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STABILITY PARAMETERS AND PERFORMANCE OF SOME NEW WHITE MAIZE GENOTYPES

M.E.M. Abd El Azeem, M.A. Abd El Moula, H.A.A. Gamea and A.A. Abd El Mottalb

Maize Research Dept., Field Crops Research Institute, ARC, Giza, Egypt.

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ABSTRACT: *This study aimed to the investigate the performance and stability across five locations i.e. Sakha, Gemmeiza, Sids, Mallawy and Nubaria of 19 genotypes of maize and two commercial check hybrids SC-10 and SC-128 during 2011 season. A randomized complete block design with 4 replications was used at each environment. Hybrid x environment interaction for the studied characters was highly significant; Eberhart and Russell, (1966) model was used to estimate different stability parameters. Genotype-environment interaction (GxE) was highly significant for all studied traits. A large portion of this interaction was accounted by linear regression on the environmental means. The non-linear components magnitude was considerably small. All hybrids exhibited significant linear response to environmental conditions. The white genotypes G4, G6, G10, G12, G14, G16, G17, G18 and G19 outyielded the check hybrid SC 10. Out of these genotypes i.e. G6 and G14 significantly out-yielded the check hybrid SC-10 (35.08 and 35.28 vs 31.69 ard fed^{-1}) but not significant than SC 128. Genotyp G4, G15 and SC-128 would be the most stable genotypes 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.*

Key words: *Maize (Zea maysl.), corn, genotype x 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 new adapted variety for wide range regions cultivation.

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. Elto and Hallauer (1980) found that the simple correlations between mean yield and regression coeffecient and mean yield and deviation from regrrision were highly significant. On the other hand, many investigators proved that the environmental variations can be classified into predictable and unpredictable variations (Allared and Bradshaw, 1964, El-Nagouly *et al*, 1980, and Mead *et al*, 1986). The predictable one 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 Abdallah *et al.* 2011) 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 Hayes, 1971) soybean (Johnson *et* al, 1955) and maize (Finlay and Wilkinson, 1963, El-Nagouly *et al*, 1980 and Abdallah *et al* 2011). However, the modified model of Eberhart and Russell (1966) was widely used by various investigators (Rowe and Andrew, 1964; Eberhart and Russell, 1969; Paroda and Hayes, 1971; El-Nagouly *et al.* 1980 and Ibrahim *et al*. 1984, Barakat and Abd El-Aal, 2007, El-Sherbieny *et al*, 2008 and Abd El-Moula 2011). 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 parameters. Lin *et al*. (1986) reported that particular genotype may considered to be stable (i) if its among environments variance is small, (ii) if its 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 identify the superior stable hybrids for grain yield, days to 50 % silking, plant height, and ear height of 21 white maize genotypes or hybrids evaluated over five locations across Egypt during 2011 summer season.

MATRIALS AND METHODS

Ninteen new white maize along with two check hybrids (S.C. 10 and SC 128) were evaluated in 2011 season at five environments across Egypt (Sakha, Gemmeiza, Sids, Mallawy and Nubaria,). These hybrids were white single 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 inner two 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 25000 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 /fed) adjusted to 15.5 % moisture (ardab = 140 kg). 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 (1969). Stability analysis for these four characters across all locations was performed according to the following model of Eberhart and Russell (1966):

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

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.

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

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

The stability parameter postulated by Wricke (1962) depends on (GE) Ik effects, which squared and summed across all environments that was denoted as ecovalence (W_i). It may be estimated as follows:

$Wi = \sum(X_{lk}-X_{l.}-X_{.k}=X..)2 /(E-1)$

X_{lk} = The interaction of genotype 1 with environment k.

$X_{i.}$= The genotype mean for 1 genotype across used environments.

$X_{.k}$= The environmental mean for k environment or genotypes mean in this environment.

X..= The general over all mean.

Coefficient of determination (R^2) were computed by individual linear regression analysis (Pinthus, 1973). Also, for each genotype, stability was measured by combining the coefficient of variation CV and mean yield (Francis and Kannenberg 1978). Genotypes with a low CV and high yield were regard as the most desirable.

RESULTS AND DISCUSSION

Analysis of variance

The results of combined ANOVA for each trait give an overall picture of the relative magnitudes of G, E and G x E variance terms (Table 1). In these data, the environment was always the most important source of variation, accounting for 63.26% (of grain yield), 71.33% (of days to 50% silking), 87.61% (of plant height) and 81.93% (of ear height) of total variation. The high variation due to environmental differences is expected in Multi-environment trials (MET) conducted through several locations or years (Yan and Kang 2003). The G x E interaction was also considerably higher than the variability attributable to genotype variation for grain yield and ear height.

Homogeneity test of error mean squares across locations was not significant 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 3 and 4 indicate 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 27.63 to 35.28 ard/fed for grain yield, 60.15 to 64.35 days for silking date, 234.25 to 257.10 cm for plant height, and 120.80 to 143.20 cm for ear height.

The 21 maize hybrids (19 new hybrids and two check hybrids SC-10 and SC-128) differed significantly with respect to all studied traits across all locations (Table 3). On the basis of across all locations mean, the white genotypes G4, G6, G10, G12, G14, G16, G17,

G18 and G19 outyielded the check hybrid SC 10. Out of these genotypes there were G6 and G14 significantly out-yielded the check hybrid SC-10 (35.08 and 35.28 vs 31.69 ard fed^{-1}) but not significant than SC 128.

Table 1. Analysis of variance of grain yield and other studied traits for 21 genotypes planted at five locations.

S.O.V	df	Grain yield		Days to 50% silking	
		MS	%TSS	MS	%TSS*
Locations (L)	4	3901.69**	63.26	1317.90**	71.33
Genotypes (G)	20	95.00**	7.70	44.68**	12.09
(G x L)	80	42.09**	13.65	7.94**	0.086
Error	120	11.06		1.54	
S.O.V	Df	Plant height		Ear height	
		MS	%TSS	MS	%TSS
Locations (L)	4	217623.14**	87.61	109311.68**	81.93
Genotypes (G)	20	1408.24**	0.028	740.50**	0.027
(G x L)	80	306.98**	0.024	238.09**	0.035
Error	120	166.66		140.72	

*, **, significant at 5% and 1% level of probability respectively. TSS, reefer to total sum of squares.

Genotype x location interaction for the four studied traits was highly significant (Table 2), except of plant height. 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). El-Nagouly *et al*. (1980), Ibrahim *et al*. (1984) and El-Sherbieny *et al* (2008) obtained samilar results.

Significant linear effect of the locations and genotype x location (Table 2) for all traits revealed that locations (locations) differed remarkably in their effect on the performance of evaluated genotypes and all genotypes 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 more obvious.

Table 2. Mean squares from analysis of variance for stability of grain yield and other studied traits for 19 genotypes and tow check hybrids, planted at five locations.

S.O.V	df	Grain yield	Days to 50% silking	Plant height	Ear height
Genotypes (G)	20	95.47**	44.68**	1353.74**	1403.42**
Locations(L)+(HxL)	84	225.02**	70.32**	10604.31**	6081.21**
L (Linear)	1	15503.50**	5271.60**	868703.22**	404698.41**
G x L (Linear)	20	62.09**	12.80**	225.01	853.11**
Pooled deviation	63	34.23**	6.03**	278.71**	1413.67**
G1	3	39.92*	1.22	231.95	378.81*
G2	3	25.64	2.41	277.81	101.70
G3	3	25.93	0.40	193.96	51.96
G4	3	16.70	2.38	87.42	40.50
G5	3	19.65	2.04	89.28	267.52
G6	3	50.80**	0.25	43.98	129.04
G7	3	34.50*	13.32**	467.89*	13.16
G8	3	50.89**	15.55**	467.46*	80.38
G9	3	33.77*	1.35	196.09	518.83*
G10	3	35.52*	1.77	225.90	166.31
G11	3	36.68*	3.34	557.71*	662.92**
G12	3	18.69	10.38**	317.96	371.79*
G13	3	2.02	9.34**	436.28	472.77*
G14	3	50.19**	7.36**	530.75*	1088.85**
G15	3	21.26	0.53	314.35	452.31*
G16	3	40.90*	12.93**	513.95*	184.27
G17	3	40.61*	3.40	170.07	218.80
G18	3	50.26**	2.38	309.99	454.94*
G19	3	31.36*	4.78*	82.94	23511.30**
SC-10	3	90.12**	1.31	191.02	417.96*
SC-128	3	3.32	30.12**	146.18	102.93
Pooled error	300	11.06	1.54	166.66	140.72

*, **, significant at 5% and 1% level of probability respectively.

Environmental index for all traits (Table 3) 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. Results shwed that Sahka follwed by Mallawy locations were the most favorable environment, which was linked to the heighest mean grain yield, while Nubaria was the poorest yielding environment. This suggests that the performance of the tested genotypes varied from one environment to another.

Estimates of various stability parameters of the 21 maize hybrids with respect to grain yield, days to 50 % silking, and plant and ear height are presented in Table (3 and 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, 3. the squared deviation (S^2_d) from the regression, 4. coeffecient of variation (CV%), 5. coeffecient of determination (R^2) and 6 percentage of ecovilance (W_i%) . 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 (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) showed that eight genotypes *i.e.,* G5, G9, G13, G16, G17, G18, G19 and SC-128 had a (b) value equal to approximately one indicating their linear response to environment was high, whereras three crosses, *i.e.* G1, G3 and G7 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 2), indicated 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), genotyp G4, G15 and SC-128 would be the most stable genotypes 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. Genotypes G12 and G14 had the highest value of regression coeffecient (bi=1.58 and 1.29 respectively) and had average grain yield exceeded the general mean (31.69 ard fed^{-1}) indicating its high performance under favourable environments.

Table 3: Estimates of environmental index for grain yield at five locations.

Environments (Locations)	environmental index			
	Grain yield (ard/fed)	Days to 50% silking (days)	Plant height (cm)	Ear height (cm)
Sakha	10.01	-1.01	57.34	28.67
Gemmeiza	0.67	-4.02	31.84	37.12
Sids	-4.54	3.47	-18.54	-20.67
Mallawy	1.65	-3.47	4.66	5.46
Nubaria	-7.78	5.03	-75.32	-50.57

TABLE 4

The ecovelence (Wi%) estimates according to Wricke (1962) can be considered as a whole estimates of stability. A low percentage of Wi% would indicate a high stability of performance. Thus, SC-128, G13, G4 and G5 is the most stable genotypes. Genotype G3 and SC-10 are highly unstale showing the highest Wi% (11.46 and 10.75, respectivily). The coeffecient of deterrmination (R^2) ranged from 0.54 to 0.99 for grain yield suggesting that a large portion of variation for this trait could be attributed to linear regrrision on environmental index. The most stable genotypes had the highest coeffecient of determination were G4, G5, G11, G12, G13, G15 and SC-128.

For days to 50% silking date ranged from 60.15 for genotype G5 to 64.60 days for SC 10. Five genotypes i.e. G2, G3, G5, G6 and G8 were considered to be the most stable hybrids (toward earliness) across all locations, since they possessed small and insignificant deviation from linearity, low CV%, highe R^2 , low Wi%.

With respect to plant height, five hybrids, i.e.G7, G8, G11, G14, and G16 were considered to be the unstable hybrids across all locations, since they possessed significant S^2d_i (Table 5). Respecting b_i of all the crosses, all the evaluated genotypes showed non-significant estimates. Regarding the R^2 estimates of all the tested genotypes, results showed high percentage revealed that plant height were the more stable trait. Genotype G6 (W_i %=0.6), G4(W_i %=1.25), G5(W_i %=1.3), G19(W_i %=1.46) and G3(W_i %=2.76) had the most stable, while genotype G 11 (W_i %=13.74) and G14(W_i %=9.02) are highly unstable. Regarding ear height, estimates of b_i of all the crosses, all the evaluated genotypes showed non-significant estimates (Table 5). Genotype G2 (W_i %=2.20), G3(W_i %=2.14), G7(W_i %=1.23), G10(W_i %=2.08) and G17(W_i %=1.49) had the most stable, while genotype G 14 (W_i %=11.79) and SC-10 (W_i %=8.00) are highly unstable.

Differencies in ranking genotypes based on stability parameters were found, indicating that stability parameters differ in genotype discimination (Table 6). Thus, SC 128 acumulate three parameters of stability, *i.e.* bi=1, non-significant S^2d_i low and W_i%, G4 acumulate five parameters of stability, *i.e.* highe grain yield, bi= 1, non-significant S^2d_i low CV% low and W_i%, and G15 acumulate for parameters of stability, *i.e.* highe grain yield, bi= 1, non-significant S^2d_i and high coeffecient of determination. Ibrahim *et al.* (1984) observed that the difference in mean performance of a particular set of genotypes (varieties and/or hybrids) due mainly to the use of that new improved varieties or hybrids and the differences among locations can be mainly attributed to the farmer factors as well as the variation in soil fertility and varied cultural procedures practiced by the farmers.

In spite of most studied hybrids exhibited good potentiality (or produced high grain yield), they were unstable over 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.

Conclusion

The results of this investigation concluded that the four genotypes or hybrids SC 128, G4, G13 and G15 which produced the highest grain yield, and reasonable degree of stability across all locations. So these hybrids should be selected and tested for advanced evaluation stages.

Table (5): Mean performance different stability parameters for grain yield and days to 50% silking of 21 maize genotypes across 5 locations.

Genotypes	Plant height (cm)							Ear height (cm)						
	Mean	bi	S^2di	CV%	R^2	Wi	Wi%	Mean	bi	S^2di	CV%	R^2	Wi	Wi%
G1	240.75	0.98	65.29	20.96	0.98	176.65	3.20	125.60	0.99	238.08*	29.42	0.94	347.68	7.48
G2	246.45	1.05	111.15	21.86	0.98	234.01	4.24	130.50	1.05	-39.03	29.34	0.99	102.25	2.20
G3	244.60	0.97	27.30	20.40	0.99	152.30	2.76	129.90	0.93	-88.77	26.19	0.98	99.51	2.14
G4	245.65	1.02	-79.24	21.14	0.99	68.93	1.25	126.70	0.97	-100.23	27.92	0.97	133.14	2.87
G5	242.80	0.98	-77.38	20.55	0.99	71.91	1.30	129.40	1.04	126.79	29.18	0.98	105.55	2.27
G6	244.40	1.00	-122.68	20.94	1.00	33.23	0.60	128.60	1.01	-11.68	29.19	0.95	272.76	5.87
G7	235.30	0.96	301.23*	21.17	0.96	365.59	6.63	120.80	0.96	-127.57	28.97	0.99	58.58	1.26
G8	234.25	1.03	300.80*	22.75	0.97	360.97	6.55	122.90	1.15	-60.34	34.20	0.98	275.83	5.94
G9	246.70	1.07	29.43	22.18	0.99	196.76	3.57	134.05	1.13	378.10*	31.06	0.96	355.12	7.64
G10	247.45	0.95	59.24	19.70	0.98	195.11	3.54	134.10	0.90	25.58	24.41	0.99	96.67	2.08
G11	258.20	1.18	391.05*	23.60	0.97	757.64	13.74	140.65	1.03	522.19**	27.13	0.94	329.80	7.10
G12	261.85	0.85	151.30	16.70	0.97	482.44	8.75	139.10	0.80	231.06*	21.12	0.96	370.56	7.98
G13	257.10	0.97	269.62	19.44	0.97	338.66	6.14	137.75	0.96	332.05*	25.71	0.96	185.08	3.98
G14	251.95	0.90	364.09*	18.63	0.95	497.37	9.02	133.85	0.96	948.12*	27.23	0.90	547.62	11.79
G15	261.65	1.04	147.69	20.39	0.98	250.73	4.55	140.90	1.06	311.58*	27.61	0.97	212.84	4.58
G16	245.65	0.99	347.29*	20.81	0.96	387.27	7.02	131.40	1.03	43.54	28.83	0.97	182.63	3.93
G17	252.10	1.12	3.41	22.77	0.99	285.47	5.18	137.25	0.99	78.07	26.20	0.99	69.25	1.49
G18	253.85	0.99	143.33	20.15	0.98	232.80	4.22	136.65	1.05	314.21*	28.27	0.96	227.77	4.90
G19	255.00	0.96	-83.72	19.17	0.99	80.38	1.46	139.70	0.89	23370.57**	23.34	0.98	144.42	3.11
SC-10	256.90	1.06	24.36	21.04	0.99	176.41	3.20	143.20	1.14	277.23*	29.25	0.96	371.72	8.00
SC-128	236.60	0.92	-20.48	19.97	0.99	170.10	3.08	124.05	0.95	-37.80	28.19	0.97	156.87	3.38
Mean	248.35							131.16						
LSD0.05	12.64							11.62						

Table 6. Ranks of genotypes for mean grain yield and phenotypic stability parameters 21 maize across environments.

Genotypes	Mean grain yield (ard/fed)	b_i	S^2d_i	CV%	R^2	W_i%
G1	17	3	14	3	18	15
G2	16	8	7	12	8	5
G3	21	1	8	1	21	21
G4	10	6	3	6	6	3
G5	15	14	5	16	4	4
G6	2	7	19	7	16	13
G7	11	2	11	2	20	18
G8	18	4	20	5	19	17
G9	19	9	10	14	11	8
G10	6	5	12	4	17	11
G11	14	19	13	19	7	14
G12	7	21	4	21	3	19
G13	12	15	1	13	1	2
G14	1	18	17	17	9	16
G15	4	17	6	15	5	7
G16	20	16	16	18	12	10
G17	9	12	15	11	13	9
G18	5	10	18	9	14	12
G19	3	11	9	8	10	6
SC-10	13	20	21	20	15	20
SC-128	8	13	2	10	2	1

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مقاييس الثبات ومتوسط الاداء لبعض التراكيب الوراثية الجديدة من الذرة الشامية البيضاء

محمد المهدي محمد عبد العظيم ، مجدي احمد عبد المولى ، حمدي السيد أحمد جامع ، ايمن احمد عبد المطلب

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

الملخص العربي

تختلف التراكيب الوراثية من الذرة الشامية في مدى استجابتها للظروف البيئية المتغيرة. لذلك يساعد تحليل الثبات على معرفة قدرة هذة التراكيب على الانتاجية الفعالة تحت مدى واسع من الظروف البيئية. وقد استخدمت طريقة Eberhart and Russell (1966) لتقدير احصاءات الثبات المختلفة لعدد 19 تركيب وراثي ابيض بالاضافة الى اثنين من هجن المقارنة هما هـ فـ –10 و هـ فـ –128، كما استخدم تصميم القطاعات الكاملة العشوائية فى اربعة تكرارات وذلك فى خمس من محطات البحوث الزراعية هي سخا ، الجميزة ، سدس ، ملوي و النوبارية لتقدير قيمة التفاعل بين هذة التراكيب الوراثية والبيئات الإختبارية.

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 ، وقد أعطت محصول عالي فى كل الجهات وكذلك فى التحليل التجميعى. وقد كان التفاعل بين التراكيب الوراثية والبيئة 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 محصوليه عالية. أظهرت تسعة تراكيب جديدة بيضاء تفوقا على هجين المقارنة هـ فـ –10 من بين هذة الهجن تفوق التركيب الوراثي G6 , G14 معنويا على هـ فـ –10 . اظهرت التراكيب الوراثية G4 ,G13وG15 بالإضافة الى الهجين الفردي 128 أفضل القيم لمقاييس الثبات المستخدمة.

Table (4). Mean performance different stability parameters for grain yield and days to 50% silking of 21 maize genotypes across 5 locations.

Genotypes	Grain yield (ard/fed)							Days to 5 % silking (days)						
	Mean	Bi	S^2di	CV%	R^2	Wi	Wi%	Mean	bi	S^2di	CV%	R^2	Wi	Wi%
G1	29.58	0.66	28.86**	17.74	0.73	51.38	6.05	62.55	1.00	-0.32	6.55	0.99	0.51	0.36
G2	29.62	0.98	14.58	23.67	0.90	19.31	2.27	61.00	1.01	0.87	6.86	0.97	2.29	1.64
G3	27.63	0.35	14.87	11.74	0.54	97.40	11.46	61.10	0.76	-1.14	5.12	0.99	4.32	3.10
G4	32.22	0.88	5.64	19.31	0.92	15.28	1.80	61.60	0.88	0.84	5.92	0.97	2.25	1.61
G5	30.44	1.10	8.59	25.40	0.94	16.68	1.96	60.15	0.72	0.50	4.96	0.96	6.91	4.96
G6	35.08	0.94	39.74**	20.16	0.81	38.84	4.57	60.65	0.81	-1.29	5.44	1.00	2.62	1.88
G7	31.97	0.51	23.44*	13.44	0.65	70.24	8.27	61.95	1.11	11.78**	7.82	0.88	12.27	8.80
G8	29.58	0.69	39.83**	18.93	0.70	56.20	6.62	60.55	0.66	14.01**	5.34	0.69	20.47	14.68
G9	29.27	1.00	22.71*	24.84	0.88	25.33	2.98	62.80	0.93	-0.19	6.12	0.98	1.62	1.16
G10	33.21	0.79	24.46*	17.91	0.81	34.88	4.11	62.80	0.99	0.23	6.47	0.99	0.97	0.69
G11	31.09	1.34	25.62*	30.38	0.92	48.36	5.69	63.80	1.30	1.80	8.42	0.98	8.46	6.06
G12	32.82	1.58	7.63	33.08	0.97	74.98	8.83	63.10	1.26	8.84*	8.44	0.94	11.81	8.47
G13	31.64	1.11	-9.04	23.80	0.99	3.54	0.42	63.85	1.12	7.80*	7.38	0.94	6.63	4.76
G14	35.28	1.29	39.13**	26.25	0.89	52.78	6.21	62.30	1.26	5.82*	8.38	0.96	8.53	6.12
G15	33.92	1.22	10.20	25.06	0.94	24.59	2.90	64.35	1.21	-1.01	7.71	0.99	3.57	2.56
G16	28.09	1.12	29.84*	28.86	0.88	33.41	3.93	62.50	0.66	11.39**	4.96	0.76	16.71	11.99
G17	32.46	1.03	29.55*	23.18	0.87	30.63	3.61	63.20	1.16	1.86	7.57	0.98	3.67	2.63
G18	33.77	1.00	39.20**	22.00	0.83	37.70	4.44	62.20	0.97	0.84	6.45	0.98	1.33	0.95
G19	34.11	1.02	20.30*	21.54	0.89	23.60	2.78	63.10	0.92	3.24*	6.15	0.93	4.55	3.27
SC-10	31.25	1.36	79.06**	32.33	0.83	91.32	10.75	64.60	1.35	-0.23	8.77	0.94	15.74	11.29
SC-128	32.60	1.06	-7.74	22.14	0.99	3.08	0.36	61.50	0.92	28.58**	6.27	0.94	4.20	3.01
Mean	31.69							62.36						
LSD0.05	3.25							1.21						