ISSN 1110-0419

Annals Of Agric. Sc., Moshtohor,
Vol. 47(1): Ag. 61-71, (2009).

GENOTYPE X ENVIRONMET INTERACTION FOR YIELD AND ITS COMPONENTS IN BREAD WHEAT (*Triticum aestivum*, L.)

BY

Afaf M. Tolba
Agron. Dept., Fac. Agric., Ain Shams Univ., Shoubra El-Kheima, Cairo

ABSTRACT

Thirty wheat promising lines and five commercial grown cultivars (Giza 164, Sakha 69, Sakha 92, Sids 8 and Sids 9) were tested for grain yield and its components under Fayoum and Kalubia Governorate (Shalakan) conditions. Results obtained revealed that wheat genotypes and genotype x location interactions had a significant effect on grain yield and its components, while insignificant effect for the two studied locations. The lines were significantly higher compared with the wheat check cultivars for grain yield and its components. On the other hand, line no. 16 showed superiority than the other lines in both locations in grain yield and some of its components, this line could be useful for improving wheat productions.

Positive and significant correlation coefficient were recorded between grain yield/plant and number of spikes/plant, main spike length, number of spikelets/ spike, number of kernels/ spike, Kernels weight/spike and1000- kernel weight.

The path coefficient analysis revealed that the direct effect of no. of kernels/spike, number of spikes/plant and 1000-kernel weight and their interactions were the most contributors to grain yield/plant at Fayoum location while the major contributors to grain yield at Shalakan location were the direct effect number of kernels/spike, main spike length, number of spikes/plant and their joint effects.

Kay wards: Wheat, Genotypes, Lines, Cultivars, Correlation and Path coefficient.

INTRODUCTION

Under Egyptian conditions, there is a great gap between wheat production and consumption. This gap seems to increase annually due to population increase as well as constancy or decrease in the wheat production. There is an urgent need to increase the productivity level of wheat to reduce the food gap and to minimize importation. Wheat breeders have to develop a new set of varieties with higher production. This can obtained through hybridization and genotypes selection. Bilgin *et al.* (2008) concluded that significant differences existed among cultivars, locations and production through years with highest variations among characters were found in grains/spike, spike length and grain yield. Li *et al.* (2006) revealed that different locations and wheat genotypes has had a significant effect on productive tillers, number of grains spike, 1000 grain weight and grain yield. Several investigators studied the productivity of wheat cultivated varieties and advanced lines for further improvement of productivity under different environments such as, Dessalegn *et al.* (2000); Moshref *et al.* (2000); Siahpoosh *et al.* (2001); Sabo *et al.* (2002); Ahmad *et al.* (2004); Blanco *et al.* (2004); Dashtaki *et al.* (2004); Fufa *et al.* (2005); Khalil *et al.* (2005); and Li *et al.* (2006).

Correlation and path coefficient analysis are helpful to the breeder to determine the relative importance of yield components in influencing grain yield. Li, *et al.* (2006), recorded that the spikes per hectare and 1000-grain weight had a significant effect on the yield. He also indicated that the contribution of yield components to yield were spikes per hectare (r=0.93), 1000-grain weight (r=0.88) and kernels per spike (r=0.81). On the other hand, Bilgin *et al.* (2008) found that grain yield showed positive and significant correlations with 1000-grain weight. Large phenotypic correlations between grain yield and its components of wheat were recorded by several breeders (Kishor *et al.*, 1992; Mishra, and Chandraker 1992; Cooper *et al.*, 1994; Lombardo *et al.*, 1996; Salem *et al.*, 1998; Narwal *et al.*, 1999; Altinbas *et al.*, 2000; Sabo *et al.*, 2002 and Blanco *et al.*, 2004)

Many investigators used the path analysis to partition phenotypic correlations to direct and indirect effects Eissa and Awaad 1994; Dokuyucu and Akkaya 1999; (Narwal, *et al.*, 1999; Tammam *et al.*, 2000 and 2005 and El- Marakby, *et al.*, 2007). Siahpoosh *et al.*, 2001 showed that seed yield, number of kernels per main spike and number of spikelets per main spike were the best indices for increasing grain yield in wheat.

The aim of this investigation was to evaluate the productivity of some promising wheat genotypes under Fayoum and Kalubia environmental conditions.

MATERIALSAND METHODS

Five common wheat cultivars namely; Giza 164, Sakha 69, Sakha 92, Sids 8 and Sids 9 and thirty promising lines were used in this study. The lines are considered pure lines resulted by pedigree selection from segregating generations of the crosses between Giza 160, Giza 157 and three Mexican varieties i.e. MD 689 / B/ chere "S", Bow "S"//YD "S" / ZZ "S" and KvZ // con / pj bg 62 (Tolba, 1994). All genotypes were evaluated for grain yield and its components under two locations, i.e., the experimental Farm of the Dar El-Ramad Research Station, Faculty of Agriculture, Fayoum University and Faculty of Agriculture, Ain Shams University, at Shalakan, Kalubia Governorate during 2003/2004 and 2004/2005 seasons. Wheat grains were sown on 14 and 21 November in the first growing season and 26 and 24 November in the second growing season at the two experimental farms, respectively. Randomized complete block design was used with three replications; each replicate consisted of 3 rows with 2.5 meters in length and 20 cm in between. The plants were individually spaced at 10 cm within row. All ordinary cultural practices of growing wheat in each experimental location were followed as recommended.

At harvesting, 10 guarded plants from every experimental plot were chosen at random and the following data of yield and its components were recorded, i.e. number of spikes/plant, main spike length (cm), number of spikelets/spike, number of kernels/spike, Kernels weight/spike (g), grain yield/plant (g) and1000-kernel weight (g).

Statistical procedures:-

Analyses of variance for the different studied genotypes of both seasons under investigation for the studied two locations were carried out. Test of homogeneity of variance for both seasons with each location was made and proved to be insignificant for yield and its components; accordingly the combined analysis for the two seasons was performed within each location (Snedecor and Cochran, 1992). The differences among means were tested using least significant difference (LSD).

Phenotypic correlation coefficient for all possible pairs of characters was determined for each location (over the two years) and partitioning of phenotypic correlation coefficients to direct and indirect effects and its relative importance effects were made by determining path coefficient analysis using the method explained and utilized by Dewey and Lu (1959).

RESULTS AND DISCUSSION

A- Response of grain yield and its components:-

Data in Table (1) show the response of grain yield and its components to the effect of locations, genotypes and their interactions for thirty wheat promising lines and five cultivars.

1- Effect of locations:-

Data obtained revealed insignificant response for grain yield and its components between the studied two locutions, i.e. Fayoum and Kalubia (Shalakan). This indicates the environmental conditions under both locations do not differ much to affect the performance of the studied wheat lines and cultivars. It could be considered that the two locations acts as similar in their effect on growth and wheat yield. Salem *et al.* (2002) recorded that the number of studied locations were not enough to be considered a good sample, thus, the degree of freedom corresponding to locations was one, which was not enough to reveal the real differences among locations which agree with the present study.

2- Effect of wheat genotypes:-

Results in Table (1) show significant differences among different wheat genotypes for grain yield and its components, suggesting the presence of fair amount of genetic variability.

Data obtained indicates that most of the promising studied lines show significant superiority than the cultivated wheat varieties. This was true for the grain yield and its components.

Due to the tested lines, it was appeared that line no. 16 was significantly higher than most of the other tested lines in no. of spikes/plant, main spike length, no. of spikelets/spike, no. of kernels/spike and grain yield/plant. In addition, lines no. 4 and 17 for main spike length, lines no. 17, 18, 19, 15 and 4, respectively, for no. of spikelets/spike, as well as line no.11 for 1000-kernel weight surpassed the other studied lines, in this respect.

It could be concluded that the line no.16 proved higher potentiality of production than the other studied lines and this may be due to its ability to produce more spikes/plant, spike length, spikelets/spike, and no. of kernels/spike. This may be due to its gene action ability to induce this trend. Khan *et al.* (2008) also recorded that wheat genotypes had a significant effect on productive tillers, number of grains/spike, and 1000-grain weight and grain yield. Such variability among different wheat genotypes for grain yield and its components were recorded by many breeders investigators such as, Dessalegn *et al.* (2000), Salem *et al.* (2002), Ahmad *et al.* (2004), Fufa *et al.* (2005), Li *et al.* (2006) and Bilgin *et al.* (2008).

3- Effect of locations x wheat genotypes:-

The effects of interaction between location and wheat genotype were significant for grain yield and its attributes, indicating that the genotypes interacted considerably with the varying locations (Table 1).

Number of spikes/plant shows a superiority in lines 16 and 20 under Fayoum location as well as lines1 and 16 under Shalakan one than the other studied lines as well as the wheat check cultivars investigated, which showed the lowest significant no. of spikes/plant.

The main spike length shows more significant elongation in lines 17, 20, 4, 24, 11and 16, respectively, under Fayoum conditions as well as line 12 in Shalakan. This was true in comparison with the other studied lines as well as the wheat cultivars tested that produced lesser main spike length.

With respect to number of spikelets/ spike, the great number of spikelets/spike was in favor of lines no. 19, 20, 11, 15 and 5, respectively, under Fayoum conditions as well as lines no. 17, 4, 18 and 1, respectively; in Shalakan in comparison with the other studied lines as well as the wheat check cultivars.

Table (1): Performance of wheat genotypes for yield and its components under Fayoum (F) and Shalakan (Sh) locations (combined analysis of 2003/2004 and 2004/2005seasons).

Characters	Number of spikes/plant			Main spike length (cm)			Number of spikelets/spike		
Genotypes	F	Sh	Mean (G)	F	Sh	Mean (G)	F	Sh	Mean (G)
1	13.86	17.33	15.59	12.07	12.88	12.48	23.60	26.23	24.91
2	13.58	15.70	14.64	12.25	14.17	13.21	23.99	24.41	24.20
3	13.14	13.62	13.38	11.65	13.22	12.44	23.37	25.28	24.32
4	15.75	15.11	15.43	13.22	14.18	13.70	23.73	26.97	25.35
5	14.54	13.88	14.21	12.94	12.44	12.69	25.56	22.07	23.82
6	13.73	15.42	14.58	10.91	13.67	12.29	23.11	25.18	24.14
7	11.88	14.23	13.06	10.12	11.17	10.64	23.12	21.50	22.31
8	13.76	16.17	14.97	12.93	12.69	12.81	23.02	23.54	23.28
9	11.45	15.76	13.61	12.61	10.20	11.41	24.62	23.25	23.94
10	13.84	18.32	16.08	10.18	11.40	10.79	22.68	23.00	22.84
11	16.30	14.02	15.16	13.13	13.53	13.33	25.85	23.26	24.55
12	14.60	16.60	15.60	10.86	16.06	13.46	23.92	25.24	24.58
13	10.79	14.96	12.88	12.87	12.72	12.79	24.24	23.18	23.71
14	12.10	12.42	12.26	10.98	11.80	11.39	23.33	24.18	23.75
15	13.60	12.26	12.93	12.41	12.70	12.55	25.57	25.82	25.69
16	17.47	17.07	17.27	13.06	13.92	13.49	25.24	25.41	25.32
17	11.18	13.25	12.21	13.61	13.54	13.57	24.90	27.08	25.99
18	11.40	11.72	11.56	12.32	12.30	12.31	24.70	26.57	25.63
19	12.14	14.95	13.55	12.36	13.05	12.70	26.52	24.53	25.52
20	17.60	14.28	15.94	13.37	13.02	13.20	26.26	22.26	24.26
21	12.46	13.89	13.18	11.76	12.62	12.19	24.60	23.48	24.04
22	15.23	12.82	14.02	11.84	13.06	12.45	23.05	24.56	23.80
23	13.41	14.19	13.80	11.98	12.07	12.03	21.00	20.27	20.64
24	14.58	12.20	13.39	13.19	12.05	12.62	23.87	24.11	23.99
25	12.29	13.67	12.98	12.46	12.62	12.54	23.72	23.39	23.55
26	17.08	11.88	14.48	13.02	13.07	13.04	24.10	24.40	24.25
27	14.53	16.08	15.30	13.17	12.80	12.99	24.77	25.27	25.02
28	13.71	13.32	13.51	11.80	11.19	11.49	24.09	22.09	23.09
29	13.94	11.94	12.94	12.48	11.72	12.10	24.25	23.26	23.76
30	11.22	11.50	11.36	11.70	12.13	11.91	23.65	23.68	23.67
Giza 164	11.72	12.10	11.91	10.19	11.77	10.98	21.28	21.22	21.25
Sakha 69	11.40	11.62	11.51	10.11	11.79	10.95	22.79	22.57	22.68
Sakha 92	10.36	11.08	10.72	10.36	11.61	10.99	21.43	20.92	21.18
Sids 8	10.80	11.54	11.17	10.31	11.47	10.89	23.19	20.70	21.95
Sids 9	11.38	12.10	11.74	9.90	11.34	10.62	20.73	22.21	21.47
Mean	13.34	13.91	13.63	11.95	12.57	12.26	23.82	23.75	23.78
LSD at 5%: L		NS			NS			NS	
G			0.63			0.49			0.79
LXG	0.89			0.69			1.11		

G: Genotypes L: Locations

Table (1): Continued.

Characters	Number of kernels/spike			1000-kernel weight (g)			Grain yield /plant		
Genotypes	F	Sh	Mean (G)	F	Sh	Mean (G)	F	Sh	Mean (G)
1	65.97	72.40	69.18	55.20	46.50	50.85	26.99	25.76	26.38
2	77.72	54.40	66.06	64.84	44.25	54.55	27.51	22.08	24.79
3	75.88	58.48	67.18	46.68	39.31	43.00	22.82	17.44	20.13
4	75.11	62.64	68.88	59.69	47.44	53.56	30.40	25.07	27.73
5	76.82	55.49	66.15	55.06	46.57	50.82	31.18	22.17	26.68
6	63.07	65.33	64.20	63.55	51.80	57.67	27.18	25.22	26.20
7	63.20	54.98	59.09	41.49	53.04	47.26	24.10	19.39	21.75
8	58.86	51.80	55.33	45.21	36.72	40.97	23.75	22.37	23.06
9	64.56	59.18	61.87	44.40	46.00	45.20	23.30	19.88	21.59
10	43.22	55.00	49.11	53.97	48.43	51.20	23.71	20.95	22.33
11	70.39	56.32	63.35	70.85	56.80	63.83	32.32	24.23	28.27
12	61.37	60.39	60.88	40.85	56.09	48.47	23.66	23.16	23.41
13	54.34	55.28	54.81	58.15	47.38	52.76	17.01	22.71	19.86
14	51.06	61.17	56.11	46.53	38.44	42.48	18.55	18.97	18.76
15	50.55	63.42	56.98	57.34	39.83	48.58	25.31	23.42	24.36
16	74.92	66.88	70.90	68.47	49.83	59.15	35.72	27.91	31.81
17	55.23	70.91	63.07	53.89	33.23	43.56	21.20	24.58	22.89
18	69.45	60.90	65.18	38.17	36.25	37.21	20.43	23.40	21.92
19	56.30	62.96	59.63	44.12	45.26	44.69	21.65	21.90	21.77
20	65.61	48.63	57.12	65.80	46.15	55.97	32.46	23.93	28.19
21	56.78	64.44	60.61	45.69	42.80	44.24	21.44	22.78	22.11
22	50.77	71.32	61.05	49.67	44.77	47.22	21.48	24.75	23.11
23	67.65	52.85	60.25	59.34	50.35	54.84	26.98	20.93	23.95
24	45.96	55.49	50.72	54.08	46.20	50.14	24.94	22.12	23.53
25	54.75	47.82	51.28	53.07	46.35	49.71	25.18	19.34	22.26
26	66.30	44.67	55.49	46.43	54.96	50.56	24.18	18.01	21.10
27	52.90	66.03	59.47	64.62	46.79	55.71	19.62	23.45	21.54
28	52.01	53.52	52.77	44.58	39.03	41.81	17.78	18.75	18.27
29	55.77	55.33	55.55	46.10	47.60	46.85	18.45	19.35	18.90
30	64.32	49.45	56.89	46.83	40.35	43.59	20.57	17.74	19.15
Giza 164	44.37	45.65	45.01	39.84	40.31	40.07	18.15	19.05	18.60
Sakha 69	45.69	50.06	47.88	37.11	48.75	42.93	17.84	18.67	18.25
Sakha 92	45.04	46.49	45.76	36.26	33.60	34.93	18.52	16.89	17.70
Sids 8	51.24	43.98	47.61	32.99	43.05	38.02	16.70	17.87	17.29
Sids 9	55.13	48.61	52.02	41.30	32.23	36.77	18.22	19.43	18.82
Mean	59.49	56.93	58.21	50.63	44.75	47.69	23.41	21.53	22.47
LSD at 5%: L		NS			NS			NS	
G			1.66			1.03			0.87
LXG	2.34			1.46			1.23		

G: Genotypes L: Locations

Regarding number of kernels/spike, significant response was observed due to the interaction of L X G, showing superiority in lines 2, 5 and 3, respectively, in Fayoum conditions and lines 1, 22 and 17, respectively, in Shalakan conditions in comparison with the other lines tested and wheat check cultivars that gave lower no. of kernels/spike.

Results of seed index (1000-kernel weight) were significantly higher in line 11 especially at Fayoum where this line recorded the highest 1000-kernel weight of 70.85 g.

Data also in Table (1) revealed that the line no. 16 in Fayoum and Shalakan conditions, proved to give the highest and significant production for grain yield/plant in comparison with the other tested wheat lines. The wheat check cultivars were the lowest ones as compared with both line 16 and the other lines. With lesser production were found in Sids 8 and Sakha 92 in Fayoum and Shalakan locations, respectively. These results were true in both locations studied.

In respect to the provirus obtained results, it could be concluded that line 16 is advisable for the breeders and growers to obtain more wheat grain yield due to its superiority in the grain yield and some of its components under the two different studied locations. This may be due to its different ecological conditions. The significance of G x E interactions reported in the present study for bread wheat grain yield and its components, were also reported by several investigators such as Salem *et al.* (2002) as well as Khalil *et al.* (2005) who said that the cultivar x location interactions were significant for yield and its components indicating inconsistent performance of cultivars over locations. Blanco *et al.* (2004) reported that significant line x environment interactions suggest that genotype x environment effects may be important for grain yield and its component traits. Contrary, Dessalegn *et al.* (2000) stated that the effects of environment and genotypes were highly significant but their interaction was non-significant.

B- Correlation and both coefficient analysis:-

1- Correlation coefficient:-

Data in Table (2) shows the correlation coefficient between wheat grain yield/ plant and its components for the studied lines and the cultivated varieties under Fayoum and Shalakan conditions.

Table (2): Phenotypic correlation coefficients between yield and its components under Fayoum and Shalakan locations (combined analysis of 2003/2004 and 2004/2005 seasons).

Studied characters		Fayoum				
		X2	X3	X4	X5	X6
Grain yield/plant	X1	0.74**	0.50**	0.40*	0.67**	0.73**
No. of spikes/plant	X2		0.51**	0.39*	0.42*	0.64**
Main spike length	X3			0.67**	0.43**	0.61**
No. of spikelets/spike	X4				0.34*	0.41*
No. of kernels/spike	X5					0.43*
1000-kernel weight	X6					
		Shalakan				
Grain yield/plant	X1	0.56**	0.59**	0.60**	0.73**	0.26
No. of spikes/plant	X2		0.37*	0.28	0.42*	0.41*
Main spike length	X3			0.60**	0.39*	0.34*
No. of spikelets/spike	X4				0.72**	-0.02
No. of kernels/spike	X5					0.04
1000-kernel weight	X6					

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

It is obvious that grain yield/plant exhibited highly correlated at the 1% level with all yield components at Fayoum except the r value with no. of spikelets/spike which was significant at the 5% level. At Shalakan the r values between grain yield/plant and its components were highly significant except with 1000-kernel weight which was insignificant.

Due to the correlation coefficient between wheat yield components itself; it was higher for main spike length x no. of spikelets/ spike followed by no. of spikes/plant and main spike length with seed index. This was true under Fayoum conditions. Under Shalakan location the no. of spikelets/spike X no. of kernels/spike was the highest correlated followed by the no. of spikelets/spike X main spike length.

It could be concluded that the wheat grain yield could be adjusted by the breeders for increasing through the selection for the higher no. of spikes/plant as well as no. of kernels/spike since they acts together with the more number of spikelets/spike to produce the higher grain yield/plant as well as the seed index. Many breeders recorded high positive significantly correlation between grain yield and its components (Narwal *et al.*, 1999. Altinbas *et al.*, 2000, Sabo *et al.*, 2002, Blanco *et al.*, 2004, Li *et al.*, 2006, El-Marakby *et al.*, 2007 and Bilgin *et al.*, 2008).

2- Path coefficient analysis:-

Tables (3 and 4) show the path coefficient analysis as well as the percentage of relative importance of wheat yield contributors under Fayoum and Shalakan conditions.

Table (3): Path coefficient analysis of yield and its components under Fayoum and Shalakan locations (combined analysis of 2003/2004 and 2004/2005 seasons).

Source of Variation	Fayoum	Shlakan
1-Number of spikes/plant *vs.*		
Direct effect	0.382	0.207
Indirect effect via main spike length	-0.061	0.112
Indirect effect via No. of spikelets/spike	0.018	-0.009
Indirect effect via No. of kernels/spike	0.161	0.229
Indirect effect via1000-kernel weight	0.239	0.020
Total correlation	0.740	0.560
2-Main spike length *vs.*		
Direct effect	-0.120	0.302
Indirect effect via No. of spikes/plant	0.195	0.077
Indirect effect via No. of pikelets/spike	0.032	-0.019
Indirect effect via No. of kernels/spike	0.165	0.213
Indirect effect via1000-kernel weight	0.228	0.017
Total correlation	0.500	0.590
3-Number of spikelets/spike *vs.*		
Direct effect	0.047	-0.031
Indirect effect via No. of spikes/plant	0.149	0.058
Indirect effect via main spike length	-0.080	0.181
Indirect effect via No. of kernels/spike	0.131	0.393
Indirect effect via1000-kernel weight	0.153	-0.001
Total correlation	0.400	0.600
4-Number of kernels/spike *vs.*		
Direct effect	0.384	0.545
Indirect effect via No. of spikes/plant	0.160	0.087
Indirect effect via main spike length	-0.052	0.118
Indirect effect via No. of spikelets/spike	0.016	-0.022
Indirect effect via1000-kernel weight	0.161	0.002
Total correlation	0.670	0.730
5-1000 - kernel weight *vs.*		
Direct effect	0.374	0.050
Indirect effect via No. of spikes/plant	0.244	0.085
Indirect effect via main spike length	-0.073	0.103
Indirect effect via No. of spikelets/spike	0.019	0.001
Indirect effect via No. of kernels/spike	0.165	0.022
Total correlation	0.730	0.260

Table (4): Percentage of relative importance (RI %) for yield and its components under Fayoum and Shalakan locations (combined analysis of 2003/2004 and 2004/2005 seasons).

Studied characters		Fayoum		Shlakan	
		CD	RI%	CD	RI%
Direct effect					
No. of spikes/plant	**X1**	0.146	11.269	0.047	4.366
Main spike length	**X2**	0.014	1.094	0.091	8.455
No. of spikelets/spike	**X3**	0.002	0.171	0.001	0.089
No. of kernels/spike	**X4**	0.148	11.387	0.297	27.537
1000-kernel weight	**X5**	0.140	10.802	0.002	0.223
Indirect effect					
(X1) via (X2)		-0.046	3.581	0.049	4.496
(X1) via (X3)		0.014	1.082	-0.004	0.349
(X1) via (X4)		0.123	9.516	0.099	9.210
(X1) via (X5)		0.183	14.122	0.009	0.808
(X2) via (X3)		-0.008	0.579	-0.011	1.042
(X2) via (X4)		-0.039	3.035	0.128	11.902
(X2) via (X5)		-0.054	4.193	0.010	0.933
(X3) via (X4)		0.012	0.948	-0.024	2.256
(X3) via (X5)		0.014	1.113	0.001	0.006
(X4) via (X5)		0.124	9.538	0.002	0.198
Residual		0.228	17.572	0.304	28.132
Total		1.000	100.000	1.000	100.000

Due to the total correlation, data in Table (3) appeared that no. of spikes/plant (0.740) was the highest under Fayoum conditions followed by seed index (0.730), no. of kernels/spike (0.670), main spike length (0.500) and no. of spikelets/spike (0.400), respectively. Whilst under shalakan conditions it was no. of kernels/spike (0.730) followed by no. of spikelets/spike (0.600), main spike length (0.590), no. of spikes/plant (0.560) and seed index (0.260), respectively.

The direct effect was positive and higher on grain yield through no. of kernels/ spike (0.384) as well as no. of spikes/plant (0.382) and seed index (0.374), respectively, under Fayoum conditions as well as no. of kernels/spike (0.545), main spike length (0.302) and no. of spikes/plant (0.207), respectively, under Shalakan conditions. Negative direct effect on grain yield/plant was recorded by main spike length at Fayoum conditions and no. of spikelets/spike at Shalakan conditions. Li *et al.* (2006) recorded that spikes per hectare had the highest positive direct effect on yield (0.853), followed by kernels/spike and 1000-grain weight. Siahpoosh *et al.* (2001) reported that seed yield, number of kernels per main spike, number of spikelets per main spike were the best indices for increasing grain yield in wheat. Narwal *et al.* (1999) revealed that grains per spike and spike length had positive and large direct effect on grain yield. The indirect effect for 1000-kernel weight via no. of spikes/plant (0.244), followed by no. of spikes/plant (0.239) and main spike length (0.228) via 1000-kernel weight under Fayoum conditions, as well as, number of spikelets/ spike (0.393) followed by no. of spikes/plant (0.229) and main spike length (0.213) via no. of kernels/spike under Shalakan conditions were positive and high values on grain yield.

The components of grain yield variation determined directly and jointly in grain yield for Fayoum and Shalakan locations are presented in Table (4). It is clear that the 5 traits and their interactions as sources of total grain yield variations, after subtracting the residual effects, were responsible for 82.428% at Fayoum and 71.868% at Shalakan. In Fayoum location, the main sources of grain yield variations arranged according to their importance were: Joint effect of spikes/plant with 1000-kernel weight (14.122), direct effect of kernels/spike (11.387%), direct effect of spikes/plant (11.269%), direct effect of 1000-kernel weight (10.802%), joint effect of kernels/spike with 1000-kernel weight (9.538%), joint effect of spikes/plant with kernels/spike (9.516%) and joint effect of main spike length with 1000-kernel weight (4.193%). These main sources are responsible for about (70.827%) of the variation.

As for Shalakan location, the main sources in order of importance were: direct effect of no. of kernels/spike (27.537%), joint effect of main spike length with kernels/spike (11.902%), joint effect of spikes/plant with kernels/spike (9.210%), direct effect of main spike length (8.455%), joint effect of spikes/plant with main spike length (4.496%) and the direct effect of no. of spikes/plant (4.366%). The main sources contribute for about (65.966%) of variation.

It could be concluded that the environmental conditions prevailing at both locations excreted their effects on the correlation and relative importance of characters contributing to grain yield, since at Fayoum the important traits were kernels/spike, spikes/plant and seed index and their interactions, while at Shalakan, the important traits were kernels/spike, main spike length and spikes/plant and their joint effects. Therefore, it is advisable for wheat breeders to take into account to practice selection for the above traits to isolate high yielding varieties of wheat .components

REFERENCES

Ahmad, F.; Shah, S.S.; Hulam, H. and Raziuddin, F.M. (2004): Evaluation of different wheat genotypes under agro-climatic conditions of Mansehra. Sarhad Journal of Ariculture 20: 4, 29-532.

Altinbas, M.; Budak, N. and Tosun, M. (2000): Relationships between yield and some quality traits in bread wheat (*T.aestivum* L.). Ege Universitesi Ziraat Fakultesi Dergisi. 37: 2/3, 149-156.

Bilgin, O.; Korkut, K.Z.; Baser, I.; Dagloglu, O.; Ozturk, I. and Kahraman, T. (2008): Determination of variability between grain yield and yield components of durum wheat varieties (*Triticum durum*) in Thrace Region. Journal of Tekirdag Agricultural Faculty. 5: 2, 101-109.

Blanco, A.; Gadaletaand, A. and Simeone, R. (2004): Variation for yield and quality components in durum wheat backcross inbred lines derived from ssp. Dicoccoides. Bodenkultur. 54: 3, 163-170.

Cooper, M.; Byth, D.E. and Woodruff, D.R. (1994): An investigation of the grain yield adaptation of advanced CIMMYT wheat lines to water stress environments in Queensland. I. Crop physiological analysis. Australian Journal of Agricultural Research. 45: 5, 965-984.

Dashtaki, M.; Yazdansepas, A.; Mirak, T.N.; Ghannadha, M.R.; Joukar, R.; Islampour, M.R.; Moayedi, A.A.; Kouchaki, A.R.; Nazeri, M.; Oskooie, M. S. A.; Aminzadeh, G.; Soltani, R. and Ashouri, S. (2004): Stability of grain yield and harvest index in winter and facultative bread wheat (*Triticum aestivumL.*) genotypes. Seed and Plant. 20, 3:Pe263-Pe279.

Dessalegn, T.; Girma, B.; Payne, T.S.; Deventer, C.S.V. and Labuschagne, M. T. (2000): Sources of variation for grain yield performance of bread wheat in northwestern Ethiopia. The Eleventh Regional Wheat Workshop for Eastern, Central and Southern Africa, Addis Ababa, Ethiopia, 18-22 September:16-24.

Dewey, D.R. and Lu, K.A. (1959): A correlation and path coefficient analysis of components of crested wheat grass seed production. Argon. J., 51: 515-518.

Dokuyucu, T. and Akkaya, A. (1999): Path coefficient analysis and correlation of grain yield and yield components of wheat (*Triticum aestivum*, L.) genotypes. Rachis 18 (2):17-20.

Eissa, M.M. and Awaad, H.A. (1994): Path coefficient analysis for some yield attributes in ten wheat crosses. Zagazig J. Aric. Res., 21(3A):617- 629.

El-Marakby, A.M.; Mohamed, A.A.; Afaf, M. Tolba and Saleh, S. H. (2007): Correlation and path coefficient analysis for some traits in diallel crosses of bread wheat under different environments. Egyp. J. Plant Breed. 11(1):101-113.

Fufa, H.; Baenziger, P.S.; Beecher, B. S.; Graybosch, R.A.; Eskridge, K.M. and. Nelson, L. A (2005): Genetic improvement trends in agronomic performances and end-use quality characteristics among hard red winter wheat cultivars in Nebraska. Euphytica. 144: 1/2, 187-198.

Khalil, I. H.; Aftab; S. Tariq and Fazle, S. (2005): Genotype x location interaction for yield and its associated traits in spring wheat. Sarhad Journal of Agriculture. 21: 1, 29-32.

Khan, M.J.; Jehan, B.; Khalill, I. A.; Mohammad, S. and Mohammad, I. (2008): Response of various wheat genotypes to salinity stress sown under different locations. Sarhad Journal of agriculture, 24, 1: 21-29.

Kishor, N.; Chaubey, C. N. and Ahmad, Z. (1992): Stability analysis for yield and some quality traits in wheat (*Triticum aestivum* L.). Indian Journal of Genetics & Plant Breeding. 52, 4: 356-360.

Li, W.; Yan, Z. H.; Wei, Y. M.; Lan, X. J. and Zheng, Y. L. (2006): Evaluation of genotype x environment interactions in Chinese spring wheat by the AMMI model, correlation and path analysis. Journal of Agronomy and Crop Science. 192, 3:221-227.

Lombardo, G. M.; Prima, G. di.; Gallo, G. di. and Palumbo, M. (1996): Adaptation and productivity of common wheat (*Triticum aestivum* L.) in a Mediterranean environment. Rivista di Agronomia. 30, 3: 350-354.

Mishra, R. K. and Chandraker, P. K. (1992): Stability of performance of some promising wheat varieties. Advances in Plant Sciences. 5, 2: 496-500.

Moshref, M. K.; Mostafa, P. K. and Hanna, N. S. (2000): Expected genetic advance of some characteristics in bread wheat. Annals of Agricultural Science (Cairo). 45, 2: 477-489.

Narwal, N. K.; Verma, P. K. and Narwal, M. S. (1999): Genetic variability, correlation and path-coefficient analysis in bread wheat in two climatic zones of Haryana. Agricultural Science Digest (Karnal). 19, 2: 73-76.

Sabo, M.; Bede, M. and Hardi, Z. U. (2002): Variability of grain yield components of some new winter wheat genotypes (*Triticum aestivum*, L.). Rostlinna Vyroba. 48, 5: 230-235.

Salem, A. H.; Eissa, M. M. and Swelam, A. A. (1998): Yield components and yield stability of bread wheat in water limited environments. Triticeae III. Proceedings of the Third International Triticeae Symposium, Aleppo, Syria, and 4-8 May: 405-410.

Salem, A. H.; Eissa, M.M. and Swelam, A.A. (2002): Genotype-environment interaction and stability for grain yield and its related characters in bread wheat. Egypt. J. Appl. Sci; 17 (11): 141-161.

Siahpoosh, M. R.;. Assad, M. T; Emam, Y.; Saidi, A. and Kheradnam, M. (2001): Implication of four selection indices in wheat cultivars (*Triticum aestivum.*) for increasing the grain yield. Iranian Journal of Agricultural Sciences. 32, 1: 219 - 236.

Snedecor, G. W. and Cochran, W.G. (1992): Statistical Methods. 8th Ed. Iowa State Univ., Press, Ames. Iowa, USA.

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

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

Tolba, M. Afaf (1994): Breeding studies on some characters of wheat. Ph. D. Thesis, Fac. Agric., Ain Shams Univ., Egypt.

التفاعل بين التراكيب الوراثية والظروف البيئية للمحصول ومكوناته فى قمح الخبز

عفاف محمد طلبة
قسم المحاصيل – كلية الزراعة – جامعة عين شمس – شبرا الخيمة – القاهرة.

تم تقييم المحصول ومكوناته لثلاثين سلالة واعدة من القمح مع خمس اصناف منزرعة وهى جيزة ١٦٤ ، سخا ٦٩ ، سخا ٩٢ ، سدس ٨ ، سدس ٩ وذلك تحت تأثير الظروف البيئة لمنطقتى الفيوم والقليوبية (شلقان).

أظهرت النتائج المتحصل عليها وجود اختلافات معنوية بين التراكيب الوراثية مع بعضها البعض وكذلك كان التفاعل بين المواقع والتراكيب الوراثية معنوياً وذلك للمحصول ومكوناته. كما أظهرت النتائج أيضاً عدم وجود تأثير معنوى بين المناطق تحت الدراسة للمحصول ومكوناته.

أوضحت النتائج تفوق السلالات معنوياً كمقارنه بالأصناف التجارية، وكانت السلالة رقم ١٦ هى الأكثر تفوقاًعن باقى السلالات وعن أصناف المقارنة فى المحصول وبعض مكوناتة والتى يمكن الإستفادة منها فى استنباط صنف جديد متفوق فى أكثر من منطقة.

أظهرت نتائج الإرتباط ومعامل المرور والأهمية النسبية ان محصول الحبوب كان عالي المعنوية فى الإرتباط بصفات عدد الحبوب بالسنبلة، عدد السنابل للنبات، وزن لألف حبة وطول السنبلة الرئيسية ومعنوياً مع عدد السنيبلات / سنبلة تحت ظروف منطقة الفيوم، ولصفات عدد الحبوب بالسنبلة ، طول السنبلة، عدد السنابل للنبات وعدد السنيبلات / سنبلة تحت ظروف منطقة شلقان، وهذة الصفات كانت أكثر الصفات مساهمة فى تباين محصول الحبوب سواء من حيث تأثيرها المباشر أو المشترك مع بعضها البعض. لذا يجب على المربى أن يأخذ هذه الصفات فى اعتباره عند الإنتخاب للمحصول العالى فى برامج التربية.