Bull.Fac, Agric.,Cairo Univ.,63:29-36 (2012).

UTILIZATION OF LINE X TESTER MODEL FOR EVALUATING THE PERFORMANCE OF SOME NEW YELLOW MAIZE INBRED LINES

(Received: 22. 11. 2011)

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ABSTRACT

Twenty two selected S_5 yellow maize inbred lines developed from different heterotic groups at Sakha Agric. Res. Stn. were topcrossed to two yellow single cross testers *i.e.,* SC 162 and SC 166 in 2009 summer season. The resultant 44 topcrosses along with two commercial check hybrids (SC 162 and TWC 352) were evaluated in 2010 growing season at Sakha and Sids Agric. Res. Stn. for the number of days to 50% silking, plant and ear heights, resistance to late wilt disease, and grain yield. The results demonstrated that the magnitude of variance due to testers was higher than that of lines for the number days to 50% silking and plant height, while the opposite was true for ear height, percentage of wilted plants and grain yield. The magnitude of variance due to lines x location interaction was higher than variance of testers x location interaction for all the studied traits, except for ear height, revealing that the lines were affected more by the environmental conditions than the testers. The magnitude of the ratio of general to specific combining ability variances ($\delta^2_{gca}/\delta^2_{sca}$) revealed that the additive gene action had the major role in determining the inheritance of all the studied traits. The additive gave action, however, interacted more with the environmental conditions ($\delta^2_{gca \text{ x Loc}}$) than non-additive component ($\delta^2_{sca \text{ x Loc}}$) for all the studied traits. The single cross testers ranked the 22 inbred lines differently, the tested lines L-6, L-8, L-9, L-10, L-11 and L-22 were the best general combines for high yielding ability. Parental females, L-1, L-13, L-14, L-15, L-16, L-17 and L-22 were significantly better general combiners for earliness. Parental lines L-1 and L-4 were good donors for shortness and L-11 and L-20 for late wilt resistance. The tester SC166 manifested better GCA effects for earliness and short plants. The results showed that eight topcrosses *i.e.,* L-10 x SC162, L-22 x SC166, L-10 x SC166, L-9 x SC162, L-11 x SC166, L-8 x SC166, L-12 x SC162 and L-22 x SC162 significantly outyielded the best check SC 162. These yellow hybrids are promising genetic materials for yielding ability in future maize breeding programs.

Key words : *combining ability, gene action, line X tester, maize, topcross.*

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1. INTRODUCTION

The major goal of the Maize Research Department in Egypt is developing high yielding yellow maize hybrids. Continuously, looking for elite inbred lines that possess higher general and specific combining ability effects to be used as parents for new superior hybrids and/or replace the currently used ones. Topcross (test cross) method using broad and/or narrow genetic base testers is widely used to evaluate new improved inbred lines for combining ability and yield performance. In this regard, the choice of a suitable tester is an important decision. Matzinger, (1953) showed that a narrow genetic base tester contributes more to line x tester interaction than does a heterogeneous one. Lonnquist and Lindsey, (1964) reported that the use of common tester parent reduced the range of trait expression among the progenies being evaluated.

Russel *et al.* (1973) and Walejko and Russel, (1977) stated that the inbred testers were effective for determining general and specific combining ability effects. Hallauer and Miranda (1981) found that the low performing testers gave a better idea of general combining ability (GCA) of the lines than high performing testers. Liakat and Teparo (1986) found that the inbred line as a narrow genetic base exhibited the highest genetic variation in the test cross progenies for general combining ability effects for grain yield.

Topcross procedure was first suggested by Davis, (1927) as an early testing to determine the usefulness of the lines for hybrid development programs.

The concept of general (GCA) and specific (SCA) combining ability was first defined by Sprague and Tatum (1942). They and other investigators (Hassaballa *et al.,* 1980; El-Morshidy and Hassaballa, 1982; Mahmoud, 1996; Konak *et al.,* 1999; Zelleke, 2000; Abd El-Moula and Abd El-Azeem, 2008; Abd El-Moula and Abd El-Aal, 2009 and Abd El-Azeem *et al.,* 2010) reported that the variance components due to SCA for maize grain yield and other agronomic traits was larger than that due to GCA, indicating the importance of non-additive type of gene action in the inheritance of these traits. Mathur *et al.* (1998) reported significant GCA variance for days to 50% silking in maize. On the other hand, the environment X GCA interaction for grain yield was significant for both lines and testers (Hede *et al.,* 1999; Nass *et al.,* 2000; El-Zeir *et al.,* 2000 and El–Morshidy *et al.,* 2003). However, Soliman and Osman, (2006) Abd El-Aal (2007) and Abd El-Moula and Abd El Aal (2009) revealed that the additive component of gene action had the major role in the inheritance of grain yield and other traits of maize compared with the non-additive one.

The objectives of this study were to (i) assess the efficiency of the two testers in estimating combining ability effects of the 22 newly developed yellow inbred lines, (ii) identify the most superior line(s) and crosses for further use in the breeding program and (iii) determine GCA and SCA as well as the type of gene action involved in the manifestation of grain yield and other agronomic traits.

2. MATERIALS AND METHODS

Twenty–two yellow maize (*Zea mays* L.) inbred lines in S_5 generation *i.e.* Sk-5002-25 to Sk-5002-45 and Sk-5002-48 were derived from different heterotic groups through selection in the disease nursery at Sakha Agric. Res. Stn., were used in this study. In 2009 summer season, the 22 inbred lines were topcrossed to each of two narrow genetic base single cross testers, *i.e.,* SC 162 and SC 166 at Sakha Res., Stn. The two testers were developed by Maize Res. Dept. In 2010 summer season, the obtained 44 topcrosses along with two commercial check hybrids; TWC 352 and SC 162 were evaluated in replicated yield trials conducted at Sakha and Sids Agric. Res. Stn. The experimental design was randomized complete block with four replications. Plot size was one row, 6 m long and 80 cm apart and hills were spaced 25cm along the row. Two grains were planted per hill and thinned later to one plant per hill to provide a population density of approximately 21000 plants fed^{-1} (one feddan= 4200 m^2). All cultural practices for maize production were applied as recommended. Data were recorded for the number of days to 50% silking, plant height (cm), ear height (cm), percentage of wilted plants (data were transformed using arcsin), and grain yield per plot adjusted to 15.5% grain moisture and converted to ardabs/feddan (one ardab=140kg).

Analysis of variance was performed for the combined data across locations according to Steel and Torrie (1980). Homogeneity test was used and found to be not significant for the studied traits; therefore the data were analyzed on the basis of combined analysis across locations. The combining ability and types of gene action were computed for all studied traits according to Kempthorne (1957).

3. RESULTS AND DISCUSSION

Combined analysis of variance for the five studied traits is presented in Table 1. Highly significant differences were detected among locations for all studied traits, indicating that the two locations differed in their environmental conditions. Mean squares due to crosses were highly significant for all traits. Partitioning the sum of squares due to crosses into its components according to Singh and Chaudhary (1979) showed that the mean squares due to lines and testers were highly significant for all traits except for ear height and the percentage of wilted plants for testers. These results revealed that greater diversities existed among testers and lines. Meanwhile, mean squares of lines x testers interaction were significant only for grain yield, indicating that the lines (females) differed in order of performance in crosses with each of the testers (males). Mean squares due to the interaction of lines with locations were significant for all the studied traits, except for plant and ear heights, while, the interactions of testers and lines x testers with locations were not significant for all the studied traits. These interactions with locations were indicative of different rankings of genotypes from one location to another. These results are in accordance with those obtained by El-Itriby *et al*. (1990); Sadek *et al.* (2000); Gado *et al.* (2000); Soliman *et al.* (2001) and Abd El-Moula and Abd El-Aal (2009).

The magnitude of the variance due to testers was higher than variance of lines for days to 50% silking and plant height, while the opposite was true for ear height, percentage of wilted plants and grain yield.

Table (1): Analysis of variance for the studied traits of 44 testcrosses combined across Sakha and Sids locations in 2010 growing season.

SOV	df	Mean squares				
		Days to 50% silking	Plant height (cm)	Ear height (cm)	Wilted plants %	Grain yield ard/fed
Locations (Loc)	1	1543.09**	805258.2**	510570.6**	6780.79**	28110.23**
Rep/Loc	6	31.12	1496.7	776.7	194.42	206.63
Crosses (C)	43	10.58**	514.58**	343.96**	92.01**	39.87**
Lines (L)	21	17.98**	864.0**	628.1**	132.55**	66.78**
Testers (T)	1	45.82**	2446.5**	213.3	122.04	3.48**
L x T	21	1.51	73.2	66.0	50.04	14.70*
Loc x C	43	1.74	142.01	114.01	89.68**	12.97**
Loc x L	21	2.84*	205.2	135.2	149.5**	18.20**
Loc x T	1	0.03	104.7	266.0	12.44	0.01
Loc x L x T	21	0.73	80.6	85.5	33.53	8.35
Pooled error	258	1.55	139.9	124.7	37.15	7.66
CV %	-	1.99	4.6	7.4	66.84	10.05

*, ** indicate significance at 0.5 and 0.01 level of probability, respectively.

The magnitude of the variance due to lines x location interaction was higher than the variance of testers x location interaction for all the studied traits except for ear height. This indicated that lines were more affected by the environmental conditions than testers. Similar findings were obtained by Soliman and Sadek (1999), El-Zeir *et al.* (2000) and El-Morshidy *et al.* (2003). However, Amer and El-Shenawy (2007) obtained significant interaction between locations, lines, and testers for silking data, ear height and grain yield. Also, Gado *et al.* (2000); Soliman (2000) and El-Morshidy *et al.* (2003) reported that testers were affected much more by the environmental conditions than lines.

Mean performance of 44 topcrosses along with the check hybrids TWC 352 and SC 162 are presented in Table 2. For the number of days to 50% silking, the results showed that the earliest cross was L-13 x SC 166 (59.9 days), while the latest cross was L-2 x SC 162 (65.4 days). Generally, 43 and one topcrosses were significantly earlier than the commercial check hybrid SC 162 and TWC 352, respectively.

For plant height, the shortest topcrosses were L-1 x SC166 (238 cm) and L-1 x SC162 (244 cm), while the tallest topcrosses were L-9 x SC162 and L-12 x SC162 (274 cm). On the other hand, 14 crosses were significantly shorter than the shortest check hybrid TWC 352.

Regarding ear height, the lowest ear placement was recorded by crosses L-1 x SC166 (132cm) and L-1 x SC162 (136cm), however the highest ear placement was recorded by crosses L-12 x SC162 (165cm) and L-12 x SC166 (162cm). Meanwhile, 27 and 3 crosses had significant lower ear placement than the check hybrid SC162 and TWC352, respectively.

For the percentage of wilted plants, the highest susceptibility was (13.9%) for the cross L-14 x SC 166 followed by (13.3%) for the cross L-19 x SC 166. On the other hand, the best resistant crosses were L-1 x SC162, L-9x SC166, L-11 x SC166 and L-20 x SC166. These crosses showed zero % susceptibility as well as the best resistant check hybrid SC162.

For grain yield, the lowest value was recorded by the cross L-16x SC166 (23.95 ard/fed). On the other hand, the highest value was recorded by L-10 x SC 162 (33.66 ard/ fed). Eight crosses *i.e.*, L-10 x SC162, L-22 x SC166, L-10 x SC166, L-9 x SC162, L-11 x SC166, L-8 x SC166, L-12 x SC162, L-22 x SC162 significantly outyielded the best check hybrid SC162. These results pointed out that the eight topcrosses which showed superiority over the checks had accumulated favorable alleles for grain yield and could be used in future program for hybrid yellow maize development especially at new land as new yellow three way crosses.

General combining ability effects of the lines and testers for all the studied traits are presented in Table 3. Desirable and significant values of GCA effects were obtained by line L-1 for days to 50% silking, plant height and ear height; L-4 for plant and ear heights; L-6, L-8, L-9 and L-10, for grain

Table (2): Average performance of 44 topcrosses and checks for grain yield and other agronomic traits, combined across Sakha and Sids locations in 2010 growing season.

Inbred lines	Days to 50% silking		Plant height (cm)		Ear height (cm)		Wilted plants %		Grain yield ard/fed	
	SC162	SC166	SC162	SC166	SC162	SC166	SC162	SC166	SC162	SC166
L-1	61.4	61.1	244	238	136	132	0.0	4.9	26.68	25.58
L-2	65.4	64.1	254	253	154	155	6.8	2.8	24.53	26.46
L-3	64.5	63.8	268	262	157	154	5.6	7.0	26.77	27.70
L-4	63.9	62.8	255	248	143	142	5.3	7.8	24.52	24.78
L-5	62.4	61.9	262	256	147	150	0.5	3.1	28.06	27.02
L-6	62.8	61.1	270	256	156	143	1.1	3.6	28.99	28.96
L-7	63.1	61.9	255	255	146	148	6.5	1.7	26.37	28.66
L-8	62.8	62.0	260	259	148	148	3.5	5.5	28.70	30.10
L-9	63.5	62.9	274	268	159	160	2.1	0.0	30.73	29.19
L-10	62.1	62.0	268	262	156	156	1.7	1.0	33.66	31.04
L-11	64.6	62.8	271	263	155	159	2.1	0.0	27.70	30.34
L-12	64.0	63.0	274	270	165	162	2.8	3.7	29.97	26.44
L-13	61.6	59.9	263	260	155	150	7.5	7.9	25.86	26.94
L-14	61.1	61.4	266	253	149	145	6.2	13.9	27.39	25.10
L-15	62.0	61.3	256	255	149	149	4.4	4.0	27.52	28.04
L-16	61.9	61.5	252	249	148	145	0.5	2.6	28.47	23.95
L-17	61.4	61.1	259	251	150	141	0.5	2.5	29.07	28.32
L-18	63.3	62.4	264	256	151	149	6.1	5.3	26.22	25.42
L-19	63.5	63.4	263	252	149	146	3.9	13.3	24.37	24.43
L-20	62.3	62.3	269	266	151	153	0.5	0.0	26.00	25.81
L-21	63.0	61.9	271	263	159	156	0.5	3.8	26.58	26.94
L-22	61.1	61.4	258	261	149	154	2.7	3.0	29.86	32.54
Checks										
TWC 352	61.8		267		152		0.6		25.07	
SC 162	65.9		277		164		0.0		26.72	
$LSD_{0.05}$	1.21		11.49		10.86		6.44		2.79	

yield, L-11 and L-20 for resistance to late wilt disease; L-13, L-14, L-15, L16 and L-17 for days to 50% silking and L-22 for days to 50% silking and grain yield.

Estimates of GCA effects of the testers revealed that, tester SC166 was a good general combiner for days to 50% silking and plant height.

Specific combining ability effects for all the studied traits are shown in Table 4. Four topcrosses *i.e.*, L-16 x SC162, L-12 x SC162, L-22 x SC166 and L-11 x SC166 had the highest positive and significant SCA effects for grain yield. Similarly, two topcrosses *i.e.*, L-11 x SC166 and L-13 x SC166 exhibited significant desirable SCA effects for earliness, but two other crosses *i.e.*, L-19 x SC162 and L-7 x SC166 had negative and significant SCA effects for resistance to late wilt disease and the cross L-6 x SC166 had significant desirable SCA effects for plant and ear heights.

The estimates of combining ability variance components (δ^2_{gca} and δ^2_{SCa}) and their interactions with locations (δ^2_{gca} x Loc and δ^2_{SCa} x Loc) for grain yield and other studied traits are presented in Table 5. The gca variance played the major role in determining the inheritance of all the studied traits. This indicated that the largest part of the total genetic variability associated with these traits was the result of additive gene action. Similar findings were also obtained by Soliman *et al.* (2001) and Abd El-Azeem *et al.* (2004). Also, Russell *et al.* (1973); Hallauer and Miranda (1981); El-Itrby *et al.* (1990); Soliman and Osman (2006); Abd El-Aal (2007) and Abd El-Azeem *et al.* (2010) indicated the importance of additive gene action in affecting grain yield of maize. Moreover, the additive gene effects interacted more with different environmental conditions prevailing in the two locations than non-additive gene action for all the studied traits. This result is in agreement with the findings of several investigators (El-Itrby *et al.* 1990; Soliman *et al.* 2001; Abd El-Azeem *et al.* 2004; Abd El-Aal 2007 and Abd El-Azeem *et al.* 2010) who reported that the additive types of gene action were more affected by environment than non-additive ones. On the other hand, Shehata and Dahawan (1975) and Sadek *et al.* (2000) and (2002) also found that the non-additive genetic variation interacted more with the environment than the additive component.

This study suggested that eight topcrosses *i.e.*, L-10 x SC162, L-22 x SC166, L-10 x SC166, L-9 x SC162, L-11 x SC166, L-8 x SC166, L-12 x SC162, L-22 x SC162 should be further tested for the commercial use. In addition, the promising inbred lines L-6, L-8, L-9, L-10, L-11 and L-22 possessed the highest favorable GCA effects for grain yield and L-1, L-13, L-14, L-15, L-16, L-17 and L-22 for earliness (Table 3). These inbreds could be used to from a new synthetic variety of yellow maize, which could be also used as a base population for the extraction of more favorable yellow lines for developing high yielding and earlier single cross hybrids of yellow maize.

Table (3): General combining ability effects ($\hat{g}_i$) of the studied inbred lines and the testers for grain yield and other agronomic traits, combined across Sakha and Sids locations in 2010 growing season.

Inbred lines	Days to 50% silking	Plant height (cm)	Ear height (cm)	Wilted plants (%)	Grain yield ard/fed
L-1	-1.185**	-18.95**	-16.39**	-1.478	-1.409*
L-2	2.315**	-6.01*	3.86	1.624	-2.053**
L-3	1.690**	5.30	4.73	2.304	-0.322
L-4	0.878	-8.57*	-7.89**	3.816**	-2.884**
L-5	-0.310	-0.51	-2.14	-2.423	0.003
L-6	-0.497	3.18	-0.77	-1.153	1.435*
L-7	0.065	-4.64	-3.95	0.394	-0.034
L-8	-0.060	-0.39	-2.71	0.826	1.860*
L-9	0.753*	10.93**	8.86**	-2.943	2.422**
L-10	-0.372	5.18	5.29	-2.885	4.816**
L-11	1.253**	7.18*	6.05*	-3.463*	1.485*
L-12	1.065**	12.55**	12.73**	-0.429	0.672
L-13	-1.685**	1.74	1.86	4.482**	-1.134
L-14	-1.185**	-0.26	-3.83	5.200**	-1.290
L-15	-0.810*	-4.39	-1.83	1.260	0.24
L-16	-0.747*	-9.39**	-3.95	-2.388	-1.34
L-17	-1.185**	-4.89	-5.21	-2.413	1.160
L-18	0.378	-0.14	-0.45	2.932	-1.734**
L-19	1.003**	-2.26	-3.21	4.102**	-3.140**
L-20	-0.185	7.36**	1.55	-4.557**	-1.628*
L-21	0.003	7.49**	6.73*	-2.331	-0.797
L-22	-1.185**	-0.51	0.67	-0.476	3.672**
SE for g_i	0.311	2.96	2.79	1.524	0.692
SE for g_i-g_j	0.439	4.18	3.95	2.155	0.978
SC162	0.361**	2.64**	0.78	-0.589	0.099
SC 166	-0.361**	-2.64**	-0.78	0.589	-0.099
SE for g_i	0.094	0.89	0.84	0.459	0.209
SE for g_i-g_j	0.132	1.26	1.19	0.650	0.295

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

Table (4): Specific combining ability (S_{ij}) of the 44 topcrosses for grain yield and other agronomic traits, combined across Sakha and Sids locations in 2010 growing season.

Inbred line	Days to 50% silking		Plant height (cm)		Ear height (cm)		Wilted plants (%)		Grain yield (ard/fed)	
	SC162	SC166	SC162	SC166	SC162	SC166	SC162	SC166	SC162	SC166
L-1	-0.236	0.236	0.43	-0.43	1.22	-1.22	-3.00	3.00	0.46	-0.46
L-2	0.264	-0.264	-2.26	2.26	-1.03	1.03	2.71	-2.71	-1.06	1.06
L-3	0.014	-0.014	0.18	-0.18	0.97	-0.97	0.22	-0.22	-0.57	0.57
L-4	0.202	-0.202	0.80	-0.80	-0.15	0.15	-0.85	0.85	-0.23	0.23
L-5	-0.111	0.111	0.49	-0.49	-2.28	2.28	-0.98	0.98	0.41	-0.41
L-6	0.452	-0.452	4.30*	-4.30*	5.72**	-5.72**	-1.16	1.16	0.09	-0.09
L-7	0.264	-0.264	-2.89	2.89	-1.97	1.97	3.19*	-3.19*	-1.24	1.24
L-8	0.014	-0.014	-2.51	2.51	-0.84	0.84	-0.79	0.79	-0.79	0.79
L-9	-0.048	0.048	0.30	-0.30	-1.03	1.03	2.72	-2.72	0.69	-0.69
L-10	-0.298	0.298	0.30	-0.30	-0.97	0.97	0.66	-0.66	1.21	-1.21
L-11	0.577*	-0.577*	1.05	-1.05	-2.59	2.59	2.20	-2.20	-1.40*	1.40*
L-12	0.139	-0139	-0.57	0.57	0.72	-0.72	0.12	-0.12	1.66**	-1.66**
L-13	0.514*	-0.514*	-1.26	1.26	1.35	-1.35	0.42	-0.42	-0.63	0.63
L-14	-0.486	0.486	3.49	-3.49	1.03	-1.03	-1.58	1.58	1.04	-1.04
L-15	0.014	-0.014	-2.39	2.39	-1.09	1.09	0.74	-0.74	-0.34	0.34
L-16	-0.173	0.173	-1.51	1.51	0.78	-0.78	-1.07	1.07	2.16**	-2.16**
L-17	-0.236	0.236	1.36	-1.36	3.41	-3.41	-1.04	1.04	0.28	-0.28
L-18	0.077	-0.077	1.49	-1.49	0.41	-0.41	1.00	-1.00	0.29	-0.29
L-19	-0.298	0.298	3.11	-3.11	1.03	-1.03	-3.71**	3.71**	-0.14	0.14
L-20	-0.361	0.361	-1.26	1.26	-1.84	1.84	1.10	-1.10	-0.01	0.01
L-21	0.202	-0.202	1.36	-1.36	0.35	-0.35	-1.07	1.07	-0.28	0.28
L-22	-0.486	0.486	-4.01	4.01	-3.22	3.22	-0.42	-0.42	-1.42*	1.42*
SE for S_{ij}	0.249		2.09		1.98		1.58		0.68	
SE for S_{ij}- S_{KL}	0.621		5.91		5.58		3.05		1.38	

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

Table (5): Estimates of general (δ^2_{gca}) and specific (δ^2_{SCa}) combining ability vaiances for grain yield and other traits, combined across Sakha and Sids locations in 2010 growing season.

Parameters	Days to 50% silking	Plant height (cm)	Ear height (cm)	Wilted plant %	Grain yield
δ^2_{gca}	1.029	49.429	35.132	5.157	3.257
$\delta^2_{gca\ x\ Loc}$	0.264	15.568	6.216	14.496	1.232
δ^2_{SCa}	-0.004*	-8.345	-7.332	1.611	0.881
$\delta^2_{SCa\ x\ Loc}$	-0.204	-14.824	-9.786	-0.903	0.173

* Negative estimates are considered zero.

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الاستفادة من نموذج السلالة × الكشاف لتقييم آداء بعض السلالات الجديدة من الذرة الشامية الصفراء

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ملخص

تم إجراء التهجين القمى لـ 22 سلالة صفراء من الذرة الشامية مشتقة من الجيل الذاتى الخامس من مجاميع ائتلافية مختلفة مع كشافين من الهجن الفردية صفراء الحبوب جيزة 162، جيزة 166 فى موسم 2009 بمحطة البحوث الزراعية بسخا، وتم تقييم الهجن القمية الـ 44 الناتجة مع اثنين من الهجن التجارية للمقارنة (جيزة 162 والهجين الثلاثى جيزة 352) فى محطات البحوث الزراعية بسخا وسدس فى موسم 2010 لصفات عدد الأيام حتى ظهور حراير 50% من النباتات، ارتفاع كلا من النبات والكوز، الإصابة بمرض الذبول المتأخر، محصول الحبوب (أردب/ فدان) . أشارت النتائج إلى أن قيمة التباين الراجع للكشافات كان أعلى من قيمة التباين الراجع للسلالات لصفتى التزهير وارتفاع النبات بينما كان العكس صحيحاً بالنسبة لصفات ارتفاع الكوز، نسبة الإصابة بالذبول المتأخر وكذلك محصول الحبوب. كما كان تباين تفاعل السلالات مع المناطق أكبر من تباين تفاعل الكشافات مع المناطق مما يشير إلى أن السلالات كانت أكثر تأثراً بالمناطق عن الكشافات فيما عدا صفة ارتفاع الكوز. أظهر التباين الراجع للفعل الوراثى المضيف دوراً أكثر أهمية فى وراثة الصفات محل الدراسة بالمقارنة بالتباين الراجع للفعل غير المضيف ومع ذلك كان التفاعل بين التأثير المضيف والبيئة أعلى من التفاعل بين التأثير غير المضيف والبيئة لجميع هذه الصفات. أظهرت السلالات 6 ، 8 ، 9 ، 10 ، 11 ، 22 تأثيرات مرغوبة ومعنوية للقدرة العامة على التآلف لصفة محصول الحبوب. كما امتلكت السلالات 1 ، 13 ، 14 ، 15 ، 16 ، 17 ، 22 أفضل التأثيرات المعنوية المرغوبة لصفة التبكير. كانت للسلالتين 1 ، 4 أفضل التأثيرات المرغوبة لصفتى قصر الارتفاع والكوز والسلالتين 11 ، 20 لصفة المقاومة لمرض الذبول المتأخر. أظهر الهجين الفردى الأصفر الكشاف جيزة 166 أنه مختبر جيد لصفات التبكير وقصر الارتفاع والكوز. كما أشارت النتائج إلى وجود عدد 8 هجن قمية صفراء مبشرة للمحصول العالى وهى (10 × هـ ف 162) ، (22 × هـ ف166) ،(10 × هـ ف166) ، (9 ×هـ ف 162) ، (11× هـ ف166) ، (8 × هـ ف166) ، (12× هـ ف162) ، (22 × هـ ف162) حيث تفوقت على أفضل هجن المقارنة جيزة 162 فى صفة محصول الحبوب مما يشير إلى أهمية هذه الهجن الصفراء والتى يمكن الاستفادة منها فى البرامج المستقبلية للتربية للمحصول العالى من الحبوب.

المجلة العلمية لكلية الزراعة – جامعة القاهرة – المجلد (63) العدد الأول (يناير2012): 29-36.