

GENETIC STABILITY OF SOME WHEAT GENOTYPES UNDER FOUR VARIOUS ENVIRONMENTS

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ABSTRACT

Ten wheat genotypes (*Triticum aestivum* L.) were Evaluated for yield and its attributing characters under four environments(two locations x two seasons).The genotypes were; Sakha 93, Sakha 94, Giza 168, Sids 1, Sids4, Sids6, Sids9, Sakha61, Gemmeiza 9 and Gemmeiza 10 The mean performance, phenotypic stability and interrelationship between various characters were computed. The results indicated that, significant genotypes; genotype x environment, environmental linear and genotype x environment linear variance for all studied characters. Regression coefficient (b) deviated significantly from unity ($b > 1$) for genotypes, Sids 1 and Sakha 61 for plant height , Sids9 and Gemmeiza 9 for spike length and Sids 9 for 1000 grain weight; indicating that these genotypes were adapted to favorable environments for these characters.

The "b" value deviated significantly from unity and was less than one ($b < 1$) in Sids 1, Sids 4 and Sids 9 for 1000 grain weight , grain weight / spike, and grain yield ardab / fad . The genotypes for considering the stability parameters (C.V% and S^2d accompanied with mean performance (X), the most desired and stable wheat genotypes were Gemmeiza9 for plant height, spike grain weight and grain yield (ard /fad), Sids 1 for spike length , grain weight/spike . While Sakha 94 was stable for number of spikes/plant.

Correlation coefficients values were positive and significant between yield /fad and each of all studied characters except plant height.

INTRODUCTION

Plant breeders make efforts to evolve new varieties characterize by high yielding ability for seed yield in addition to their quality. Seed yield is a complex characters which is greatly affected by environments (E) which include edaphic and climatic conditions. Plant breeders faced the problem of genotypes x environment interaction in the development of bread wheat cultivars. The interactions GxE interactions complicates selection of genotypes with superior performance. It has been suggested that a significant G x E interaction reduced the correlation between phenotypic and genotypic values as well as progress from selection (Kang and Martin, 1987). Across environment it is of great attention that it forms a challenge difficulty to the breeder when improving and developing superior genotypes (Eberhart and Russel, 1966). The effect of environmental stress on plant metabolism completely and thereby reduction both growth and development of crop is still not completely understood (Pessarakli, 1994). Many researches on wheat studied the inheritance and environmental effects Misra *et al.* 1991; Deswal *et al.* 1996; Kara 1997 Salem *et al.* 1998; Haji and Hunt 1999; Kara 2000, El-Morshidy *et al.* 2001 and salama *et al* 2008 .The present study was designed to estimate stability of grain yield / fad and related characters for ten released bread wheat cultivars.

MATERIALS AND METHODS

Four field experiments, including ten genotypes of wheat (*Triticum aestivum* L.) were undertaken at the two locations; Tag El- Ezz Research Station, (Dakahilia Governorate) Agricultural Research Center (A.R.C).and Experimental Farm, of Fac. Agriculture, Swease Univ. Ismalia Governorate, Souse University. Egypt during the two successive winter growing seasons (2006/2007 and 2007/2008) for each trial. The planting date was 10th November in both seasons. The ten wheat genotypes were; Sakha 93, Sakha 94, Giza 168, Sids 1, Sids4, Sids6, Sids9, Sakha 61, Gemmeiza 9 and Gemmeiza10. The randomized complete block design with three replications was used for each trial. The experimental plot consisted of 5 rows, row length was 2 m, row to row spacing was 20 cm., plant spacing was 10 cm. Data of the following characters (yield and its components) were estimated.

- 1- Plant height (cm)
- 2- Spike length(cm)
- 3- Number of spikelet's / spike
- 4- Number of grains / spike
- 5- Number of spikes / plant
- 6- 1000-grain weight (g.)
- 7- Grain weight / spike (g.)
- 8- Grain yield ardeb / fad

Biometric analysis:

Analysis of variance was performed for different characters through the two growing seasons according to Steel and Torrie (1980). Parameters of stability for studied characters of wheat genotypes under 4 environments (2 seasons x 2 location) were calculated according to Eberhart and Russel (1966) method.

2- Correlation studies:

Interrelations between different wheat characters were calculated according to the method described by Snedecor and Cochran (1980).

RESULTS AND DISCUSSION

Analysis of variance due to stability parameters of eight studied characters for ten wheat genotypes under two locations i.e. Tag El-Ezz Research Station, and Experimental Farm Agriculture, El Ismailia, Ismalia Governorate, Swease canal University are presented in Table (1). Statistical analysis exhibited that the mean squares among the wheat genotypes were highly significant for all studied characters suggesting that wheat genotypes were genetically different.

Genotypes (G) and environments (E) (two locations) had highly significant effect on all characters under study, indicating that these characters are affected by changes which happened in each location. Moreover the variances due to environments (Linear) was significant for all studied traits, indicating that these characters were highly influenced by the combination of environmental conditions (seasons and locations).

The interaction between genotypes and environments (Linear) had highly significant effect on the studied characters. These results are in agreement with those reported by Salem *et al.* (1990) and (2002).

The data obtained revealed significant variations for pooled deviation regarding all studied characters exhibiting that stability of these characters are different Coefficient of variability (C.V.%) as standard measurement of stability (Tables 2 and 3) exhibited that the C.V. estimates diverted from either genotypes or character to another, these values ranged from 09.82 to 27.71 % for plant height, 2.10 to 10.33 % for spike length, 3.35 to 8.47 % for number of spikelet's / spike, 10.33 to 21.32 % for number of grains / spike, 1.82 to 6.80 for number of spikes / plant, 15.28 to 47.32 for 1000 grain weight, 0.71 to 2.0 for grain weight/spike and 0.82 to 9.52 for grain yield ardab / faddan, it could be noticed from the obtained data that the stable genotypes were Gemmeiza 9 for plant height, number of spikes/plant and number of grains/spike, Sakha 93 for number of spikeles/spike, grain weight/spike and grain yield / faddan, as they exhibited low value of C.V. and the b value near from unity on the other hand the wheat genotypes Sids 4 for plant height, Sids 9 for spike length and Sids 1 for number of spikes /plant, that recorded the highest coefficient of variation regression "b" (Table 2 and 3) deviated from unity ($b > 1$) in these genotypes indicating that the genotypes were adapted to favorable environments.

Otherwise, the "b" value deviated from unity and was less than one ($b < 1$) in genotypes Sids 9 for plant height, number of grains / spike and number of spikes / plant. Gemmeiza 10 for number of spikelets / spike Sids 1 for number of spikelet's/spike indicating that these genotypes were more adapted to stress environments.

Considering the stability parameters (C.V.%), b and S^2d accompanied and mean performance (\bar{X}), the most desired and stable wheat genotypes were; Gemmeiza 9 for plant height, spike length, number of spikelets / spike, number of grains/spike, number of spikes / plant and grain yield /faddan.

Genotype Giza 168 recorded the highest value of mean performance for plant height, Sids 9 for spike length, number of spikelets/spike, number of grains/spike, grain weight / spike and grain yield / faddane, Meanwhile Sakha 94 recorded the highest estimates for number of spikes/plant. In this respect; Haji and Haunt (1999), Salem *et al* (2000), El-Morshidy *et al* (2001) Soheir Abd-Allah (2002), Salem *et al.* (2002) and salama *et al.* (2008).

2- Simple correlation analysis:

Simple correlation coefficients, among studied characters are given in Table (4). Results showed that significant positive correlation was found between grain yield / faddan and all studied characters except plant height, between 1000-grain weight and plant height, between grain weight / spike and all studied characters except plant height, between number of grains/spike and, each of spike length and number of spikelet's / spike, between number of spikelets / spike and each of plant height, spike length, between spike length and plant height.

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Positive and significant correlation between characters, indicated that selection of these characters may improve wheat genotypes concerning high yielding ability. These results are in agreement with those obtained by Hamada (1988), Fayed (1992), El-Bana and Aly (1993) and Salama *et al* (2008).

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الثبات الجيني لبعض التراكيب الوراثية في القمح تحت اربع بيئات مختلفة

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أقيمت أربعة تجارب حقلية في موقعين مختلفين وهما محطة البحوث الزراعية بتاج العز – دقهلية (مركز البحوث الزراعية) ومزرعة كلية الزراعة جامعة قناة السويس بالإسماعلية خلال الموسمين ٢٠٠٦/٢٠٠٧ و ٢٠٠٧/٢٠٠٨ وذلك لدراسة الثبات الوراثي لعشرة تراكيب من قمح الخبز المصري وذلك لمحصول الحبوب وبعض الصفات ذات العلاقة بالمحصول وهي ارتفاع النبات وطول السنبله وعدد السنيبلات وعدد حبوب السنبله وعدد السنابل للنبات ووزن الالف حبة ووزن حبوب السنبله وتم استخدام الأصناف التالية :- سخا٩٣ ، سخا٩٤ ، جيزة ١٦٨ ، سدس ١ ، سدس ٤ ، سدس ٦ ، سدس ٩ ، سخا ٦١ ، جيزة ٩ و جيزة ١٠ وكان التصميم المستخدم هو القطاعات الكاملة العشوائية في ثلاث مكررات.

وقد أوضحت النتائج الآتي:

- ١- إختلاف التراكيب الوراثية تحت الدراسة في إستجابتها لظروف الموقع والموسم الزراعي وأظهرت نتائج الثبات أن الأصناف سدس ٦ وسخا ٦١ متفوقة في صفة ارتفاع النبات وسدس ٩ سخا ٦١ متفوقة في طول السنبله وسدس ٩ لوزن الالف حبة كانت الأصناف المتأقلمة لظروف خاصة وعالية للصفات المختلفة حيث كانت قيمة *b* لهذه الأصناف أكبر من الوحدة بينما كانت *b* أقل من الوحدة للصنف سدس ٤ ، سدس ٦ ، وذلك لصفة وزن الالف حبة وسدس ١ وسدس ٤ وسدس ٦ لصفات وزن حبوب السنبله ومحصول الحبوب للقدان وهذه الأصناف يمكن أن تتحمل الظروف البيئية القاسية.
- بينما كان الصنف سخا ٦١ هو أكثر الأصناف ثباتا لصفات وزن الالف حبة ومحصول الحبوب للقدان وكان الصنف سخا ٩٤ أفضل الأصناف ثباتا بالنسبة لارتفاع النبات وجميزه ٩ لعدد السنابل للنبات.
- ٢- وجود ارتباط موجب ومعنوي بين محصول الحبوب للقدان وجميع الصفات ما عدا صفة ارتفاع النبات.

Table (1): Variance to stability analysis for plant height, spike length, number of spikelet's /spike, number of grains /spike, number of spikes / plant, 1000- grain weight(g), spike grain weight (g) and grain yield (ardab / Faddan) for genotypes under two locations during 2006/2007 and 2007 / 2008 winter growing seasons

S.O.V	d.f	Plant height	Spike length (cm)	Number of spikelet's / spike	Number of grains /spike	Number of spikes/plant	1000 - grain weight (gm)	Spike grain weight (gm)	Grain yield ardab / Faddan
Genotypes (G)	9	27.51**	13.17**	21.11**	11.03**	4.16**	22.64**	0.7 5**	10.15**
Environmental (Env. X G)	30	55.82**	22 .26**	12.26**	21.26**	2.19**	31.22 *	0.5 1**	10.21**
Environmental (liner)	1	32.17**	12.11**	11.47**	20.36**	2.17**	19.2 7**	023**	06.13**
G X Env.(liner)	9	24.3 3**	11.12**	997**	17.41**	2.10**	17.96**	0.410*	05.10*
Pooled deviation	20	18.56	09.51*	11.32**	13.92**	1.02	08.83**	0.229**	10.9**
Genotypes									
Sakha 93	2	11.81**	07.93*	6.51**	06.77**	0.4 1	07.11*	0.19**	09.09**
Sakha94	2	11.17**	06.16**	5.36*	06.91**	0.5 2	08.5 7**	0.15**	10.05
Giza 168	2	21.36**	08.88**	7.21**	07.36**	02.09**	08.39**	0.12**	04.02
Sids 1	2	17.82**	07.53**	8.11**	05.04**	02.14**	05.8 1	0.11**	0.5.04
Sids 4	2	9.92**	09.24**	4.21*	03.52**	0.31	09.7 3**	0.13**	03.13**
Sids6	2	7 5*	11.11**	9.3 6**	11.07**	02.12*	08.68**	0.10**	04.10**
Sids 9	2	6.87	6.24**	7. 3**	11.00**	01.17**	05.4 2	0. 07*	07. 07**
Sakha 61	2	3.84	10.36**	4.1 9*	06.34**	02.15**	04.46	0.10**	03.10**
Gemmeiza9	2	15.58**	10.29**	7.2 2**	07.85**	01.02**	06.89*	0.1 9**	07.79**
Gemmeiza10	2	19.36**	11.52**	8 3**	10.63**	02.18*	07.22*	0.15**	09.15**
Pooled error	120	3.92	1.79	2.12	1.20	0.24	0.916	0.03	0.53

Table (2): Estimates of stability analysis for plant height(cm), spike length(cm), number of spikelet's /spike, number of grains /spike of ten wheat genotypes under two locations during 2006 / 2007and 2007/ 2008 winter growing seasons

Characters	Plant height(cm)				Spike length(cm)				Number of spikelet's / spike				Number of grains /spike			
	\bar{x}	c.v	bl	S ² d	\bar{x}	c.v	bl	S ² d	\bar{x}	c.v	bl	S ² d	\bar{x}	c.v	bl	S ² d
Sakha 93	96.69	16.80	1.0 1	07.51	10.39	04.21	1.03	02.21**	22.26	06.55	1.04	3.82**	53.53	21.11	1.09	10.71
Sakha94	97.97	24.11	1.0 3	10.32**	10.57	02.1	1.31	01.48	22.50	07.22	1.15	4.71	53.92	21.05	0.62	10.91**
Giza 168	100.03	18.21	1.25	08.13	10.37	06.62	1.20	02.77	21.25	06.44	0.60	5.41	53.27	21.32	0.14	09.17
Sids 1	94.21	15.16	1.22	06.29	12. 97	09.32	1.01	02.32**	26.23	06.33	0.04	3.51**	65.09	11.61	0.15	08.29
Sids 4	89.00	26.21	1.11	09.36*	12. 70	09.22	0.20	04.61	25.66	08.47	0.05	4.83	63.77	10.82	0.71	10.10
Sids6	88.77	20.53	1.60	08.20	11.97	10.31	0.36	04.38	25.15	07.22	0.06	3.81	55.18	20.72	0.19	10.50**
Sids 9	95.12	27.71	0.04	08.10*	12.73	10.33	1.42	02.83	26.00	05.36	0.19	2.51**	64.77	20.52	0.06	10.36
Sakha 61	85.95	15.20	1.50	04.51	10.33	08.19	1.33	03.31**	21.14	07.34	0.19	4.19	51.95	18.88	1.05	05.46**
Gemmeiza9	99.46	09.82	1.02	03.82	11. 70	09.61	1.1 1	02.32	24.02	03.35	1.06	3.77**	54.40	17.99	0.99	06.56
Gemmeiza10	99.35	18.11	1.36	03.31	11. 40	07.28	1.08	01.52	23.41	04.22	0.05	3.52	54.08.	10.33	0.98	04.16
Overall mean	94.15				11.52				23.76				56.99			

Table (3) : Estimates of stability analysis for number of spikes / plant, 1000 - grain weight(g), spike grain weight(g) and grain yield (ardab / Fadden) of ten wheat genotypes under two locations during 2006 / 2007and 2007/ 2008 winter growing seasons

Characters Genotypes	Number of spikes /plant				1000-grain weight (g)				Grain weight /spike(g)				Grain yield(ardab /fadden)			
	\bar{x}	c.v	bl	S ² d	\bar{x}	c.v	bl	S ² d	\bar{x}	c.v	bl	S ² d	\bar{x}	c.v	bl	S ² d
Sakha 93	9.00	6.80	1.41	2.51	55.97	24.21	1.03	10.21**	2.62	1.31	1.04	0.82**	15.95	07.11	1.09	3.71
Sakha94	11.35	4.11	0.93	2.32**	54.40	22.1	1.01	10.48	2.68	1.02	1.05	0.71	16.77	06.05	0.92	4.91**
Giza 168	7.97	5.21	0.95	2.13	54.70	21.62	1.20	19.77	2.23	2.0	0.60	0.41	15.53	06.32	0.94	3.17
Sids 1	4.69	5.16	1.22	1.29	59.70	47.32	1.01	15.32**	2.99	1.41	0.04	0.51**	15.27	05.61	0.15	4.29
Sids 4	5.12	4.21	1.11	1.36*	58.39	29.22	0.20	9.61	2.94	1.31	0.05	0.83	15.09	0.82	0.71	2.10
Sids6	4.21	4.53	1.60	2.20	59.33	30.31	0.36	15.38	2.89	1.48	0.06	0.81	15.18	08.72	0.19	3.50**
Sids 9	5.77	3.71	0.04	1.10*	57.97	30.33	1.42	8.83	2.96	1.52	0.19	0.51**	14.40	09.52	0.46	6.36
Sakha 61	7.95	3.20	1.10	1.01	53.37	21.19	1.03	17.31**	2.22	1.14	0.19	0.19	14.08	08.88	1.05	5.46**
Gemmeiza9	6.03	1.82	1.07	1.02	65.73	16.61	1.11	15.32	2.86	0.92	1.06	0.37**	17.77	06.91	0.97	2.56
Gemmeiza10	7.46	2.11	1.06	0.81	63.57	15.28	1.08	10.52	2.76	0.71	1.05	0.52	16.92	03.33	0.81	2.16
Overall mean	7.15				58.31				2.55				15.50			

Table (4) : Simple correlation coefficients between different studied characters (combined data over two seasons)

Characters		1	2	3	4	5	6	7	8
1	Plant height (cm)	-	0.724**	0.682**	0.241	0.363	0.571*	0.363	0.384
2	Spike length(cm)		-	0.896**	0.810**	-0.816**	-0.523*	0.611**	0.526*
3	Number of spikelet's /spike			-	0.552*	-0.891**	-0.789**	0.636**	0.891**
4	Number of grains /spike				-	-0.516*	-0.743**	0.986**	0.741*
5	Number of spikes/plant					-	-0.977**	0.991**	0.892**
6	1000- grain weight (gm)						-	0.752**	0.545*
7	Grain weight / spike(g)							-	0.903**
8	Grain yield (ardab /Fadden)								-

* Significant at 0.05 levels significance

** Significant at 0.01 levels significance