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PHENOTYPIC STABILITY PARAMETERS FOR SOME PROMISING YELLOW MAIZE GENOTYPES UNDER DIFFERENT ENVIRONMENTAL CONDITIONS

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ABSTRACT: *This study was mainly aimed to estimate stability parameters for ten promising yellow maize topcrosses. These crosses along with two commercial yellow check hybrids; SC 155 and SC 3084 were evaluated in 2006 growing season under different environmental conditions at Sakha, Gemmeiza, Sids, and Mallawy Agricultural Research Stations to estimate stability parameters for grain yield, days to 50% silking, plant height and ear height. These topcrosses were developed at Gemmeiza Research Farm and constituted in 2005 summer season. Randomized complete block design with four replications was used. Results obtained showed that two single crosses, i.e. SC Gm-1302 x Gm 1021 and SC Gm-1304 x Gm 1021 significantly outyielded the commercial check hybrid SC 155 by 0.41 and 1.56 ard/fad, respectively. Meanwhile, these two crosses were as earlier as the check hybrid SC 3084 and were medium in plant and ear height. Highly significant genotype x environment interaction was detected for all studied traits. A larger portion of this interaction was accounted for the linear regression on the environmental means. The magnitude of non linear components was considerably small. Stability parameters indicated that five single crosses, i.e. SC Gm-1302 x Gm 1021, SC Gm-1303 x Gm 1021, SC Gm-1304 x Gm 1021, SC Gm-1308 x Gm 1021, and SC Gm-1310 x Gm 1021 possess high yielding potential and earliness, as well as medium in plant and ear heights. These hybrids were more responsive to a wide range of environments. In other words, these hybrids could be the most stable hybrids across all locations, since they had small and insignificant deviations from linearity. These five hybrids would be recommended as stable, high yielding hybrids and/or incorporated as breeding stocks for further use.*

Key words: *Yellow Maize, Hybrids, Genotypes, Environments, Stability.*

INTRODUCTION

Developing high yielding yellow single crosses is considered among the main target of national maize program to fulfill the wide spreading of yellow maize hybrids across Egypt. The new hybrids must be tested in multi-location trials which play an important role in plant breeding and agronomic research. Therefore, the new hybrids must show high performance for yield over a wide range of environmental conditions. Crossa (1990) stated that the main objectives of these trials are to accurately estimate and predicted yield

based on limited experimental data and determine yield stability and the pattern of response of genotypes across environments. The terms phenotypic stability, yield stability and adaptation are often used in quite different senses. Different concepts and definitions of stability have been described by several workers (Lin *et al*, 1986; Backer and Léon, 1988).

However, Heinrich, *et al*, 1983; Lin *et al*, 1986 and Backer and Léon, 1988) reported that a stable genotype possesses an unchanged performance regardless of any variation of the environmental conditions and the superior hybrids have to be highly stable and possess a great yield potential. The instability of genotype under different environments is due mainly to high genotype environmental interactions (GEI). In yellow hybrid maize breeding, the choice of a suitable hybrids is subject to two considerations, (1) high grain yield across a wide range of environments, and (2) consistency of performance over environments. Consistency of performance is dependent mainly on the genotype x environment interaction (GEI). Hybrids, which show less GEI are described as more stable or well buffered. Stability of yield is defined as the ability of genotype to avoid substantial fluctuations in yield over a range of environments (Freeman, 1973; Francis and Kannenburg, 1978; Fernandez, 1991 and Hohls *et al*, 1995).

Evaluation of new maize hybrids under different locations or environments would provide maize breeders with important information about the performance of these hybrids and whether they behave similarly or differently to different environments. Plant breeders are more interested in hybrids that are not affected much by environment to environment variations, *i.e.* the stable hybrid(s). Some hybrids, however, show their best performance at certain locations. Evaluation of these hybrids on the average basis over different locations would underestimate their productivity of such hybrids were grown at their best performing environments. Although the phenotype of an individual is determined by both genotype and environment, these two effects are not always additive (Perkins and Jinks, 1968 and Hohls *et al*, 1995).

The regression deviation method was first proposed by Eberhart and Russell (1966) and Perkins and Jinks (1968). This analysis generates both a λ-value, which corresponds to the b-value and the deviation value, s^2d_i. However, Freeman (1973), Lin *et al*, (1986), Baker (1988) and Becker and Léon (1988) mentioned that stability analysis provides a general summary of the response patterns of genotypes to environmental changes. The main type of stability analysis, termed Joint regression analysis involves the regression of genotype means on an environmental index. Joint regression analysis provides a means of testing whether the genotypes have characteristic linear responses to environmental change. It also has been widely used and reviewed by many investigators (Finlay and Wilkinson, 1963; Eberhart and Russel, 1966; Perkins and Jinks, 1968; Shukla, 1972, Hardwick and Wood, 1972; Freeman, 1973; and Hohls *et al*, 1995). However, Freeman and Perkins

(1971), Hill (1976), Westcott (1986), Crossa (1988), Ragheb *et al* (1993 a & b), Abd El-Aziz (2000) and Mahmoud and Atia (2005) 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 variation 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 caused by more permanent features, while the unpredictable variations are caused by year to year fluctuations in weather, insect infestation and disease infection. On the other hand, George *et al* (1966), Dhillon and Singh (1977), Francis and Kannenberg (1978), suggested that the environmental variations can be minimized by grouping the locations into regions of similar environmental conditions to reduce the magnitude of genotype x environment interaction within region,. They obtained a highly significant genotype x environment interaction, even after grouping the environments into regions of similar climatic conditions. Eberhart and Russel (1966) stressed that the most important stability parameters was the deviation from linear regression mean square because all types of gene action were involved in this parameter. Lin *et al* (1986) reported that a particular genotype may be considered to be stable if (i) its deviation among environments variance is small, (ii) its response to environments is parallel to the mean response of all genotypes in the trial or (iii) the residual mean square from regression model on the environmental index is small. However, in highly heterogeneous environments subdivision may be necessary to maximize performance (and genetic gain) in each environment. The stability analysis can be a powerful tool to examine the regional variation and to divide regions into sub-regions.

The objective of this study was to estimate stability degree of some promising yellow maize top (single) crosses for grain yield, days to 50% silking, plant height and ear height at different environments.

MATERIALS AND METHODS

Ten promising yellow maize single crosses were developed at Gemmeiza Research Station, ARC by crossing the highly GCA common parent inbred line "Gm 1021" with 10 promising yellow maize inbred lines derived from different heterotic groups, *i.e.* Gm-1301, Gm-1302, Gm-1303, Gm-1304, Gm-1305, Gm-1306, Gm-1307, Gm-1308, Gm-1309 and Gm-1310 respectively. These hybrids were constituted in 2005 growing season. The resultant 10 single crosses along with two commercial yellow check hybrids; SC 155 and Pioneer SC 3080 were evaluated in replicated yield trials conducted at four locations (environments), *i.e.* Sakha (Env-1), Gemmeiza (Env-2), Sids (Env-3) and Mallawy (Env-4) Agricultural Research Stations, ARC, Egypt in 2006 growing season. Randomized complete block design with four replications was used. Plots were consisted of two ridges, 6 m long and 80 cm apart.

Planting was done in hills spaced 25 cm along the ridge. Two grains were planted per hill and thinned to one plant/hill before the first irrigation, giving a plant density of 22000 plants per faddan (Faddan= 4200m^2). Nitrogen fertilizer in urea form, 120 kg N/fad was splitted into two equal doses and was applied before the first and second irrigation. Phosphorus and potassium were broadcasting at the rate of 30 kg P_2O_5 and 24 kg K_2O for all plots before sowing irrigation. All other cultural practices for maize production were applied as recommended. Ears were harvested at maturity, weighed and about 5 kg/plot were taken for measuring moisture percentage. Grain yield was adjusted to 15.5% moisture content and recorded in ardab/faddan (ard/fad), where one ardab=140 kg. Data were recorded for adjusted grain yield in ard/fad, number of days to 50% silking, plant height and ear height. The four studied traits were statistically analyzed for each location and combined (Steel and Torrie, 1980). Stability analysis for these traits across all locations was performed according to the following model of Eberhart and Russel (1966):

$$Y_{ij} = U_i + \beta_i I_j + \sigma_{ij}$$

Where:

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

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

β_i = 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.

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

RESULTS AND DISCUSSION

Test of homogeneity of the error mean squares across all locations was not significant indicating that selection of these locations was not biased. Hence, the combined analysis was performed in this study. It is worth noting that the locations used provided a wide range of environments (Table 1).

Results obtained in Tables 1 and 2 indicate that the average grain yield (ard/fad), days to 50% silking, plant height and ear height for the ten maize hybrids and two checks differed greatly and significantly from one location to another. Based on the combined data across all locations, it ranged from 23.07 to 29.33 ard/fad, 59.2 to 61.4 days, 254.3 to 273.5 cm and 140.9 to 158.0 cm for grain yield, silking date, plant height and ear height, respectively. Coefficient of variation (CV%) were below 10% for all experiments. Allard and Bradshaw (1964), Ibrahim *et al* (1984), Ragheb *et al* (1993 a & b) and Abd El-Aziz (2000) observed that the differences in mean performance of a particular set of genotypes are considered to be mainly due to the use of those new improved varieties or hybrids and the differences among locations can be mainly attributed to the farmer factor, as well as the variation in soil fertility

and varied cultural procedures. The environmental index for all traits was calculated as the difference between the location mean and the mean over all locations. For the four studied traits, the indices covered a wide range and displayed a good distribution within this range. Therefore, the assumption for stability analysis is fulfilled as suggested by Perkins and Jinks (1968) and Eberhart and Russell (1966).

Table (1): Mean squares and degrees of freedom for grain yield and other agronomic traits maize hybrids evaluated under different environmental condition.

S.O.V.	DF	Grain yield	Days to 50% silking	Plant height	Ear height
Combined					
Environments(Env)	3	472.6**	817.6**	7088.8**	4043.1**
Rep (Env)	12	5.7	4.1	214.9	191.6
Genotypes (G)	11	45.0**	8.4**	481.8**	412.6**
G x Env	33	29.9**	3.2**	114.1**	83.6**
Pooled error	132	4.6	1.6	60.5	35.4
CV%		7.77	2.12	2.96	3.91
Sakha (Env-1)					
Rep's	3	3.7	5.2	335.1	521.4
Genotypes (G)	11	11.2	5.7	330.0**	297.7**
Error	33	6.6	4.3	140.1	71.2
CV%		8.35	3.16	4.29	5.26
Gemmeiza (Env-2)					
Rep's	3	1.99	1.14	54.41	7.63
Genotypes (G)	11	78.87**	3.20**	195.52**	254.23**
Error	33	1.54	0.44	18.38	9.47
CV%		4.34	1.20		2.01
Sids (Env-3)					
Rep's	3	9.67	8.22	231.80	76.25
Genotypes (G)	11	10.14**	0.70	224.43**	68.54**
Error	33	4.27	0.49	43.19	24.89
CV%		8.86	1.17	2.00	3.59
Mallawy (Env-5)					
Rep's	3	7.391	1.639	238.188	161.361
Genotypes (G)	11	34.621**	8.265**	74.157	42.856
Error	33	6.177	1.336	40.339	36.134
CV%		8.77	1.90	2.47	3.86

*, ** indicate significant at 0.05 and 0.01 levels of probability, respectively

Table (2): Average grain yield (ard/fad), days to 50% silking, plant height (cm) and ear height (cm) of twelve elite new maize hybrids evaluated under four environments, 2006 growing season.

Entry	ENV -1	ENV -2	ENV -3	ENV -4	Mean	ENV -1	ENV -2	ENV -3	ENV -4	Mean
	Grain yield (ard/fad)					Days to 50% silking				
SC Gm-1301xGm1021	29.0	27.6	24.5	30.4	27.88	65.0	54.3	60.0	60.8	60.0
SC Gm-1302xGm 1021	33.4	27.9	22.6	30.8	28.68	64.5	55.8	60.3	58.8	59.8
SC Gm-1303xGm 1021	29.3	29.1	22.8	30.9	28.01	67.0	55.8	60.3	60.3	60.8
SC Gm-1304xGm 1021	31.2	29.1	27.5	31.5	29.83	66.0	56.0	61.0	61.0	61.0
SC Gm-1305xGm 1021	28.7	31.4	21.3	26.1	26.89	67.0	55.5	60.3	61.3	61.0
SC Gm-1306xGm 1021	31.5	30.1	24.6	28.6	28.70	67.5	54.8	60.0	60.3	60.6
SC Gm-1307xGm 1021	28.8	30.6	20.7	25.7	26.44	66.0	57.3	60.3	62.3	61.4
SC Gm-1308xGm 1021	30.0	31.2	22.6	29.6	28.36	64.8	55.0	59.3	59.3	59.6
SC Gm-1309xGm 1021	30.7	31.1	22.6	30.1	28.62	64.0	54.5	59.8	58.5	59.2
SC Gm-1310xGm 1021	32.7	15.0	23.0	21.6	23.07	64.3	55.3	60.3	59.0	59.7
SC 155	30.6	29.7	23.9	28.8	28.27	65.3	54.3	60.3	61.0	60.2
Pioneer 3080	30.1	30.0	25.9	25.8	27.95	64.5	56.3	60.5	63.3	61.1
Mean	30.5	28.6	23.3	28.3	27.68	65.5	55.4	60.2	60.5	60.4
LSD 0.05	3.69	1.78	2.97	3.56	1.49	ns	0.95	ns	1.66	0.9
0.01	4.95	2.39	3.98	4.79	1.94	ns	1.28	ns	2.23	1.1
Entry	Plant height (cm)					Ear height (cm)				
SC Gm-1301xGm1021	282.8	266.8	252.0	175.8	264.4	107.1	114.3	114.3	93.6	155.9
SC Gm-1302xGm1021	282.8	267.8	248.0	146.8	263.4	156.0	142.0	140.4	88.0	153.9
SC Gm-1303xGm1021	275.8	268.0	256.3	160.5	265.9	123.0	114.9	114.4	89.4	151.6
SC Gm-1304xGm1021	291.8	280.3	262.5	148.5	273.5	133.0	141.4	138.5	83.9	158.0
SC Gm-1305xGm1021	278.0	270.3	250.0	142.3	266.2	126.2	127.8	118.0	92.2	155.8
SC Gm-1306xGm1021	270.3	260.0	234.0	162.0	254.3	121.9	104.7	115.2	86.7	145.0
SC Gm-1307xGm1021	274.3	255.8	243.8	162.8	256.8	108.8	105.5	101.9	93.2	149.8
SC Gm-1308xGm1021	258.8	276.5	241.0	162.5	257.5	108.1	103.6	98.8	84.0	150.5
SC Gm-1309xGm1021	264.5	266.3	244.3	146.8	257.8	119.0	117.6	115.4	96.6	155.2
SC Gm-1310xGm1021	285.5	271.3	254.8	174.3	267.6	151.5	135.7	131.7	94.3	157.1
SC 155	274.0	277.8	248.8	148.8	265.3	99.5	105.4	97.0	81.2	151.9
Pioneer 3080	274.0	268.8	248.0	166.8	261.3	99.5	100.0	100.6	83.9	140.9
Mean	276.0	269.1	248.6	158.1	262.8	121.1	117.7	115.5	88.9	152.1
LSD 0.05	17.0	6.15	10.7	10.3	5.39	12.1	4.4	7.2	8.6	4.12
0.01	22.8	8.26	12.7	12.2	7.04	16.3	5.9	9.6	11.6	6.23

Based on the combined data, the ten maize hybrids differed significantly with respect to all studied traits across all locations (Table 1). Considering grain yield, the obtained data in Table (2) showed that the yellow single cross hybrid; SC Gm-1304 x Gm 1021 produced the highest grain yield (29.83 ard/fad) and significantly outyielded the commercial yellow check hybrid SC 155 and SC 3084 by 1.56 and 1.88 ard/fad, respectively. Moreover, five single crosses of lines G-1302, Gm-1303, Gm-1306, Gm-1308 and G1309 x Gm 1021 produced high grain yield and did not significantly differ from the highest check hybrid SC 155 (Table 2). Respecting days to 50% silking, four single crosses, *i.e.* Gm-1302 x Gm-1021, Gm-1308 x Gm-1021, Gm-1309 x Gm-1021 and Gm-1310 x Gm-1021 exhibited the lowest number of days to 50% silking and were insignificantly earlier than either the two check hybrids. However, three of them produced high grain yield. For plant height, the four crosses of between Gm 1021 and each Gm-1306, Gm-1307 Gm-1308 and Gm-1309 possessed the shortest plants (254.3, 256.8, 257.5 and 257.8 cm, respectively. These crosses were also significantly shorter than either of the two check hybrids. However, the first three crosses exhibited the lowest ear placement.

Results obtained in Tables (1 and 3), reveal that the genotypes x environment interaction (GEI) for grain yield and other studied traits was highly significant. In this regard, Eberhart and Russell (1966), Freeman and Perkins (1971), El-Nagouly, *et al* (1980), Ibrahim *et al* (1984), Ragheb *et al* (1993 a & b) Abd El-Aziz (2000) and Mahmoud and Atia (2005) stated that the basic cause of the differences among genotypes in their yield stability is the wide occurrence of genotype x environment interaction (GEI). Such significant interactions encourage maize breeders to develop high yielding and more uniform hybrids under varied environmental conditions. High yield potentiality and average stability are due to most attributes involved in determining the wide adaptation of a new variety or hybrids (Eberhart and Russell, 1966 and Crossa, 1988).

The significant linear effect of environments (Table 3) for grain yield and other three studied traits revealed that locations (environments) differed remarkably in their effects on the performance of evaluated genotypes, and all hybrids responded differently within the specific range of varied locations. Significant pooled deviation, on the other hand, was obtained for grain yield ear and plant height. This means that the deviation of all genotypes from linearity was significant and more obvious. These results are in the same line with those obtained by Shukla (1972); Vasil and Milas (1984) and Abd El-Aziz (2000).

Estimates of various stability parameters for all studied genotypes (10 new single cross hybrids as well as two checks) with respect to grain yield, days to 50% silking plant height and ear height are presented in Table (4) and Figure 1. These parameters are 1. average of different genotypes over all environments, 2. regression coefficient (b) of the average performance on environmental indices, and 3. squared deviation (S^2_d) of the average from

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. However, Johnson, *et al* (1955), Paroda *et al* (1973) 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.

Table (3): Stability analysis of variance for grain yield, days to 50% silking, plant height and ear height of 10 promising yellow single cross hybrids and 2 check hybrids evaluated under different environmental conditions, 2006 season.

S.O.V	DF	Grain yield	Days to 50% silking	Plant height	Ear height
Total	47	15.433**	14.039**	161.336**	103.330**
Genotypes (G)	11	11.260**	2.088**	120.461**	103.161**
Env + G x E	36	16.708**	17.690**	173.826**	103.381**
Env. (linear)	1	354.442**	610.682**	5316.563**	3032.339**
G x E (linear)	11	1.476	0.9291*	13.346	11.949
Pooled deviation	24	9.616**	0.6648	33.098*	23.248*
SC Gm-1301x Gm 1021	2	2.971	0.430	25.738	5.702
SC Gm-1302x Gm 1021	2	2.791	0.897	14.696	10.752
SC Gm-1303x Gm 1021	2	4.506**	0.511	3.320	12.144
SC Gm-1304x Gm 1021	2	2.053	0.026	51.127	29.784
SC Gm-1305x Gm 1021	2	8.738**	0.166	19.420	8.917
SC Gm-1306x Gm 1021	2	0.404	0.378	19.134	9.193
SC Gm-1307x Gm 1021	2	6.893**	0.797	38.128	37.946*
SC Gm-1308x Gm 1021	2	3.821	0.144	152.767**	21.244
SC Gm-1309x Gm 1021	2	3.000	0.619	18.952	13.855
SC Gm-1310x Gm 1021	2	71.673**	0.610	19.013	14.527
SC 155	2	0.372	0.501	31.991	19.608
Pioneer 3080	2	8.174**	2.897**	2.890	95.301**
Pooled error	144	1.182	0.461	18.343	12.109
CV %		7.77	2.12	2.96	3.91

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

Table (4). Stability parameters for grain yield, days to 50% silking, plant height and ear height of 10 promising yellow single cross hybrids and 2 check hybrids evaluated under different environmental conditions, 2006 season

Genotypes	Grain yield (ard/fad)			Days to 50 % silking			Plant height			Ear height		
	Aver age	b	S^2_d	Aver age	b	S^2_d	Aver age	b	S^2_d	Aver age	b	S^2_d
1. SC Gm-1301xGm 1021	27.88	1.585	1.79	60.0	0.967	-0.03	264.4	1.185	7.40	155.9	0.686	- 6.41
2. SC Gm-1302xGm 1021	28.68	1.536	1.61	59.8	1.395	0.44	263.4	0.895	- 3.65	153.9	0.942	- 1.36
3. SC Gm-1303xGm 1021	28.01	1.952	3.32**	60.8	1.053	0.05	265.9	0.425	- 15.02	151.6	1.001	0.04
4. SC Gm-1304xGm 1021	29.33	1.318	0.87	61.0	0.239	-0.43	273.5	1.670	32.78	158.0	1.568	17.68
5. SC Gm-1305xGm 1021	26.89	2.718	7.56**	61.0	0.600	-0.29	266.2	1.029	1.08	155.8	0.858	- 3.19
6. SC Gm-1306xGm 1021	28.70	0.585	- 0.78	60.6	0.907	-0.08	254.3	1.021	0.79	145.0	0.871	- 2.92
7. SC Gm-1307xGm 1021	26.44	2.414	5.71**	61.4	1.316	0.34	256.8	1.442	19.79	149.8	1.770	25.84*
8. SC Gm-1308xGm 1021	28.36	1.798	2.64	59.6	0.560	-0.32	257.5	2.886	134.42**	150.5	1.325	9.14
9. SC Gm-1309xGm 1021	28.62	1.593	1.82	59.2	1.160	0.16	257.8	1.016	0.61	155.2	1.070	1.75
10. SC Gm-1310xGm 1021	23.07	7.786	70.49**	59.7	1.151	0.15	267.6	1.018	0.67	157.1	1.095	2.42
11. SC 155	28.27	0.561	- 0.81	60.2	1.043	0.04	265.3	1.321	13.65	151.9	1.273	7.50
12. Pioneer 3080	28.68	2.629	6.99**	61.1	2.508	2.44**	261.3	0.397	- 15.45	140.9	2.805	83.19**

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

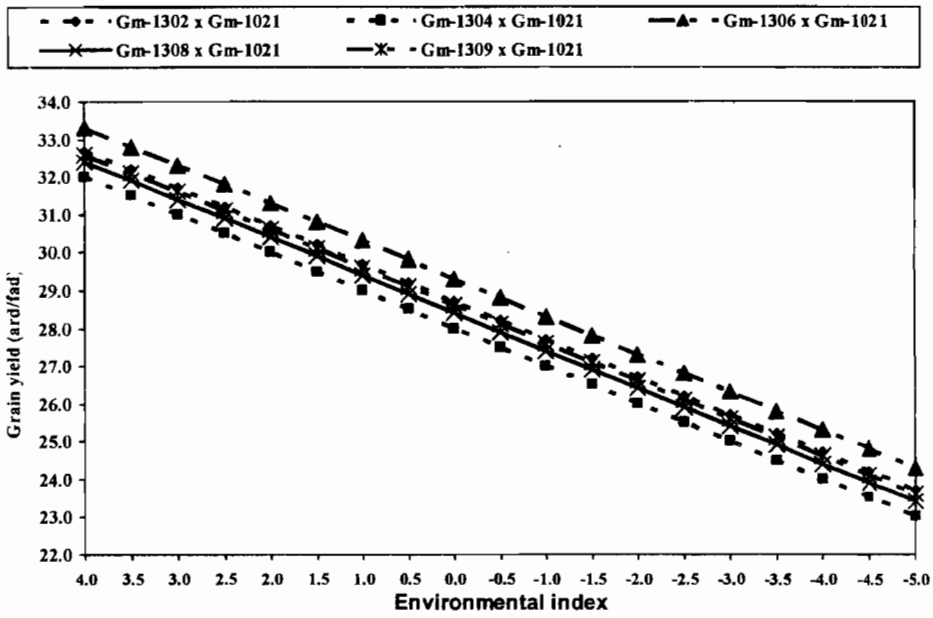

Fig (1). Response of new yellow maize single crosses to different environmental conditions.

The regression analysis (Table 4), shows that each hybrid had a (b) value equal to one indicating their linear response to environmental indices (Fig 1). On the other hand, the highly significant pooled deviation for grain yield and plant and ear height indicated that some 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), the hybrids SC Gm-1301 x Gm 1021, SC Gm-1302 x Gm 1021, SC Gm-1304 x Gm 1021, SC Gm-1308 x Gm 1021and SC Gm-1309 x Gm 1021 would be considered the most stable hybrids with respect to grain yield, since the regression coefficient values of the average of these crosses on the environmental index are approximately equal one, and their deviations from linearity are small and insignificant (Table 4). For days to 50% silking, all studied crosses, except the four single cross hybrids of inbred lines Gm-1304, Gm-1305, Gm-1308 x Gm-1021 as well as Pion 3084 were considered to be the most stable hybrids (towards earliness) across all locations, since it possessed small and insignificant deviations (-0.03, 0.44, 0.05, -0.08, 0.34, 0.16, 0.15 and 0.04, respectively). With respect to plant height (Table 4), six out of the ten studied single cross hybrids, *i.e.* Gm-1301 x Gm-1021, G-1305 x Gm-1021, Gm-1306 x Gm-1021, Gm-1309 x Gm-1021, Gm-1310 x Gm-1021 and Gm-1311 x Gm-1021 would be considered the most stable hybrids across all

locations, since they had small and insignificant deviations. However, all hybrids which had significant deviations were considered to be unstable across all locations. For ear height, another six single cross hybrids, *i.e.* Gm-1302 x Gm-1021, Gm-1303 x Gm-1021, Gm-1305 x Gm-1021, Gm-1306 x Gm-1021, Gm-1309 x Gm-1021, Gm-1310 x Gm-1021 were considered stable genotypes across all locations, since it possessed low and insignificant values of deviation and the values of regression coefficient were around one (Table 4).

Generally, six single crosses, *i.e.* Gm-1302 x Gm-1021, Gm-1303 x Gm-1021, Gm-1304 x Gm-1021, Gm-1306 x Gm-1021, Gm-1308 x Gm-1021 and Gm-1309 x Gm-1021 produced high gain yield (28.68, 28.01, 29.33, 28.70, 28.36, and 28.62, respectively). It were earlier in silk appearance and medium in plant height with low ear placement as compared to the commercial check hybrid SC 155 and Pion 3084. These hybrids were more responsive to a wide range of environments and could be the most stable hybrids, since they had small and insignificant deviations, and had the highest yielding potentiality. These six hybrids might be recommended to be released as stable high yielding resistant hybrids and/or incorporated as breeding stock for further use.

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إحصاءات الثبات المظهري لبعض التراكيب الوراثية المبشرة من الذرة الشامية الصفراء

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الملخص العربي

تهدف هذه الدراسة الى تقدير درجة الثبات الوراثى لبعض الهجن الفردية الصفراء المبشرة . فقد تم تقييم عدد ١٠ هجن فردية صفراء الحبوب تم استنباطها بمحطة بحوث الجميزة موسم عام ٢٠٠٥ ، بالإضافة الى هجينين تجاريين صفراء الحبوب للمقارنة هما هـــ.ف. ١٥٥ ، هـــ.ف. بيونير ٣٠٨٤ وذلك تحت ظروف بيئية مختلفة فى محطات البحوث الزراعية بسخا ، والجميزة ، وسدس ، وملوى فى موسم النمو ٢٠٠٦ لتقدير درجة ثبات كل من محصول الحبوب وتاريخ ظهور ٥٠% حريرة وإرتفاع كل من النبات والكوز وذلك باستخدام تصميم قطاعات كاملة العشوائية فى أربع مكررات. أظهرت النتائج المتحصل عليها أن الهجينان الفرديان Gm-1302 x Gm-1021, Gm-1304 x Gm-1021 تفوقا معنويا فى المحصول على محصول هجين المقارنة الفردى الأصفر هـــ.ف. ١٥٥ بمعدل زيادة قدرة ٠,٨ إردب/فدان لكل منهما ، وفى نفس الوقت فقد كانا مبكرين معنويا عن هجين المقارنة التجارى هـــ.ف. بيونير ٣٠٨٤ وكذلك أظهرا ارتفاع نبات وكوز متوسطين. وكان التفاعل بين التراكيب الوراثية والبيئية معنويا لكل 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 عدا صفة التزهير وارتفاع الكوز ، وقد أظهرت النتائج ارتفاع قيمة 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. على مستوى جميع الجهات ، كما أظهرت خمسة هجن فردية هى Gm-1302 x Gm-1021, Gm-1303 x Gm-1021, Gm-1304

x Gm-1021, Gm-1308 x Gm-1021 and Gm-1310 x Gm-1021 قدرة محصولية عالية مع التبكير فى التزهير ، وإنخفاض ارتفاع كل من النبات والكوز حيث كانت هذه الهجن أكثر استجابة للنمو فى مختلف الظروف البيئية ، بمعنى آخر تعتبر هذه الهجن أكثر الهجن ثباتا فى مختلف الظروف البيئية حيث كانت قيمة معامل الإنحدار الخطى لكل منها مساوية للواحد الصحيح تقريبا وكذلك كانت قيم الإنحراف عن الأنحدار الخطى لها غير معنوية.