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YIELD STABILITY AND GENOTYPE-ENVIRONMENT INTERACTION OF SOME PROMISING YELLOW MAIZE HYBRIDS

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ABSTRACT

Phenotypic stability for grain yield and other agronomic traits of eight yellow maize hybrids along with four new check hybrids were estimated by growing these genotypes under five different environmental conditions (Sakha, Gemmeiza, Sids, Nubaria and Mallawy) during 2010 summer season. A randomized complete block design with 4 replications was used at each environment. Genotype-environment interaction (GxE) was highly significant for all studied triats. A large portion of this interaction was accounted by linear regression on the environmental means. The magnitude of non-linear components was considerably small. All hybrids exhibited significant linear response to environmental conditions. Yellow single-cross hybrid SC Gz 136Y, and SC Gz 137Y outyielded the check hybrids SC 162 (32.13 and 31.45 vs 30.85 ard fed^{-1}). However, grain yield of the yellow three-way crosses TWC Gz 138Y and TWC Gz 522Y significantly surpassed the check hybrids TWCC 352 (27.58 and 25.59 vs 24.18 ard fed^{-1}). The most stable hybrids were SC Gz 136Y, TWC Gz 138Y, and TWC Gz 321W for grain yield, SC Gz 137Y, SC Gz 13Y for silking date; SC 13, TWC 520, TWC522, SC166 for plant height ; SC Gz 135, TWC Gz138, SC Gz162, and SC Gz166 hybrids for ear height.

Key word: ***Zea mays, Maize, Corn, Genotype × environment, and Stability***

INTRODUCTION

Developing of high yielding maize (*Zea mays* L.) hybrids that are well adapted to a wide range of environments is a major objective of Maize Research Program and different seed production agencies. To achieve this breeding goal, it is essential that maize breeders use stability technique that identify high stable, genotypes accurately in a multi-location yield trials conducted under different environmental conditions. However, stability performance is one of the most desirable properties of a particular genotype(s) released as a new adapted variety for a wide range of regions.

Regression approachs (Finlay and Wilkinson 1963, and Eberhart and Russell 1966) are widely-used methods for detecting stable genotypes. However, Freeman and Perkins (1971), Hill (1975), Hill and Baylor (1983) and Westcott (1966) have pointed out that stability parameters determined for a given entry will vary according to the mean performance of the genotypes with which the entry is compared. On the other hand, many investigators proved that the environmental variations can be classified into predictable and unpredictable variations (Allard and Bradshaw 1964, El-Nagouly *et al* 1980, and Mead *et al* 1986). The predictable ones are caused by more permanent features, while the unpredictable variations are caused by year-to-year fluctuations in weather, insect infestation, and disease infection.

To reduce the magnitude of genotype x environment interaction within region, Horner and Frey (1957), George *et al* (1966), Murray and Vehalem (1970), Dhillon and Singh (1977), Francis and Kannenberg, (1987), Ibrahim *et al* (1984), and Ragheb *et al* (1993 a and b) suggested that the environmental variations can be minimized by locations grouping into regions of similar environmental conditions. They obtained a highly significant genotype x environment interaction even after grouping the environments into regions of similar climatic conditions.

Several breeders used the regression analysis to estimate stability and adaptability for several genotypes of different crops such as wheat (Baker 1969), barley (Paroda and Hays 1971) soybean (Johnson *et al* 1955) and maize (Finlay and Wilkinson, 1963, El-Nagouly *et al*, 1980, and Ragheb *et al*, 1993 a). However, the modified model of Eberhart and Russell (1966) is widely used by various investigators (Rowe and Andrew 1964, Eberhart and Russell 1969, Paroda and Hays 1971, El-Nagouly *et al* 1980 and Ibrahim *et al* 1984, Ragheb *et al*, 1993 a and b, Barakat and Abd El-Aal 2007, and El-Sherbieny *et al* 2008). On the other hand, Eberhart and Russell (1966) stressed that the most important stability parameter appeared to be the deviation mean square because all types of gene action were involved in this parameter. Lin *et al* (1986) reported that a particular genotype may considered to be stable (i) if it's among environments variance is small, (ii) if it's response to environments is parallel to the mean response of all genotypes in the trial, or (iii) if the residual mean square from regression model on the environmental index is small.

The main objective of this investigation was to estimate stability parameters for grain yield, days to 50 % silking, plant height, and ear height of 12 yellow maize hybrids evaluated across five locations in Egypt during 2010 summer season.

MATRIALS AND METHODS

Eight new yellow maize single (SC) and three-way (TWC) crosses, i.e. SC Gz 134Y, SC Gz 135Y, SC Gz 136Y, SC Gz 137Y, TWC Gz 138Y, SC Gz 13Y, TWC Gz 520Y, and TWC Gz 522Y along with four check hybrids (SC162Y, SC166Y, TWC 352Y, and TWC 321W) were evaluated in 2010 season at five environments across Egypt (Sakha, Gemmeiza, Sids, Nubaria, and Mallawy). These hybrids were yellow single and three-way crosses developed by the Egyptian Maize Research Program.

Planting date at all locations was during the first half of June. The preceding winter crop was wheat in all trials. A randomized complete block design (RCBD) with 4 replications was used at each environment. Plot size consisted of 4 rows, 6 m long and 80 cm apart. The two inner rows were harvested (plot size = 1/500 feddan (fed), one feddan = 4200 m^2). Planting was done in hills (2-3 kernels/hill) equally spaced 25 cms along the ridge. Thinning to one plant/hill was done 21 days after planting to secure 21000 plants/faddan. Nitrogen fertilizer was applied in the form of urea at the rate of 120 kg N/feddan in three equal doses, the first dose was applied at planting, the second after thinning and the third before the second irrigation (36 days after planting). Pest control and other cultural practices were carried out as recommended. At harvest, 110-120 days after planting, weight of harvested ears/plot, shelling percentage, and grain moisture were recorded. These data were used to calculate the grain yield (ardab (ard)/fed) adjusted to 15.5 % moisture. Plant and ear height were measured in cm from the soil surface to the base of tassel and the node bearing the upper ear, respectively.

Adjusted grain yield as well as days to 50 % silking, plant height, and ear height were statistically analyzed at each location according to **Steel and Torrie (1980).** Stability analysis for these four characters across all locations was performed according to the following model of **Eberhart and Russell (1966):**

$$Yij = Ui + \beta iIj + Oij$$

where:

Yij = variety mean of the i^{th} variety at the j^{th} environment (location).

Ui = mean of the i^{th} variety over all environments.

βi = regression coefficient that measures the response of the i^{th} variety to varying environments.

Ij = environmental index obtained as the mean of all varieties at the environment j^{th} minus the grand mean.

Oij = deviation from the regression of the i^{th} variety at the j^{th} environment.

RESULTS AND DISCUSSION

Error mean squares of homogeneity test across locations was not significant, indicating that the selection of these locations was not biased and hence the combined analysis was followed up in this investigation. It is worthy to note that the recently used locations provided a wide range of environments. Results in Tables (1 and 2) indicated that grain yield (ard/fed), the average days to 50 % silking, and plant and ear height for all evaluated hybrids greatly and significantly differed from one location to another. Based on the combined data, hybrid means ranged from 23.77 to 33.86 ard/fed for grain yield, 56.30 to 61.65 days for silking date, 234.85 to 280.00 cm for plant height, and 134.60 to 156.95 cm for ear height. Coefficient of variations (C.V.%) were below 16% for all experiments. Ibrahim *et al* (1984) and

Table 1. Average grain yield (ard/fed) and days to 50% silking for 8 new single and three-way crosses and four check hybrids evaluated at five environments , (2010 season).

Genotypes	Grain yield (ard/fed)						Days to 50% silking					
	Sakha	Gemmeiza	Sids	Nubaria	Mallawy	Mean	Sakha	Gemmeiza	Sids	Nubaria	Mallawy	Mean
SC134	33.48	28.03	26.18	25.16	36.11	29.79	58.25	61.75	58.25	62.50	57.25	59.60
SC135	32.93	28.82	27.62	23.37	39.84	30.52	60.50	62.75	62.50	62.50	60.00	61.65
SC136	35.91	28.67	29.66	25.95	40.48	32.13	59.75	62.75	59.75	60.50	58.75	60.30
SC137	33.65	28.84	32.11	22.16	40.51	31.45	57.75	60.00	57.50	59.50	55.50	58.05
TWC138	32.03	24.62	24.17	22.39	34.68	27.58	59.25	61.00	59.50	62.50	56.00	59.65
SC 13	24.48	26.14	22.62	22.26	23.34	23.77	55.50	58.75	55.75	57.25	54.25	56.30
TWC 520	25.70	22.40	22.88	25.48	23.27	23.95	56.00	59.25	56.50	56.75	54.75	56.65
TWC522	27.48	22.37	24.24	22.65	31.22	25.59	57.25	59.25	55.75	57.50	53.25	56.60
Checks (SC162)	38.95	24.24	25.20	29.90	35.95	30.85	62.50	64.00	63.25	62.75	61.25	62.75
(SC166)	39.74	23.06	31.19	31.94	43.38	33.86	60.50	63.00	61.50	62.50	60.75	61.65
(TWC352)	27.73	20.74	21.38	22.32	28.72	24.18	58.50	60.50	57.75	62.50	56.75	59.20
(TWC321)	35.32	26.59	29.07	27.07	38.42	31.29	60.75	62.25	63.50	61.00	59.75	61.45
Env. Average	32.28	25.38	26.36	25.05	34.66	28.75	58.87	61.27	59.29	60.65	57.35	59.50
CV %	8.94	1.78	7.92	9.00	5.53	7.46	1.23	1.14	1.63	0.98	2.02	1.43
LSD 0.05	4.15	4.90	3.00	3.24	2.75	1.32	1.04	1.01	1.38	0.85	1.66	0.52
Environmental index	3.53	-3.37	-2.39	-3.70	5.91		-0.63	1.77	-0.21	1.15	-2.15	

Table 2. Average plant height (cm) and ear height (cm) for 8 new single and three-way crosses and four check hybrids evaluated at five environments , (2010 season)

Genotypes	Plant height (cm)						Ear Height (cm)					
	Sakha	Gemmeiza	Sids	Nubaria	Mallawy	Mean	Sakha	Gemmeiza	Sids	Nubaria	Mallawy	Mean
SC134	291.00	279.75	256.25	203.75	269.75	260.10	157.50	162.00	133.75	100.00	149.75	140.60
SC135	310.75	290.00	251.25	206.25	291.00	269.85	161.00	161.50	132.50	90.00	152.25	139.45
SC136	307.25	281.75	262.50	213.75	298.25	272.70	151.75	136.50	138.75	95.00	151.00	134.60
SC137	308.25	270.00	265.00	190.00	283.00	263.25	164.50	144.00	140.00	90.00	148.00	137.30
TWC138	301.25	270.00	253.75	206.25	291.00	264.45	176.00	160.50	138.75	108.75	162.25	149.25
SC 13	279.25	257.25	237.50	205.00	256.25	247.05	158.75	162.00	131.25	101.25	146.50	139.95
TWC 520	269.50	261.50	241.25	191.25	253.00	243.30	147.00	157.00	132.50	98.75	148.75	136.80
TWC522	261.75	242.25	230.00	188.75	251.50	234.85	155.75	142.00	125.00	108.75	143.25	134.95
Checks (SC162)	329.75	282.25	257.50	212.50	303.75	277.15	189.00	169.50	155.00	106.25	165.00	156.95
(SC166)	286.75	270.25	247.50	188.75	267.50	252.15	175.00	158.00	140.00	98.75	160.00	146.35
(TWC352)	296.00	237.25	246.25	207.75	268.50	251.15	165.25	159.00	131.25	117.50	151.75	144.95
(TWC321)	317.25	295.50	280.00	225.00	282.25	280.00	177.00	157.75	157.50	118.75	159.00	154.00
Env. Average	296.52	269.81	252.39	203.23	276.31	259.67	164.87	155.81	138.02	102.81	153.12	142.93
CV %	4.01	1.75	3.01	7.86	3.81	4.17	6.02	2.87	5.21	13.73	6.45	6.76
LSD 0.05	17.09	6.79	10.93	22.99	15.13	6.71	14.27	6.43	10.34	20.31	14.20	5.98
Environmental index	36.85	10.14	-7.28	-56.44	16.64		21.94	12.88	-4.91	-40.12	13.81	

Ragheb *et al* (1993 a and b) observed that the difference in mean performance of a particular set of genotypes (varieties and/or hybrids) is due mainly to the use of new improved varieties or hybrids and the differences among locations might be attributed to the farmer factors as well as the variation in soil fertility and varied cultural procedures practiced by the farmers. Environmental index for all traits was calculated as the difference between the location mean and the mean across all locations. For the four studied traits, the indices covered a wide range and displayed a good distribution within this range.

Hybrid × environment interaction for the four studied traits was highly significant (Table 3). In this respect, El-Nagouly *et al* (1980), Ibrahim *et al* (1984), Ragheb *et al* (1993 a), and El-Sherbieny *et al* (2008) obtained similar results. Such significant interactions encourage maize breeders to develop high yielding and more uniform hybrids under varied environmental conditions. High yield potential and average stability are due to most attributes involved in determining the wide adaptation of a new variety or hybrid (Eberhart and Russell 1966).

Significant linear effect of the environments and genotypes × environments (Table 3) for all traits revealed that environments (locations) differed remarkably in their effect on the performance of evaluated genotypes and all hybrids responded differently within the specific range of varied locations. On the other hand, highly significant pooled deviation was obtained for all studied traits. This means that the deviation of all genotypes from linearity was significant and obvious.

The 12 maize hybrids (8 new hybrids and four check hybrids) differed significantly with respect to all studied traits across all locations (Table 3). On the basis of across all locations mean, the yellow single-cross hybrids SC Gz 136Y, and SC Gz 137Y insignificantly outyielded the check hybrids SC 162 (32.13 and 31.45 *vs* 30.85 ard fed^{-1}). However, grain yield of the yellow TWC Gz 138Y and TWC Gz 522Y significantly surpassed the check hybrids TWC 352 (27.58 and 25.59 *vs* 24.18 ard fed^{-1}) (Table 1).

Estimates of environmental index (Tables 1 and 2) showed that Mallawy was the most favorable environment, which was linked to the heighest mean grain yield, while Nubaria was the poorest yielding environment (34.66 and 25.05 ardabs $feddan^{-1}$),. This suggests that the performance of the tested genotypes varied from one environment to another.

Estimates of various stability parameters of the 12 maize hybrids with respect to grain yield, days to 50 % silking, and plant and ear height are presented in Table (4). Stability parameters in this table are: (1) the average (x) for different traits, (2). the regression coefficient (b) of the performance on environmental indices, and (3). the squared deviation (S^2_d) from the

Table 3. Stability analysis of variance for grain yield and other agronomic traits of 12 maize hybrids evaluated under different environmental conditions, (2010 season).

SOV	df	Grain yield	Days to 50% silking	Plant height	Ear height
Environments (E)	4	938.15**	113.84**	59715.68**	28619.92**
Varieties	11	254.74**	97.12**	4001.47**	1097.43**
Env,Env.V	48	112.41**	13.12**	5295.77**	2566.20**
Env (linear)	1	3752.46**	457.09**	238998.18**	114479.69**
V.Env (linear)	11	79.10**	4.41**	528.06**	294.72**
Pooled Deviation	36	21.47**	3.46**	260.84**	151.56*
Deviation V1	3	6.61	4.55**	228.96	137.29
Deviation V2	3	26.92**	2.10*	245.27	91.59
Deviation V3	3	5.64	2.23*	121.82	318.02*
Deviation V4	3	60.07**	0.22	215.54	186.57
Deviation V5	3	2.76	4.67**	163.33	73.13
Deviation V6	3	13.18*	0.70	67.30	164.41
Deviation V7	3	12.23	2.45*	228.09	235.66
Deviation V8	3	2.95	4.32**	26.79	105.53
Deviation V9	3	60.05**	1.31	369.14*	98.38
Deviation V10	3	61.98**	1.11	140.79	29.84
Deviation V11	3	4.07	9.37**	960.03**	186.21
Deviation V12	3	1.23	8.42**	362.99*	192.11
Pooled error	165	4.5976	0.7288	117.45	93.368

***, ** indicate significant at P = 0.01 and 0.05 probability levels, respectively.**

Table 4. Stability parameters of grain yield and other agronomic traits for 12 maize hybrids evaluated at five locations across Egypt, (2010 season)

Genotypes	Grain yield			Days to 50 % silking			Plant height			Ear height		
	Average	B	S_{di}^2	Average	B	S_{di}^2	Average	B	S_{di}^2	Average	B	S_{di}^2
SC134	29.79	1.049	6.605	59.60	1.404	4.554**	260.10	0.946	228.96	140.60	1.007	137.29
SC135	30.52	1.314	26.92**	61.65	0.734	2.100*	269.85	1.163	245.27	139.45	1.218	91.591
SC136	32.13	1.319	5.636	60.30	0.880	2.226*	272.70	1.043	121.83	134.60	0.896	318.02*
SC137	31.45	1.316	60.07**	58.01	1.158	0.220	263.25	1.241	215.54	137.30	1.122	186.57
TWC138	27.58	1.216	2.760	59.65	1.447	4.671**	264.45	1.048	163.33	149.25	1.065	73.13
SC 13	23.77	0.004	13.18*	56.30	1.100	0.702	247.05	0.781	67.302	139.95	0.989	164.41
TWC 520	23.95	0.056	12.226	56.65	0.971	2.455*	243.30	0.857	228.08	136.80	0.903	235.66
TWC522	25.59	0.830	2.946	56.60	1.335	4.318**	234.85	0.800	26.795	134.95	0.726	105.53
SC162	30.85	1.255	60.05**	62.75	0.574	1.315	277.09	1.254	369.14*	156.95	1.254	98.38
SC166	33.86	1.624	61.98**	61.65	0.637	1.109	252.05	1.066	140.78	146.35	1.199	29.835
TWC352	24.18	0.826	4.068	59.10	1.288	9.373**	251.10	0.864	960.03**	144.95	0.782	186.21
TWC321	31.29	1.191	1.232	61.45	0.471	8.418**	280.00	0.939	362.98*	154.00	0.839	192.11

*, ** indicate significant at P = 0.01 and 0.05 probability levels, respectively.

regression. According to the definition of Eberhart and Russell (1966), a stable preferred hybrid would have approximately, b = 1, $S^2_d = 0$, and a high mean performance.

On the other hand, Johnson *et al* (1955), Paroda *and* Hayes (1971) and Lin *et al* (1986) considered the squared deviation from regression as a measure of stability, while the regression was regarded as a measure of response of a particular hybrid to environmental indices.

Regression analysis in Table (4) shows that eight hybrids had a (b) value equal approximately to one, indicating that their linear response to environment was high, whereras four crosses, i.e. SC Gz 13Y, TWC Gz 520Y, TWC Gz 522Y, and TWC Gz 352Y were not stable since b values were small. On the other hand, the highly
significant pooled deviation based on across all locations analysis was recorded for grain yield, days to 50% silking, and plant and ear height (Table 3), indicating that most of the studied hybrids differed significantly with regard to the deviation from their respective average linear response. According to Paroda and Hayes (1971) and Lin *et al* (1986), hybrids SC Gz 136Y, TWC Gz 138Y, and TWC Gz 321W would be the most stable hybrids across locations with respect to grain yield since the regression coefficient values were equal to one and their deviations from linearity were small and insignificant. Single cross SC Gz166 had the highest value of regression coeffecient (bi=1.624) and had average grain yield exceeded the grand mean (33.86 ard fed^{-1}), indicating its high performance under favourable environments.

For days to 50% silking, two crosses, i.e. SC Gz 137Y, and SC Gz 13Y were considered to be the most stable hybrids (toward earliness) across all locations, since they possessed small and insignificant deviation from linearity (0.22 and 0.702, respectively). With respect to plant height, four hybrids, i.e. SC 13, TWC 520, TWC522, and SC166 were considered to be the most stable hybrids (toward shortness) across all locations, since they possessed small and insignificant deviation from linearity (67.302, 228.08, 26.795 and 140.78, respectively).Regarding ear height, hybrids SC Gz 135, TWC Gz138, SC Gz162, and SC Gz166 were the most stable hybrids (toward low ear placement) across all locations, since they possessed small and insignificant deviation from linearity (91.59, 73.13, 98.83, and 29.83, respectively).

Though most studied hybrids exhibited good potentiality (or produced high grain yield), they were unstable across a wide range of environments. This instability can be overlooked by excess improvement of stability of the parental inbred lines through evaluating these lines under wide range of environmental conditions. this considered as one of the most important objectives of the on farm trial program.However, developing hybrids for specific locations is another breeding strategy.

REFERENCES

Allard, R.W. and A.D. Bradshaw (1964). The implication of genotype-environmental interactions in plant breeding. Crop Sci. 4: 503-508.

Baker, R.J. (1969). Genotype-environment interaction in yield of wheat. Can. J. Plant Sci. 49: 743-751.

Barakat, A. A., and A.M.M. Abd El-Aal (2007). Phenotypic stability parameters for some promising yellow maize genotypes under different environmental conditions. Minufiya J. Agric. Res. 32(1): 203-217.

Dhillon, B.S. and J. Singh (1977). Estimates and inheritance of stability parameters of grain yield in maize. J. Agric. Sci. Camb. 88: 257-265.

Eberhart, S.A. and W.A. Russell (1966). Stability parameters for comparing varieties. Crop Sci. 6: 36-40.

Eberhart, S.A. and W.A. Russell (1969). Yield stability for a 10-line diallel of single-cross and double-cross maize hybrids. Crop Sci. 9: 357-361

El-Nagouly, O.O., M.A. Khalifa, E.M. Shokr and E.A. Mahmoud (1980). Estimates of stability for yield and some yield components of maize (*Zea mays* L.) under different treatments of irrigation. Annals Agric. Sci. Moshtohor 14: 75-85.

El-Sherbieny, H.Y., T.A. Abdallah, A.A. El-Khishen, and Afaf A.I. Gabr (2008). Genotype x environment interaction and stability analysis for grain yield in some white maize (*Zea mays* L.) hybrids. Annals of Agric. Sci., Moshtohor 46(4): 277-283.

Finlay, K.W. and G.N. Wilkinson (1963) The analysis of adaptation in plant breeding. Aust. J. Agric. Res. 14: 742- 754.

Francis, T.R. and L.W. Kannenberg (1987). Yield stability studies in short season maize 1. A descriptive method for grouping genotypes. Can. J. Plant Sci. 58: 1029-1034.

Freeman, G.H. and J.M. Perkins (1975). Environmental and genotype-environmental components of variability. VIII. Relation between genotypes grown in different environments and measure of these environments. Heredity 27: 15-23.

George, H.L.; L.G. Liang; E.G. Heyne and T.L. Walter (1966). Estimates of variety x environment interaction in yield tests of three small grain crops and their significance in breeding program. Crop Sci. 6: 135-139.

Hill, J. (1975). Genotype x environment interaction - a challenge for plant breeding. J. Agric. Sci. Camb. 85: 477-493.

Hill, R.R. and J.E. Baylor (1983). Genotype x environment interaction analysis for yield in alfalfa. Crop Sci. 23: 811-815

Horner, T.W. and K.G. Frey (1957). Methods for determining natural area for oat varietal recommendations. Agron. J. 47: 313-315.

Ibrahim, M.S.A., O.O. El-Nagouly and M.I. Salama (1984). On- farm evaluation for yield stability of naize varieties in Egypt. Administrative Report. Proc. EMCIP. Vol 1: 103- .12.

Johnson, H.W., H.F. Robinson and R.E. Comstock (1955). Estimates of genetic and environmental variability in soybeans. Agron. J. 47: 314-318.

Lin, C.S.; M.R. Binns and L.P. Lefkovitch (1986). Stability analysis: Where do we stand ? Crop Sci. 26: 894-900.

Mead, R., J. Riley, K. Dear and S.P. Singh (1986). Stability comparison of intercropping and monocropping systems. Biometrics 42: 253-266

Murray, J.C. and L.M. Vehalem (1970). Genotype x environment interaction study of cotton in Oklahoma. Crop Sci. 10: 197-199.

Paroda, R.S. and J.D. Hayes (1971). An investigation of genotype-environment interaction for rate of ear emergence in spring barley. Heredity 26: 157-175.

Ragheb, M.M.A., H.Y.Sh. El-Sherbieny, A.A.Bedeer, and S.E. Sadek (1993a). Genotype-environment interaction and stability in grain yield and other agronomic characters of yellow naize hybrids. Zagazig J.Agric. Res. 20(5): 1435-1446.

Ragheb, M.M.A., A.A.Bedeer, A.Sh.Gouda, and Sh.F.Abolsaad (1993b). Phenotypic stability parameters for grain yield and other agronomic characters of white maize hybrids under different environmental conditions. Zagazig J.Agric. Res. 20(5): 1447-1461.

Rowe, P.R. and R.H. Andrew (1964) Phenotypic stability for systematic series of corn genotypes. Crop Sci. 4: 563- 567.

Steel, R.G.D. and J.H. Torrie (1980). Principles and Procedures of Statistics. McGraw-Hill Book Company, New York, Toronto and London.

Westcott, B. (1966). Some methods of analyzing genotype-environment interaction. Heredity 56: 243-253.

ثبات المحصول والتفاعل الوراثي البيئي لبعض الهجن المبشرة من الذرة الشامية الصفراء

مجدي احمد عبد المولى

قسم بحوث الذرة الشامية – معهد بحوث المحاصيل الحقلية – مركز البحوث الزراعية

قدرت درجة ثبات صفات انتاجية محصول الحبوب وعمر النبات عند تاريخ ظهور ٥٠ % من الحريرة وارتفاعي النبات و الكوز فى ثمانية من الهجن الفردية والثلاثية صفراء الحبوب المبشرة الجديدة من الذرة الشامية مقارنة باربعة هجن تجارية أخرى والتى قيمت (جميع هذه الهجن) فى الموسم الصيفى لعام ٢٠١٠ وذلك فى خمس محطات البحوث الزراعية هي سخا ، الجميزة ، سدس ، النوبارية ، ملوى وقد استخدم تصميم القطاعات الكاملة العشوائية فى اربعة تكرارات بكل بيئة. وقد أظهرت النتائج أن التفاعل بين التراكيب الوراثية

والبيئات كان معنويا للصفات تحت الدراسة. وقد اختلف سلوك الهجن موضع الدراسة من حيث كمية المحصول والصفات المدروسة الأخرى اختلافا معنويا بين الجهات ، وكذلك فى التحليل التجميعى. وقد أثر التفاعل بين التراكيب الوراثية والبيئة تأثيرا معنويا على كل من محصول الحبوب والصفات الأخرى موضع الدراسة ، ويرجع جزء كبير من هذا التفاعل الى الإنحدار الخطى ، كما كان الجزء الراجع الى الإنحراف عن الإنحدار الخطى معنويا ولكن متوسط القيمة وذلك فى جميع الصفات موضع الدراسة. أظهرت النتائج ارتفاع قيمة معامل الإنحدار الخطى وزيادتها عن الواحد الصحيح لكثير من الهجن موضع الدراسة مما يدل على ان الهجين الأكثر استجابة وثباتا للظروف البيئية المختلفة يجب ان يكون ذو قدرة محصولية عالية ومتوسط الارتفاع مع انخفاض موقع الكوز. وقد كانت اكثر الهجن ثباتا هي الهجن جيزة ١٣٦ ، ١٣٨ و ٣٢١ بالنسبة لمحصول الحبوب والهجينين جيزة١٣٧،١٣ لتاريخ التزهير و الهجن جيزة ١٣، ٥٢٠، ٥٢٢، و ١٦٦ لارتفاع النبات والهجن جيزة ١٣٥، ١٣٨، ١٦٢ و جيزة ١٦٦ بالنسبة لارتفاع الكوز