J. Agric. Sci. Mansoura Univ., 28(7): 5201 - 5213, 2003

STABILITY PARAMETERS FOR YIELD AND ITS ATTRIBUTES IN SOME BREAD WHEAT GENOTYPES

Ammar, S. El. M. M. *; M. M. El-Ashry*; M. S. El-Shazly* and R. A. Ramadan**

*** Agronomy Dept., Fac. Of Agric., Suez Canal Univ.**

****ARC Crop Research Institute, Wheat Crop Dept., Giza**

ABSTRACT

Two field experiments were carried out during 1998/1999 and 1999/2000 seasons. This investigation aimed to evaluate twenty wheat genotypes under two different locations i.e. El-Salhia which represents sandy loam soil and Hanout, Kafr Sakr District which considered light clay soil. The components of genotype x environment interaction and phenotypic stability were computed for number of days to 50% heading, flag leaf area, plant height, spike length, number of spike/m^2, number of grains/spike, 1000-grains weight and grain yield ardb/fad.

The results clearly indicated highly significant differences among wheat genotypes, environments and their interaction. Wheat genotypes differed in their response to changes in environments.

Genotypes No. 3 and 14 were stable and adapted under all environments for grain yield ardb/fad. Moreover, the first genotype (No. 3) shown higher developmental elasticity where gave higher yield and yield components under both favourable and unfaourable environments. Genotype No. 13 was adapted for favourable environments for spike length, number of grains/spike and grain yield ardb/fad. Meanwhile, genotype No. 7 was adapted for less favourable environment for flag leaf area, plant height and grain yield ardb/fad.

INTRODUCTION

Breeding for high yielding and stable varieties has always been important objective of all plant breeding programs. But grain yield being sensitive to environmental fluctuation posses a major challenge for developing stable varieties, where genotype environments interactions are often described as inconsistent differences among genotypes from one environment to another. The inconsistency m ay a rise f or two r easons, o ne being the difference in responses of the same set of genes to different environments and the other being the expression of different sets of genes in various environments (Cockerham, 1963). It the same set of genes is expressed, then differences in responses may be regarded as heterogeneity of genetic or error variances (or both) across environments.

A significant GE-interaction can be partitioned into components using regression analysis proposed by Finally and Wilkinson, 1963 and Eberhart and Russell, 1 966). S tability p arameters a re e stimated f rom t he r egression analysis. One stability parameters is estimated as the linear regression coefficient (bi) of a variety mean on the average of all varieties in the particular environmental and another parameter is deviations from regression (S^2d) for each variety (Eberhart and Russell, 1966). However, the magnitude of (bi) and mean of each variety can be an indication of environmental adaptation (Bilbro and Ray, 1967).

Significant interaction between varieties x locations x years has been described as a major important factor of linear component for wheat yield and contributing characters which revealed by (Duwayri and Nachit, 1989 and Jalaluddin and Harrison, 1993). Also, highly significant genotype x location, genotype x year and genotype x location x year interactions were reported for yield and its attributes (Hindi *et al.*, 1990; Abd El-Moneim, 1999; Salem *et al.*, 2000; Awaad and Aly, 2002 and El-Marakby *et al.*, 2002).

The present study aims to evaluate twenty different wheat genotypes for grain yield and some of yield attributes and to determine the yield stability of bread wheat genotypes tested under four environments (2 locations x 2 years).

MATERIALS AND METHODS

Two field experiments were carried out during two winter successive growing seasons i.e. 1998/1999 and 1999/2000. This investigation aimed to evaluate twenty genetically diverse bread wheat genotypes for growth characters as well as yield under two different locations at Sharkia governorate i.e. El-Salhia which represents sandy-loam soil and Hanout, Kafr Sakr District which considered light clay soil. The combinations between two experiments and two locations give four diverse environments.

The pedigree and origin of the studied wheat genotypes are presented in Table (1), while Table (2) represents the mechanical and chemical analysis of soil of two experiment sites. Wheat grains were sown in plots containing 17 row, each row 3 m length and 20 cm width (plot area 10.2 m^2) with a seeding rate of 10 g/row. Sowing dates in both of the two seasons were on 26^{th} and 28^{th} November, in El-Salhia and Hanout, respectively.
Randomized complete block design with four replications was used. The normal cultural practices for wheat production was applied at the proper time as recommended in the two locations. The samples from ten guarded plants were used to estimate the following characters.

1- Days to 50% heading
2- Plant height (cm)
3- Flag leaf area
4- Spike length
5- Number of spikes/m^2
6- Number of grains/spike
7- 1000-grains weight
8- Grains yield ardb/fad.

Statistical procedures

1- Genotype x environments interaction

The obtained data were subjected to the conventional analysis of variance according to Steel and Torrie (1980). To provide information about genotype x environments interaction effect and examining relative magnitude of the different sources of variation, combined analyses of variance were computed over years and locations to estimate their effects on the studied genotypes. Combined analysis was again carried out over all environments (i.e. years and locations combination) with genotypes as a fixed variable and environments as random variable using a microcomputer software MSTAT-c (1986).

Table (1). Pedigree and origin of the studied wheat genotypes .

No.	Genotype	Pedigree	Origin
1	Sakha 92	Napo. 63 / India 66 // wern "s"	Egypt
2	Sids 3	Sakha 69 / Giza 155	Egypt
3	Sids 2	HD 2206/Hork "s"/3/ Nopo 63/India 66/wern "s"	Egypt
4	Sakha 61	INIA-RL 4220 X7C/YR "s"	Egypt
5	Giza 165	M4339 – IY – IM – 2Y – 1M – 2Y – OB	Egypt
6	Giza 163	T. aestivum / Bon // Cno / 7C	Egypt
7	Giza 164	KVZ / Buha "s" // KA 7 / Bb	Egypt
8	Sakha 8	INDUS × NORTEIN "s" PK 3418	Egypt
9	Gemmeiza 1	Maya 74 "s" /ON/1160-147/3/Bb/Gallo /4/chat "s"	Egypt
10	Giza 167	Au/up 301//511 Sx /3/ pew "s"/41/Mai "s" pew "s"	Egypt
11	Sahel 1	N.S..732 / PIM // veery "s"	Egypt
12	Sakha 69	INIARL 422OX7C/YR "s" Cm 15430-25-50	Egypt
13	Sids 1	HD2172/pavon "s" //1158.57/Maya 74 "s"	Egypt
14	Sids 9	Maya "s" / Mom "s" 141 CMH47 - 428/MRC// Gup / 3 / CM4 - 47A - 582 / S /Giza 157-24-Sd 10003 - ssd 1sd - 1sd - 0sd	Egypt
15	Line A	Vee "s" / SWM6525 CGM4017 – 1GM – 7GM – 3GM – 0GM .	D (B.W) 1993-1994 Introduced
16	Line B	Nac / Vee "s". CM64224 - 2Ap - 2AP - 1Ap - 3Ap - 5Ap - OAp.	D (B.W) 1993-1994 Introduced
17	Line C	55 - 1744 / 7C / 5N / Rd1 / 3 / Crow "s". SWM / 2008 - 2Ap - 3Ap - OAp.	D (B.W) 1993-1994 Introduced
18	Line D	Nd/Ug 9144//ka1/ Bb/3/ Yaco "s" /4/Vee# 5 "s". CM85839-1Y-OM-OY-4M-OY.	B (B.W) 1993-1994 Introduced
19	Line E	Seri #3/Buc "s'. CRG68-C-100-3B.	B (B.W) 1993-1994 Introduced
20	Line F	Trap 1/Bow "s" CM88127-21M-OSY-OH-3Y-OM.	B (B.W) 1993-1994 Introduced

2- Stability statistics

Lin *et al.* (1986) introduced a brief description for stability statistics as follows:

1- The variance of a genotype across environments, can be a measure of stability.
2- The regression coefficient (bi) for each genotype is taken as a stability parameter.
3- The residual mean square (MS) of deviation from the regression defined as stability measure. Moreover, Bilbro and Ray (1976) considered that genotype with b= 1 was adapted for all environments, genotype with b < 1 was considered adapted for low yielding environments and genotype with b>1 was considered better adapted for high yielding environments, depending upon the genotype mean yield.

Table (2): Mechanical and chemical analysis of the soil of the experimental field at 1st growing season 1998 / 1999 .

Soil fractions	El-Salhia	Hanout
Coarse sand %	49.35	7.40
Fine sand %	26.70	16.25
Silt %	10.14	35.80
Clay %	13.81	40.55
Chemical analysis :		
Organic matter %	1.05	2.25
Available nitrogen (p.p.m)	32.50	75.15
Available phosphorus (p.p.m)	11.95	35.25
Available potassium (p.p.m)	115.15	395.50
EC (mellemos/cm at 25c)	0.75	1.15
pH	7.45	8.00

RESULTS AND DISCUSSION

Genotype x environment interaction

The analysis of variance due to the effect of environmental conditions (2 locations and 2 years) for yield and some yield attributes of twenty wheat genotypes are shown in (Table 3). Partitioning the environmental effects into locations (L), years (Y) and their interactions (LY) items, revealed that they were highly significant in all studied characters. The significant effects of environments on yield and its related characters obtained herein are in agreement with those detected by Duwayr and Nachi (1989), Krenzer *et al.* (1992) and Jalaluddin and Harrison (1993).

Highly significant differences were obtained for genotypes (G) respecting the studied characters overall environments.

With respect to first order interaction of genotypes with each of years (Y) and locations (L), the obtained results indicated that they were highly significant in all studied characters. Mean squares of (G x L) interaction were higher in magnitude as compared with those of (G x Y) for yield and its attributes, indicate that locations exerted more effect on relative genotypic potential than years of these characters. Similar conclusion was reported by Hindi *et al.* (1990), Ismail (1995) and Hassan (1997) in wheat.

Table (3): Partitioning of environment variation and genotype x environment (GE) interaction based on years and location for studied characters in bread wheat.

Source of variation	d.f.	No. of days of 50% heading	Flag leaf area (cm^2)	Plant height (cm)	Spike length (cm)	No. of spikes/m^2	No. of grains/ spike	1000-grain weight (g.)	Grain yield ardb fad.
Year (Y)	1	14.03**	444.21**	1394.45**	22.10**	10351.25**	453.63**	1054.95**	39.48**
Location (L)	1	669.90**	1274.03**	485.06**	31.82**	25597.01**	1828.83**	530.45**	344.87**
Y x L	1	53.63**	11.99**	122.51**	0.026	49.61**	44.25**	9.35**	1.18**
R (YL)	12	1.52	2.00	2.23	0.098	5.69	5.32	1.06	0.59
Genotypes (G)	19	216.11**	102.64**	334.47**	34.52**	4365.08**	1373.85**	77.12**	33.96**
G x Y	19	7.28**	4.91**	18.28**	0.408**	52.53**	12.40**	5.77**	0.295**
G x L	19	18.17**	43.45**	37.95**	1.22**	252.10**	50.69**	3.55**	0.779**
G x Y x L	19	6.92**	8.12**	31.36**	0.433**	44.00**	10.32**	5.32**	0.517**
Error	228	1.62	1.184	1.83	0.116	7.84	3.66	0.373	0.102

Highly significant second order (G x Y x L) interaction for grain yield and its related characters implies different response of genotype over years-locations combinations indicated that they were highly influenced by changes in the environment, also providing evidence for necessity of testing studied genotypes in multiple environments. The significance of environment x cultivars interaction, although indicative of the effect of environments on the behaviour of all tested cultivars, can not provide information on the response of the individual cultivar and caused difficulty in identifying the stable an superior cultivar. For that, the stability and adaptation parameters of each cultivar were computed.

Stability analysis:

Stability analysis of variance (Table 4 and 5) revealed that the mean square among the genotypes were highly significant for all studied characters.

Table (4): Mean squares of variance for G x E interaction for heading date (days), flag leaf area, plant height and spike length for combined data

Source of variation	d.f.	No. of days of 50% heading	Flag leaf area (cm^2)	Plant height (cm)	Spike length (cm)
Genotype (G)	19	54.2861**	25.8517**	83.6184**	8.6298**
Environments (E)	3	61.6666**	142.6640**	530.4166**	4.4964**
Genotype x Environment	57	2.7094**	4.7407**	7.2982**	0.1716**
E + (G x E)	60	5.6573**	11.6370**	33.4552**	0.3879**
E (linear)	1	185.0595**	427.9858**	159.2734**	13.4882**
G x E (linear)	19	5.2174**	7.6922**	9.3552**	0.2476**
Pooled deviation	40	1.3812**	3.1020**	5.9573**	0.1270**
Genotypes					
1	2	0.6173	1.7252**	4.8397**	0.0387
2	2	0.0103	0.8537	5.4430**	0.4120**
3	2	7.1624**	2.6788**	3.4655**	0.0110
4	2	1.7449**	1.8212**	1.5624*	0.0493
5	2	0.3208	0.4339	6.4616**	0.1082*
6	2	0.8952	0.1185	9.9694**	0.2263**
7	2	0.8001	1.2016**	1.6155*	0.0618**
8	2	0.8753	3.0732**	5.4919**	0.0930**
9	2	1.7700*	4.6046**	1.5160*	0.0631
10	2	0.2587	0.6777	2.3094**	0.0603
11	2	1.9599**	6.2982**	0.6893	0.2100**
12	2	0.4437	1.4999**	1.4885*	0.2952**
13	2	0.3544	2.2706**	6.7233**	0.0308
14	2	0.3769	8.8275**	13.6281**	0.1823**
15	2	5.7090**	0.7873	10.4648**	0.3496**
16	2	0.4777	6.8768**	5.8229**	0.0438
17	2	1.3280**	1.8619**	3.0946**	0.1200**
18	2	0.8078	15.4646**	22.5877**	0.0974*
19	2	1.0543	0.8129	6.0251**	0.0032
20	2	0.6255	0.1509	1.9523**	0.0836
Pooled error	228	0.4042	0.2939	0.4568	0.0291

Genotypes x environments interaction as indicated by Env. + (G x Env.) were highly significant for all studied characters suggesting that, wheat genotypes are highly influenced by changes in the environments.

Table (5): Mean squares of variance for G x E interaction for number of spikes/m^2, number of grains/spike, 1000-grains weight and grain yield ardb/fad. for combined data

Source of variation	d.f.	No. of spikes/m^2	No. of grains/ spike	1000-grain weight (g.)	Grain yield ardb fad.
Genotype (G)	19	1084.4736**	343.3257**	18.8824**	8.489**
Environments (E)	3	3043.5000**	194.1562**	134.0364**	32.126**
Genotype × Environment	57	28.5701**	6.1310**	1.2722**	0.132**
E + (G x E)	60	179.3167**	15.5323**	7.9102**	1.732**
E (linear)	1	9129.5352**	582.4495**	401.9613**	96.3821**
G x E (linear)	19	32.5710**	12.6305*	1.7161**	0.206**
Pooled deviation	40	25.2654**	2.7377**	1.0011*	0.090**
Genotypes					
1	2	15.7043**	0.3913	0.7374*	0.0479
2	2	2.6175	4.6606**	1.6009**	0.0236
3	2	5.2965*	5.2893**	1.5821**	0.0856
4	2	1.7377	0.4264	0.2873	0.0328
5	2	3.2290	0.3650	0.6087*	0.0371
6	2	14.0707**	3.4258*	0.6349*	0.0077
7	2	12.1118**	7.0266**	0.0715	0.0008
8	2	38.4065**	2.2336*	1.5302**	0.3378**
9	2	24.4490**	3.8422**	0.9189*	0.0624*
10	2	93.8919**	5.3143**	0.4298*	0.0860*
11	2	1.7836	1.1946	2.6549*	0.2050**
12	2	2.7314	0.8989	0.1375	0.1110**
13	2	5.5615*	0.4115	1.0219*	0.0785*
14	2	197.6513**	2.4157*	0.0114	0.1632**
15	2	7.4887*	0.5278	1.1971**	0.0693*
16	2	1.5955	0.0412	0.2583	0.1450**
17	2	43.7718**	4.8123**	1.7064**	0.1412**
18	2	11.4482*	4.3929**	1.3206**	0.0150
19	2	19.5126**	6.4285**	2.1964**	0.0099
20	2	3.8978	0.6564	1.1254**	0.1544**
Pooled error	228	2.0866	0.9167	0.1596	0.0254

The variances due to environments (Linear) were highly significantly different for all studied characters, revealing that the response to environment was genetically controlled.

Genotype x environment interaction (linear) component of variation of stability were also, highly significant for all studied character indicating the differential response to environment of the genotypes to various agro-climates. The results showed highly significant variations for pooled deviation in concern to all characters, demonstrating that the major components differences for stability were due to deviation for the linear function.

The significant of genotype x environment interaction agree with the finding of Ramadan (1994); Sharma *et al.* (1995); El-Ashry *et al.* (1996); Swelam (1996) and Orabi (1998).

Data in Table (6) indicated that wheat genotypes No. 1, 7, 16, 19 and 20 gave the highest no. of days to 50% heading and higher (bi) value more than unity and S^2d which did not deviate significant from zero, giving evidence that these wheat genotypes were stable but late flowering and could be cultivated under favorable environments. Meanwhile, genotypes No. 3, 4 and 8 were lowest mean heading date and (bi) values were less than unity as well as S^2d non significant, indicating that these genotypes were suitable for unfavorable environments through escaping from stresses. Genotypes No. 2, 11, 12 and 13 were shown bi = 1 and non significant S^2d, so, these genotypes stable and adapted for the most environments. These results are in harmony with those of Guilan Yue *et al.* (1990) and Awaad (1997).

Concerning flag leaf area, wheat genotypes No. 3 and 17 had greater flag leaf area as compared to the mean ($\bar{X}_G$ = 26.27), bi > 1 and S^2d non significant demonstrating that these genotypes were stable and could be cultivated in Hanout location (favourable environment). While wheat genotypes No. 2, 4, 7 and 13 had higher flag leaf area and lower bi (bi < 1) and S^2d non significant from zero, emphasizing that they may be effectively for growing under El-Salhia location (less favourable environment).

~~For plant~~ height, wheat genotypes No. 7, 10, 12 and 20 were the tallest ~~plants~~ and gave the lowest bi values (bi < 1) as well as S^2d non significant from zero, these results showed that these genotypes were stable and adapted for less favorable environments. However, the other genotypes showed significant S^2d indicating that these genotypes were unstable for all environments. These results are in harmony with Awaad and Ali (2002).

It is note to that, wheat genotypes No. 2, 3, 13 and 14 were the longest spike length ($\bar{X}_G$ = 9.94). At the same these genotypes had non significant S^2d and bi values were more than unity (bi >1). These results demonstrated that these genotypes were stable and adapted for favourable environments. Genotypes No. 5 and 12 gave higher mean values for spike length and bi values less than unity indicating that these genotypes were stable for less favourable environment.

Data of mean performance over locations, bi regression coefficient and S^2d deviation from regression for 20 wheat genotypes under four environments (2 seasons x 2 locations) for grain yield ardb/fad and yield components number of spikes/m^2, number of grains/spike and 1000-grain weight are given in Table (7).

The number of spikes/m^2 was unstable for all genotypes except genotypes No. 3 and 16 which were stable (S^2d non significant) and adapted for unfavorable environments (bi < 1).

Regarding number of grains/spike, genotype No. 13, 15 and 16 seemed to be stable for favourable environments. Since bi values more than unity and had the lowest S^2d and higher mean performance than mean over population.

Table (6): Mean performance ($\bar{x}$) and stability parameters for heading date, flag leaf area, plant height and spike length

Geno-types	No. of days to 50% heading			Flag leaf area / (cm²)			Plant height (cm)			Spike length (cm)		
	x	bi	S²d	x	bi	S²d	x	bi	S²d	x	bi	S²d
1	101.62	2.02	0.21	26.54	0.61	1.43	100.25	1.53*	4.38*	9.32	1.24*	0.09
2	95.75	1.11	0.39	29.74	0.96	0.56	100.12	0.96*	8.99*	12.03	1.87*	0.38
3	97.06	-0.19	6.76*	28.83	1.71*	2.38	103.93	0.66	3.01*	12.49	1.99*	-0.02
4	97.31	0.50	1.34	27.15	0.29	1.53	97.65	0.86*	1.11	8.79	1.48*	0.02
5	102.62	0.63	- 0.08	25.85	0.24	0.14	104.77	1.58*	6.00*	10.08	0.58	0.07
6	101.18	0.26	0.49	26.81	0.87	-0.18	110.71	1.45*	9.51*	9.78	0.45	0.20
7	103.62	1.31*	0.40	29.09	0.81	0.91	104.55	0.97*	1.16	9.70	1.28*	0.03
8	95.187	0.27	0.47	20.08	3.32*	2.78*	92.33	0.66	5.04*	8.21	0.30	0.06
9	99.06	-0.20	1.37	25.27	0.88	4.31*	102.73	0.83*	1.06	9.94	1.21	0.03
10	101.93	0.27	-0.15	26.77	0.47	0.38	102.81	0.92*	1.85	9.86	1.43*	0.03
11	93.37	1.29*	1.56	20.96	1.28	6.00*	92.77	0.54	0.23	8.00	7.84*	0.18
12	94.12	1.29*	0.03	26.61	1.29	1.21	105.52	0.87*	1.03	10.14	0.67	0.27
13	95.25	1.19*	- 0.04	30.39	0.77	1.98	101.39	1.15*	6.27*	12.56	1.69*	0.01
14	95.87	0.98*	- 0.02	26.69	2.03*	8.53*	102.00	1.12*	13.17*	13.02	1.41*	0.15
15	102.37	1.79*	5.30	26.40	2.21*	0.49	103.47	1.10*	10.01*	9.49	1.14	0.32
16	100.25	1.97*	0.07	23.72	1.58*	6.58*	101.66	1.30*	5.37*	9.75	1.03	0.01
17	102.87	0.98*	0.92	27.24	1.27*	1.57	101.10	0.55	2.64	8.78	0.96	0.09
18	101.50	0.33	0.40	26.07	0.29	15.17*	101.41	1.55*	22.13*	9.68	0.90	0.06
19	103.81	2.22*	0.65	24.72	1.40*	0.52	102.64	0.51	5.57*	8.33	0.10	- 0.02
20	105.31	1.99*	0.22	26.42	0.99	-0.14	111.04	0.89	1.50	8.95	0.80	0.05
X	99.50	-	-	26.27	-	-	102.14	-	-	9.94	-	-

Table (7): Mean performance ($\bar{x}$) and stability parameters for number of spike/m^2 , number of grains/spike, 1000-grain weight and grain yield ardb/fad.

Geno-types	No. of spike/m^2			No. of grains/spike			1000-grain weight (g)			Grain yield ardab/fad		
	x	bi	S^2d	x	bi	S^2d	x	bi	S^2d	x	bi	S^2d
1	300.80	1.13*	13.62*	53.60	1.17*	- 0.53	49.22	0.71*	0.58	14.82	0.79*	0.02
2	270.60	1.04*	0.53	65.30	1.93*	3.74*	45.43	1.09*	1.44*	16.64	0.96*	0.01
3	287.60	0.81*	3.21	71.30	1.90*	4.37*	43.72	0.26	1.42*	16.98	1.03*	0.06
4	280.10	1.04*	- 0.35	46.40	0.66	- 0.49	43.82	0.83*	0.13	13.48	0.96*	0.07
5	270.70	0.95*	1.14	49.70	1.37*	- 0.55	48.85	1.20*	0.45	14.54	0.99*	0.01
6	296.80	1.40*	11.98*	48.90	0.34	2.51*	46.68	0.81*	0.48	15.58	0.81*	- 0.02
7	303.60	1.28*	10.03*	50.90	1.51*	6.11*	49.04	1.33*	- 0.08	15.81	0.86*	- 0.02
8	305.10	1.31*	36.32*	42.60	0.67	1.32	46.46	1.18*	1.37	12.89	0.80*	0.31
9	288.50	0.97*	22.36*	58.80	1.41*	2.93*	48.16	0.80*	0.76	14.08	1.25*	0.03
10	308.50	1.25*	91.81*	59.80	0.94*	4.40*	48.38	1.08*	0.27	14.66	1.27*	0.06
11	260.10	0.80*	- 0.30	42.90	0.03	0.28	44.17	0.94*	2.50	12.11	1.02*	0.18
12	281.10	1.31*	0.64	59.50	1.02*	- 0.02	51.01	1.55*	- 0.02	14.87	1.58*	0.08
13	276.50	1.28*	3.47	71.30	1.15*	- 0.51	47.74	0.62	0.86	16.24	1.20*	0.05
14	250.90	0.35	195.56*	69.00	0.98*	1.50	45.21	0.78*	- 0.15	16.43	1.09*	0.14
15	276.30	0.74*	5.40	56.30	1.26*	- 0.38	46.24	1.08*	1.04	13.34	0.73*	0.04
16	283.80	0.72*	- 0.49	57.60	1.13*	- 0.88	45.22	1.08*	0.09	12.87	0.39	0.12
17	283.30	0.78*	41.69*	49.70	1.70*	3.90*	43.89	0.94*	1.55*	13.11	0.86*	0.12
18	251.70	1.10*	9.36*	48.60	1.06*	3.48*	48.04	1.20*	1.16	13.85	0.95*	- 0.01
19	272.70	0.97*	17.43*	42.20	2.49*	5.51*	43.80	1.31*	2.04*	12.88	0.84*	- 0.01
20	276.20	0.76*	1.81	48.30	1.15*	- 0.26	45.59	1.18*	0.97	13.37	1.11*	0.13
X	281.30	-	-	54.60	-	-	46.53	-	-	14.43	-	-

Although g enotypes N o. 2 , 3 and 9 were higher mean values than general mean and bi values were more than unity, but the S^2d values were significant. This may mention that these genotypes fluctuate under the various environments . Meanwhile, genotype No. 12 gave higher mean\value than population mean, bi = 1 and lowest S^2d. these result indicated that this genotype was stable and adapted for all studied environments. These results are supported by Crossa *et al.* (1991); El-Ashry *et al.* (1996) and Awaad (1997).

Comparing with mean values, bi values and S^2d for 1000-grains weight, genotypes No. 5, 7, 10, 12 and 18 were higher mean values, bi > 1 and S^2d non significant. These result indicated that these genotypes were stable for this trait and could be cultivated under foavourable environments. Moreover, genotypes No. 1 and 13 had higher 1000-grains weight and lower bi (b < 1), indicating that these genotypes could be cultivated under less environments. These results are confirmed by Abd El-Moenim (1999) and Awaad and Ali (2002).

Concerning of grain yield ardb/fad, it is noticed that genotypes No. 3 and 14 were stable and adapted for all the studied environments, where these genotypes gave the highest mean values, lowest S^2d and bi = 1. Moreover, genotype No. 13 recorded higher grain yield ardb/fad than population mean, bi> 1 and S^2d non significant. This may be indicate that this genotype is stable and can be cultivated under favorable environments.

Genotypes No. 2, 6 and 7 gave the highest mean values, lowest S^2d and bi value less than unity (bi < 1). So these genotypes can be cultivated under unfavorable environments. These results are in agreement with those of Ramadan (1994) and Awaad and Ali (2002).

REFERENCES

Abd El-Moneim, A. M. (1999). Phenotypic stability of some performing bread wheat genotypes under low rainfed condition. Zagazig J. Agric. Res., 25 (1):1-16.

Awaad, H. A. (1997). Phenotypic stability for grain and its contributing characters in durum wheat (*Triticum turgidum* L. var durum). Annals of Agriculture Science, Moshtohor., 35 (1): 181-194.

Awaad, H. A. and A. A. Aly (2002). Phenotypic and genotypic stability parameters for grain yield and its contributing characters in bread wheat (*Triticum aestivum* L.). Zagazig J. Agric. Res., 29:983-997.

Bilbro, J. D. and L. L. Ray (1967). Environmental Stability and Adaptation of Several Cotton Cultivars. Crop Sci., 16:821-824.

Cockerham, C. C. (1963). Estimation of genetic variance . p. 53-94. In: W. D. Hanson and H. F. Robinson (ed) Statistical Genetics and Plant Breeding. MAS-NRC Publ, 982. NAS. Washington, DC.

Crossa, J. P. N. Fox.; W. H. Pfeiffer; S. Bajaram and H. G. J. R. Gauch (1991). Ammi adjustment for statistical analysis of an international wheat trail. Theoretical and Applied Genetics, 81 (1): 28-37.

Duwayri, M. and M. M. Nachit (1989). Utilization of durum wheat (*Triticum turgidum* L. var durum) land races to improve yield and yield stability in dry areas, wheat information services, 69:5-8.
Eberhart, S. A. and W. A. Russel (1966). Stability parameters for compaing varieties. Crop Sci., 6: 36-40.
El-Ashry, M. M.; M. S. El-Shazly; A. R. Al-Kaddussi,; M. M. Eissa and R. A. Ramadan (1996). Phenotypic stability of yield and yield component in some wheat genotypes under Egyptian conditions. 5th International Wheat Conference June 10-14, Ankara, Turkey, 22- 27.
El-Marakby, A. M.; A. A. Mohamed ; M. Tolba and S. H. Saleh (2002). Performance and stability b of some promising wheat lines under different environmental conditions. Egypt. J. Plant Breed. 6 (1): 43-68.
Finlay, K. W. and G. W. Wilkinson (1963). The analysis of adaptation in a plant breeding program. Aust. J. Agric. Res. 14: 742-754.
Guilan Yue, S. K. Preny; T. L. Walter and G. H. Liang (1990). Stability analysis of yield in maize wheat and sorghum and its implications in breeding programs. Plant Breeding. 104: 72-80.
Hassan, E. E. (1997). Partitioning of variance and phenotypic stability for yield and its attributes in bread wheat. J. Agric. Res. 24 (3): 421-433.
Hindi, L. H. A.; Mitkees, R. A.; A. H. El-Attar and M. K. Moshref (1990). Effect of genotype, environment and their interaction on bread wheat Proc. 4th Conf. Agron. Cairo 1: 13-17.
Ismail, A. A. (1995). The performance and stability of some wheat genotypes under different environments. Assiut J. Agric. Sci. 26 (4):15-37.
Jalaluddin, M. D. and S. A. Harrison (1993). Repeatability of stability estimators for grain yield in wheat crop Sci. 33:720-725.
Krenzer, E. G.; J. D. Thompson and B. F. Carver (1992). Partitioning of genotype x environment interactions of winter wheat forage yield. Crop Sci., 32:1143-1147.
Lin, C. S.; M. R. Binns and L. P. Lefkovitch (1986). Stability analysis: where do we stand. Crop Sci., 26:894-900.
M STAT-C (1986). A microcomputer for the design, management and analysis of agronomic research experiments. Michigan State Univ., USA.
Orabi, H. F. E. (1998). Studies on wheat breeding. M. Sc. Thesis Faculty of Agric., Zagazig Univ., Egypt.
Ramadan, R. A. (1994). Evaluation of some local and introduced wheat genotypes under different environments. M.Sc. Thesis, Fac. Agric. Suez Canal Univ., Egypt.
Salem, A. H.; S. A. Nigem, M. M. Eissa and H. F. Oraby (2000). Yield stability parameters for some bread wheat genotypes. Zagazig J. Agric. Res. 26 (4): 789-803.
Sharma, D. J.; R. K. Yadav and R. K. Sharma (1995). Genetic variability and association of some yield components in winter x spring nursery of wheat. Advances in Plant Sciences. 8 (1): 95-99.
Steel, R. G. D. And J. H. Torrie (1980). Principles and Procedures of Statistics. A Biometerical Approach. Second Ed. McGraw-Hill pp. 167-173.

Swelam, A. A. M. (1996). The assessment of genetic variance for yield and its contributing characters in wheat under different irrigation treatments. M.Sc. Thesis, Fac of Agric., Zagazig Univ.

مقاييس الثبات للمحصول ومساهماته لبعض التراكيب الوراثية من القمح

شوقى الشحات مجاهد محمد عمار* ، محمد محمد العشرى*، محمد سمير الشاذلى * ، رمضان عبد السلام رمضان**

*قسم المحاصيل – كلية الزراعة – جامعة قناة السويس

** مركز البحوث الزراعية · قسم بحوث القمح

أجريت تجربتان حقليتان خلال موسمى ١٩٩٨/١٩٩٩ و ١٩٩٩/٢٠٠٠ وتهدف الدراسة إلى تقيم عشرين تركيب وراثى من القمح تحت موقعين مختلفين هما الصالحية وتمثل الأراضي الرملية وحانوت مركز كفر صقر وتمثل الأراضي الطينية.

تم تقدير مكونات التفاعل بين التراكيب الوراثية والبيئية والثبات المظهرى للصفات الآتية: عدد الأيام لطرد ٥٠% من السنابل ، مساحة ورقة العلم ، ارتفاع النبات ، طول السنبلة ، عدد السنابل/م٢ ، عدد الحبوب/ سنبلة ، ووزن الـ ١٠٠٠ حبة ، ومحصول الحبوب اردب/فدان.
أوضحت النتائج ان هناك اختلافات معنوية بين التراكيب الوراثية والبيئية والتفاعل بينهما كما اختلفت التراكيب الوراثية فى استجابتها للتغيرات فى الظروف البيئية. التراكيب الوراثية رقم ٣ ، ١٤ كانت ثابتة وملائمة لجميع الظروف البيئية لمحصول الحبوب أردب /فدان كما اظهر التركيب الوراثى رقم ٣ مرونة خلال مراحل نموه للبيئات المختلفة حيث أعطى محصول ومكوناته مرتفعا تحت كل الظروف البيئية الملائمة والغير ملائمة واظهر أيضا التركيب الوراثى رقم ١٣ ملائمة للظروف البيئية الملائمة لصفات طول السنبلة وعدد الحبوب/سنبلة ومحصول الحبوب أردب/فدان ، بينما التركيب الوراثى رقم ٧ كان ملائما للظروف البيئية الغير ملائمة لصفات مساحة ورقة العلم ، ارتفاع النبات ، محصول الحبوب أردب / فدان.