GENETIC EVALUATION OF COTTON RECOMBINATIONS PRODUCED BY BIPARENTAL MATING SYSTEM

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Abstract

Thirty-six cotton progenies were produced by using biparental mating of SB.58 x G.91 F2 with their parents to study the extent of this system in breaking unfavorable linkage groups and obtaining new promising recombinations. North Carolina Design III was used to estimate mean performances of the progenies, the phenotypic variances and their components, heritabilities and genetic correlations for yield, its components, earliness and some fiber traits.

Generally the progenies derived from G.91 exhibited higher yield and yield components, on the other hand, the progenies of the second parent SB.58 showed better performance for fiber traits. While, there were only two progenies of G.91 behaved earlier performance for days to first flower trait comparing to other progenies of both parents. The proportional contribution values of males were higher for all studied traits with exception for micronaire value and uniformity ratio characters. The results also, revealed that the additive variances playing a major role of the inheritance of all studied characters except uniformity ratio, indicating that the direct selection could improve these traits.

Positive additive genetic correlations were detected for seed cotton yield with boll number and for boll weight with seed index, suggesting the effectiveness of indirect selection for improvement of yield and boll weight by selection for their related characters. The positive and negative dominance correlations which were detected for some traits are of interest in explaining the relatively high degree of heterotic association among traits.

INTRODUCTION

Reports of useful hybrid vigor in the F2 cotton populations have created an interest in breeding program to develop these hybrids for commercial use or to include in a suitable mating system to produce new desired recombinations (biparental mating), Meredith (1990) and Tang *et al* (1993a, 1993b) studied the yield, yield components and fiber quality potential for F2 generation in terms of genetic combining ability, they observed significant general and specific combining ability for most traits measured. Later, Tang *et al* (1996) estimated genetic variances, heritabilities and genetic correlations among 64 F2 hybrid populations and discussed the usefulness of these populations for use as hybrids or for selection for pure lines. They found dominance variances accounted for the major portion of the phenotypic variances for yield and some components, and a low proportion of additive variances for fiber traits, moreover positive additive and dominance genetic correlations were detected for fiber strength with some studied traits. On the other hand, several researchers paid attention for F2 population to produce new recombinations by using biparental mating system, El-Harony (1999) in forty progenies of biparental G.85 x Karshanseky-2 indicated that there were evidence of breaking up the linkage of some progenies which gave some high yield genotypes, he stated that additive variance accounted the major part of the phenotypic variance for all studied traits except for boll number and seed index , the results of additive correlations between traits suggested that selection for high yield pure lines should result in strains with more but smaller bolls. Abo-Arab (1999) in similar investigation reported that the biparental mating system is effectiveness in breaking unfavorable linkage groups and obtained new promising recombinations. Zeina (2002) suggested the possibility of obtaining promising strains that have high yield in biparental progenies of G.88 x Pima S_6. He showed that additive effect playing the major role of the inheritance for all traits, so the direct selection could improve these traits, he obtained highly significant positive additive, genetic and phenotypic correlations for seed cotton yield / plant with lint yield, boll weight, seed index and mean length characters.

The objective of this study reported herein aimed to the estimation of genetic variances, heritabilities and genetic correlations among thirty-six biparental progenies of SB.58 x Giza 91, the data will also provide relative sizes of additive and dominance genetic correlations among yield earliness and fiber traits and thus will provide guidance to the breeders of these populations for selection of strains useful in pure line breeding for cultivar development.

MATERIALS AND METHODS

The materials were used in this investigation as parents are the two genotypes SB.58 and Giza 91 of (*Gossypium barbadense L.*). The first parent is characterized by earliness, fiber strength lower micronaire value (finer) traits, while the second parent is described by higher yield components and also shows early maturity. North Carolina design III according to (Comstock and Robinson, 1952) was used in this study, whereas the F2 individuals (using as males) were randomly selected and backcrossed to each of their parents (using as females).

In 2003 season, eighteen F2 plants were, randomly, chosen as males and were backcrossed to their parents (females) to produce thirty-six biparental hybrids. In 2004 season, thirty-six biparental hybrids along with the two parents were evaluated at the Giza experimental farm of the Agricultural Research Center. The experimental design was a randomized complete block with two replications. Each plot consisted of two rows for each genotype, 4.5 meters long and 60 cm apart. Hills were spaced 50 cm apart and comprised one plant / hill. Normal cultural practices were applied as recommendations. At the end of the season, data on ten guarded plants were taken for the following characters:

1. Seed cotton yield / plant (SCY) in grams.
2. Lint cotton yield / plant (LY) in grams.
3. Number of bolls / plant (NB), was calculated by dividing (SCY / boll weight).
4. Boll weight (BW) in grams.
5. Lint percentage (LP), the relative amount of lint in a seed cotton sample expressed in percentage.
6. Seed index (SI), weight of 100 seeds in grams.
7. Lint index (LI), was calculated by; SI x (LP / 100-LP).
8. Position of first fruiting nude (FFN)
9. Number of days to first flower (DFF)
10. Uniformity ratio (UNF).
11. Fiber strength (FS).
12. Micronaire value (MIC).

   Fiber properties were estimated by HVI spectrum in the Technology Laboratory of the Cotton Fiber Research Department.

Genetic analysis:

Data were subjected to analysis of variance assuming all genetic components are random. The North Carolina design III is applied since the male group in this design consists of the two female progenies. In this investigation, there were six sets (s=6), each set had three male groups (m=3), in which the male group consisted of the progenies of the two females (f=2), thus, thirty-six progenies were subjected to the analysis of variance as outlined by (Comstock and Robinson, 1952) and illustrated in Table 1.

Table 1: Analysis of variance for North Carolina design III.

SOV	DF	EMS
Sets	s-1	
Replications in sets	s(r-1)	
Females in sets (F)	s	
Males in sets (M)	s(m-1)	$\sigma^2e + 2r\sigma^2m$
F x M interaction in sets	s(m-1)	$\sigma^2e + r\sigma^2ml$
Error	s(2m-1)(r-1)	σ^2e
Total	2smr-1	

s = set r = replications m = males

σ^2m = [MS due to males/sets-MS due to error] / 2r

σ^2ml = [MS due to interaction- MS due to error] / r

$\sigma^2m = (1/4)\sigma^2A$ (additive variance).

$\sigma^2ml = (1/2)\sigma^2D$ (dominance variance).

σ^2e = MS due to error/r and refer to environmental variance.

Proportional contribution of females, males and their interactions are presented by the magnitude of sum of squares of these genotypes relative to the sum of squares of crosses.

Significance of correlation coefficients was tested according to the following formula:

$$t = r\sqrt{(n-2)/(1-r^2)}$$

Where,

r = correlation coefficient.

n = number of sets under study.

RESULTS AND DISCUSSION

Mean performance of biparental crosses for yield and its components as well as earliness and fiber traits are presented in Tables 2 and 3, respectively. Table 2 showed that the mean performances of some biparental progenies as male groups, i.e. set I No.3, set IV No.2 and 3, set V No.1 and 3, and set VI No.2 were higher than their two parents for seed cotton yield and lint yield, set IV No.2 and set V No.3 for boll number, and set IV No.3, set V No.2 and set IV No.1 for lint percentage. Also, Data revealed that there were significant differences according to the females for lint yield, lint percentage and lint index. The progenies of SB.58 in set III No.3, set IV No.2 and V No.2 surpassed their parent for lint yield and lint percentage characters. While, the progenies of G.91 in set I No.2 for lint yield and lint index, set IV No.3 and set VI No.2 for lint yield and lint percentage showed higher estimates comparable to their parent. Concerning Table 3, it could be noticed that progenies of F2 x SB.58 performed well for the fiber strength comparable to the progenies of F2 x G.91; set II No.1 and No.3, set IV No.3, set V No.1 and 3 and set VI No.3. Moreover, all progenies of F2 x SB.58 exhibited lower micronaire values than the F2 x G.91 progenies except for No.1 of sets I, V and VI and No.2 of set III. Also, two progenies of F2 x SB.58 which are No.3 in set I and No.2 in set II showed lower position of first fruiting node rather than their parents, indicating the presence of female influence for these characters. These results, in general might indicate existence of new genetic recombinations, meanwhile, that it could be possible to obtain isolated strains with higher performance for yield and its components, earliness and some fiber properties compared to their parents. Miller and Rowlings (1967) accomplished new recombinations by beginning with the F2 generation and maintaining plants for six generations in an isolated block, where the mating system was mixed intermating and selfing (approximately 50% self pollination). Meredith and Bridge (1971) obtained similar results through two generations of random intermating after reaching F3.

Table 2: Mean performances for yield and its components of 36 combinations between SB58 x G.91 F2 hybrids with their parents.

Sets	Male	Female	SCY gm	LY gm	NB/P	BW gm	LP %	SI gm	LI gm
I	1	SB.58	68.8 d-k	26.2 d-k	21.2 d-I	3.25	38.2 h-l	11.2 b-e	6.88 c-i
		G.91	56.8 h-l	22.8 h-k	16.4 i	3.46	40.2 b-g	11.0 b-g	7.36 a-f
	2	SB.58	59.2 h-l	22.2 h-k	17.3 i	3.41	37.4 kl	11.1 b-f	6.63 f-i
		G.91	75.0 b-j	29.8 b-i	21.4 d-l	3.51	39.7 d-i	11.8 ab	7.73 ab
	3	SB.58	78.8 b-h	30.2 b-l	24.4 b-i	3.23	38.2 h-l	10.6 c-i	6.60 g-i
		G.91	89.4 a-d	35.2 a-c	29.9 a-c	2.99	39.4 d-j	10.0 g-k	6.50 h-l
II	1	SB.58	60.2 h-l	23.6 h-k	19.6 f-i	3.06	39.6 d-j	10.4 e-j	6.82 c-i
		G.91	74.6 b-j	30.2 b-l	24.4 b-l	3.04	40.5 a-f	9.6 l-k	6.57 g-i
	2	SB.58	61.6 g-l	24.2 g-k	19.0 g-l	3.23	39.4 d-j	10.8 b-h	7.04 b-i
		G.91	70.6 d-k	28.0 c-j	22.3 b-i	3.18	39.7 d-l	10.5 d-j	6.92 c-i
	3	SB.58	58.3 h-l	23.8 h-k	17.6 l	3.30	40.8 a-e	10.8 b-h	7.44 a-c
		G.91	65.5 e-l	26.0 e-k	20.4 e-l	3.22	39.6 d-j	10.1 f-k	6.62 f-l
III	1	SB.58	56.4 l-l	21.7 l-k	17.2 l	3.32	38.6 g-l	11.6 a-c	7.28 a-g
		G.91	61.0 g-l	24.1 g-k	16.9 l	3.62	39.5 d-j	11.8 ab	7.74 ab
	2	SB.58	66.2 e-l	25.3 a-k	19.2 f-i	3.44	38.2 h-l	11.0 b-g	6.84 c-i
		G.91	58.2 h-l	22.2 h-k	19.0 g-i	3.04	38.0 l-l	11.2 b-e	6.88 c-l
	3	SB.58	66.6 e-l	27.2 c-j	20.0 f-l	3.33	40.8 a-e	10.8 b-h	7.42 a-e
		G.91	61.5 g-l	24.6 g-k	19.8 f-i	3.12	39.9 c-h	10.2 e-k	6.80 c-I
IV	1	SB.58	65.7 e-l	25.1 f-k	21.3 d-i	3.08	38.2 h-l	10.6 c-i	6.50 h-i
		G.91	86.0 a-e	34.0 b-e	28.9 a-e	2.98	39.6 d-j	10.2 e-k	6.64 f-l
	2	SB.58	84.1 a-f	33.8 b-f	27.0 a-g	3.12	40.1 b-g	10.3 e-k	6.90 c-i
		G.91	104.9 a	42.4 a	34.5 a	3.07	40.4 b-g	9.8 h-k	6.30 l
	3	SB.58	77.8 b-l	31.0 b-h	24.4 b-l	3.18	39.9 c-h	10.4 e-j	6.87 c-i
		G.91	89.0 a-d	37.2 ab	29.0 a-d	3.00	41.8 ab	9.5 jk	6.84 c-i
V	1	SB.58	74.0 b-j	27.8 c-j	22.2 b-i	3.34	37.0 l	11.6 a-c	6.80 c-l
		G.91	95.2 ab	37.3 ab	26.8 a-h	3.55	39.2 d-k	12.3 a	7.93 a
	2	SB.58	64.0 f-l	26.7 c-j	19.6 f-i	3.28	41.7 a-c	10.2 e-k	7.26 a-g
		G.91	57.8 h-l	24.4 g-k	19.8 f-i	2.93	42.2 a	9.3 k	7.18 b-h
	3	SB.58	92.3 a-c	34.8 a-d	30.6 ab	3.04	37.8 j-l	11.0 b-g	6.66 f-i
		G.91	82.4 b-g	32.8 b-g	27.8 a-f	3.00	39.7 d-i	10.3 e-k	6.78 d-i
VI	1	SB.58	55.6 j-l	23.3 h-k	18.2 hl	3.06	41.7 a-c	10.6 c-i	7.54 a-c
		G.91	64.6 e-l	27.1 c-j	20.0 f-i	3.22	41.8 a-b	10.4 e-j	7.46 a-d
	2	SB.58	69.9 d-k	27.6 c-j	21.6 c-i	3.25	39.4 d-j	10.7 c-h	6.97 c-i
		G.91	74.6 b-j	30.6 b-h	22.6 b-i	3.31	41.0 a-d	10.4 e-j	7.28 a-g
	3	SB.58	62.3 f-l	23.0 h-k	18.8 g-i	3.34	36.8 l	11.5 a-d	6.70 c-I
		G.91	53.6 j-l	21.4 i-k	16.5 i	3.25	40.1 b-g	10.6 c-i	7.10 b-h
Mean overall males		SB.58	67.9 d-l	26.5 c-j	21.0 d-i	3.23	39.1 e-k	10.8 b-h	6.95 c-i
		G.91	73.4 c-j	29.4 b-i	23.1 b-i	3.20	40.1 b-g	10.5 d-j	7.03 b-i
Parents' mean		SB.58	46.5 l	17.7 k	17.2 i	3.07	38.1 h-l	10.6 c-i	6.55 g-i
		G.91	50.6 kl	19.7 jk	17.8 i	3.23	38.9 f-k	11.0 b-g	6.94 c-i

Table 3. Mean performances for earliness and fiber quality of 36 combinations between SB58 x G.91 F2 hybrids with their parents.

Sets	Males	Fem.	FFN	DFF	UNF %	FS gm/tex	MIC
I	1	SB 58	7.1 a-d	74.6 a-e	86.9 b-e	40.3 b-f	4.6 c-g
		G.91	6.4 c-e	70.5 c-i	87.2 b-e	40.0 b-j	5.0 a-c
	2	SB 58	7.1 a-d	76.6 a-c	88.2 b	41.8 ab	4.4 e-h
		G.91	6.6 b-e	71.6 b-i	87.2 b-e	39.3 b-j	4.9 a-d
	3	SB 58	5.9 e	66.7 hi	86.4 b-e	37.6 g-m	4.5 d-g
		G.91	6.4 c-e	71.1 c-i	86.4 b-e	37.0 j-m	5.0 a-c
II	1	SB 58	7.0 a-e	73.1 b-h	87.4 b-d	40.9 a-d	4.3 f-h
		G.91	7.2 a-d	74.4 a-e	85.6 b-e	36.9 j-m	4.9 a-d
	2	SB 58	6.2 de	70.9 c-i	87.9 bc	38.7 c-k	4.6 c-g
		G.91	6.6 b-e	74.0 a-f	85.3 b-e	38.3 d-l	5.0 a-c
	3	SB 58	7.4 a-c	73.5 a-g	87.8 bc	39.9 b-h	4.6 c-g
		G.91	7.9 a	77.8 ab	85.6 b-e	37.0 j-m	5.0 a-c
III	1	SB 58	7.8 a	79.6 a	87.1 b-e	36.4 k-n	4.7 b-f
		G.91	7.6 ab	78.0 ab	86.2 b-e	34.2 n	5.2 a
	2	SB 58	7.9 a	75.0 a-f	87.0 b-e	39.5 b-j	4.9 a-d
		G.91	7.0 a-e	67.0 g-i	87.2 b-e	40.6 b-e	4.8 a-e
	3	SB 58	7.1 a-d	74.6 a-e	86.8 b-e	37.5 g-m	4.4 e-h
		G.91	6.5 b-e	71.8 b-i	85.5 b-e	37.2 h-m	5.0 a-c
IV	1	SB 58	6.9 a-e	70.8 c-i	87.3 b-d	38.1 e-m	4.4 e-h
		G.91	7.2 a-d	71.9 b-i	84.2 de	36.4 k-n	5.2 a
	2	SB 58	7.2 a-d	73.2 b-g	86.6 b-e	39.4 b-j	4.2 gh
		G.91	6.5 b-e	66.6 i	84.1 e	37.7 f-m	5.0 a-c
	3	SB 58	7.0 a-e	69.2 d-i	88.0 bc	39.5 b-j	4.7 b-f
		G.91	7.2 a-d	71.2 c-i	84.9 c-e	36.2 k-n	5.2 a
V	1	SB 58	7.2 a-d	72.0 b-i	91.3 a	43.2 a	4.4 e-h
		G.91	7.6 ab	74.2 a-f	86.0 b-e	37.3 g-m	4.8 a-e
	2	SB 58	7.2 a-d	71.7 b-i	86.6 b-e	37.5 g-m	4.2 g-h
		G.91	6.8 a-e	70.5 c-i	85.8 b-e	35.6 l-n	5.0 a-c
	3	SB 58	7.2 a-d	70.8 c-i	87.2 b-e	41.2 a-c	4.6 c-g
		G.91	7.4 a-c	71.9 b-i	86.4 b-e	36.8 j-n	5.1 ab
VI	1	SB 58	7.2 a-d	69.0 e-i	86.0 b-e	35.8 l-n	4.8 a-e
		G.91	7.2 a-d	70.0 d-i	85.8 b-e	35.4 mn	4.8 a-e
	2	SB 58	7.3 a-d	72.3 b-i	87.1 b-e	38.6 c-k	4.0 h
		G.91	6.6 b-e	67.9 f- i	86.4 b-e	36.5 k-n	5.0 a-c
	3	SB 58	7.8 a	75.4 a-e	88.4 b	41.0 a-c	4.4 e-h
		G.91	7.5 a-c	75.5 a-d	85.4 b-e	35.4 mn	4.9 a-d
Means overall males		SB 58	7.1 a-d	72.7 b-i	87.3 b-d	39.3 b-j	4.5 d-g
		G.91	7.0 a-e	72.0 b-i	85.7 b-e	37.1 i-m	5.0 a-c
Parents' means		SB 58	7.5 a-c	71.8 b-i	87.0 b-e	39.8 b-i	4.6 c-g
		G.91	7.2 a-d	72.8 b-i	86.5 b-e	37.3 g-m	5.2 a

Mean squares in Table 4 showed highly significant differences among sets for all studied characters except for boll weight and uniformity ratio and micronaire value characters. Females mean squares were significant or highly significant for lint yield, lint percentage, seed index, lint index, uniformity ratio, fiber strength and micronaire value traits, these findings indicates that females (two parents) differed in their performances for these characters as mentioned in Tables 2 and 3. With respect to male mean squares, it is evident that all traits except boll weight and uniformity ratio were significantly or highly significant differed, revealing the differences due to influence of F2 plants, as males, in their progenies. The female x male interaction mean squares were significant for lint index and fiber strength characters; meanwhile that females behaved somewhat differently from male to another and these males differed markedly in their genetic background and proved efficient in evaluating the females' different ranking. These results may be supported by the previous studies that indicate the influence of males in making differences among biparental progenies which controlled these traits to produce new recombinations. El-Harony (1999) found highly significant mean squares of males for yield and its components, Zeina (2002) showed significant male mean squares for all traits, while female mean squares were detected only for lint percentage and fiber properties.

The proportional contribution values of males were higher for yield and its components and earliness traits (Table 5). On the other hand, the proportional contribution of females surpassed other values for uniformity ratio and micronaire value characters. Female x male interaction contribution was ranged from 11.08% for lint percentage to 34.65% for boll weight. It could be noticed that the contribution values of female and female x male interaction were similar for seed cotton yield, seed index and position of first fruiting node characters (represent 30%-40% of the total value), while, male and female contribution were equivalent for lint yield and fiber strength traits (about 73%-85% of the total value). It could be concluded that the male showed the major proportional contribution for all characters except for uniformity ratio and micronaire value. These findings confirmed the previous results that showed significant mean squares of males for most traits.

Ratios of additive, dominance, genetic and environmental variances as proportion of the phenotypic variance of biparental progenies are summarized in Table 6. Additive variance accounted for all characters except for uniformity ratio. These results revealed that the additive variances playing the major role of the inheritance for these traits. Therefore, direct selection could improve these traits. Dominance variance was of largest portion of the phenotypic variance for uniformity ratio, suggesting that the utilization of the heterosis to develop this trait might be fruitful.

Table 4. Mean squares for all studied characters of biparental progenies in 2004 season.

SOV	DF	MS											
		SCY	LY	NB/P	BW	LP	SI	LI	FFN	DFF	UNF	FS	MIC
Sets	5	978.8**	160.2**	132.4**	0.099	3.262**	1.957**	0.439**	0.884**	26.75**	1.387	8.110**	0.054
Rep./ sets	6	443.3**	45.15*	26.10	0.017	0.724	0.357	0.269**	0.232	22.46*	3.458**	1.899	0.040
Females (F) / sets	6	222.1	48.60*	29.47	0.016	4.936**	0.560*	0.312**	0.307	16.55	9.476**	18.08**	0.805**
Males (M) / sets	12	335.8**	47.93**	42.01**	0.081	6.310**	1.282**	0.327**	0.611**	27.12**	0.948	9.685**	0.069*
F x M interaction	12	111.0	17.20	8.943	0.047	1.094	0.246	0.240**	0.184	12.73	1.259	3.249*	0.064
Error	30	96.85	15.79	13.51	0.042	0.652	0.180	0.067	0.180	6.979	0.893	1.219	0.032

* and ** significant at 0.05 and 0.01 probability levels respectively.

Table 5. Proportional contribution of males, females and their interactions for all studied traits.

Sources / Traits	SCY	LY	NB/P	BW	LP	SI	LI	FFN	DFF	UNF	FS	MIC
Females (F).	19.91	37.72	22.43	5.86	25.00	15.48	21.58	16.18	17.19	68.2	41.13	75.12
Males (M).	60.19	35.58	63.95	59.49	63.92	70.89	45.26	64.41	56.35	13.65	44.08	12.93
F x M interaction.	19.90	26.70	13.62	34.65	11.08	13.63	33.16	19.41	26.46	18.13	14.79	11.95

The estimates of genotypic variances were in general larger than the environmental variances except for uniformity ratio, indicating the high broad sense heritability for most characters. Moreover, high narrow sense heritability values were detected for most traits, moderate narrow sense heritability values were estimated for boll weight, lint index, No. of days to first flower and micronaire value, while small narrow sense heritability value was found for uniformity ratio. Tang *et al* (1996) and Zeina (2002) obtained similar results; they stated that the additive variances playing the major role of the inheritance of their studied traits; for yield, yield components and fiber properties.

The estimates of genetic (Rg) and phenotypic correlation (Rp) for pairs of traits are presented in Table 7. seed cotton yield showed positive significant Rg and Rp with LY and NB/P. Moreover, the positive and significant additive correlation (Ra) was detected for seed cotton yield with boll number characters, indicating the indirect selection for seed cotton yield within these populations should result in strains with more boll number and vice versa. Boll weight was significantly positive correlated with seed index, but negatively correlated with uniformity ratio indicating that selection for boll weight will, indirectly, improve seed index, however the uniformity ratio won't be strongly affected by selection because of the low narrow sense heritability (Table 6). With respect to the dominance correlation (Rd) in Table 7, positive and significant (Rd) was observed for seed cotton yield, lint yield and boll number with uniformity ratio. The (Rd) correlations suggest that the same combinations should occur with hybrids. Negative significant (Rd) values were detected for boll weight with lint percentage and for uniformity ratio with micronaire value, Meredith (1984) and Zeina (2002) reported that dominance correlations that have highly negative significant values for any two pairs traits indicating that selection in these populations is so difficult. Several of the residual correlation values (Re) were significantly different from zero. i.e Seed cotton yield, lint yield and boll number with uniformity ratio, and lint index with fiber strength. Such (Re) values suggest that field management may have increased seed cotton yield by increasing lint yield, boll number and uniformity ratio, Tang *et al* (1996), El-Harony (1999) reported that when (Re) values are significant, these mean that selsction within this genetic material is less effective.

Previous results in general indicated that the positive additive genetic correlations as components of genetic and phenotypic correlations, i.e. between seed cotton yield with boll number and between boll weight with seed index showed that the yield and boll weight increases would rather be the result of an increase in boll number and seed index respectively. Positive dominant correlations such as seed index with lint index are of interest in explaining the relatively high degree of heterotic association among traits.

Table 6. Estimates of phenotypic variance and its components, heritability in broad sense and narrow sense for all studied characters.

Traits / parameters	SCY	LY	NB/P	BW	LP	SI	LI	FFN	DFF	UNF	FS	MIC
$\sigma^2 A$	239.0	32.14	28.50	0.038	5.658	1.103	0.261	0.431	20.14	0.055	8.465	0.038
$\sigma^2 D$	14.18	1.417	00.00	0.005	0.441	0.067	0.173	0.004	5.750	0.366	2.030	0.032
$\sigma^2 G$	253.2	33.56	28.50	0.043	6.099	1.170	0.434	0.435	25.89	0.421	10.50	0.070
$\sigma^2 E$	48.42	7.894	6.760	0.021	0.326	0.090	0.033	0.090	3.490	0.446	0.610	0.016
$\sigma^2 P$	301.6	41.45	35.26	0.064	6.425	1.260	0.467	0.525	29.38	0.868	11.10	0.086
h^2_b %	83.9	81.0	80.8	67.2	94.9	92.8	92.9	82.9	88.1	48.6	94.5	81.4
h^2_n %	79.2	77.5	80.8	59.4	88.1	87.5	55.9	82.1	68.6	6.3	76.2	43.8

Table 7. Estimates of correlation coefficients of phenotypic variances and their components for all studied traits .

Traits	Parameters	LY gm	NB/P	BW gm	LP %	SI gm	LI gm	FFN	DFF	UNF %	FS g/tex	MIC
SCY	Ra	0.68	0.84*	0.56	0.31	0.47	0.54	-0.63	-0.40	-0.21	0.11	0.03
	Rd	0.98**	0.96**	0.12	0.02	-0.01	-0.13	0.37	0.43	0.96**	-0.08	-0.14
	Rg	0.84*	0.87*	0.28	0.07	0.22	0.73	-0.21	-0.40	0.55	0.14	-0.34
	Re	0.99**	0.99**	0.22	0.04	-0.08	0.11	-0.40	-0.43	0.82*	0.15	-0.47
	Rp	0.83*	0.84*	0.45	0.16	0.48	0.70	-0.34	0.11	0.39	0.18	-0.28
LY	Ra		0.67	-0.17	0.21	-0.29	0.16	-0.62	-0.16	0.50	-.015	0.02
	Rd		0.96**	0.27	-0.16	0.09	0.00	0.38	0.45	0.92**	-0.18	-0.23
	Rg		0.88*	-0.18	0.42	-0.30	0.26	-0.21	0.60	0.86*	-0.09	-0.27
	Re		0.99**	0.22	0.05	-0.06	0.11	-0.41	-0.41	0.82*	0.15	-0.47
	Rp		0.87*	0.00	-0.22	-0.05	0.33	-0.33	0.39	0.80	-0.03	-0.24
NB/P	Ra			0.56	0.16	0.28	0.56	-0.25	-0.10	-0.20	0.19	-0.44
	Rd			0.04	0.01	-0.07	-0.23	0.15	0.51	0.88*	-0.19	-0.28
	Rg			0.23	0.53	-0.03	0.48	0.13	0.67	0.66	0.03	-0.63
	Re			0.26	0.04	-0.04	0.08	-0.39	-0.40	0.86*	0.12	-0.52
	Rp			0.36	-0.37	0.16	0.54	0.06	0.45	0.54	0.07	-0.62
BW	Ra				0.35	0.85*	0.57	0.09	-0.24	-0.89*	0.30	-0.33
	Rd				-0.84*	0.38	0.63	0.41	-0.16	0.02	-0.44	0.01
	Rg				0.17	0.87*	0.74	0.36	0.08	-0.14	0.51	-0.42
	Re				0.70	0.52	0.51	-0.40	0.57	0.18	0.66	-.0.51
	Rp				0.21	0.89*	0.88*	0.25	0.07	-0.42	0.60	-0.36
LP	Ra					0.64	0.40	-0.43	-0.24	-0.32	0.23	0.52
	Rd					0.56	0.63	-0.37	-0.20	0.06	0.79	0.09
	Rg					0.51	0.40	-0.34	-0.59	-0.43	0.34	0.58
	Re					0.84*	0.39	0.83*	0.85*	-0.34	0.68	0.19
	Rp					0.53	0.32	-0.43	-0.48	-0.32	0.35	0.60
SI	Ra						0.52	-0.20	-0.23	-0.73	0.52	0.14
	Rd						0.93**	0.53	0.59	0.06	-0.34	-0.52
	Rg						0.73	-0.08	-0.26	-0.58	0.47	-0.04
	Re						-0.06	-0.69	0.88*	-0.28	0.30	-0.51
	Rp						0.80	-0.16	-0.28	-0.51	0.50	-0.06
LI	Ra							-0.04	0.42	-0.26	0.70	-0.37
	Rd							0.58	0.30	-0.08	-0.34	-0.32
	Rg							0.02	0.03	-0.04	0.40	-0.31
	Re							-0.09	0.13	-0.05	0.91*	-0.44
	Rp							0.06	0.30	-0.01	0.75	-0.16
FFN	Ra								0.42	-0.35	-0.03	-0.74
	Rd								0.13	0.54	0.08	0.28
	Rg								0.42	0.00	0.24	-0.56
	Re								-0.52	0.99**	-0.41	-0.33
	Rp								0.40	-0.22	0.15	-0.57
DFF	Ra									0.35	0.65	-0.43
	Rd									0.43	-0.49	-0.70
	Rg									0.76	0.47	-0.24
	Re									-0.58	0.38	0.33
	Rp									0.65	0.54	-0.09
UNF	Ra										-0.04	0.30
	Rd										0.07	-0.88*
	Rg										0.11	0.58
	Re										-0.17	-0.28
	Rp										0.041	0.61
FS	Ra											-0.08
	Rd											0.33
	Rg											0.30
	Re											-0.23
	Rp											0.32

* and ** significant at 0.05 and 0.01 probability levels respectively.

The (Ra), (Rd) and (Re) values reported herein provide useful information that may be valuable for cotton breeders attempting to maximize breeding efforts for yield and its components in biparental progenies.

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التقييم الوراثى لتراكيب وراثية ناتجة من التهجين الرجعى للجيل الثانى مـــع الآباء

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أستخدم في هذا البحث ٣٦ هجينا ناتجة باستخدام طريقة التهجين الرجعى للجيل الثـــانى مـــن الهجين س.ب ٥٨ X جيزة ٩١. وذلك لدراسة مدى فاعلية هذه الطريقة للحصـــول علـــى أتحـــادات وراثية جديدة ذات صفات اقتصادية مرغوبة. وق استعمل في هذا البحث تصميم نورث كالورينـــا ٣ لتقدير متوسط أداء النسل وكذلك التباين المظهرى والوراثى ومكوناتهم ومعامـــل التوريـــث وأيضـــا دراسة الارتباط الوراثى بين صفات المحصول ومكوناته وصفات التبكير وبعض صفات الجودة.

أشارت النتائج إلى أن النسل الناتج من التهجين الرجعى بالأب جيـــزة ٩١ يمتـــاز بصـــفات المحصول ومكوناته بشكل عام بينما النسل الناتج من التهجين الرجعى بالأب س.ب ٥٨ كان أفضـــل بالنسبة لصفات الجودة. وكانت مساهمة القيم الأبوية مقارنة بالقيم الأمية أكثر تأثيرا في التباين بـــين الهجن الناتجة لجميع الصفات ماعدا صفتى الميكرونير ومعامل انتظام الطول. كما أظهرت النتائج أن التباين الراجع الى العوامل المضيفة يلعب الدور الرئيسى في توارث الصفات محل الدراسة فيما عدا معامل الانتظام مشيرا إلى فاعلية أجراء الانتخاب لهذه الصفات في برامج التربية.

وجد أن هناك ارتباط وراثى مضيف موجب بين المحصول الزهر وعدد اللوز، وكذلك بـــين وزن اللوزة ومعامل البذور مما يدل على جدوى الانتخاب الغير مباشر لزيادة المحصول عن طريق زيادة عدد اللوز. كما لوحظ أن هناك ارتباط وراثى يرجع إلى تأثير السيادة مما يدل على أثـــر قـــوة الهجين في علاقة هذه الصفات بعضها بعضا.