.0	67.8	48.6	50.2	49.4	44.1
		Average	84.8	81.9	9.5	9.8	13.8	14.5	62.9	65.5	51.8	53.4	43.9	46.3
		LSD 0.05	2.0	2.1	1.5	1.8	2.0	1.8	2.1	2.2	1.7	1.8	2.1	2.2
Grain weight/ plant (g)	3		84.5	89.3	8.7	10.0	15.3	12.6	70.5	72.8	50.4	57.3	46.2	48.1
	9		86.4	88.4	8.5	9.9	13.7	16.4	69.3	76.6	50.1	51.4	46.8	50.6
	22		85.0	80.0	7.6	8.4	14.2	11.8	68.9	69.7	55.3	59.0	44.9	48.4
	35		88.3	86.6	10.5	9.3	16.0	16.7	58.4	69.3	58.4	52.8	42.4	43.3
	38		86.7	85.8	11.0	8.5	13.9	14.1	71.1	70.3	53.6	55.6	50.8	42.8
	42		88.9	80.4	8.7	9.3	14.3	15.8	69.2	69.1	54.8	54.9	41.7	45.1
	63		88.4	86.3	8.4	8.7	13.6	14.7	69.4	69.7	57.9	56.1	48.3	45.4
	65		87.9	87.8	10.7	11.5	14.5	16.3	69.7	59.3	50.7	59.4	46.3	46.7
	77		86.6	83.1	10.5	13.4	10.8	16.6	68.3	73.8	56.0	56.2	39.0	50.2
	82		80.3	80.3	11.4	10.0	13.7	13.0	68.2	68.4	48.8	55.3	40.6	46.4
		Average	86.3	84.8	9.6	9.9	14.0	14.8	68.3	69.9	53.6	55.8	44.7	46.7
		LSD 0.05	1.7	1.9	1.5	1.9	2.4	2.2	2.3	2.6	1.3	1.6	2.5	2.6
			3.0	2.8	2.1	2.0	2.8	2.7	3.4	3.2	3.1	2.9	3.9	3.7

Pedigree selection for grain weight/plant resulted in four high yielding families i.e., No. 36, 53, 60 and 62 which outyielded the bulk sample by 13.99, 13.99, 21.33 and 14.22 % in the first population and resulted two high yielding families in the second population i.e., No. 9 and 77 which outyielded the bulk sample by 16.59 and 15.67 %, respectively after the second cycle.

Both families No. 66 in the first population and family 92 in the second population were earlier and higher in yield and would be recommended for further evaluation. Fortunately, some early families still had more spikes/plant and high grain weight.

Finally, it can concluded that, pedigree selection is an efficient method for improving the selection criterion, and the response to selection depends upon the gene pool and these results enhance the chances of using these high yielding early lines in developing new varieties.

REFERENCES

Abd El- Aty, M.S and Y.S. Katta (2002). Genetic analysis and heterosis of grain yield and related traits in bread wheat (*Triticum aestivum* L.) . J.Agric. Res.Tanta Univ., 28:287-300.

Afiah, S.A.N. (1999). Combining ability, association and path coefficients analysis of some wheat (*T. aestivum* L.) diallel cross under desert conditions. J. Agric. Sci. Mansoura Univ., 24:1583-1596.

Afiah, S.A.N. and A.M.Abdel-Hakim (1999). Heterosis, combining ability, correlation and path coefficient analysis in barley (*Hordeum vulgare* L.) grown under desert conditions of Egypt. Egypt. J.plant Breed., 3 : 53-66.

Afiah, S.A.N. and I.H.I.Darwish (2003). Response of selected F_5 bread wheat lines under abiotic stress conditions. Third Pl.Breed. Conf. Egypt. J. Plant Breed, Giza (April 26, 2003) 7:181-193.

Allard, R.W. (1960). Principles of plant breeding. John Wiley and Sons Inc. New York, London.

Awaad, H.A.(2001). The relative importance and inheritance of grain filling rate and period and some related characters to grain yield of bread wheat (*T. aestivum* L.). The Second Pl. Breed. Conf. Assiut Univ., Oct. 2nd 2001. 181-198.

El-Seidy, E.H.(1997). Inheritance of earliness and yield in some barley crosses. Annals of Agric, Sci. Moshtohor., 35:715-730.

El-Seidy, E.H. (2002). Genotypic evaluation of three wheat crosses for earliness, yield and yield components under normal and late sowing dates. The 3rd Scientific Conference of Agricultural Sciences. Assiut Univ., 20-22 Oct. 2002: 135-149.

El-Seidy, E.H.(2003). A diallel cross analysis in F_1 and F_2 generations for earliness, yield and its components of barley under favorable and water stress conditions. Third Pl.Breed. Conf. Giza (April 26,2003) Part-2., Egypt. J. Plant Breed., 7:643-663.

EL-Seidy, E.H. and A.A.Hamada (1997). Genetical studies on some economic characters in some wheat crosses. Annals of Agric. Sci., Moshtohor, 35: 49 - 62.

Falconer, D.S. (1989). Introduction to Quantitative Genetices. Hong Kong-London.

Ismail, A.A. (1995). Pedigree selection for grain yield, grain weight and earliness in two segregating populations of spring wheat. Assiut J. Agric. Sci., 26:59-72.

Johanson, H.W., H.F. Robinson and R.E. Comstock (1955). Genotypic and phenotypic correlations in soybeans and their implications in selection. Agron. J., 47:477-483.

Kheiralla, K.A.(1993). Selection response for grain yield and its components in a segregating population of spring wheat. Assiut J. Agric. Sci., 24:87-98.

Kheiralla, K.A.; M. A. El-Morshidy and M.M.Zakaria (2001). Inheritance of earliness and yield in bread wheat under favourable and late sowing dates. The Second Pl.Breed. Conf., Assiut Univ. Oct. 2nd 2001: 219-239.

Kheiralla, K.A. and T.H.I Sherif (1992). Inheritance of earliness and yield in wheat under heat stress. Assiut J.Agric. Sci. , 23:105-126.

Löffler, C.M. and R.H. Busch (1982). Selection for grain protein, grain yield and nitrogen partitioning efficiency in hard red spring wheat. Crop. Sci., 22:591-595.

Miller, P.A. ; J.C.Williams; H.F. Robinson and R.F. Comstock (1958). Estimates of genotypic and environmental variances and covariances in upland cotton and their implications in selection. Agron. J., 50:126-131.

Mahdy, E.E. (1988). Single, multiple traits selection in a segregating population of wheat, *Triticum aestivum* L. Plant Breed., 101:245-249.

Moustafa, K.M. ; M.O. Ghandorah and S.S.A. Soliman (1998). Field evaluation of F_3 and F_5 families of bread wheat under heat and drought stress at central region of Saudi Arabia. Alex.J. Agric., 43:27-38.

O'Brien , L. ; R.J. Baker and L.E. Evans (1978). Response to selection for yield in F_3 of four wheat crosses. Crop. Sci., 18:1029-1033.

الإنتخاب المنسب لصفات التبكير وعدد السنابل ووزن الحبـــوب فــى عشـــيرتين إنعزاليتين لمحصول الشعير

السيد حامد الصعيدى
قسم المحاصيل – كلية الزراعه بطنطا – جامعه طنطا

تم إجراء هذا البحث فى ثلاث مواســـم ٩٨/١٩٩٧ ، ٠٢/٢٠٠١ ، ٠٣/٢٠٠٢ حيث أجريت دورتى إنتخاب على الجيل الثالث لهجينين من الشعير ، وكان الهدف مـــن الدراسة هو تحسين صفة وزن الحبوب ، عدد السنابل على النبات والتبكير فـــى الطـرد وذلك بإستخدام طريقة الإنتخاب المنسب.

١-أوضحت النتائج أن هناك إختلافات عالية المعنوية بين العائلات فى الجيل الثالث حيث أشارت تقديرات معاملى الإختلاف المظهرى والوراثى إلى وجود إختلافات مرضيـــة للصفات المدروسة وهى تاريخ الطرد ، طول السنبلة ، عدد السنابل على النبات، عـــدد الحبوب فى السنبلة ، وزن الألف حبة ووزن الحبوب للنبات.

٢- أشارت النتائج أن درجة التوريث بمعناها الواسع عاليـــة لصفـــه تـــاريخ الطـــرد ومتوسطه لصفتى عدد السنابل ومحصول الحبوب للعشيرتين المســـتخدمتين حيــث إنخفضت درجة التوريث والتقدم الوراثى المتوقع من الجيل الثالث إلى الجيل الخامس للصفات الإنتخابية الثلاثه تحت الدراسة للعشيرتين المستخدمتين.

٣- أظهرت النتائج بعد دورتين إنتخابيتين إلى التحسين الحقيقى للتبكير فى الطرد بمقدار ٤,١٦ % فى العشيرة الأولى، ٢,٧٦ % فى العشيرة الثانية مقارنة بمتوسط عـــائلات الجيل الثالث . لقد أدى التحسين إلى زيادة فى عدد السنابل بمقدار ١٠,٨٨ % فـــى العشيرة الأولى ، ٥,٠٧ % فى العشيرة الثانية مقارنة بمتوسط عائلات الجيل الثالث (Bulk) وكذلك زاد وزن الحبوب للنبات بمقدار ٧,٥٧ % ، ٧,٦ % مقارنة بمتوسط عائلات الجيل الثالث ، ٦,٥٩ % ،٢,٤١ % بالمقارنة بالأب الأفضل فى العشـــيرتين على الترتيب وذلك بعد دورتى إنتخاب.

٣- أوضحت النتائج أن أفضل عائله فى العشيرة الأولى نتيجة للإنتخاب المنســـب هـــى العائلة رقم ٦٦ والتى أعطت محصولا أعلى من متوسط عائلات الجيل الثالث بمقدار ١٣,٠٧ % مصحوبة بتبكير بلغ ٥,٥٨ %، وأن العائلة رقم ٩٢ فى العشيرة الثانيـــة كانت الأفضل محصوليا حيث أعطت محصولا بلغ ٦,٤٥ % أعلـــى مـــن متوســط عائلات الجيل الثالث وكانت مبكرة بمقدار ٥,٨٨ % .

من نتائج هذه الدراسة يمكن القول أن طريقة الإنتخاب المنسب فعاله فى زيــــادة الصفات الإنتخابية الثلاث(وزن الحبوب – عدد السنابل على النبات و التبكير فى الطـرد) لمحصول الشعير فى دورتين إنتخابيتين.