Evaluation of new single crosses of maize isolated from the synthetic variety Giza-2 for yield and earliness

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ABSTRACT

S_1-progeny selection scheme was used between 1999 - 2003 to improve Giza-2 white maize population for grain yield and earliness. In 2003, 86 S_4-lines were crossed, as females, to line SK-5054 as a male tester to produce 86 topcrosses. These testcrosses along with the check hybrid SC-10 were evaluated in 2004 for grain yield, number of days to mid - silking and plant and ear heights at three different locations ; i.e., Gemmeiza, Nubaria and Mallawy Agric. Res. Stations using RCBD with 4 replications. The highest 15 testcrosses for each trait were selected.

Results showed that average grain yield of the selected 15 testcrosses were 7.3, 3.5 and 6.2 A/F more than SC-10 at Gemmeiza, Nubaria and Mallawy, respectively. These 15 high yielding testcrosses were also earlier than the check hybrid by 7.0, 7.3 and 4.2 days at the three locations.

Results also showed that average plant height of the top yielding crosses were less than SC-10 by 48, 55 and 41 cm. In addition, they were less than SC-10 by 36, 36, 26 cm for ear height at Gemmeiza, Nubaria and Mallawy, respectively. These 15 high yielding testcrosses if compared, as an average, to the overall average of the 86 testcrosses, they proved to be earlier, slightly taller and with higher ear placement.

The selected 15 testcrosses for each trait will be used to constitute an improved cycle (C_1) of Giza-2 white maize population. In addition superior S_4-lines will be used in the hybrid breeding program.

Key words: Maize, Combining ability effect, Phenotypic and genotypic correlation

INTRODUCTION

Davis (1927) suggested the use of testcrosses to screen new inbred lines. Earlier, broad genetic base tester was suggested. Hull (1945) suggested the use of inbred lines as tester to evaluate both general and specific combining ability. Hallauer (1975) showed that, a suitable tester should have simplicity in use and provide information that correctly classifies the relative value of lines and maximizes genetic gain. Procedures for developing and improving inbred lines of maize were reported by Geadlman and Peterson (1976), Bauman (1981) and Hallauer and Miranda (1981).They concluded that improving inbred lines resulted in increased grain yield, improved maturity and plant stature of the resultant hybrids. They indicated also that the most practical way of utilizing new inbred lines is to cross pairs of elite inbreds that complements one another. Matzinger, (1953) showed that a narrow genetic base tester contributes more to line x tester interaction than does a heterogeneous (broad-base) tester. He added that, if the objective is replacement of a line in a specific hybrid combination, SCA is of prime importance and the most appropriate tester is the opposite inbred line parent of a single cross. Stuber and Moll, 1977; Diab *et al.* (1994) indicated that the relative importance of different components of genetic variance might vary with mating designs and type of genetic materials under study. In this respect, Ragheb (1985), Vedneev (1988), El-Zeir (1999) and Gado (2000) stated that the additive genetic variance was the major source of variation responsible for the inheritance of plant and ear heights, 100-kernel weight and grain yield.

General (GCA) and specific (SCA) combining ability were first defined by Sprague and Tatum (1942). Other investigators; Matzinger *et al.* ,1953; Russell *et al.*, 1973; Stuber and Moll, 1977; reported that, the variance component due to SCA for grain yield and some other agronomic traits was relatively larger than that due to GCA . This indicated that the non-additive type of gene action appeared to be more important in materials or lines selected previously for grain yield performance. Hallauer and Miranda (1981) and Zambezi *et al.*, 1986; showed that it was commonly accepted that the use of a tester having a narrow genetic base, particularly an inbred line, would improve combining ability with the specific tester but would have little value for the improvement of GCA.

Genotypic correlation coefficients provide a measure of the genotypic associations between characters and give an indication of the characters that may be useful as indicators of the more important ones under consideration. They also may help to identify characters that have little or no importance in the selection program. The practical utility of selecting for a given character as a mean of improving another depends on the extent to which improvement in the major characters is facilited by selection for the indicators. Such improvement depends not only on the genotypic correlations but also on the phenotypic correlations and the variances, both genotypic and phenotypic, of all characters included in the selection scheme or index.

Genotypic correlations among characters for which selection is practiced may have important implications in breeding procedures; Johnson *et al.* (1955) They reported that, yield and plant height were negatively correlated. Jugenheimer (1958) Showed that, days to mid silking and maturity were positively correlated with plant and ear heights. Strong positive genetic correlation coefficient between date of flowering and both plant and ear heights was reported by Lindsey *et al.* (1963). A strong and positive genetic association between plant height and ear height and high correlation coefficient between tasseling date and both ear and plant heights was reported by Stuber *et al.* (1966). The phenotypic and genotypic correlations between yield and days to flowering was 0.249 and 0.336 respectively; Lonnquist *et al.*(1967). Correlation coefficient between yield and mid-silking was 0.78; Toryer and Hallauer (1968). Hallauer and Miranda (1981) a study involved Iowa Staff Synthetic population, indicated that days of flowering was negatively correlated with yield ($r = -0.52$), while no correlation was also obtained between yield and ear height ($r = 0.05$).

The objectives of this study were (1) to estimate total combining ability effects for 86 S_4-lines derived from Giza-2 white population and (2) to identify superior female lines which complement the new inbred line SK-5054 and their possible use in maize breeding program. (3) to estimate genotype x environment interaction as it reflects on the adequacy of testing procedures. (4) to estimate the genotypic and phenotypic correlations between grain yield, plant and ear height and days to mid silking.

MATERIAL AND METHODS

The breeding materials that were used in this investigation consisted of 86 S_4-lines derived through visual selection that started in 1999 in the breeding nursery of maize breeding program at Nubaria Agric. Res. Station for yield and earliness in the local white maize population Giza-2 using S_1-family selection scheme. About 500 S_1- families were developed in 1999 and were advanced with visual selection for high yield and earliness until 2002 where 86 S_4- lines were obtained. These S_4 - lines were testcrossed to inbred line SK- 5054 in the breeding nursery in 2003. The resultant 86 testcrosses along with the check hybrid SC-10 were evaluated in 2004 for grain yield, plant and ear height, and number of days to mid silking at three locations representing three different zone within the maize growing area in Egypt. The testing locations were Nubaria (North Delta), Gemmiza (Mid Delta) and Mallawy (South Delta), Agric. Res. Stations.

A randomized complete block design with four replications was used at each location. The plot size was one row 6 meters long and 80 cm apart. Plants were spaced 25 cm along the row providing a population density of approximately 21000 plant per faddan (faddan =4200 m^2). Data were collected on a per plot basis for yield (kg/plot), plant and ear height (cm), and days to mid silking (d). Grain yield was adjusted later to ardab/ faddan (ard=140 Kg, A/F) on 15% seed moisture basis.

Analysis of variance was carried out separately for each location according to Steel and Torrie (1980). Bartlett test of homogeneity of error mean squares revealed no significant differences among the three errors at 0.01 probability, so combined analysis was performed. As the testcross mean is a function of GCA of the tested line and GCA for the S_4- line and the SCA of the testcross, therefore, the deviation of testcross mean from the overall mean is an indicative of both types of combining ability, GCA for the tested lines and SCA for the line x SK-5054. Phenotypic and genotypic correlation was calculated from the following from of the covariance analysis between two variables.

Table 1: Form of covariance analysis

Source of variation	d.f.	E.M of cross product
Locations(Loc)	L-1	
Reps / Loc	L (r-1)	
Testcrosses(T)	T-1	$Cov_e + rCov_{lt} + rlCov_t$
T × Loc	(T-1)(L-1)	$Cov_e + rCov_{lt}$
Error	L (r-1)(T-1)	Cov_e

The phenotypic and genotypic correlations were calculated as follow:

$$\text{Phenotypic correlation12} = \frac{MC.Testcrosses12}{\sqrt{MS.Test1 \times MS.Test2}}$$

$$\text{Genotypic correlation12} = \frac{Covt12}{\sqrt{\sigma^2_{t1} \times \sigma^2_{t2}}}$$

Where the previous estimates were derived from the analysis of variance and covariance for each pair of characters.

RESULTS AND DISCUSSION

Mean squares of the four studied traits at each of the three locations and the combined data are presented in Table (2). Mean squares for differences among the 86 topcrosses for grain yield, silking date and plant and ear heights at each of the three locations were highly significant.. Analysis of variance for the four studied traits based on combined data indicated that differences among locations were highly significant for all traits, indicating that the three locations are different in their environmental conditions. Similar results were obtained by El-Zeir (1990), Shehata *et al.* (1997) and El-Zeir *et al.* (2000). Highly significant differences were detected among testcrosses for all studied traits. In addition, the interaction of lines with locations were highly significant for all traits. These results indicate that it is worthwhile to evaluate testcrosses at many environments especially for grain yield.

Table (2): Analysis of variance for grain yield, days to mid silking and plant and ear heights of 86 testcrosses evaluated at three location 2004.

Location	S.O.V.	d.f	Grain yield	Days to mid-silking	Plant height	Ear height
Gemmeiza	Rep	3	8.1*	10.4**	339.0**	36.9*
	Testcrosses	85	213.3**	3.0**	718.6**	278.6**
	Error	255	4.64	1.72	39.00	10.98
Nubaria	Rep	3	30.7**	1.06	100.0**	15.0
	Testcrosses	85	100.0**	10.9**	765.7**	393.9**
	Error	255	3.92	0.47	37.70	11.98
Mallawy	Rep	3	25.5**	0.43	13.10	5.4
	Testcrosses	85	194.3**	9.40**	748.80**	335.2**
	Error	255	6.71	0.64	40.30	9.29
Combined	Location(Loc)	2	14564.8**	1826.6**	499861.3**	124665.2**
	Rep/Loc	9	17.10	3.99	150.8	19.16
	Testcrosses (T)	85	349.35**	10.49**	1464.0**	549.9**
	T x Loc	170	44.69**	6.52**	434.6**	206.5**
	Error	765	4.26	0.94	39.05	10.75

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

Mean performance of topcrosses

1- Grain Yield

Range for grain yield and the overall mean of the 86 testcrosses are presented in Table (3). Grain yield ranged from 4.7 - 39.8, 3.7 - 30.8, 4.4 - 30.3 and 4.4 - 28.3 A/F with an average of 26.3, 17.1, 17.2 and 20.2 A/F at Gemmiza, Nubaria, Mallawy and combined data, respectively. Grain yield of the check hybrid (SC-10) was 28.2, 20.1, 20.3 and 22.9 A/F at Gemmeiza, Nubaria, Mallawy and combined data, respectively. Grain yield of the 15 top yielding crosses was significantly higher than yield of the check hybrid at each location and combined data (Table5). Average yield of the 15 testcrosses was 7.3, 3.5, 6.2 and 2.4 A/F more than the check hybrid SC-10 which correspond to 35.5, 23.6, 26.5 and 25.3 % increase at Gemmeiza, Nubaria, Mallawy and combined data, respectively.

Results showed differential response of the S_4- lines across at the three locations for grain yield which indicate the importance of testing across different environments to determine the stable superior lines. Among the top yielding 15 crosses, only four S_4-lines (32, 39, 63, and 78) were superior at the three locations and 7 S_4-lines (11, 73, 60, 43, 62, 86 and 66) had stable and good performance at two of the 3 locations. These 11 elite S_4- lines can be used in the hybrid breeding program after further testing.

Table (3): Means and range for grain yield and silking date of 86 testcrosses evaluated at three locations, in 2004.

	Grain yield (A/ F)				Days to mid- silking (d)			
	Gem.	Nub.	Mal.	Comb.	Gem.	Nub.	Mal.	Comb.
Range	4.7 - 39.8	3.7 - 30.7	4.4 - 30.3	4.4-28.3	54.7 – 60.2	54.0 - 62.7	56.7 - 64.2	55.9-60.4
Mean-topcrosses	26.3	17.1	17.2	20.2	56.2	57.2	60.6	58.0
Check (SC-10)	28.2	20.1	20.3	22.9	62.9	63.5	64.4	63.6
C.V.	8.2	11.5	12.0	10.6	2.3	1.2	1.3	1.7

2- Days to mid-silking

Highly significant differences were found at the three locations among the 86 testcrosses for number of days to mid-silking. Number of days to mid-silking of the 86 testcrosses ranged from 54.7 - 60.2, 54.0 - 62.7, 56.7 - 64.2 and 55.9-60.4 days, with an average of 56.2, 57.2, 60.6 and 58.0 days, as compared to 62.9, 63.5, 64.4 and 63.6 days for the check SC-10 at Gemmeiza, Nubaria, Mallawy, and combined data, respectively. Silking date of the 15 top yielding crosses, at each location, is presented in Table (5). Average silking date of the 15 top testcrosses was 55.9, 56.2, 60.2 and 57.8 days at Gemmeiza, Nubaria, Mallawy, and combined data, respectively. These 15 top yielding testcrosses were 7.0, 7.3, 4.2, and 5.8 days earlier than the check hybrid SC-10. Linkage between high yield and late silking is well known, but the selection procedure that was used to improve Giza-2 population for earliness was successful to achieve earlier silking between 4.2 - 7.3 days for the 15 top yielding testcrosses as compared to SC-10. This means that these 15 testcrosses (almost single crosses) have better yield and earlier silking than SC-10. The corresponding S_4- lines that showed higher yield and earlier silking as compared to the check hybrid SC-10 will be used to form an improved cycle (C_1) of Giza-2 population. Similar findings were also obtained by El-Zeir (1999), Gado (2000), and Sadek *et al.* (2002).

Table (4): Means and range for plant and ear heights of the 86 topcrosses at the three locations, in 2004.

	Plant height (cm)				Ear height (cm)			
	Gem.	Nub.	Mal.	Comb.	Gem.	Nub.	Mal.	Comb.
Range	224-296	141-215	166-238	186-241	103-143	60-106	75-118	85-117
Mean of testcrosses	253	181	197	210	122	86	95	101
Check (SC-10)	303	245	242	263	164	127	125	138
C.V.	2.5	3.4	3.2	3.0	2.7	4.0	3.2	3.2

3- Plant height

The differences among the 86 testcrosses for plant height were highly significant at the 3 locations and combined data. Plant height of the 86 topcrosses ranged from 224 - 296, 141 - 215, 166 - 238, and 186-241.cm with a mean of 253, 181, 197 and 210 cm at Gemmeiza, Nubaria, Mallawy, and combined data, respectively, which was shorter than the check hybrid SC-10 (242-303cm). Plant height of the top yielding 15 topcrosses, at each location, is presented in Table (6). Average plant height was 255,190, 201 and 212 cm at Gemmeiza, Nubaria, Mallawy, and combined data, respectively. Average plant height across locations (212cm) was 19 % less than average plant height of the check hybrid SC-10 (263 cm).

4 - Ear height

Ear height of the 86 testcrosses ranged from 103- 143, 60-106, 75 - 118 and 85-117 cm with an average of 122, 66, 95 and 101 cm at Gemmeiza, Nubaria, Mallawy, and combined data, respectively (Table 4). Ear height of the check hybrid SC-10 was 164, 127, 125 and 138 cm for the three locations and combined data. Ear height of the top yielding 15 testcrosses, at each location, is presented in Table (6). Average ear height of the top yielding testcrosses was 104 cm, which is 34 cm shorter than the check hybrid SC-10.

Results clearly showed that the selected high yielding 15 testcrosses were, on the average, higher in yield (24.6%), earlier in silk (4.2 - 7.3 days), and had shorter plant height by 51 cm and ear height by 34 cm than the check hybrid SC-10. This indicated the high efficiency of the selection procedure that was used to select for yield and earliness and shortness in Giza-2 population. Selection for earliness, as expected, was accompanied by a reduction in both plant and ear heights. Similar results were obtained by Shehata *et al.* (1997), Gado (2000), and Sadek *et al.* (2002).

Combining ability effect:

The deviation of the testcross mean from the overall mean isa function of both GCA and SCA and was designated as combining effect.

Results for combing ability effects for grain yield of the 15 top yielding crosses of S_4- lines with inbred Sk. 5054, at each location, for all studied traits are presented in Tables 7 and 8.

1. Grain yield

Combing ability effects for grain yield of the top yielding topcrosses are presented in Table 7. All effects were positive and significant and had higher values at Gemmeiza and Mallawy than at Nubaria which is in correspondence with grain yield averages at each location (Table 5).

2. Number of days to mid-silking

Combining ability (CA) effects for the number of days to mid-silking for the 15 top yielding testcrosses at each location are presented in Table 7. Negative significant CA effects were found under Nubaria and Mallawy only for most of the 15 high yielding testcrosses. None of CA effect for testcrosses was significant at Gemmeiza. This indicated that high yield of these S_4-lines was not correlated, as normal, with late flowering. This also indicated that the selection for earliness and high yield in Giza-2 was successful in inducing earliness without sacrificing high yielding ability.

3. Plant and ear heights

Combing ability effects for plant and ear heights for the 15 top yielding crosses of the topcrosses at each location are presented in Table 8. The 15 top yielding crosses at each location had taller plants and higher ear position in most cases as compared to average of the 86 testcrosses. This increases in plant and ear heights differed greatly from one location to another, which indicated the environmental effects of each location on the tested testcrosses.

Table (5) :Means of grain yield and silking date for the 15 top yielding S_4- lines at each of the three locations in 2004.

Grain yield (A/F)*								Days to mid- Silking (d)							
Gem.		Nub.		Mal.		Combined		Gem.		Nub.		Mal.		Combined	
Line	$\bar{X}$	Line	$\bar{X}$	Line	$\bar{X}$	Line	$\bar{X}$	Line	$\bar{X}$	Line	$\bar{X}$	Line	$\bar{X}$	Line	$\bar{X}$
49	39.8	11	30.7	66	30.2	11	28.3	49	57.5	11	58.0	66	60.0	11	58.7
11	38.6	3	28.0	32	29.0	32	26.2	11	56.5	3	55.5	32	58.2	32	56.8
73	37.2	1	26.2	63^{+}	29.0	66	26.0	73	56.0	1	55.7	63	61.2	66	58.3
60	36.8	86	25.7	56	28.9	73	25.9	60	55.7	86	54.0	56	58.5	73	56.8
25	36.5	48	25.6	84	27.0	63	25.4	25	56.0	48	55.7	84	58.7	63	57.6
43	35.8	21	24.0	54	26.9	62	25.2	43	55.7	21	56.5	54	60.2	62	59.4
62	35.3	64	22.8	43	26.7	39	25.1	62	57.5	64	54.5	43	61.5	39	57.0
32^{+}	35.0	39^{+}	22.6	73	26.6	43	25.1	32	55.0	39	56.7	73	58.7	43	58.4
86	35.0	53	22.4	62	26.6	78	24.9	86	55.5	53	57.0	62	62.0	78	58.5
39^{+}	34.7	12	21.7	78^{+}	25.8	3	24.8	39	55.0	12	56.7	78	61.7	3	57.6
35	34.1	10	21.4	85	24.5	48	24.7	35	55.0	10	57.0	85	62.0	48	57.8
66	33.9	78^{+}	21.1	12	24.3	56	24.6	66	56.2	78	57.5	12	61.5	56	56.6
78^{+}	33.7	42	20.8	60	24.0	49	24.4	78	56.0	42	55.2	60	58.7	49	59.1
27	33.0	32^{+}	20.6	48	23.8	60	24.3	27	54.7	32	57.0	48	60.7	60	57.4
63^{+}	32.9	63^{+}	20.5	39^{+}	23.6	86	24.1	63	56.0	63	55.5	39	59.2	86	56.8
Mean	35.5	Mean	23.6	Mean	26.5	Mean	25.3	Mean	55.9	Mean	56.2	Mean	60.2	Mean	57.8
S.C-10	28.2	S.C-10	20.1	S.C-10	20.3	S.C-10	22.9	S.C-10	62.9	S.C-10	63.5	S.C-10	64.4	S.C-10	63.6
L.S.D (0.05)	3.0		2.7		3.6		5.4		1.8		1.0		1.1		2.0
L.S.D (0.01)	3.9		3.6		4.7		7.0		2.4		1.3		1.5		2.7

* A/F = 0.33 Mg / ha.

+ top yielding across the three locations.

Table (6) :Means of plant and ear height for the 15 top yielding S_4- lines at each of the three locations in 2004.

Plant height (cm)								Ear height (cm)							
Gem.		Nub.		Mal.		Combined		Gem.		Nub.		Mal.		Combined	
Line	$\overline{X}$	Line	$\overline{X}$	Line	$\overline{X}$	Line	$\overline{X}$	Line	$\overline{X}$	Line	$\overline{X}$	Line	$\overline{X}$	Line	$\overline{X}$
49	237	11	194	66	210	11	233	49	136	11	97	66	112	11	113
11	282	3	168	32	203	32	208	11	137	3	74	32	97	32	107
73	253	1	205	63	171	66	212	73	118	1	106	63	82	66	109
60	250	86	204	56	215	73	218	60	117	86	99	56	109	73	100
25	290	48	165	84	209	63	203	25	143	48	76	84	105	63	97
43	260	21	176	54	184	62	215	43	131	21	79	54	100	62	112
62	253	64	188	43	202	39	206	62	134	64	91	43	97	39	99
32	235	39	1811	73	198	43	214	32	133	39	86	73	91	43	105
86	265	53	215	62	213	78	215	86	134	53	103	62	108	78	104
39	247	12	192	78	207	3	200	39	120	12	101	78	106	3	92
35	260	10	199	85	231	48	208	35	124	10	105	85	114	48	96
66	248	78	185	12	204	56	218	66	132	78	83	12	96	56	109
78	253	42	206	60	187	49	206	78	123	42	98	60	87	49	106
27	250	32	187	48	204	60	204	27	120	32	91	48	92	60	96
63	251	63	186	39	191	86	231	63	129	63	80	39	91	86	117
Mean	255	Mean	190	Mean	201	Mean	212	Mean	128	Mean	91	Mean	99	Mean	104
S.C.10	303	S.C.10	245	S.C.10	242	S.C.10	263	S.C.10	164	S.C.10	127	S.C.10	125	S.C.10	138
L.S.D (0.05)	9		9		9		17		5		5		4		12
L.S.D (0.01)	11		11		11		22		6		6		6		15

Table (7) Combining ability effects of the15 selected testcrosses for grain yield and days to mid-silking at the three locations in 2004.

Grain yield (A/F)								Days to mid Silking (d)							
Gem.		Nub.		Mal.		Combined		Gem.		Nub.		Mal.		Combined	
Line	$\overline{X}$	Line	$\overline{X}$	Line	$\overline{X}$	Line	$\overline{X}$	Line	$\overline{X}$	Line	$\overline{X}$	Line	$\overline{X}$	Line	$\overline{X}$
49	13.46	11	13.59	66	13.02	11	8.08	49	1.30	11	0.77	66	-0.61	11	0.66
11	12.34	3	10.83	32	12.80	32	6.00	11	0.23	3	-1.73	32	-2.36	32	-1.26
73	10.93	1	9.04	63	11.73	66	5.80	73	-0.20	1	-1.48	63	0.65	66	0.32
60	10.46	86	8.60	56	11.63	73	5.70	60	-0.45	86	1.78	56	-2.10	73	-1.26
25	10.19	48	8.52	84	9.74	63	5.24	25	-0.20	48	-1.48	84	-1.86	63	-0.43
43	9.55	21	6.82	54	9.68	62	5.01	43	-0.45	21	-0.73	54	-0.35	62	1.41
62	8.98	64	5.68	43	9.51	39	4.89	62	1.30	64	-2.73	43	0.90	39	-1.01
32	8.71	39	5.43	73	9.38	43	4.90	32	-1.20	39	-0.48	73	-1.85	43	0.41
86	8.70	53	5.25	62	9.37	78	4.65	86	0.55	53	-0.23	62	1.40	78	0.49
39	8.44	12	4.53	78	8.60	3	4.64	39	-1.20	12	0.52	78	1.15	3	-0.43
35	7.78	10	4.26	85	7.23	48	4.44	35	-1.20	10	-0.23	85	1.40	48	-0.18
66	7.60	78	4.01	12	7.08	56	4.42	66	0.05	78	0.52	12	0.90	56	-1.43
78	7.03	42	3.66	60	6.76	49	4.15	78	-0.20	42	-1.98	60	-1.85	49	1.07
27	6.67	32	3.50	48	6.53	60	4.12	27	-1.45	32	-0.23	48	0.15	60	-0.59
63	6.60	63	3.38	39	6.39	86	3.85	63	-0.20	63	-1.73	39	-1.36	86	-1.18
L.S.D (0.05)	2.98		2.74		3.59		5.35		1.82		0.95		1.11		2.04
L.S.D (0.01)	3.92		3.61		4.72		7.03		2.39		1.25		1.45		2.68

Table(8): Combining ability effects of the15 selected testcrosses for plant and ear height at each of the three locations in 2004.

Plant height (cm)								Ear height (cm)							
Gem.		Nub.		Mal.		Combined		Gem.		Nub.		Mal.		Combined	
Line	$\bar{X}$	Line	$\bar{X}$	Line	$\bar{X}$	Line	$\bar{X}$	Line	$\bar{X}$	Line	$\bar{X}$	Line	$\bar{X}$	Line	$\bar{X}$
49	-16.14	11	13.19	66	13.08	11	22.63	49	13.30	11	10.79	66	17.45	11	12.27
11	28.60	3	-12.55	32	6.08	32	-2.37	11	15.05	3	-11.54	32	1.95	32	6.10
73	-0.89	1	23.62	63	-25.66	66	1.29	73	-4.69	1	20.54	63	-12.29	66	8.35
60	-3.69	86	22.62	56	17.58	73	7.63	60	-5.19	86	13.29	56	13.95	73	-1.06
25	42.35	48	-15.55	84	12.33	63	-7.79	25	20.80	48	-9.45	84	10.70	63	-3.81
43	6.10	21	-5.30	54	-13.16	62	4.13	43	9.05	21	-6.45	54	5.70	62	10.94
62	-0.089	64	7.19	43	4.58	39	-4.21	62	11.80	64	5.54	43	1.95	39	-1.73
32	-18.89	39	-0.30	73	1.08	43	3.29	32	11.05	39	0.549	73	-3.29	43	3.85
86	11.10	53	33.62	62	15.58	78	4.54	86	12.05	53	16.79	62	13.45	78	2.94
39	-6.64	12	10.69	78	9.83	3	-10.87	39	-2.19	12	15.54	78	10.95	3	-8.81
35	6.60	10	17.62	85	34.08	48	-2.46	35	1.80	10	19.54	85	18.95	48	-4.48
66	-5.89	78	4.44	12	6.83	56	7.54	66	9.80	78	-3.20	12	1.70	56	7.69
78	-0.64	42	25.44	60	-10.41	49	-4.62	78	1.05	42	11.79	60	-7.54	49	5.19
27	-3.14	32	5.69	48	7.33	60	-6.12	27	-1.94	32	5.29	48	-2.29	60	-4.65
L.S.D (0.05)	8.65		8.51		8.80		16.68		4.59		4.79		4.22		11.49
L.S.D (0.01)	11.37		11.18		11.56		21.92		6.04		6.30		5.55		15.11

Table (9): Phenotypic and genotypic correlation coefficients (between parenthesis) between the four characters evaluated in 2004.

	Days to mid -Silking	Plant height	Ear height	Grain yield
Silking date		0.089 (0.750)	-0.007 (-0.033)	-0 577** (-0.799)
Plant height			0.711** (0.905)	0.245* (0.383)
Ear height				0.356** (0.537)

*,** indicate significance at the 0.05 and 0.01 levels respectively.

Phenotypic and genotypic correlation:

The genotypic and phenotypic correlations are presented in table (9). In general the genotypic correlations were slightly higher that the phenotypic. Silking date had the highest negative genetic correlation with grain yield with -0.799 while the corresponding phenotypic correlation was -0.577. The genotypic correlation between silking date and plant height was (0.750) highly positive correlation but its phenotypic correlation was (0.089). Whereas the genotypic and phenotypic correlations between silking date and ear height was negative and not significant because the error of this character were higher. Plant height had the highest positive genetic correlation with ear height 0.905 and its phenotypic correlation was 0.711. The positive genetic correlation between plant height and grain yield was 0.383 but its phenotypic correlation was 0.245. The genetic correlation between ear height and grain yield was 0.537 but the phenotypic correlation was 0.356. Similar results were obtained by Jugenheinner (1958), Lindsey *et al* (1963), Stuber (1966) and Hallauer and Miranda (1981).The previous correlation coefficients would suggest that the top yield hybrids were taller in plant and ear heights and later in maturity.

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الملخص العربي

تقييم هجن فردية جديدة لصفة التبكير و المحصول للذرة الشامية المعزولة من الصنف التركيبى جيزة-٢

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استخدمت طريقة الانتخاب في الجيل الذاتي الأول ما بين سنوات ١٩٩٩ – ٢٠٠٣ لتحسين عشيرة الذرة البيضاء جيزة – ٢ لصفه محصول الحبوب والتبكير. في موسم ٢٠٠٣ تم تهجين ٨٦ عائلة منتخبة من عائلات الجيل الذاتي الرابع (S_4) مع السلالة الاختبارية سخا ٥٠٥٤ ونتج عن ذلك ٨٦ هجين قمى. تم تقييم هذه الهجن القمية مع هجين فردي ١٠ كهجين للمقارنة في موسم ٢٠٠٤ في تصميم القطاعات كاملة العشوائية في أربع مكررات لصفات محصول الحبوب , عدد الأيام حتى الوصول إلي ٥٠% حرائر وكذلك ارتفاع النبات وارتفاع الكوز بكل من

محطة البحوث الزراعية بالجميزة والنوبارية وملوي. وتم انتخاب أعلا ١٥ هجين قمي لكل صفة بكل محطة.

أظهرت النتائج أن متوسط محصول الحبوب لأعلا ١٥ هجين قمي لصفة محصول الحبوب كان أعلا من هجين المقارنة بمقدار ٧,٣ , ٣,٥ , ٦,٢ أردب / فدان بمحطات الجميزة والنوبارية وملوي علي التوالي , كما ان هذه الهجن القمية كانت مبكرة عن هجين المقارنة بمقدار ٧,٠ , ٧,٣ , ٤,٢ يوم بنفس المحطات علي التوالي أظهرت النتائج أيضا أن متوسط ارتفاع النبات لأعلا ١٥ هجين قمي في محصول الحبوب كان أقل من هجين المقارنة بمقدار ٤٨ , ٥٥ , ٤١ سم , وأقل بمقدار ٣٦ , ٣٦ , ٢٦ سم بالنسبة لارتفاع الكوز بمحطات الجميزة والنوبارية وملوي علي التوالي.

أظهرت تقديرات التلازم أن هناك علاقة تلازم وراثي ومظهري موجب ومعنوي ما بين تاريخ التزهير وارتفاع النبات وارتفاع الكوز وأيضا ما بين المحصول وكلا من ارتفاع النبات وارتفاع الكوز.

وعلى العكس هناك علاقة تلازم وراثي ومظهري سالب ومعنوي ما بين المحصول وتاريخ التزهير.

عند مقارنة متوسط أعلا ١٥ هجين قمي للصفات الأربعة تحت الدراسة بمتوسط الـ ٨٦ هجين قمي نجد أنها أعلا محصولا وأكثر تبكيرا ولكن ارتفاع النبات وارتفاع الكوز كان أعلا قليلا.

سيتم استخدام السلالات الخمسة عشر المنتخبة التي أعطت أعلا قيم لمحصول الحبوب وكذلك صفة التبكير لتكوين الحلقة الأولي المحسنة (C_1) من عشيرة جيزة - ٢ كما سيتم استخدام السلالات المتفوقة منها في برنامج إنتاج الهجن.