Assiut J. Agric. Sci., (46) No. (4) 2015 (1-11) *ISSN: 1110-0486*
Website: http://www.aun.edu.eg/faculty_agriculture/arabic *E-mail: ajas@aun.edu.eg*

Line X Tester Analysis and Heterosis in Grain Sorghum Hybrids under Arab-ElAwamer Conditions

Eatemad Mohamed Hussien
Grain Sorghum Dept., Field Crops Research Institute, ARC, Giza, Egypt

Abstract:

Sixteen F_1 grain sorghum crosses, its parents (four female lines and four male lines) and one commercial hybrid (Shandaweel-305) as check were evaluated for yield and five other characters in 2014 seasons at Arab El-Awamer Res. Station and Shandaweel Res. Station. Randomized Completed Block Design with three replications was used at each location. The obtained data showed significant orhighly significant differences between locations, genotypes, locationsxgenotypes and location x parents inter actionfor all studied traits except panicle width. Males x females x locations interaction was significant or highly significant for all studied traits. The heterosis values of the better parent ranged from -26.9% in 1000 grain weight to 52.03% in panicle width / plant.Then, the results showed that six crosses were highly significant early flowered than the check and Five crosses were highly significantly out yielded the check 305. The heterosis values of most crosses were highly significant for panicle width, panicle length and grain yield more than the best parent.

The female line ICSB-88005 had significantly negative and positive GCA effects for days to 50% flowering and grain yield / plant, respectively. This result indicates that this line had desirable gene action and could be considered good combiners for both traits. Six crosses had negative and significant SCA effects for days to 50% flowering and they were considered to be the best combiners for earliness. One cross **(**ICSR-93004 x ICSB-89002**)** showed positive and highly significant SCA for grain yield / plant. The female line (ICSB-88005) had positive and highly significantly GCA effect for grain yield and vice-versa for days to 50% flowering. This line had favorable gene action and could be considered good combiners for both traits.

Keywords: Grain Sorghum, Genotypes, Heterosis, Line X Tester

Received on: 8/9/2015 **Accepted for publication on:** 5/10/2015

Referees: Prof. Elsayed A. Elsayed Prof. Adel S. Taghian

Introduction:

In Egypt, grain sorghum is the fourth cereal crop, ranking after wheat, maize and rice. In 2012 season, the area cultivated with grain sorghum was 143.000 ha and the total production was 800,000 metric tons (FAO 2012). Seventy percent of the area is sown in Assiut and Sohag Governorates. Because of progressive consumption that attributed to the growth of the population, the harvested production is inadequate for local use. Consequently, the base of any current studies is concentrating on high grain yield potential and theother of its attributes in grain sorghum.

The discovery of cytoplasmic male sterile (CMS) lines in sorghum facilitates the production of hybrids. Development of hybrids in Egypt is still depending on exotic CMS and restorer lines. Selection among these lines to produce hybrids depends on their good performance of general and specific combining abilities as a first step for hybrid program.

El- Menshawy (1996), Amir (1999), Bakheit *et al.* (2004) and Abo-Elwafa *et al*. (2005) reported that the hybrids were earlier, taller and had higher 1000 grain weight and grain yield than their better parents. Better parent heterosis showed wide variation reaching to 50.9% for plant height (Mahmoud, 1997) and 16.0, 69.6, 24.2 and 26.0% for earliness, plant height, grain weight and grain yield, respectively (El-Menshawy, 1996).

General combining ability effects for male parents were positive and significant for plant height, days to 50% flowering, panicle length and width, 1000 grain weight and grain yield. Also, general combining ability effects for females and restorers were positive and significant for all the studied traits except for 1000 grain weight (Mahmoud, 1997). General combining ability was found to be more important than specific combining for plant height and gain weight (Radwan *et al*., 1997). Twelve crosses out of eighty had positive significant differences in specific combining ability for grain yield (Hovny *et al*., 2000). The objectives of the present study were to evaluate some grain sorghum genotypes and their hybrid for potential and estimate the general and specific combining abilities, as well as heterosis in the obtained hybrids.

Materials and Methods:

Sixteen crosses of grain sorghum hybrids were developed at Arab El-awamer Station, Assiut and Shandaweel Agric. Res. Station, Sohag, Egypt in 2014 season. These hybrids were developed from four introduced cytoplasmic male sterile lines (A-lines) and four restorer lines (R-lines) using line X tester mating design. The origin of the four male sterile lines and the four restorer are presented in (Table 1).

Table (1): Origin and agronomic traits of the parental lines and the check at Shandaweel in 2014 season.

No.	Genotype	Origin
I- Cytoplasmic male sterile lines (CMS lines):		
1	ICSB-37	Indian
2	ICSB-89002	Indian
3	ICSB-47	Indian
4	ICSB-88005	Indian
II-Restorer lines (R-lines):		
1	ICSR -89016	Indian
2	ICSR-93004	Indian
3	ICSR-90012	Indian
4	ICSR-89028	Indian
III- Check (Shandaweel-305) :		
1	Sh-305	Egypt

In 2014 season, the 16 crosses, their parents (four male sterile lines and four restorer lines) and one check (hybrid Shandaweel - 305) were grown at Shandaweel, Sohag and Arab El-Awamr, Assiut Agric. Res. Stations. The genotypes in both locations were sown in a randomized complete block design with three replications at both locations.Plot size was one row with 4 meter long and 70 cm apart. Sowing was done in hills spaced 20 cm. Thinning was done to two plants / hill after hoeing (three weeks from sowing) at both locations. Cultural practices were done and followed the recommendations for growing grain sorghum production in Egypt in both locations. Data were recorded on days to 50% blooming, plant height (cm), 1000-grainweight, grain yield (g), panicle length and width (cm). A combined analysis over the two locations was done according to Gomez and Gomez (1984) for all studied traits. The combining ability effects were estimated using Line X tester analysis according to Kempthorne (1957). Estimates of narrow-sense heritability were calculated according to Kempthorne (1957). Heterosis was calculated as the percentage of deviation from best parent and its significances was tested by the appropriate L.S.D. test.

Results and Discussion:

A- Mean Performance and heterosis:

The results in (Table2) clearly showed that six crosses (no.1,3,4,7,15 and 16) were significantlyearlier than the check hybrid. Five crosses (no.,4,5,6,12 and 16) out of the 16 crosses were significantly surpassing the check hybrid (Sh-305) for grain yield / plant. While, six crosses were significantly taller in plant height than the check which are (no.,2,3,4,5,6 and 7). Two crosses (no., 4 and 16) and six crosses (no., 1,3,6,7,8 and 12) were more than the check inpanicle width and panicle length than the check hybrid,respectively. On the other hand, one cross (no., 9) was higher than check hybrid in 1000-grain weight.

Table (2): Mean performance of studied traits of 16 crosses and their parents over two locations in 2014.

No.	Genotypes	Days to 50% flowering	Plant height (cm)	*Panicle length(cm)*	Panicle width (cm)	1000 grain weight (g)	Grain yield per plant (g)
1	ICSR -89016* ICSA-37	68.17	173.8	30.45	7.697	34.85	60.11
2	ICSR-89016*ICSA-89002	75.84	194.4	28.17	6.750	33.75	56.19
3	ICSR -89016* ICSA-47	68.34	180.6	30.02	6.584	25.35	57.08
4	ICSR-89016 *ICSA-88005	68.84	180.6	28.27	8.717	25.14	66.38
5	ICSR-93004* ICSA-37	80.50	180.3	25.33	5.867	30.66	61.92
6	ICSR-93004 *ICSA-89002	73.50	178.5	30.14	6.633	30.60	65.19
7	ICSR -93004* ICSA-47	69.67	186.6	30.05	5.250	32.02	56.94
8	ICSR-93004 *ICSA-88005	72.00	165.3	30.15	7.884	35.27	57.92
9	ICSR-90012 *ICSA -37	72.34	156.9	28.22	7.200	36.12	60.18
10	ICSR -90012 *ICSA-89002	73.84	155.1	27.20	6.300	31.78	54.50
11	ICSR -90012 * ICSA-47	76.67	134.8	27.80	6.800	26.10	55.04
12	ICSR -90012 * ICSA-88005	75.67	157.1	29.38	6.600	28.41	62.00
13	ICSR-89028 *ICSA-37	76.84	155.7	25.43	6.133	32.94	59.89
14	ICSR-89028 *ICSA-89002	73.50	144.3	24.19	4.600	24.01	47.39
15	ICSR-89028* ICSA-47	68.50	162.6	27.15	6.434	30.75	53.17
16	ICSR-89028 * ICSA-88005	68.33	160.0	28.44	8.367	32.79	62.12
	Parents	**72.66**	**166.6**	**28.15**	**6.741**	**30.66**	**58.50**
17	ICSR -89016	68.34	146.7	21.70	4.567	32.14	43.09
18	ICSR-93004	75.17	165.7	24.25	4.450	22.75	43.24
19	ICSR-90012	70.34	154.1	21.72	5.967	27.85	35.12
20	ICSR-89028	76.17	131.4	20.89	5.834	27.16	47.55
21	ICSB-37	70.67	133.2	22.95	5.600	30.84	44.33
22	ICSB-89002	76.00	117.9	20.34	4.967	27.35	45.82
23	ICSB-47	67.00	106.9	21.92	4.234	27.90	43.80
24	ICSB-88005	68.00	132.8	20.53	5.734	34.38	53.77
25	Shandaweel 305	**70.50**	**166.3**	**28.52**	**7.834**	**35.50**	**55.45**
	LSD 0.05	2.62	8.0	2.48	0.326	2.42	4.83

*, ** Significant at 0.05 and 0.01 levels of probability, respectively.

The combined analysis over the two locations (Table 3) revealed highly significant differences due to genotypes for all studied traits. The interaction of genotypes x locations was also highly significant or significant for all studied traits. Moreover, parents, crosses, males, females and males x females had highly significant or significant differences for all studied traits. Also, cross X location, parent X location, and females X location were highly significant or significant of studied traits except for panicle width. The males X location was highly significant for studied traits except panicle width and panicle length. Results also, indicated that highly significant differences were found among parents vs. crosses, indicating the presence of significant average heterosis. The interaction between males X females X locations was highly significant or significant for all studied traits.

Table (3): Combined analysis of variance of 16 F_1's and 8 parents over two locations in 2014 studied season.

S.O.V	d.f	Mean squares					
		Days to 50% flow-ering	Plant height (cm)	Panicle width (cm)	Panicle length (cm)	Grain yield per plant (g)	1000 grain weight
Location (L)	1	1553.7**	69841.3**	5.921**	1855.5**	82177.8**	8616.5**
Rep (Location)	4	36.22	20.93	0.113	9.562	18.28	15.31
Genotypes (G)	23	84.42**	2994.6**	8.815**	73.79**	407.6**	85.53**
Parents (P)	7	85.75**	2175.2**	2.895**	10.24**	162.0**	18.51**
Parents vs.Crosses	1	45.86**	29931.4**	78.86**	1295.3**	6193.3**	518.5**
Crosses (C)	15	86.37**	1581.2**	6.908**	22.01**	136.5**	87.94**
Female (F)	3	97.5**	970.3*	2.831**	9.108*	129.0**	62.87**
Male (M)	3	85.22**	1240.3**	3.905**	12.81*	161.3**	88.54**
F × M	9	1234.6**	22981.1**	101.375**	322.8**	1950.7**	1268.6**
G ×L	23	29.95**	856.1**	0.140*	58.98**	328.7**	36.81**
P ×L	7	24.70**	1840.3**	0.007	11.50**	109.3**	4.85**
P vs. C ×L	1	626.2**	17997.1**	2.970**	1308.5**	7242.8**	780.9**
C × L	15	34.39**	382.9**	0.178	29.86**	181.7**	45.92**
F × L	3	16.17*	3090.7**	0.009	11.12*	89.52*	26.78**
M × L	3	40.11**	1179.1**	0.003	3.398	142.5**	19.25*
F ×M × L	9	497.1**	4320.2**	2.666*	443.1**	2648.2**	673.5**
Error b	92	5.288	50.58	0.083	4.505	18.39	4.317

*, ** Significant at 0.05 and 0.01 levels of probability, respectively.

Table (4): Heterosis as a percentage for the best parent of sixty hybrids averaged over two locations in 2014 season for the six studied traits.

No.	Genotypes	Days to 50% flowering low parent	Plant height (cm)	Panicle length (cm)	Panicle width (cm)	1000 grain weight (g)	Grain yield per plant (g)
1	**ICSR -89016* ICSA-37**	-0.24	18.52**	32.68**	37.44**	8.45**	35.57**
2	**ICSR-89016*ICSA-89002**	13.92**	8.83**	4.47**	4.76**	-0.58	39.66**
3	**ICSR -89016* ICSA-47**	2.84**	1.81*	22.95**	20.67**	17.12**	35.75**
4	**ICSR-89016 *ICSA-88005**	8.73**	16.87**	10.78**	5.14**	6.8**	25.94**
5	**ICSR-93004* ICSA-37**	10.98**	32.59**	29.8**	35.91**	5.03**	22.63**
6	**ICSR-93004 *ICSA-89002**	-2.22**	7.73**	24.26**	33.56**	11.88**	42.28**
7	**ICSR -93004* ICSA-47**	4.98**	0.67	25.25**	5.59**	14.09**	18.95**
8	**ICSR-93004 *ICSA-88005**	-3.29**	9.85**	15.8**	-21.14**	-12.22**	-0.35
9	**ICSR-90012 *ICSA -37**	1.99**	23.14**	36.96**	44.16**	-21.11**	30.31**
10	**ICSR -90012 *ICSA-89002**	3.98**	12.63**	23.92**	17.98**	14.76**	29.98**
11	**ICSR -90012 * ICSA-47**	14.43**	-12.55**	26.84**	13.97**	-6.45**	25.65**
12	**ICSR -90012 * ICSA-88005**	2.24**	23.74**	23.88**	10.29**	10.22**	11.81**
13	**ICSA-37 ICSR-89028 ***	1.23	23.13**	30.26**	52.03**	-26.9**	23.46**
14	**ICSR-89028 *ICSA-89002**	5.88**	-0.24	24.33**	37.5**	2.57*	7.71**
15	**ICSR-89028* ICSA-47**	11.27**	1.91*	35.26**	10.61**	-17.38**	15.31**
16	**ICSR-89028 * ICSA-88005**	0.49	20.51**	36.15**	43.43**	-4.65**	15.52**

*, ** Significant at 0.05 and 0.01 levels of probability, respectively.

Data in (Table 4) showed that the heterosis estimates for days to 50% flowering declared that 2 crosses (no.,6,8) out of 16 crosseswere highly significant earlier than the early parent. While, 13 crosses (no., 1,2,3,4,5,6,8,9,10,12,13,15 and 16) were significant and highly significantly taller than their tallest parent. For 1000-grain weight, 9 crosses (no., 1,3,4,5,6,7,10,12 and 14) out of 16 crosses were heavier than the best parent. The heterosis estimates for grain yield / plant, indicated that 15 crosses were highly significantly exceeded their better parents. The heterosis estimated for panicle length and width, displayed that the 16 crosses had highly significantly exceededthe better parents. In both traits similar results were obtained by Radwan *et al.* (1997), Salunke and Deore (1998), Haussmann *et al.* (1999) Hovny *et al.* (2001) and Sayed (2003). The heterosis estimates for 1000 grain weight were significantly higher than the best parent in 9 crosses (no.,1,3,4,5,6,7,10,12 and 14).

B- Combining ability:

B-1- General combining ability:

The estimates of general combining ability (GCA) effects of the parental lines for all studied traits over two locationsare presented in (Table5). The GCA effects for days to 50% flowering declared that two CMS-lines (ICSB-47 and ICSB-88005) and one R-line (ICSR -89016) had negative and highly significantly GCA effects. These lines may be considered good combiners and having favorable genes for earliness. In addition, for plant height, two R-lines (ICSR -89016 and ICSR-93004) had positive and highly significant GCA effects, meaning that it had desirable gene action for tallness. While, two R-lines (ICSR-90012 and ICSR-89028) had negative and highly significant GCA effects, meaning that these R-lines had desirable gene action for shortness.

For 1000-grain weight, one CMS-line (ICSB-37) and one R-line (ICSR-93004) showedpositive andhighly significant GCA effects, that means these lines had favorable gene action for heavy grain weight.

Regarding to the grain yield / plant, two CMS-lines (ICSB-37and ICSB-88005) and one R-line (ICSR-93004) had positive and significant GCA effects, these lines had favorable genes for grain yield / plant and considered best combiners for grain yield.Concerning panicle width, one CMS-line (ICSB-37) and one R-line (ICSR-93004) showed positive significantly GCA effects, That means these lines had favorable gene action for panicle width. In addition, for panicle length, both (ICSR -89016) and CMC (ICSB-88005) showed positive and significant GCA effects, That means these lines had favorable gene action for panicle length.

Table (5): Estimates of general combining ability effects for all studied traits over twolocations.

		Days to 50% flowering	Plant height (cm)	Panicle length(cm)	Panicle width (cm)	1000 grain weight (g)	Grain yield per plant (g)
Female lines	ICSB-37	1.8021**	0.0187	-0.7906	2.9833**	2.9833**	2.0233*
	ICSB-89002	1.5104**	1.4354	-0.726	-0.6233	-0.6233	-2.6833**
	ICSB-47	-1.8646**	-0.5271	0.6073	-2.1017**	-2.1017**	-2.9458**
	ICSB-88005	-1.4479**	-0.9271	0.9094*	-0.2583	-0.2583^{ns}	3.6058**
Male lines	ICSR -89016	-2.3646**	15.6896**	1.0781*	-0.885*	-0.885*	1.4392
	ICSR-93004	1.2604**	11.0146**	0.7698	1.4792**	1.4792**	1.9908*
	ICSR-90012	1.9688**	-15.6812**	0.001	-0.0567	-0.0567^{ns}	-0.5692
	ICSR-89028	-.08646	-11.0229**	-1.849**	-0.5375	-0.5375^{ns}	-2.8608**
	S.E	**0.47**	**1.45**	**0.43**	**0.06**	**0.042**	**0.88**

*,** Significant at 0.05 and 0.01 levels of probability, respectively.

Table (6): Estimated of specific combining ability effects for all studied traits over two locations.

No.	Genotypes	Days to 50% flowering	Plant height (cm)	Panicle length (cm)	Panicle width (cm)	1000 grain weight (g)	Grain yield per plant (g)
		Com.	Com.	Com.	Com.	Com.	Com.
1	ICSR -89016* ICSA-37	-3.9271**	-8.5646**	2.0156*	0.2742	2.0958*	-1.8575
2	ICSR-89016*ICSA-89002	4.7812**	2.6271	-2.7927**	-0.5275**	-4.4617**	-0.5958
3	ICSR -89016* ICSA-47	-4.0938**	5.9063*	0.8594	0.4892**	2.5342**	0.2308
4	ICSR-89016 *ICSA-88005	3.2396**	0.0313	-0.0823	-0.2358	-0.1683	2.2225
5	ICSR-93004* ICSA-37	4.0313**	10.6521**	-0.3323	-0.0192	4.6025**	-1.0675
6	ICSR-93004 *ICSA-89002	-1.9271*	-0.6229	1.9427*	0.8925**	-0.9117	7.3842**
7	ICSR -93004* ICSA-47	-2.3021*	2.7396	-0.2219	0.2425	1.7975*	-0.7458
8	ICSR-93004 *ICSA-88005	0.1979	-12.7687**	-1.3885	-1.1158**	-5.4883**	-5.5708**
9	ICSR-90012 *ICSA -37	-0.0938	-1.2354	0.1844	-0.3817*	-2.3192*	0.085
10	ICSR -90012 *ICSA-89002	-2.3854*	9.4563**	0.526	-0.6867**	1.9833*	-0.61
11	ICSR -90012 * ICSA-47	3.9062**	-15.6646**	-0.9552	0.5467**	-2.3975**	0.05
12	ICSR -90012 * ICSA-88005	-1.4271	7.4437*	0.2448	0.5217**	2.7333**	0.475
13	ICSR-89028 *ICSA-37	-0.0104	-0.8521	-1.8677*	0.1267	-4.3792**	2.84
14	ICSR-89028 *ICSA-89002	-0.4688	-11.4604**	0.324	0.3217*	3.39**	-6.1783**
15	ICSR-89028* ICSA-47	2.4896**	7.0188*	0.3177	-1.2783**	-1.9342*	0.465
16	ICSR-89028 * ICSA-88005	-2.0104*	5.2938	1.226	0.83**	2.9233**	2.8733
	S.E	**0.94**	**2.90**	**0.87**	**0.12**	**0.85**	**1.75**

*,** Significant at 0.05 and 0.01 levels of probability, respectively.

B-2- Specific combining ability effects:

The estimates of specific combining ability (SCA) effects over the two locations were presented in (Table-6). It is clear that six crosses (no., 1, 3, 6, 7, 10 and 16) had negative and highly significant or significant SCA effects for days to 50% flowering, indicating that these crosses are represented the best combination for earliness. While, five crosses (no., 2,4,5,11 and 15) had positive and significant or highly significant SCA effects. In general, crosses which had negative significant SCA effects for

days to 50% flowering were early in flowering. These results were in agreement with those obtained by Mahmoud (2002), El-Abd (2003), Amir (2004), Amir (2008) and Mahmoud *et al*, (2013) who found that crosses had negative significant specific combining ability effects were early flowering. Moreover, general and specific combining ability effects were effective in predicting hybrid performance in all traits.

For plant height, five crosses (no., 3, 5, 10, 12 and 15) had positive and significant or highly significant SCA effects and four crosses (no., 1,8,11 and 14) had negative and highly significant effect SCA, the negative SCA effects indicating that these crosses are represented the best combination for shortness and vice-versa for positive SCAeffects.

Eight crosses (no., 1,3,5,7,10, 12,14 and 16) showed positive and significant or highly significant SCA effects for 1000- grain weight, indicating that these crosses may be considered the best combinations for heavy grain weight.

With respect to grain yield / plant, data showed that one cross (no., 6) had positive and highly significant SCA effects, indicating that this cross would be considered the best combiner and had favorable gene combination for grain yield / plant.

Regarding panicle width,five crosses (no., 3,6,11,12,14,16) showed positive and highly significant or significant SCA effects over the two locations and two crosses (no., 1,6) showed positive and significant SCA effects for panicle length indicating that these crosses are represented the best combination for panicle width and panicle length, respectively.

Similar results were obtained by Badhe and Patil (1997), Changang *et al*. (1998), Shakoor and Qureshi (1999), Mostafa and El-Menshawi (2001), Mahmoud (2002), Sayed (2003) and Hovny (2001).

From the above data, it can be concluded that, the CMS-lines (ICSB-37 and ICSB-88005) and the R-line (ICSR-93004) had the best GCA values in grain yield / plant.

Generally, the cross (ICSR-93004*ICSB-88005) is the best combination and had positive and highly significants out-yielded the check Shandaweel-305.

References:

Abo-Elwafa, A.T.A.Ahmed, E.A. Hassaballa and M.A.Sayed. 2005. Heterosis and line X tester analysis of combining ability in grain sorghum (*Sorghum bicolor* L.*) Moench).* Assiut J. Agric. Sci.*, 36: 159-175.*

Amir, A.A.1999. Line X tester analysis for combining ability in grain sorghum (*Sorghum bicolor* L.*)*Moench). M.Sc. Thesis, Fac. of Agric., Assiut Univ., Egypt.

Amir, A. A. (2004).Breeding for drought tolerance in some grain sorghum genotypes and their hybrids. Ph.D. Thesis, Fac. Agric., Assiut Univ., Egypt.

Amir, A. A. 2008. Evaluation of some grain sorghum crosses and their parents under two levels of irrigation. (The Second Field Crops Conference),FCRI, ARC, Giza, Egypt, 241-261.

Bakheit, B. R., M.R.A. Hovny, A.H. Galal and A.A. Abd EL-

Mottaleb., 2004. Heterosis and combining ability in grain sorghum (*Sorghum bicolor*L. Moench). Assiut J. Agric. Sci., 35: 165-183.

Badhe, P.L., and H.S. Patil. 1997. Line x tester analysis in sorghum. Annals of Agric. Res. 18: 281-284. (C.F. Plant Breed. Abst. 68 (2):1540, 1998).

Changang, M., A. Ximei, Z. Fuyao, Z. JinBo, W. Lixen and L. Peiliang. 1998. Analysis of the combining ability of newly developed sorghum male sterile lines A2F4A and A1356A. Acta Agric. Boreali-Sinico. 13: 81-85. (C.F. Plant Breed. Abst. 69 (3): 2055, 1999).

El-Abd. M. H. H., (2003). A genetic analysis of moisture stress tolerance in sorghum M.Sc. Thesis, Faculty of Agic. Assiut Univ., Egypt.

El- Menshawy, M.M.S. 1996. A study on the production of grain sorghum hybrids. Ph.D. Thesis, Fac. of Agric., Cairo Univ., Egypt.

FAO. 2012. HTTP:// APPSL.FAO. ORG/SERVLET/XTESERV-LET.JRUN.

Gomez, K.A. and A.A. Gomez. 1984. Statistical Procedures for Agricultural Research. John Wiley and Sons. New York. 2nd ed.

Haussmann, B.I.G., A.B. Obilana, P.O. Ayiecho, A. Blum, W. Schipprack, and H.H. Geiger. 1999. Quantitative-genetic parameters of sorghum [*Sorghum bicolor* L. Moench] grown in semi-arid areas of Kenya. Euphytica 105: 109-118.

Hovny, M.R.A., O.O. El-Nagouly and E.A. Hassaballa. 2000. Combining ability and heterosis in grain sorghum (*Sorghum bicolor* L. Moench). Assiut J. Agric. Sci., 31 (3): 1-16.

Hovny, M.R.A., M.M. El-Menshawi and O.O. El-Nagouly. 2001. Combining ability and heterosis in grain sorghum (*Sorghum bicolor* L. Moench). Bull. Fac. Agric., Cairo Univ., 52: 47-60.

Kempthorne, O. 1957. Yield stability of single, three way and double cross hybrids. Sorghum Newsletter, 33-59.

Mahmoud, K.M. 1997. Combining ability and heterosis in grain sorghum (*Sorghum bicolor* L.Moench). M.Sc. Thesis, Faculty of Agric. Assiut Univ., Egypt.

Mahmoud, Kh. M. 2002. Breeding for yield and related traits of grain sorghum under water stress conditions. Ph.D. Thesis, Faculty of Agric. Assiut Univ., Egypt.

Mahmoud, Kh.M., H. I. Ali and A. A. Amir (2013). Line* Tester analysis and heterosis in grain sorghum hybrids under water stress conditions. Assiut J. Agric. Sci., No. (2): 13-38 .

Mostafa, M.S.A. and M.M. El-Menshawi. 2001. Combining ability estimates from diallel crosses among grain sorghum (*Sorghum bicolor* L. Moench) restorer lines. Egypt. J. Appl. Sci. 16: 142-149.

Radwan, M.S., M.S.A. Mostafa and M.M. El-Menshawy. 1997.

Combining ability and heterosis in grain sorghum. Egypt. J. Plant Breed. 1: 73-84.

Salunke, C.B. and G.N. Deore. 1998. Study of heterosis for physiological traits and grain yield in rabbi sorghum. Annals of Plant Physiology. 12: 130-135. (C.F. Plant Breed. Abst. 70 (2): 1456, 2000).

Sayed M.A.E., 2003. Heterosis and line x tester analysis of combining ability in grain sorghum (*Sorghum bicolor* L. Moench). M.Sc. Thesis, Faculty of Agric. Assiut Univ., Egypt.

Shakoor, A. and A.S. Qureshi. 1999. Genetic effects and heritability for early maturity and no senescence traits in sorghum (*Sorghum bicolor* L.). Sarhad J.

Singh, R.K. and B.D. Chaudhry. 1977. Biometrical Methods in quantitative genetic analysis. P. 178-185. Kalyani: pub. New Delhi.

Assiut J. Agric. Sci., (46) No. (4) 2015 (1-11) *ISSN: 1110-0486*
Website: http://www.aun.edu.eg/faculty_agriculture/arabic *E-mail: ajas@aun.edu.eg*

أستخدام طريقة تحليل السلالة فى الكشاف وقوة الهجين فى انتاج ذرة الحبوب الرفيعة تحت ظروف عرب العوامر

اعتماد محمد حسين
قسم بحوث الذرة الرفيعة – معهد بحوث المحاصيل الحقلية – مركز البحوث الزراعية– مصر

الملخص:

تهدف هذه الدراسة إلى معرفة سلوك وقوة الهجين والقدرة العامة والخاصة علي الائتلاف في الهجن الناتجة من التلقيح بين أربعة سلالات عقيمة عقم ذكرى سيتوبلازمى وأربعة سلالات معيدة للخصوبة. تم إنتاج الهجن في مزرعة محطة بحوث جزيرة شندويل بسوهاج و قد تم تقييم الستة عشرة هجينا وآبائها بالإضافة لهجين المقارنة هجين شندويل – ٣٠٥ في مزرعة محطة بحوث جزيرة شندويل بسوهاج– مصر ومحطة عرب العوامر بأسيوط عام ٢٠١٤ م.

أوضحت النتائج لتحليل التباين المشترك أن هناك اختلافات معنوية بين الآباء و الهجن الناتجة منها. وقد اوضحت النتائج ان هناك ست هجن عالية المعنوية بالنسبة لصفة التبكير فى التزهير وأن معظم الهجن كانت ذات قيم عالية المعنوية بالنسبة لقوة الهجين لكل من طول وعرض القنديل ومحصول الحبوب عن أفضل الأبوين. وقد وجد أن سلالتين عقيمتين هما: (ICSB-37 و ICSB-88005) وسلالة أخري معيدة للخصوبة (ICSR- 93004). هذه لها قدرة عامة على الائتلاف موجبة وعالية المعنوية لصفة محصول الحبوب للنبات الواحد، وأن السلالة العقيمة (ICSB-88005) بالاضافة الى ذلك مبكرة فى التزهير لذلك تعتبر هذه السلالة العقيمة تمتلك الجين المرغوب وتوصف بانها السلالة الجيدة لعمل هجن جيدة لكل من صفتى محصول الحبوب بالقنديل والتبكير فى التزهير.

وأيضا أظهرت النتائج أن هجين واحد له قدرة خاصة الائتلاف وعالية المعنوية لصفة محصول الحبوب للنبات الواحد وهو (ICSB-93004 *ICSR-89002) ومتفوق على هجين المقارنة شندويل–٣٠٥، ويجب تقييم هذا الهجين في تجارب موسعة لكي يتم إنتاجه على نطاق تجارى.