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HETEROSIS, INBREEDING DEPRESSION AND COMBINING ABILITY ANALYSIS IN SOME COTTON CROSSES (*GOSSYPIUM BARBADENSE.L*)

EL-ADLY,H.H.

Cotton Research Institute, A RC, Giza

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Abstract

Four cotton varieties belonging to *Gossypium barbadense L i.e.*Giza80, Giza83, Australian and Pima early were selected as parents and crossed in a half diallel pattern to evaluate general and specific combining ability effects (GCA and SCA) and heterosis effects for some agronomic traits i.e. boll weight (BW), seed cotton yield (SCY), lint yield (LY), lint percentage (L%), seed index (SI), lint index (LI), micronaire value (Mic), pressly index (PI) and Upper half means (U.H.M). Analysis of variance revealed significant differences among entries for all traits studied except for BW, Mic and PI in the F_1's and BW and SI in F_2's which showed insignificant differences. The mean squares, in both F_1's and F_2's for general combining ability (GCA) were significant for all traits except for BW in F_1's, SI and U.H.M in F_2's and Mic values in both populations (F_1 and F_2). Meanwhile the mean squares for specific combining ability (SCA) were significant for LY, L%, SI, LI and U.H.M in F_1's and SCY, LY, L% and Mic values in F_2's. The GCA/SCA ratio of variance components indicated that additive genetic variance was generally of greater importance for SCY, LY, L%, SI and PI in the F_1 hybrids and for BW, SCY, LY, SI, LI, PI and U.H.M in the F_2 generation. Mid-parents heterosis values were significant and positive for U.H.M cross Giza83 x Pima early (P2 x P4), SCY, LY and U.H.M cross Australian x Pima early (P3 x P4). On the other hand significant negative heterotic values were observed for BW cross Giza80 x Australian (P1 x P3), BW, L%, LI, PI and U.H.M cross Giza80 x Pima early (P1 x P4), BW, SCY, LY, SI, LI, PI and U.H.M cross Giza83 x Australian (P2 x P3), LY, L% and LI cross Giza83 x Pima early (P2 x P4) and BW, SI and PI cross Australian x Pima early (P3 x P4). Only slight heterosis values relative to the better-parent were observed in this set of material for all characters studied except for SCY in cross Giza80 x Australian (P1 x P3) and BW cross (Australian x Pima early (P3 x P4) that gave significant positive estimates to the heterotic effects relative to better-parent. Regarding inbreeding depression, significant negative effects were obtained for Mic values cross Giza80 x Australian (P1 x P3), LI, Mic and U.H.M cross Giza80 x Pima early (P1 x P4) and cross Giza83 x Pima early (P2 x P4).

INTRODUCTION

Diallel analysis is one of the methods that reveal yield potentiality of the cotton cultivars and their crosses on the basis of their general and specific combining ability.

General combining ability (GCA) includes the additive genetic variance, while specific combining ability (SCA) could be considered as a measure of non-additive genetic variance arising largely from dominance and epistatic deviations. Several studies have been established in this respect by many investigators. El-Dobaby et al (1997) found highly significant effects for GCA and SCA for each of seed cotton yield/ plant, boll weight, lint percentage, seed index and lint index. Hendawy et al (1999) reported that both GCA and SCA were highly significant for all studied fiber attributes .Khorgade et al (2000) determined GCA and SCA in seven American cotton genotypes, They indicated that the GCA and SCA were highly significant for ginning percentage, lint index, seed index, microniare value and Upper half means. El-Adl et al (2001) reported significant GCA and SCA for seed cotton yield/plant and its component characters. Zie et al (2001) revealed that GCA were highly significant for boll weight and ginning out-turn, while SCA were highly significant for yield and staple length. Laxman and Genesh (2003) revealed that SCA variance were higher for boll weight, seed cotton yield, seed and lint index and halo length than GCA. Ismail et al (2005) studied combining ability in some Egyptian cotton genotypes, they found that significant positive GCA effects with regard to seed cotton yield and most of its contributing variables.

The objective of this investigation is to study the relative magnitude of additive and non-additive genetic variance through evaluating both general and specific combining ability (GCA and SCA) effects for yield and yield components in 4 x 4 diallel crosses

MATERIAL AND METHODES

A half diallel set of four cotton cultivars namely, Giza80, Giza83, Australian and Pima early belonging to *G.barbadense .L* were evaluated for seed cotton yield and some agronomic characters, In 2004 season the four parents were grown and all possible crosses were carried out. In 2005 season, the 6 F_1's hybrid seeds were planted in order to obtain the F_2's generations through self-fertilization. The parental varieties were also crossed to obtain additional F_1's hybrid seeds. The F_1's seeds and F_2's seeds were produced at Giza Experimental station of the Agricultural Research Center in 2004 and 2005 seasons. In 2006 season, a randomize complete blocks trial with three replicates was carried out including the four parental varieties and six F_1's and F_2's populations in Seds Experimental Station, Agricultural Research Center at Bany souif governorate. Each plot was two rows 7m long and 60 cm a part, the hill to hill distance was 50 cm. The hills were thinned to one plant/hill. Cultural practices were carried out as usually done in Seds Experimental Farm.

A representative random samples of ten individual plants in each plot were chosen for studying the following traits.

1- Boll weight (BW). Average weight in grams.

2- Seed cotton yield/plant (SCY) in grams.

3- Lint yield/plant (LY) in grams.

4- Lint percentage (L %)

5- Seed index (SI) in grams

6- Lint index (LI) in grams.

7- Micronaire reading (Mic)

8- Pressly index (PI)

9- Upper half means (U.H.M)

Estimates of combining ability effects were carried out according to Griffing's (1956) method 2 model 1 and were analyzed on a plot mean basis to obtain estimates of general and specific combining ability (GCA and SCA) effects and variances. All effects were assumed to be fixed.

Heterosis was expressed for all studied traits as percent increase of the F1, s performance above the mid-parents (MP) and better-parents (BP) values. Inbreeding depression was calculated from comparison between F1 and F2.

RESULTS AND DISCUSSION

Analysis of variance

The Analysis of variance for genotypes, general combining ability (GCA) and specific combining ability (SCA) in addition to GCA/SCA ratio are presented in Table 1 for the two populations (F1 and F2). The results in Table (1) showed that the differences among genotypes were significant or highly significant for all traits in both populations (F_1's and F_2's) except for boll weight (BW), micronairee values (Mic) and pressely index (PI) in F_1's and boll weight (BW) and seed index (SI) in F_2's. Mean squares results of GCA and SCA (Table1) showed that the GCA effects were significant or highly significant for all traits except for boll weight (BW) and micronaire values (Mic) in F_1's and seed index (SI), micronaire values (Mic) and Upper half means (U.H.M) in F_2's. The results obtained for SCA effects were significant or highly significant for lint yield (LY), lint percentage (L%), seed index (SI), lint index (LI) and Upper half means (U.H.M) in F_1's generations and seed cotton yield (SCY), lint yield (LY), lint percentage (L%) and micronaire values (Mic) in F_2's generations. GCA/SCA ratio indicated that the GCA was greater than SCA for all traits studied in the two generations except for boll weight (BW), lint index (LI), micronaire values (Mic) and Upper half means (U.H.M) in F_1's and lint percentage (L %) and micronaire values in

F_2's, generations, Therefore, it could be concluded that most of the genetic variance for those traits was due to additive and non-additive gene actions. These results are in general agreement with those reported by Rahoumah and El-Shaarawy (1992), Khorgade et al (2000), El-Adle et al (2001), Laxman and Genesh (2003) and Ismail et al (2005).

Combining ability

General combining ability effects (GCA) of the parents for each trait are presented in Table 2. The results showed that the parent Giza80 showed insignificant GCA effects for all traits in both generations except for Upper half means (U.H.M) which showed significant positive GCA effects in F_1's generation. Meanwhile, the parent Giza83 showed highly significant and positive GCA effects for boll weight (BW) and lint percentage (L %) in F_1's. So GCA effects were negative and highly significant for seed index (SI) in F_1's. Moreover, the GCA effects of the parent Australian were negative and significant or highly significant for seed cotton yield (SCY), lint yield (LY) in both generations, seed index (SI) and lint index (LI) in F_1's generation. The parent Pima early revealed highly significant positive GCA effects for seed cotton yield (SCY) in F_1's and F_2's generations, lint yield (LY) and seed index (SI) in F_2's and F_1's generation, respectively. On the other hand Upper half means (U.H.M) trait for the same parent recorded negative and highly significant GCA effects.

It is worth noting that, estimates of GCA effects ($g^{\wedge}{}_{I}$) either positive or negative would indicate that a given parent is much better or much poor than the average of the group involved in the diallel system.

Table 3 showed the SCA effects for each of the six combinations crosses. From those results it could be noticed that the cross (P1xP2) showed significant or highly significant positive SCA for lint yield (LY), lint percentage (L%), lint index (LI) in F_1's generation and micronaire value (Mic) in both generations. On the other hand the F_1's generation for the cross (P1xP2) recorded negatively significant SCA effects for boll weight (BW), seed cotton yield (SCY) and lint yield (LY) traits in F_2's generation. The cross (P1xP3) exhibited significant positive SCA effects for seed index (SI) in F_1's, micronaire value (Mic) in both generations and Pressley index (PI) in F_2's generation. Highly significant positive SCA effects for the cross (P1xP4) were noticed for lint percentage (L %) in F_2's, seed index (SI) in F_1's, lint index and micronaire value (Mic) in both generations, while Upper half means (U.H.M) recorded significant negative SCA effects in F_1's generation. Insignificant SCA effects were observed for all traits in cross (P2xP3) except for seed cotton yield (SCY), lint yield (LY) and micronaire value (Mic) traits in F_2's generation which recorded positively significant SCA estimates, while L% in F_2's and Mic in F_1's showed significant negative SCA effects. The cross

(P2xP4) showed significant negativel SCA effects in F_1's generation for seed cotton yield (SCY), lint yield (LY), lint index (LI), micronaire value (Mic) and Upper half means (U.H.M) in F_1'sgeneration, while lint percentage (L %) recorded highly significant negative SCA effects in both generations. On the other hand, the micronaire value for the cross (P2xP4) recorded highly significant positive SCA effects only in F_2's generation. With respect to cross (P3xP4) Table (3), revealed significant positive SCA for boll weight (BW) and Upper half means (U.H.M) in F_1's generation. Meanwhile negatively significant SCA effects were recorded for seed cotton yield (SCY), lint yield (LY), lint percentage (L %) in F_2's generation and lint index in F_1's generation.

The crosses which showed significant positive SCA effects could be considered promising crosses for improving these traits.

Heterosis and inbreeding depression

Table (4) revealed mid-parents and better parent hetrotic effects for the characters studied

Concerning the cross (P1 x P2), insignificant heterotic effects relative to mid-parents were found for all traits. While, heterosis effects to better parent were negative and significant for BW, SI, LI and PI. Regarding the cross P1 x P3 negative and significant heterotic effects relative to mid-parents were found for only BW and better parent for BW, LY, SI, LI and 2.5% SL, while SCY trait revealed positively significant heterosis to better parent (Table 4). All traits studied in the cross P1x P4 showed negative and significant heterotic effects relative to mid-parents and better parent except for SCY, LY, and SI which showed insignificant heterosis effects relative to mid- parents and Mic uints relative to mid and better parents heterotic effects. Significant negative heterosis effects relative to mid-parents and better parent were observed for BW, SCY, LY, SI, LI and U.H.M, while PI trait showed negative and significant heterosis relative to mid-parents in cross (P2 x P3). With respect to the cross (P2 x P4), (Table 4) insignificant heterosis effects were detected for SCY, Mic and PI relative to mid and better parents, while BW recorded significant negative heterotic effect to better parent and 2.5% SL showed positively significant heterosis effect to mid-parents. The cross P3 x P4 showed negative and significant heterosis effects relative to mid-parents for all traits except for L%, LI and Mic, while better parent heterosis effects were negatively significant for L%, SI, PI and U.H.M traits. On the other hand, BW trait revealed positively significant heterotic effect to better parent (Table 4).

Inbreeding depression (ID %) effects were calculated for each cross. Most of the crosses showed insignificant inbreeding depression for characters studied except for Mic trait in cross (P1 x P3) and LY, Mic and U.H.M in the crosses (P1 x P4) and (P2 x P4) which showed significant negative inbreeding depression effects (Table 4). The above results indicated that insignificant ID% may be due to the presence of linkage between genes in these materials. In general, the present investigation revealed that not only additive but also non-additive genetic variances were important in the inheritance of yield and yield components characters in cotton breeding programs.

Table 1. Mean squares for genotypes and combining ability (GCA and SCA) in F1, s and F2, s generations for traits studied

S.O.V	Generations	BW	SCY	LY	L%	SI	LI	Mic	PI	U.H.M
Genotypes (G)	F1	0.040	4385.818**	649.994**	3.473**	0.958**	0.314**	0.018	0.092	3.031**
	F2	0.088	6681.763**	915.815**	4.031**	0.231	0.075*	0.214**	0.099*	0.853*
General combining ability (GCA)	F1	0.009	2961.368**	336.278**	1.986**	0.394**	0.051*	0.003	0.072*	0.820**
	F2	0.050**	3414.587**	383.575**	1.275**	0.099	0.039**	0.002	0.042*	0.680
Spacific combining ability (SCA)	F1	0.015	712.225	156.858*	0.744**	0.282**	0.132**	0.007	0.010	1.106**
	F2	0.019	1633.588**	266.120**	1.378**	0.066	0.018	0.106**	0.029	0.087
GCA/SCA	F1	0.600	4.158	2.144	2.669	1.397	0.386	0.429	7.2	0.741
	F2	2.632	2.090	1.441	0.925	1.500	2.167	0.019	1.448	7.816

*' ** Significant at the 5% and 1% level of probability, respectively.

Table 2. Parental mean performances and mean estimates of GCA effects of four parents and their F1,s and F2,s generations.

Traits	Generations	P1 (G80)	P2 (G83)	P3 (Australian)	P4 (Pima early)	L.S.D		g_i^	g_i^ - g_{ij}^
						1%	5%		
BW	$\bar{x}$	3.3	3.1	3.0	2.8				
	F1	0.008	0.031	0.019	-0.058	0.083	0.063	0.032	0.055
	F2	0.003	0.125^{**}	-0.042	-0.086	0.116	0.088	0.045	0.077
SCY	$\bar{x}$	269.53	299.07	256.8	281.5				
	F1	12.881	-4.375	-29.347^{**}	20.842^{**}	19.678	14.949	7.627	12.454
	F2	-8.911	1.150	-24.372^{**}	32.133^{**}	17.049	12.952	6.608	10.790
LY	$\bar{x}$	102.17	119.83	101.30	106.3				
	F1	5.661	0.050	-10.594^{**}	4.883	7.485	5.686	2.901	4.738
	F2	-2.989	1.272	-8.622^{**}	10.339^{**}	6.654	5.055	2.579	4.212
L%	$\bar{x}$	38.67	40.0	38.57	37.67				
	F1	0.106	0.494^{**}	-0.228	-0.828^{**}	0.392	0.298	0.152	0.247
	F2	0.386	0.297	-0.053	-0.631	1.156	0.878	0.448	0.232
SI	$\bar{x}$	8.9	9.4	9.6	10.7				
	F1	0.033	-0.189^{**}	-0.194^{**}	0.350^{**}	0.142	0.108	0.055	0.095
	F2	0.006	-0.028	-0.144	0.167	0.245	0.186	0.095	0.158
LI	$\bar{x}$	5.6	6.3	6.0	6.4				
	F1	0.089	0.056	-0.117^{*}	-0.028	0.142	0.108	0.055	0.084
	F2	-0.064	0.069	-0.075	0.069	0.116	0.088	0.045	0.063
Mic	$\bar{x}$	4.0	4.2	4.2	4.1				
	F1	0.022	-0.011	0.017	-0.028	0.077	0.059	0.030	0.055
	F2	0.006	0.017	-0.028	0.006	0.067	0.051	0.026	0.044
PI	$\bar{x}$	10.1	9.9	9.8	9.6				
	F1	-0.042	-0.064	0.164	-0.058	1.625	1.235	0.063	0.105
	F2	0.008	-0.047	0.114	-0.075	1.161	0.882	0.045	0.071
U.H.M	$\bar{x}$	30.3	30.3	29.9	29.1				
	F1	0.253^{*}	0.008	0.007	-0.269^{**}	0.258	0.196	0.100	0.167
	F2	0.239	0.078	-0.161	-0.156	0.325	0.247	0.126	0.202

*' ** Significant at the 5% and 1% level of probability, respectively.

Table 3. Estimates of Spacific combining ability effects (S_{ij}) for traits studied

Traits	Generations	P1 x p2	P1 x p3	P1 x p4	P2 x p3	P2 x p4	P3 x p4	L.S.D		S_{ij}	$S_{ii}-S_{ij}$
								1%	5%		
BW	F1	-0.156	0.022	-0.001	-0.033	0.011	0.189*	0.224	0.171	0.086	0.083
	F2	-0238*	-0.038	0.107	-0.060	-0.049	0.018	0.284	0.216	0.110	0.104
SCY	F1	32.698	15.403	-10.119	-3.708	-39.030*	9.291	47.660	36.207	18.473	17.613
	F2	-54.606**	-28.250	-6.656	41.756**	-15.417	-31.528*	41.283	31.370	16.005	15.260
LY	F1	14.602*	6.713	-3.946	-0.442	-17.387*	-8.209	18.130	13.773	7.027	6.700
	F2	-20.683**	-12.222	0.350	16.417**	-9.844	-13.550*	16.117	12.244	6.247	5.956
L%	F1	0.813*	-0.353	-0.198	-0.276	-1.253**	-0.620	0.947	0.719	0.367	0.350
	F2	0.313	-0.537	0.974*	-0.814*	-1.237**	-1.253**	0.888	0.674	0.344	0.328
SI	F1	0.142	0.314*	0.837**	0.170	0.026	0.164	0.359	0.272	0.139	0.132
	F2	-0.144	0.206	-0.106	0.239	0.394	-0.089	1.914	1.454	0.742	0.224
LI	F1	0.309*	0.181	0.492**	0.081	-0.274*	-0.302*	0.323	0.245	0.125	0.120
	F2	0.018	0.029	0.251**	0.062	0.018	-0.038	0.243	0.184	0.094	0.089
Mic	F1	0.116**	0.088**	0.032**	-0.120**	-0.068**	0.004	0.018	0.014	0.071	0.068
	F2	0.184**	0.229**	0.262**	0.151*	0.318**	0.029	0.165	0.125	0.064	0.062
PI	F1	-0.004	0.134	-0.077	0.023	0.012	0.118	1.290	0.980	0.500	0.151
	F2	0.089	0.261*	0.050	0.017	0.139	-0.056	0.273	0.208	0.106	0.101
U.H.M	F1	0.349	-0.018	-0.540*	-0.140	-0.662**	1.038**	0.624	0.474	0.242	0.231
	F2	-0.217	-0.011	-0.017	-0.020	0.078	0.250	0.777	0.590	0.301	0.287

***' ** Significant at the 5% and 1% level of probability, , respectively.**

P1 x P2 (Giza80 x Giza83)
P2 x P3 (Giza83 x Australian)
P1 x P3 (Giza80 x Australian)
P2 x P4 (Giza83 x Pima early)
P1 x P4 (Giza80 x Pima early)
P3 x P4 (Australian x Pima early)

Table 4. Heterosis value (%) over both mid parents (M.P) and better- parent (B.P) and inbreeding depression for characters studied.

Crosses	Parametrs	Characters								
		BW	SCY	LY	L%	SI	LI	Mic	PI	U.H.M
P1 x P2	H.M.P	- 6.250	-10.728	-8.802	1.500	-3.261	-1.667	0.000	-4.950	-1.320
	H.B.P	- 9.091*	-15.027	-15.522	-17.50	-16.589**	-7.813*	-2.381	-8.824**	-1.320
	I.D	- 6.667	0.000	-0.234	0.000	-4..494	-0.508	0.000	3.125	0.000
P1 x P3	H.M.P	-12.500**	-16.239	-12.984	1.062	-0.433	1.724	0.000	-1.000	-1.993
	H.B.P	-15.152**	26.295*	-35.355**	2.425	-13.777**	-7.813*	-2.381	2.941	-2.640*
	I.D	0.000	-16.241	-14.010	2.895	-4.348	0.000	-9.756**	0.000	-0.339
P1 x P4	H.M.P	-9.677*	-14.592	-16.391	-3.065**	-2.041	-6.667*	-2.439	-3.030**	-3.367**
	H.B.P	-15.152**	-21.323*	-27.339**	-7.5**	-10.023**	-12.500**	-4.762	-5.882*	-5.281**
	I.D	0.000	-8.615	-7.538	0.270	-4.479	-7.143**	-17.500**	-2.083	-3.484**
P2 x P3	H.M.P	-12.500**	-28.772**	-28.281**	0.967	-8.613**	-8.065**	-2.381	-1.980**	-2.990*
	H.B.P	-15.152**	-33.805**	-33.823**	-0.825	-18.463**	-10.938**	-2.380	-2.9410	-3.630**
	I.D	0.000	0.000	0.000	0.000	-3.793	0.000	0.000	0.000	0.000
P2 x P4	H.M.P	-3.226	-17.294	-24.228**	-3.785**	-2.970	-15.625**	-2.381	0.000	2.357*
	H.B.P	-9.091*	-19.728	-28.565**	-6.575**	-8.154**	-15.625**	-2.381	-3.922	0.330
	I.D	10.000	10.888	6.507	2.248	4.082	-7.407**	-7.317**	2.000	2.632*
P3 x P4	H.M.P	-16.129**	22.159*	19.642*	-0.393	-4.950*	-4.839	-2.381	-3.030**	12.741**
	H.B.P	21.212**	9.934	3.538	-5.075**	-10.028**	-3.125	-2.381	-5.882*	-3.630**
	I.D	0.000	0.003	0.000	0.000	-1.042	0.000	0.000	0.000	0.000

*' ** Significant at the 5% and 1% level of probability, , respectively

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تحليل الهجن المتبادلة وقوة الهجين والإنخفاض الراجع للتربية الذاتية لبعض أصناف القطن الباربادينس

حسن حسين العدلى

معهد بحوث *القطن*- مركز *البحوث الزراعية*- *الجيزة*

أستخدم فى هذة الدراسة أربعة أصناف من القطن تتبع النوع الباربادينس وهى جيزة٨٠ جيزة٨٣ واسترالى وبيما مبكر. واستخدم نظام الهجن التبادلية بين هذه الأباء الأربعة حيث أجريت جميع التهجينات الممكنة فى موسم ٢٠٠٤ وفى موسم ٢٠٠٥ تم أعادة التهجين مرة أخرى مع زراعة الجيل الأول للحصول على الجيل الثانى وذلك بمحطة البحوث الزراعية بالجيزة. فى موسم ٢٠٠٦ تم تقييم الأباء الأربعة مع الجيل الأول والثانى لجميع الهجن الناتجة وذلك فى تجربة قطاعات كاملة العشوائية فى ثلاثة مكررات وذلك بمحطة البحوث الزراعية بسدس وفيما يلى ملخص لأهم النتائج المتحصل عليها.

١- فى دراسة تحليل التباين أظهرت النتائج وجود اختلافات معنوية لكل الصفات المدروسة عدا صفة متوسط وزن اللوزة فى الجيل الأول والثانى وكذلك لصفة متوسط وزن ١٠٠ بذرة فى الجيل الثانى وقراءة الميكرونير ومعامل برسلى فى الجيل الأول.

٢- أظهرت النتائج أن تباين القدرة العامة للتالف كان معنويا لجميع الصفات المدروسة فى الجيل الأول والثانى عدا صفة متوسط وزن اللوزة والميكرونير فى الجيل الأول وصفة متوسط وزن ١٠٠ بذرة وقراءة الميكرونير وطول التيلة فى الجيل الثانى. بينما اظهر تباين القدرة الخاصة على التالف معنوية لكل الصفات المدروسة فى الجيل الأول والثانى عدا صفة متوسط وزن اللوزة ومحصول القطن الزهر وقراءة الميكرونير ومعامل برسلى فى الجيل الأول قراءة ولصفة متوسط وزن اللوزة ووزن ١٠٠ بذرة ومعامل الشعر ومعامل برسلى وطول التيلة وذلك فى الجيل الثانى.

٣- أظهرت نتائج النسبة بين التباين الراجع إلى القدرة العامة للتالف والقدرة الخاصة للتألف أن التباين الوراثى المضيف أكبر من التباين الوراثى الغير مضيف وذلك لصفات محصول القطن الزهر والشعر وتصافى الحليج ومتوسط وزن ١٠٠ بذرة ومعامل برسلى فى الجيل الأول ولصفة متوسط وزن اللوزة ومحصول القطن الزهر والشعر ومتوسط وزن ١٠٠ بذرة ومعامل الشعر ومعامل برسلى وطول التيلة.

٤- لوحظ أن قوة الهجين منسوبة لمتوسط الأباء كانت معنوية وسالبة لصفة متوسط وزن اللوزة فى الهجين(جـ٨٠ × استرالى) ولصفة متوسط وزن اللوزة وتصافى الحليج ومعامل الشعر ومعامل برسلى وطول التيلة للهجين (جـ٨٠ × بيما مبكر) ولصفة متوسط وزن اللوزة ومحصول القطن الزهر والشعر ومتوسط وزن ١٠٠ بذرة ومعامل الشعر ومعامل برسلى وطول التيلة للهجين (جـ٨٣ × استرالى) ولصفة محصول القطن الشعر وتصافى الحليج ومعامل الشعر للهجين

(جـ٨٣ × بيما مبكر) ولصفة متوسط وزن اللوزة ومتوسط وزن ١٠٠ بذرة ومعامل برسلى للهجين (استرالى × بيما مبكر).

٥- لوحظ أن قوة الهجين منسوبة لأفضل الأباء أظهرت قيم معنوية وموجبة لصفات محصول القطن الزهر للهجن جـ٨٠ × استرالى ومتوسط وزن اللوزة للهجين(استرالى × بيما مبكر).

٦- أعطت قيم الإنخفاض الراجع إلى التربية الداخلية قيما غير معنوية لكل الصفات المدروسة فى معظم الهجن عدا صفة قراءة الميكرونير فى الهجن(جـ٨٠ × استرالى) ومعامل الشعر وقراءة الميكرونير وطول التبلة للهجن(جـ٨٠ × بيما مبكر) و (جـ٨٣ × بيما مبكر) حيث أعطت قيما معنوية وسالبة.