PERFORMANCE AND SOME GENETIC PARAMETERS FOR SIXTY PROMISING LINES OF BREAD WHEAT (*Triticum aestivum* L.)

Afaf M. Tolba and S.H.Saleh
Dept. of Agron., Fac. of. Agric., Ain Shams University, Cairo, Egypt
(Received: Dec. 27, 2011)

ABSTRACT: *This study was conducted at the Experimental Farm of the Faculty of Agriculture, Ain Shams University, at Shalakan, Kalubia Governorate, Egypt during the period of 2008/2009 and 2009/2010 seasons, to study mean performance and some genetic parameters of grain yield and some other agronomic traits, i. e. days to heading, plant height, spike length, number of spikes/ plant, number of spikelets/ spike, number of kernels/ spike and 1000-kernel weight in sixty promising lines and seven check cultivars of bread wheat. The results obtained revealed the presence of high significant differences between seasons, genotypes and the interaction of seasons with genotypes for all studied traits except spike length and no. of spikes/ plant for seasons x genotypes interaction. The lines; 8, 41 and 42 exhibited the best performance in both growing seasons and surpassed the check cvs. for grain yield and most yield components. Phenotypic coefficient of variation values were near those of genotypic coefficient of variation for all traits, this indicate that environment had no major role to influence variation among genotypes. This may interprets the high values of heritability and effectiveness of expected genetic gain as a result of selection. The highest estimates of phenotypic and genotypic coefficient of variation were shown by number of spikes/ plant and grain yield/ plant. However, days to heading, no. of spikelets/ spike and 1000-kernel weight exhibited low phenotypic and genotypic coefficient of variations. The heritability estimates in broad sense were moderate to high for the studied traits giving values ranging from 55.29 % for days to heading to 94.60 % for plant height. Predicted genetic gain as a percentage of the mean ranged from 4.99 % for days to heading to 25.59 % for no. of spikes/ plant. Significant and positive phenotypic and genotypic correlation coefficients were found between grain yield/ plant and each of spike length, no. of spikelets/ spike, no. of spikes/ plant, no. of kernels/ spike and 1000-kernel weight. Thus, these traits could be considered as selection criteria in wheat breeding programs for yield improvement.*

Key words: *Wheat, Triticum aestivum L., Phenotypic and genotypic coefficient of variation, Heritability, Expected genetic gain, Correlation.*

INTRODUCTION

The production of wheat in Egypt is not enough for human consumption; meanwhile the cultivated land is limited and wheat occupying relatively small area because of the competition with the other winter crops. Plant breeders have a significant role in breeding tolerant abiotic stresses (salinity, drought, poor soils, high temperature.........etc.) cultivars for new reclaimed lands to increase wheat production area. Information about phenotypic and genotypic coefficients of variation, heritability, expected genetic gain and correlation coefficients among studied traits can help breeders for increasing the selection efficiency. Rady *et al.* (1981); Ehdaie and Waines (1989); Belay *et al.* (1993); Moghaddam *et al.* (1997); Menshawy (2007) and Abd El-Fattah *et al.* (2009) found significant variation in yield and its components among wheat genotypes, moderate values of phenotypic and genotypic variation for grain yield, moderate to high values of heritability and expected genetic gain for grain yield, moderate to high values of heritability and expected genetic gain for grain yield and its compounds and significant positive correlation between grain yield and its components. The main objectives of this work were: (1) studying performance of 60 promising lines of bread wheat compared with seven commercial cultivars. (2) Estimating phenotypic and genotypic coefficients of variation, heritability in the broad sense, expected genetic gain upon selection and correlation coefficients among studied traits to formulate appropriate breeding program to improve yield.

MATERIALS AND METHODS

The field experimental work of the present investigation was carried out at the Experimental Farm of the Faculty of Agriculture, Ain Shams University, at Shalakan, Kalubia Governorate, Egypt during the two successive growing seasons 2008/2009 and 2009/2010 to study the performance of 67 genotypes of bread wheat and estimate some genetic parameters for some agronomic traits. The genetic materials used in this study consisted of 60 promising lines and 7 check cultivars (Giza 168, Sakha 93, Sakha 94, Sids 1, Gemmeiza 7, Gemmeiza 9 and Gemmeiza 10) of bread wheat. The promising lines were developed and evaluated in F_7 in Agronomy Dep., Fac. of Agric., Ain Shams Univ. by Tolba (2000), while, the seven cultivars were obtained from wheat Dept. Agric. Res. Cent., Giza, Egypt. Wheat grains were sown on 16 and 20 November in the first and the second seasons, respectively. The experimental design used in each season was randomized complete blocks with three replicates; each replicate consisted of 67 plots of wheat entries distributed randomly within the replicate. The plot consisted of three rows. Each row was 3 m in length and 20 cm apart. Grains were spaced at 10 cm within row and one plant was left per hill. The recommended cultural practices for wheat production were followed during the growing seasons. Monthly mean of minimum and maximum temperature degrees (°C) and relative humidity (%) in the experimental area during the two successive growing seasons are shown in Table (1). Days to heading, was measured as the number of days from sowing till the main stem spikes of about 50% of plants per plot were fully emerged from the flag leaf. At the harvest, plant height (cm), spike length (cm), number of spikes/ plant, number of spikelets/ spike, number of kernels/ spike, 1000-kernel weight (g) and grain yield/ plant (g) were recorded on 10 competitive individual plants for each genotype in each replicate. Statistical analysis was performed for each season then; combined analysis for both seasons was carried out after doing the homogeneity test according to Gomez and Gomez (1984). L.S.D was computed to compare differences among means at 5% level. The forms of combined analysis of variances and expected mean squares over the two seasons are presented in Table (2).

The genetic parameters in the present study were calculated using the following equations according to Steel and Torrie (1980).

1- Phenotypic (P.C.V) and genotypic (G.C.V) coefficient of variation.

$$P.C.V = \frac{\sigma P}{\overline{X}} x100$$

$$G.C.V = \frac{\sigma G}{\overline{X}} x100$$

Where: σP, σg and $\overline{X}$ are the phenotypic, the genotypic standard deviation and genotypes mean, respectively.

2- Broad sense heritability (h^2)

$$h^2 = \frac{\sigma^2 g}{\sigma^2 g + \frac{\sigma^2 gy}{y} + \frac{\sigma^2 e}{ry}} x\,100$$

Where: $\sigma^2 g$, $\sigma^2 gy$ and $\sigma^2 e$ denote variance of genotypes, interaction between genotypes and years and environment, respectively, whereas r and y denote number of replications and years, respectively.

Table 1. The average degrees of maximum and minimum temperature (^{0}C) and relative humidity (R.H %) in the experimental area during the two seasons 2008/2009 and 2009/2010.

Month	Max temp.	Min temp.	Max. R.H	Min. R.H
		2008/2009		
Nov.	25.93	16.09	81.14	40.32
Dec.	22.24	12.84	79.91	41.75
Jan.	21.51	11.18	76.32	36.02
Feb.	22.18	10.62	76.83	33.95
Mar.	23.08	11.28	78.30	36.58
Apr.	28.08	12.47	79.57	33.04
May	29.31	13.59	79.23	36.21
		2009/2010		
Nov.	24.72	15.70	81.29	43.31
Dec.	22.31	13.28	77.50	41.35
Jan.	23.23	12.57	78.55	37.43
Feb.	24.75	13.02	75.24	35.63
Mar.	26.78	13.33	80.05	36.60
Apr.	28.43	14.03	79.88	34.40
May	31.26	15.04	79.77	33.49

Table 2. Analysis of variance and expectations of mean squares for bread wheat genotypes over the two growing seasons.

S.O.V.	d.f.	M.S.	EMS
Seasons (S)	(s-1)	M_4	----------------------
Genotypes (G)	(g-1)	M_3	$\delta^2_e + r\delta^2 gs + rs\delta^2 g$
G x S	(g-1)(s-1)	M_2	$\delta^2_e + r\delta^2 gs$
Error	s (r-1)(g-1)	M_1	δ^2_e

3- The expected genetic gain upon selection (AG):

a-As an amount $\Delta G = (h^2)(\sigma p)(K)$

Where: h^2 = the broad sense heritability.

σp = standard deviation of phenotypic variance.

K = selection differential coefficient given the value 2.06 at 5% selection intensity.

b- As percentage of the mean = $\frac{\Delta G}{\bar{X}} x100$

Where: $\bar{X}$ = genotypes mean.

4- Phenotypic and genotypic correlation coefficients were calculated between all possible pairs of studied traits.

RESULTS AND DISCUSSION

Analysis of variance and mean performance

The analysis of variance for all studied traits are presented in Table (3). The combined analysis indicates the presence of high significant differences between seasons, genotypes and the interaction of seasons with genotypes for all studied traits except spike length and no. of spikes/ plant for seasons x genotypes which were insignificant. These results reveal presence of sufficient genetic variability among genotypes regarding the studied traits. These results are in line with those mentioned by Ehdaie and Waines (1989); Iskandar (2000); Menshawy (2007); Seleem and Hendawy (2007) and Abd El-Fattah *et al.* (2009) who found highly significant differences between wheat genotypes, seasons and genotypes x seasons interaction.

Table 3. Mean squares of single and combined analysis of variance for all the traits studied of bread wheat genotypes (G) in the two growing seasons (S) 2008/2009 and 2009/2010.

Source of variation	Df	2008/2009	2009/2010	Combined	2008/2009	2009/2010	Combined
		Days to heading			Plant height (cm)		
S	1			1895.84**			56764.07**
G	66	85.37**	55.78**	97.55**	493.79**	348.18**	798.83**
SG	66			43.61**			43.15**
Error	264			1.84			7.19
		Spike length (cm)			No. of spikes/plant		
S	1			65.75**			3983.30**
G	66	2.57**	2.97**	4.72**	14.04**	7.37**	18.70**
SG	66			0.82			2.71
Error	264			0.62			2.03
		No. of spikelets/spike			No. of kernels/spike		
S	1			6.99**			4602.42**
G	66	5.01**	5.66**	8.60**	114.78**	147.36**	207.07**
SG	66			2.06**			55.07**
Error	264			0.71			14.12
		1000-kernel weight (g)			Grain yield/plant (g)		
S	1			2313.36**			36057.78**
G	66	28.52**	22.75**	39.51**	51.17**	14.97**	50.87**
SG	66			11.76**			15.28**
Error	264			2.99			2.24

The mean values of the studied genotypes for grain yield/ plant and its related agronomic traits in each of the two growing seasons and their combined data are shown in Table (4). The results reveal that wheat genotypes greatly differed in their response in both growing seasons for the studied traits. Number of days to heading ranged from 84.33 days (line 8) to 106 days (line 23) and from 80.67 (line 24) to 97 days (lines 12 and 38) in the first and second season, respectively. Table (4) shows that some lines were earlier than the check varieties in the first season and some in the second season meantime, the line 47 was earlier than the check varieties in both seasons. With respect to plant height, it ranged from 93.83 cm (the cv. Gemmeiza 10) to 150.23 cm (line 12) and from 75.89 cm (the cv. Sakha 93) to 123.22 cm (line 12) in the first and second season, respectively. The line 12 was the tallest and surpassed all the check varieties over the two seasons. Concerning spike length, it ranged from 8.90 cm (line 12) to 13.75 cm (the cv. Gemmeiza 7) and from 8.44 cm (line 56) to 13 cm (line 35) in the first and the second season, respectively. Some lines were superior to 5 out of the seven check varieties in the first season and some in the second meantime, the line 35 was superior to most of the check varieties in both seasons. With respect to number of spikes/ plant, it ranged from 11.06 (line 1) to 18.83 (line 58) and from 6.28 (line 1) to 12.12 (line 41) in the first and second season, respectively. Some lines were superior to 5 out of the seven check

Table 4. Mean performance of 67 bread wheat genotypes (G) for all the traits studied in the two growing seasons (S) 2008/2009 and 2009/2010 and their combined data.

	Days to heading			Plant height (cm)			Spike length (cm)			No. of spikes/plant		
Genotypes	2008/2009	2009/2010	Combined	2008/2009	2009/2010	Combined	2008/2009	2009/2010	Combined	2008/2009	2009/2010	Combined
Lines:1	103.00	90.67	96.83	102.11	76.45	89.28	11.40	11.06	11.23	11.06	6.28	8.67
2	90.33	95.67	93.00	111.44	84.67	98.06	10.11	9.28	9.69	16.33	8.44	12.39
3	92.67	84.33	88.50	137.83	103.67	120.75	10.50	9.72	10.11	14.78	8.50	11.64
4	90.67	89.67	90.17	142.11	106.67	124.39	9.63	10.11	9.87	16.78	8.45	12.61
5	95.00	88.00	91.50	120.89	91.45	106.17	12.44	10.89	11.67	18.00	10.00	14.00
6	91.67	84.33	88.00	115.72	88.61	102.17	9.78	8.68	9.23	15.55	6.94	11.25
7	84.67	91.67	88.17	107.33	88.17	97.75	12.94	11.10	12.02	17.67	10.50	14.08
8	84.33	86.67	85.50	110.98	86.67	98.82	11.71	10.53	11.12	18.50	11.11	14.81
9	90.67	88.33	89.50	125.33	99.17	112.25	11.06	11.00	11.03	14.33	8.72	11.53
10	92.33	82.67	87.50	138.67	111.56	125.11	11.61	10.61	11.11	15.94	8.00	11.97
11	85.67	92.33	89.00	108.94	94.00	101.47	11.67	11.28	11.47	14.44	9.72	12.08
12	92.00	97.00	94.50	150.23	123.22	136.73	8.90	8.95	8.92	13.61	8.94	11.28
13	92.33	81.00	86.67	132.35	106.94	119.64	10.77	10.05	10.41	15.00	8.17	11.58
14	93.00	86.00	89.50	130.22	110.50	120.36	10.72	10.06	10.39	14.95	9.06	12.00
15	91.67	93.00	92.33	138.73	105.50	122.12	8.96	8.50	8.73	12.56	7.83	10.19
16	95.33	92.00	93.67	102.66	83.00	92.83	11.22	10.55	10.89	12.56	7.17	9.86
17	100.33	91.67	96.00	104.45	85.89	95.17	11.78	10.92	11.35	15.06	6.67	10.86
18	92.00	94.00	93.00	102.56	81.67	92.11	11.06	10.16	10.61	14.17	9.50	11.83
19	99.00	95.00	97.00	115.94	91.22	103.58	10.72	8.89	9.81	15.22	10.22	12.72
20	101.00	87.00	94.00	109.72	90.33	100.03	11.70	10.92	11.31	12.45	7.39	9.92
21	92.33	89.00	90.67	115.95	95.56	105.75	12.06	10.11	11.08	14.78	9.45	12.11
22	84.67	90.00	87.33	144.06	116.94	130.50	11.87	10.95	11.41	13.06	7.06	10.06
23	106.00	91.33	98.67	115.67	88.17	101.92	12.33	12.14	12.23	17.08	9.67	13.38
24	97.00	80.67	88.83	107.39	94.11	100.75	10.89	8.94	9.92	14.50	7.39	10.94
25	86.33	91.33	88.83	130.33	110.61	120.47	11.83	10.67	11.25	14.56	8.83	11.69
26	93.00	92.00	92.50	109.01	83.00	96.00	12.10	10.86	11.48	15.17	7.78	11.47
27	92.33	82.67	87.50	108.28	90.33	99.31	12.00	12.26	12.13	18.06	10.00	14.03
28	94.33	81.33	87.83	104.95	90.22	97.59	12.09	10.56	11.32	13.89	6.72	10.31

Table 4. Cont.

Genotypes	Days to heading			Plant height (cm)			Spike length (cm)			No. of spikes/plant		
	2008/2009	2009/2010	Combined	2008/2009	2009/2010	Combined	2008/2009	2009/2010	Combined	2008/2009	2009/2010	Combined
29	92.33	95.67	94.00	104.44	80.00	92.22	11.46	9.53	10.49	13.56	7.72	10.64
30	94.00	89.33	91.67	125.11	95.28	110.19	11.61	10.39	11.00	14.33	8.67	11.50
31	100.00	88.67	94.33	115.39	89.17	102.28	11.61	11.47	11.54	17.89	10.00	13.94
32	88.33	88.00	88.17	113.22	100.28	106.75	11.06	10.22	10.64	11.89	6.39	9.14
33	101.33	90.33	95.83	120.46	100.05	110.25	12.22	11.64	11.93	17.22	11.17	14.19
34	95.00	96.00	95.50	119.54	91.89	105.72	13.37	10.33	11.85	14.50	8.56	11.53
35	87.33	83.00	85.17	117.06	95.72	106.39	12.72	13.00	12.86	17.07	10.67	13.87
36	91.00	90.33	90.67	122.17	101.06	111.61	11.55	11.00	11.28	13.89	8.83	11.36
37	96.33	92.00	94.17	106.44	89.00	97.72	11.89	10.94	11.41	17.28	10.00	13.64
38	100.67	97.00	98.83	109.78	89.00	99.39	10.56	8.95	9.75	15.72	10.06	12.89
39	91.00	91.33	91.17	129.33	101.45	115.39	9.22	8.61	8.92	13.94	7.61	10.78
40	102.00	95.33	98.67	122.11	101.44	111.78	12.00	11.56	11.78	18.07	11.19	14.63
41	92.00	87.00	89.50	117.33	88.17	102.75	11.72	10.81	11.27	17.75	12.12	14.93
42	92.33	86.67	89.50	106.17	76.67	91.42	13.06	11.00	12.03	17.69	10.78	14.24
43	95.67	92.33	94.00	117.50	85.67	101.58	12.09	12.00	12.05	17.48	10.48	13.98
44	95.00	92.67	93.83	113.22	92.61	102.92	11.78	11.67	11.72	18.16	10.75	14.46
45	101.00	92.00	96.50	100.50	83.22	91.86	11.06	10.33	10.69	15.67	9.61	12.64
46	84.67	90.00	87.33	96.56	83.95	90.25	11.44	9.22	10.33	16.11	7.67	11.89
47	86.67	81.33	84.00	137.83	106.67	122.25	11.72	10.25	10.99	13.94	8.72	11.33
48	102.00	91.67	96.83	117.70	94.78	106.24	11.22	11.58	11.40	17.75	11.07	14.41
49	101.00	93.67	97.33	125.89	95.22	110.56	11.28	11.56	11.42	18.31	10.88	14.60
50	93.33	88.67	91.00	106.97	78.72	92.85	11.41	11.69	11.55	17.08	10.37	13.73
51	97.67	88.67	93.17	122.78	96.78	109.78	10.84	9.89	10.36	15.17	9.22	12.19
52	91.33	87.67	89.50	131.00	109.39	120.19	10.44	10.55	10.50	15.07	6.39	10.73
53	94.00	87.67	90.83	142.64	120.28	131.46	11.34	10.83	11.09	12.50	8.00	10.25
54	90.67	87.00	88.83	99.72	82.89	91.31	11.83	11.78	11.81	17.25	11.18	14.22
55	92.00	89.33	90.67	117.54	96.61	107.08	11.37	11.69	11.53	17.38	11.09	14.23
56	103.00	96.00	99.50	129.28	105.22	117.25	10.39	8.44	9.42	14.33	8.78	11.56
57	94.00	86.33	90.17	110.89	90.22	100.56	11.17	11.21	11.19	17.47	11.17	14.32
58	94.00	86.67	90.33	118.22	96.78	107.50	11.56	11.00	11.28	18.83	11.22	15.02

Table 4. Cont.

59	91.67	86.33	89.00	130.83	101.61	116.22	11.67	10.72	11.19	15.94	8.72	12.33
60	96.00	95.67	95.83	111.39	85.50	98.44	12.05	10.89	11.47	16.89	10.74	13.81
Check varieties (C V.)												
Giza 168	89.67	88.00	88.83	101.17	80.78	90.97	12.39	10.97	11.68	11.33	6.56	8.94
Sakha 93	89.67	87.33	88.50	96.39	75.89	86.14	11.33	10.61	10.97	12.22	7.16	9.69
Sakha 94	101.33	95.67	98.50	116.38	89.00	102.69	12.03	10.73	11.38	11.56	6.78	9.17
Sids 1	100.33	95.00	97.67	119.56	86.61	103.08	11.77	10.75	11.26	12.78	6.56	9.67
Gemmeiza 7	96.00	92.33	94.17	121.72	92.89	107.31	13.75	12.67	13.21	18.15	9.89	14.02
Gemmeiza 9	104.67	96.33	100.50	115.56	90.06	102.81	11.77	10.97	11.37	10.39	7.56	8.97
Gemmeiza 10	102.67	96.00	99.33	93.83	76.39	85.11	10.52	10.72	10.62	12.22	10.17	11.19
Mean (C V.)	97.76	92.95	95.36	109.23	84.52	96.87	11.94	11.06	11.50	12.66	7.81	10.24
Grand mean	94.26	89.92	92.09	117.43	93.66	105.54	11.43	10.63	11.03	15.3	9.00	12.15
LSD 0.05												
S			0.27			0.53			0.15			0.28
G	2.40	1.96	1.54	4.05	4.60	3.05	1.37	1.17	0.90	2.59	1.97	1.62
SG			2.18			4.31			ns			ns
	No. of spikelets/spike			No. of kernels/spike			1000-kernel weight (g)			Grain yield/plant (g)		
Genotypes	2008/2009	2009/2010	Combined	2008/2009	2009/2010	Combined	2008/2009	2009/2010	Combined	2008/2009	2009/2010	Combined
Lines:1	23.11	22.11	22.61	57.46	50.15	53.81	42.15	38.83	40.49	32.57	12.89	22.73
2	24.32	24.94	24.63	63.06	51.83	57.44	40.75	39.25	40.00	29.03	11.53	20.28
3	22.78	22.11	22.44	51.33	37.28	44.31	50.21	43.40	46.80	21.05	12.69	16.87
4	25.75	25.17	25.46	57.44	39.56	48.50	43.54	36.66	40.10	31.82	11.59	21.70
5	25.72	23.56	24.64	68.50	51.44	59.97	46.33	44.49	45.41	34.77	14.43	24.60
6	22.72	21.17	21.94	61.55	44.67	53.11	49.15	40.37	44.76	33.86	11.56	22.71
7	25.94	23.45	24.69	69.79	64.50	67.14	47.90	43.25	45.57	36.28	15.45	25.87
8	24.97	23.44	24.20	66.32	54.17	60.24	49.32	43.00	46.16	38.81	17.37	28.09
9	22.78	21.94	22.36	54.77	52.89	53.83	50.09	40.09	45.09	33.67	12.03	22.85
10	22.11	21.55	21.83	61.18	54.35	57.76	44.69	40.83	42.76	33.63	13.94	23.78
11	21.75	22.28	22.01	55.05	49.22	52.14	50.33	42.08	46.21	35.02	14.53	24.77
12	22.44	23.56	23.00	49.95	38.05	44.00	48.01	44.32	46.16	24.77	12.78	18.77
13	22.44	21.28	21.86	60.25	52.74	56.49	43.11	37.76	40.43	30.35	11.11	20.73

Table 4. Cont.

Genotypes	No. of spikelets/spike			No. of kernels/spike			1000-kernel weight (g)			Grain yield/plant (g)		
	2008/2009	2009/2010	Combined	2008/2009	2009/2010	Combined	2008/2009	2009/2010	Combined	2008/2009	2009/2010	Combined
14	22.08	22.83	22.46	64.06	41.55	52.81	49.98	41.92	45.95	28.89	11.85	20.37
15	25.16	25.28	25.22	59.86	50.28	55.07	43.54	37.23	40.39	28.72	12.03	20.38
16	21.42	22.89	22.15	63.07	59.83	61.45	40.05	39.80	39.92	25.77	12.88	19.33
17	22.64	24.50	23.57	62.57	54.33	58.45	43.11	37.16	40.14	32.28	11.74	22.01
18	24.72	25.17	24.94	53.95	54.28	54.11	47.23	37.45	42.34	29.92	13.00	21.46
19	22.19	23.11	22.65	56.45	43.89	50.17	45.91	42.46	44.18	32.25	13.06	22.65
20	22.42	22.28	22.35	50.70	56.50	53.60	47.98	38.72	43.35	30.40	13.74	22.07
21	21.64	23.19	22.42	61.40	64.75	63.08	48.77	39.39	44.08	31.90	11.81	21.86
22	21.65	22.97	22.31	63.01	52.61	57.81	46.33	39.24	42.78	34.91	10.79	22.85
23	26.53	25.33	25.93	73.00	64.78	68.89	48.28	43.20	45.74	38.03	15.12	26.58
24	21.89	20.31	21.10	56.00	51.11	53.56	45.73	40.28	43.00	27.22	10.41	18.82
25	23.19	23.47	23.33	56.89	50.72	53.81	46.61	37.08	41.85	30.90	12.83	21.86
26	22.84	24.05	23.45	57.06	57.72	57.39	41.32	39.00	40.16	34.36	12.74	23.55
27	24.16	24.11	24.14	66.06	60.50	63.28	47.63	44.58	46.11	37.06	15.26	26.16
28	23.47	21.39	22.43	63.75	56.75	60.25	40.29	38.99	39.64	29.52	9.48	19.50
29	23.53	24.25	23.89	64.33	48.50	56.42	42.93	40.23	41.58	28.69	12.08	20.39
30	24.74	24.72	24.73	54.33	48.55	51.44	49.93	41.95	45.94	30.56	13.01	21.78
31	24.11	24.67	24.39	70.56	58.60	64.58	48.61	45.25	46.93	37.53	16.22	26.87
32	22.67	20.44	21.56	57.22	50.11	53.67	45.25	40.19	42.72	34.25	8.30	21.27
33	22.55	23.39	22.97	57.55	58.06	57.81	49.30	45.57	47.44	37.63	16.49	27.06
34	22.75	22.50	22.62	58.22	58.28	58.25	37.66	38.42	38.04	35.23	14.17	24.70
35	25.08	24.72	24.90	68.96	59.15	64.06	52.50	47.06	49.78	37.29	16.14	26.72
36	24.22	22.72	23.47	62.00	53.72	57.86	49.50	41.87	45.69	28.93	14.32	21.62
37	25.65	24.22	24.93	67.96	58.90	63.43	48.54	38.50	43.52	35.99	15.33	25.66
38	24.05	23.78	23.91	64.20	42.61	53.40	43.20	39.16	41.18	34.30	13.03	23.66
39	22.97	23.06	23.01	59.53	49.39	54.46	43.56	41.74	42.65	31.74	12.83	22.28
40	24.00	24.06	24.03	69.39	57.90	63.65	46.99	45.91	46.45	36.82	16.33	26.58
41	23.08	23.42	23.25	72.33	67.25	69.79	51.43	45.57	48.50	39.46	19.61	29.54
42	24.00	23.07	23.53	69.13	67.36	68.24	48.33	44.33	46.33	39.93	19.22	29.58
43	24.81	23.83	24.32	69.80	66.62	68.21	44.56	42.25	43.40	35.44	16.15	25.80
44	23.22	23.40	23.31	67.23	63.91	65.57	49.31	44.71	47.01	35.15	15.11	25.13

Table 4. Cont.

	No. of spikelets/spike			No. of kernels/spike			1000-kernel weight (g)			Grain yield/plant (g)		
Genotypes	2008/2009	2009/2010	Combined	2008/2009	2009/2010	Combined	2008/2009	2009/2010	Combined	2008/2009	2009/2010	Combined
45	23.89	25.00	24.44	63.66	51.78	57.72	46.45	35.35	40.90	32.26	12.74	22.50
46	20.44	19.42	19.93	63.74	50.11	56.92	46.59	42.47	44.53	34.88	12.12	23.50
47	23.00	21.45	22.23	61.72	50.17	55.94	44.09	40.60	42.35	33.27	12.33	22.80
48	24.06	22.44	23.25	67.66	59.27	63.47	47.87	45.03	46.45	36.62	15.82	26.22
49	23.83	24.14	23.99	60.39	61.24	60.81	46.40	46.21	46.31	36.16	15.35	25.76
50	22.75	22.75	22.75	62.39	62.22	62.31	47.07	44.17	45.62	38.02	15.28	26.65
51	22.56	24.11	23.33	51.28	49.28	50.28	46.14	41.29	43.72	26.34	12.08	19.21
52	21.83	23.57	22.70	57.45	55.00	56.22	46.97	40.43	43.70	29.93	12.95	21.44
53	22.11	23.44	22.78	59.44	55.28	57.36	44.66	40.69	42.68	26.56	12.14	19.35
54	22.67	22.36	22.51	66.23	64.25	65.24	46.70	43.93	45.31	36.70	16.15	26.42
55	24.17	24.11	24.14	69.41	64.95	67.18	48.14	43.53	45.83	36.28	16.35	26.32
56	25.06	26.44	25.75	62.17	50.67	56.42	41.23	39.92	40.57	25.68	14.22	19.95
57	23.44	23.28	23.36	66.94	63.58	65.26	45.53	37.55	41.54	35.71	15.89	25.80
58	23.86	21.89	22.88	67.82	58.28	63.05	46.30	43.07	44.69	37.05	17.24	27.15
59	23.33	22.94	23.14	61.06	54.67	57.86	43.86	40.77	42.31	30.92	10.84	20.88
60	23.67	20.71	22.19	67.24	61.25	64.24	47.61	45.38	46.49	36.42	15.82	26.12
Check varieties (C V.)												
Giza 168	22.78	21.56	22.17	63.47	55.25	59.36	45.00	39.46	42.23	30.04	12.62	21.33
Sakha 93	21.22	21.67	21.45	45.89	52.11	49.00	49.81	41.84	45.82	28.81	11.36	20.09
Sakha 94	24.33	21.67	23.00	55.28	54.17	54.72	44.30	41.41	42.85	28.95	11.75	20.35
Sids 1	21.67	21.83	21.75	49.78	52.46	51.12	47.15	41.74	44.45	28.52	12.01	20.27
Gemmeiza 7	24.89	24.31	24.6	70.59	63.08	66.84	47.88	45.90	46.89	36.05	17.23	26.64
Gemmeiza 9	24.72	23.83	24.28	58.11	54.24	56.18	47.3	41.24	44.27	29.37	13.94	21.65
Gemmeiza 10	22.31	22.55	22.43	53.44	56.3	54.87	39.64	39.65	39.65	25.44	14.40	19.92
Mean (C V.)	23.13	22.49	22.81	56.65	55.37	56.01	45.87	41.61	43.74	29.60	13.33	21.46
Grand mean	23.39	23.12	23.25	61.53	54.76	58.14	46.22	41.42	43.82	32.64	13.70	23.17
LSD 0.05												
S			0.17			0.74			0.34			0.29
G	1.22	1.49	0.96	6.94	5.05	4.27	3.21	2.30	1.96	2.66	2.15	1.70
SG			1.36			6.04			2.78			2.41

varieties in no. of spikes/plant in the first season and some in the second season meantime, the lines; 8, 33, 40, 41, 42, 44, 48, 49, 54, 55, 57 and 58 gave the highest values for no. of spikes/ plant over the two seasons superior to most of the check varieties. Number of spikelets/ spike, ranged from 20.44 (line 46) to 26.53 (line 23) and from 19.42 (line 46) to 26.44 (line 56) in the first and second season, respectively. Table (4) shows that some lines were superior to the check varieties in no. of spikelets/ spike in the first season and some in the second meantime, the two lines; 4 and 23 recorded the highest values for no. of spikelets/ spike compared to the check varieties in both seasons. Concerning number of kernels/ spike, it ranged from 45.89 (the cv. Sakha 93) to 73.00 (line 23) and from 37.28 (line 3) to 67.36 (line 42) in the first and second season, respectively. Table (4) shows that some lines were superior to most of the check varieties in no. of kernels/spike in the first season and some in the second season meantime, the lines; 7, 23, 27, 31, 35, 37, 40, 41, 42, 43, 44, 48, 54, 55, 57, 58 and 60 showed the highest values of no. of kernels/ spike in both seasons superior to most of the check varieties. For 1000-kernel weight, it ranged from 37.66 g. (line 34) to 52.50 g (line 35) and from 35.35 g (line 45) to 47.06 g (line 35) in the first and second season, respectively. Some lines were superior to 5 out of the seven check varieties in 1000-kernel weight in the first season and some in the second season meantime, the two lines; 35 and 41 were the best and surpassed the mean of the check varieties over the two seasons. Grain yield/ plant, ranged from 21.05 g (line 3) to 39.93 g (line 42) and from 8.30 g (line 32) to 19.61 g (line 41) in the first and second season, respectively. Table (4) shows that some lines were superior to the check varieties in grain yield/ plant in the first season and some in the second season meantime, the lines; 8, 41 and 42 showed superiority over the check varieties over the two seasons. However, the reduction in grain yield and other studied traits in the second season compared to the first season might be due to the wide changes in weather conditions between the two seasons especially higher temperature during the late stage of plant growth (Table 1) that force maturity of the crop which indirectly reduces yield by directly affecting various yield contributors (Verma and Singh, 1988). Generally, the lines; 8, 41 and 42 exhibited the best performance in both growing seasons and surpassed the check cvs. for grain yield and most yield components. Thus, these lines could be used in breeding programs for improving wheat grain yield.

Genetic parameters

The data of phenotypic (P.C.V) and genotypic (G.C.V) coefficient of variations, broad-sense heritability (h^2 b.s) and expected genetic gain are shown in Table (5). For number of days to heading, the phenotypic coefficient of variation over the two seasons gave a value of 4.38%, which was approximately equal to the corresponding genotypic coefficient of variation (3.26%), indicating the existence of genetic differences among genotypes for days to heading. Estimates of the broad sense heritability for this trait gave a value of 55.29% which is considered as a moderate estimate, indicating that days to heading is affected by both genotypic and environmental factors. The expected genetic gain upon selecting the earliest 5% of wheat genotypes would be 4.59 day or about 4.99% of the population mean. These results suggested that a relative progress can be achieved through the selection for early lines. Concerning plant height, the phenotypic and genotypic coefficient of variation over the two seasons had values of 10.93% and 10.63%, respectively. These inclined estimates detected for P.C.V and G.C.V, suggested that the effect of environment on the expression of this is relatively less than the genotypic effect.

Table 5. Means, phenotypic (P.C.V) and genotypic (G.C.V) coefficient of variation, broad sense heritability (h^2 b.s) and expected genetic gain for the traits studied of bread wheat genotypes over the two seasons.

Traits	Mean	P.C.V %	G.C.V %	h^2 b.s %	Expected genetic gain	
					Amount	% mean
Days to heading	92.09	4.38	3.26	55.29	4.59	4.99
Plant height (cm)	105.54	10.93	10.63	94.60	22.49	21.31
Spike length (cm)	11.03	8.04	7.31	82.63	1.51	13.69
No. of spikes/plant	12.15	14.53	13.44	85.51	3.11	25.59
No. of spikelets/spike	23.25	5.15	4.49	76.05	1.88	8.07
No. of kernels/spike	58.14	10.10	8.66	73.41	8.88	15.28
1000-kernel weight (g)	43.82	5.86	4.91	70.24	3.71	8.47
Grain yield/plant (g)	23.17	12.57	10.51	69.96	4.20	18.11

Thus, selection for this trait may be providing a chance for some genetic improvement. The broad sense heritability for this trait gave an estimate of 94.60% which is considered a high estimate, indicating that this trait is mainly affected by the genetic factors and partially by the environmental ones. The expected genetic gain upon selecting the best 5% for plant height in the wheat genotypes would be 22.49 cm or about 21.31% of the population mean. This relatively high gain percentage support the conclusion mentioned above for importance of the genetic role in the expression of this trait. With respect to spike length, the phenotypic coefficient of variation over the two season gave a value of 8.04%, which is relatively in the same range of the genotypic one (7.31%), indicating that the effect of environmental on spike length were relatively less than those of the genotypic factor. Thus, selection for tallest spike may lead to genetic improvement of this trait. The broad sense heritability for this trait had an estimate of 82.63%, which is considered a high percentage, indicating that spike length is mainly determined by the genetic factors with few environmental influences. The expected genetic gain upon selecting the best 5% of the genotypes for spike length would be 1.51 cm or about 13.69% of the population mean. For number of spikes/ plant the phenotypic coefficient of variation over the two seasons gave a value of 14.53%, which is approximately equal to its corresponding genotypic one (13.44%), indicating that the effect of the environmental factors on no. of spikes/ plant relatively less than those of the genotypic ones. Thus, selection for this trait may lead to some genetic improvement in such population.

The broad sense heritability for no. of spikes/ plant had an estimate of 85.51%, which is considered a high percentage, indicating that no. of spikes/ plant is mainly determined by the genetic factors with few environmental influences. Thus, selection may lead to progressive genetic improvement for this trait. The expected genetic gain upon selecting the best 5% of the genotypes for no. of spikes/ plant would be 3.11 spike or about 25.59% of the population mean. This result suggested that a relative high progress can be achieved through selection for this trait in such population. Regarding number of spikelets/ spike, the phenotypic coefficient of variation over the two seasons gave a value of 5.15%, whereas the genotypic one gave a value of 4.49%, indicating that this trait is affected by both genetic and environmental factors. The broad sense heritability for this trait gave an estimate of 76.05%, which is considered a relatively high estimate, indicating that this trait is mainly determined by genetic factors and partially by environmental ones. The expected genetic gain upon selection the best 5% of wheat population would be 1.88 spikelet or about 8.07% of the populations mean. Concerning number of kernels/ spike, the phenotypic and genotypic coefficients of variation over the two seasons had values of 10.10% and 8.66%, respectively. The inclined estimates detected for the P.C.V and the G.C.V., suggesting that the effect of environment on the expression of this trait is relatively less than the genotypic effects. Thus selection for this trait may provide a chance for some genetic improvement. Estimation of the broad sense heritability for this trait gave a value of 73.41% which is considered a relatively high estimate, indicating that no. of kernels/ spike is mainly determined by the genetic factors and partially by the environmental ones. The expected genetic gain upon selecting the best 5% of wheat populations would be 8.88 kernel or about 15.28% of populations mean. This relatively moderate gain percentage support the conclusion mentioned above for the genetic role in the expression of this trait. With respect to 1000-kernel weight, the phenotypic coefficient of variation over the two seasons had a value of 5.86% which is inclined to the genotypic coefficient of variation (4.91%), indicating the predominance of genotypic effects over the environmental ones. The broad sense heritability for 1000-kernel weight in the wheat population under the study, gave a value of 70.24% which is considered a relatively high estimate. The expected genetic gain upon selecting the best 5% of the genotypes would be 3.71 g or about 8.47% of the general wheat populations mean over the two seasons. Regarding grain yield/ plant, the phenotypic coefficient of variation over the two seasons gave a value of 12.57%, which is somewhat near the value of the genotypic one (10.51%), indicating that, this trait is determined by both genetic and environmental factors with predominance of the genetic ones. The broad sense heritability for grain yield/plant gave an estimate of 69.96% which is considered a relatively high estimate, indicating that this trait is mainly determined by the genetic factors and partially by the environmental ones. The expected genetic gain upon selecting the best 5% of the wheat genotypes would be 4.20 g or about 18.11% of the population mean. This result suggested that a relatively high progress can be achieved through the selection for this trait in such population. Similar results were obtained by Rady *et al.* (1981); Ehdaie and Waines (1989); Amin *et al.* (1992); Belay *et al.* (1993); Moghaddam *et al.* (1997); Menshawy (2007); and Abd El-Fattah *et al.* (2009) who reported that the phenotypic and genotypic coefficient of variation, heritability and expected genetic gain for grain yield and its components were moderate to high.

Phenotypic and genotypic correlation coefficients

Phenotypic and genotypic correlation coefficients among the various studied characters for 67 genotypes of bread wheat are presented in Table (6). Generally, phenotypic and genotypic correlation coefficients were similar in signs in all cases except correlation between days to heading and plant height. Also, genotypic correlation coefficients were comparatively higher in magnitudes than the corresponding phenotypic one. These findings reflect that, the significant correlation detected herein in most cases were mainly due to genetic effect. Grain yield/ plant showed significant relationship under phenotypic and genotypic levels with all studied traits except days to heading; whereas, grain yield/ plant was positively associated and significant with spike length, no. of spikelets/ spike, no. of spikes/ plant, no. of kernels/ spike and 1000-kernel weight for the two types of correlations, but negative and significant correlation coefficient values were recorded with plant height under both phenotypic and genotypic correlations. These results indicated that, the breeder can utilize such correlated response to obtain high grain yield genotypes through selection for one or more of these traits. These results are in agreement with the results that obtained by Salem and El-Banna (1982); Belay *et al.* (1993); Moghaddam *et al.* (1997); Tammam *et al.* (2000); Tammam *et al.* (2005); Abd El-Fattah *et al.* (2009) and Saleh (2011) who found positive and significant correlation coefficient between grain yield/ plant and each of spike length, no. of spikelets/ spike, no. of spikes/ plant, no. of kernels/ spike and 1000-kernel weight. Other inter-traits correlations revealed that days to heading was significantly and positively correlated with no. of spikelets/ spike at the two levels of correlation and plant height only at genotypic level, while it gave negative and significant correlation with 1000- kernel weight only at genotypic level. Regarding plant height, negative and significant correlation coefficient was obtained with each of spike length and no. of kernels/ spike under both types of correlations. Spike length gave positive and significant correlation coefficient with no. of spikes/ plant, no. of kernels/ spike and 1000-kernel weight at phenotypic and genotypic levels. Number of spikelets/ spike exhibited positive and significant correlation coefficient with no. of spikes/ plant and no. of kernels/ spike under both phenotypic and genotypic correlations. Number of spikes/ plant showed positive and significant correlation with no. of kernels/ spike and 1000-kernel weight at phenotypic and genotypic levels. However, number of kernels/ spike showed positive and significant correlation coefficient with 1000-kernel weight under both types of correlations. Similar results were obtained by Belay *et al.* (1993); Hassan *et al.* (1995); Iskandar (2000); Seleem and Hendawy (2007) and Abd El-Moneam and Sultan (2009) who found significant and positive correlation between different pairs of studied traits. The rest cases of correlations were insignificant.

Table 6. Phenotypic (r_{ph}) and genotypic (r_g) correlation coefficients between all pairs of eight traits recorded for bread wheat genotypes over the two growing seasons.

		1	2	3	4	5	6	7	8
1- Grain yield/plant	r_{ph}	0.00	-0.03	-0.25*	0.61**	0.27*	0.78**	0.76**	0.52**
	r_g	0.00	-0.04	-0.26**	0.67**	0.29**	0.84**	0.81**	0.55**
2- Days to heading	r_{ph}		0.00	-0.20	-0.02	0.33**	-0.04	-0.01	-0.15
	r_g		0.00	*0.20**	-0.03	0.35**	-0.04	-0.01	*-0.16**
3- Plant height	r_{ph}			0.00	-0.29*	0.05	-0.07	-0.31*	0.05
	r_g			0.00	-0.32**	0.05	-0.08	-0.32**	0.05
4- Spike length	r_{ph}				0.00	0.13	0.38**	0.66**	0.39**
	r_g				0.00	0.13	0.41**	0.74**	0.43**
5- No.of spikelets/spike	r_{ph}					0.00	0.39**	0.31*	0.05
	r_g					0.00	0.41**	0.33**	0.05
6- No.of spikes/plant	r_{ph}						0.00	0.63**	0.53**
	r_g						0.00	0.69**	0.59**
7- No.of kernels/spike	r_{ph}							0.00	0.28*
	r_g							0.00	0.30**
8- 1000-kernel weight	r_{ph}								0.00
	r_g								0.00

***and** denote significant differences at 0.05 and 0.01of probability levels, respectively**

REFERENCES

Abd El-Fattah, H. B., M. Sayed and S. Battah (2009). Heritability and genetic gain in some breed wheat genotypes. Proc. 6th Plant Breed. Conf. May 3-5. Ismalia, Egypt. J. Plant Breed. 152-165.

Abd El-Moneam, M. A. and M.S. Sultan (2009). Performance of some bread wheat genotypes and its genetic parameters under irrigation and drought conditions. Proc. 6th Plant Breed. Conf. May 3-5. Ismalia, Egypt. J. Plant Breed. 204-219.

Amin, M.R., N.C.D. Barma and M.A. Razzaque (1992). Variability, heritability, genetic advance and correlation study in some quantitative characters in durum wheat. Ethiopia. Rachis, 11:30-32.

Belay, G., T. Tesemma and D. Mitiku (1993). Variability and correlation studies in durum wheat in Alem-tena. Ethiopia. Rachis, 12: 38-41.

Ehdaie, B. and J. G. Waines (1989). Genetic variation, heritability and path analysis in landraces of bread wheat from South Western Iran. Euphytica. 41: 183 –190.

Gomez, K.A. and A.A. Gomez (1984). Statistical Procedures for Agricultural Research. 2nd ed., 97-107, John Wiley & Sons, New York.

Hassan, A.M., M.K. El- Khatib, M.M. Bakheet, N.S. Hanna and Halla Abou Talib (1995). Studies on genotypic and phenotypic correlations for some economic characters in some wheat hybrids. Egypt. J. Appl. Sci. 10(12): 210-216.

Iskandar, M.H. (2000). Mean performance, interrelationships and path coefficients for yield and yield components of some Egyptian long spikes wheat cultivars using various seeding rates and nitrogen levels in East delta region. Egypt. J. Appl. Sci. 15(1): 36-55.

Menshawy, A.M.M. (2007). Evaluation of some early bread wheat genotypes under different sowing dates: 1-Agronomic characters. Proc. Fifth Plant Breed. Conf. May 27. Egypt. J. Plant Breed. Special Issue. 11(1): 41-55.

Moghaddam, M., B. Ehdaie and J. C. Waines (1997). Genetic variation and interrelationships of agronomic characters in landraces of bread wheat from southeastern Iran. Euphytica 95 (3): 361 – 369.

Rady, M.S., M.E. Gomaa and A.A. Nawar (1981). Genotypic variability and correlation coefficients in quantitative characters in a cross between Egyptian and Mexican wheats (*Triticum aestivum*,L.). Minufiya J. Agric. Res., 4: 211-234.

Saleh, S.H. (2011). Performance, correlation and path coefficient analysis for grain yield and its related traits in diallel crosses of bread wheat under normal irrigation and drought conditions. World J. of Agric. Sciences. 7(3): 270-279.

Salem, A. H and M. N. EL- Banna (1982). Estimates of genetic variation, heritability genetic advance and correlation of some growth characters, yield and yield attributes in wheat. Zagazig J. Agric. Res. Bull. No. 496: 1 – 18.

Seleem, S.A. and H.I. Hendawy (2007). Mean performance, correlation and path coefficient analysis for grain yield and its components in bread wheat (*Triticum aestivum* L.). Egypt. J. Appl. Sci. 22 (4B): 444-458.

Steel, R.G. D. and J.H. Torrie (1980). Principals and Procedures of Statistics: A biometrical approach. 2 nd ed., Mcgaw-Hill book company, New York.

Tammam, A. M., E. A. M. El-Sayed and M. B. Tawfelis (2005). Studies of correlation and path coefficient analysis for some yield attributes in some bread wheat genotypes under two environments. J. Agric. Sci. Mansoura Unvi., 30 (2): 785 – 799.

Tammam, A.M., S.A. Ali and E.A.M. El-Sayed (2000). Phenotypic, genotypic correlations and path coefficient analysis in some bread wheat crosses. Assiut J. Agric. Sci. 31(3): 73-85.

Tolba, M. Afaf (2000). Evaluation of different bread wheat lines in the F_7 generation for grain yield and its attributes. J. Agric. Sci. Mansoura Univ. 25(10):6061-6073.

Verma, R.S. and M. Singh (1988). Studies on grain development pattern and yield of wheat varieties under different sowing dates. Ind. J. Agron. 33 (2): 193-195.

الأداء وبعض المعالم الوراثية لستين سلالة مبشرة من قمح الخبز

عفاف محمد طلبه ، سمير حسن صالح

قسم المحاصيل– كلية الزراعة– جامعة عين شمس– شبرا الخيمة– القاهرة– مصر

الملخص العربي

أجريت هذه الدراسة في المزرعة التجريبية لكلية الزراعة– جامعة عين شمس بشلقان– محافظة القليوبية خلال الموسمين الزراعيين ٢٠٠٨/٢٠٠٩– ٢٠٠٩/٢٠١٠، وذلك بهدف دراسة متوسط السلوك وبعض الثوابت الوراثية لمحصول الحبوب وبعض الصفات المحصولية الأخرى مثل عدد الايام حتي طرد ٥٠% من السنابل ، ارتفاع النبات ، طول السنبله ، عدد السنابل / نبات ، عدد السنيبلات / سنبله ، عدد الحبوب / سنبله ووزن الالف حبه في ستين سلالة مبشرة من قمح الخبز وسبعة أصناف تجاريه للمقارنة وقد أظهرت نتائج الدراسة المتحصل عليها مايلي:

- وجود اختلافات عالية المعنوية بين كلا من موسمي الزراعة، التراكيب الوراثية والتفاعل بين التراكيب الوراثية وموسمي الزراعة لكل الصفات المدروسة ما عدا التفاعل بين موسمي الزراعة والتراكيب الوراثية لصفتي طول السنبلة وعدد السنيبلات/ سنبلة. كما تفوقت السلالات أرقام ٨، ٤١ ، ٤٢ على أصناف المقارنة في محصول الحبوب و معظم مكوناته خلال موسمي الزراعة.
- أقتربت قيم معاملي التباين المظهري والوراثي من بعضها البعض بالنسبة للصفات المدروسة مما يدل على ان البيئة ليس لها دور رئيسي في التأثير على التباين بين التراكيب الوراثية وهذا يفسر ارتفاع قيم درجة التوريث لهذه الصفات وفاعلية التحسين الوراثي المتوقع نتيجة الانتخاب.
- سجلت صفتي عدد السنابل/ نبات ومحصول الحبوب أعلى قيم لمعاملي التباين المظهري والوراثي في حين سجلت صفتي عدد الأيام من الزراعة حتى طرد ٥٠% من السنابل وعدد السنيبلات/ سنبلة أقل قيم لمعاملي التباين المظهري والوراثي. كذلك كانت قيم كفاءة التوريث المقدرة على المستوى الواسع متوسطة إلى عالية للصفات المدروسة حيث تراوحت قيمها ما بين ٥٥,٥٩% لصفة عدد الأيام من الزراعة حتى طرد ٥٠% من السنابل إلى ٩٤,٦٠% لصفة أرتفاع النبات. كما تراوح التحسين الوراثي المتوقع كنسبة مئوية ما بين ٤,٩٩% لصفة عدد الأيام من الزراعة حتى طرد ٥٠% من السنابل إلى ٢٥,٥٩% لصفة عدد السنابل/ نبات.
- وجد تلازم موجب ومعنوي بين محصول الحبوب للنبات الفردي وكل من طول السنبلة، عدد السنيبلات/ سنبلة، عدد السنابل/ نبات، عدد الحبوب/ سنبلة ووزن الألف حبة تحت معاملي الارتباط المظهري والوراثي وبالتالي فالانتخاب لصفة أو أكثر من تلك الصفات سوف يكون مجديا في الحصول على تراكيب وراثية عالية المحصول.