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IMPROVINIG EGYPTIAN COTTON USING F_2 DOUBLE CROSS

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ABSTRACT

Six diverse strains were used to produce 45 possible double crosses. F2 of these hybrids were raised in randomized block design with 3 replications. The data were analyzed, according to Rawling and Cockerham (1962) model. The most important aspects of the double-cross hybrid was relative importance of the arrangement of parents i.e the order effect in these hybrids.

The Suvin (P_5), Australian (P_1) and BBB (P_2) were the best as one parent for seed cotton and lint yield, lint percentage and upper half mean respectively. The highest 2-lines of general effect were exhibited by (P_2 x P_3), (P_1 x P_3) and (P_1 x P_2) for seed cotton and lint yield, lint percentage and fiber length respectively. The highest specific effect of 2-lines interaction with arrangement were (P_1 x P_4) (- -),(P_1 x P_3) (- -) and (P_2 x P_5) (- -) for the same traits respectively, while its irrespective arrangement was (P_1 -) (P_3 -) for seed cotton and lint yield and lint percentage and it was (P_1 -) (P_4 -) for fiber length.

For 3-line interaction with arrangement were (P_4 x P_5)(P_1-) (P_1 x P_2) (P_5 x -) and (P_1 x P_4)(P_6-) for the same traits respectively. While irrespective of order were (P_1 x P_4)(P_5 -), (P_1 x P_3)(P_4-) and (P_3 x P_6)(P_6-).

For the best 4-lines interaction with arrangement and irrespective were (P_2 x P_4) (P_5 x P_2) for seed cotton and lint yield, and for lint percentage (P_1 x P_6) (P_2 x P_3) were the best in case the arrangement, while the best irrespective arrangement were (P_2 x P_4)(P_5 x P_6). With respect fiber length the best 4-lines interaction with arrangement were (P_1 x P_3) (P_2 x P_5) and (P_2 x P_5) (P_4 x P_6) while the best irrespective arrangement were (P_1 x P_2) (P_4 x P_6).

INTRODUCTION

The understudying of genetic architecture of each breeding materials is a matter of great interest for selecting the parents and crosses in order to establish the most efficient breeding programme for attaining quick and maximum genetic improvement. Combining ability analysis among selected parents depends mainly on both type of gene action and the amount of potential genetic variability involved. The most important aspect of double-cross hybrids is the relative importance of arrangement of parents to form the double crosses. El-Tabbakh and El-Nakhlawy (1995) investigated inter-specific crosses of *G.barbadense* x *G. hirsutum*. They observed that the general combining ability variance was found to be significant for boll weight, while specific combining ability was detected to be significant for lint percentage. In the same time, both GCA and SCA variances were found to be significant for seed cotton yield/plant. Abou El-Yazied (2004) indicated that the comparison of parental varieties for their combining ability revealed that the varieties; Giza 88, Suvin and Pima exhibited higher percentages than (P.H.P) and were the best combiners for yield and yield component traits. While the most pronounced SCA effects were found in the crosses; (P.H.P x BBB), (P.H.P x TNB1), (P.H.P x 24022), (P.H.P x Suvin) P.H.P, (P.H.P x Giza 88), (P.H.P x 24022), (TNB1 x Suvin), (TNB1 x Giza 88), (24022 x Suvin), (24022 x Giza 88) and (Suvin x Giza 88) for yield and yield component traits. El-Hoseiny (2004) found that yield and its of all components exhibited insignificant GCA and SCA except lint percentage which exhibited significant GCA and SCA. The high ratio of GCA / SCA indicting more important additive gene effect in inheritance. El-Hoseiny (2009) found that Parent Australian (P_1) and BBB (P_2), P_2 and P_4 had highest and negative value of 2-line general effect which were good specific combination of (P_1 x P_2)(--) and (P_2 x P_4)(--) when they go into another arrangement i.e. (P_1 x -)(P_2 x -) and (P_2 x -)(P_4 x-) showed the positive 2-line specific for most earliness traits as undesirable direction. Said (2011) found that moderate narrow sense heritability estimates from (30 -50) for yield and yield components while high narrow sense of heritability for upper half mean (over 50%) was obtained. Potdukh and Parmar (2006) indicated that yield and yield components exhibited low value of heritability. They added that, high estimates (101.28) were observed for seed index followed by seed cotton yield (30.04). This study was conducted to giving the information on order effect of parent to form double crosses and estimated the genetic component for double crosses.

MATERIALS AND METHODS

Six parents belonging to *Gossypium barbadense,* L. i.e.; Australian (P_1), BBB (big black boll) (P_2), Karshenky (P_3) and Suvin (P_5), as well as, two varieties of extra-long staple, Giza 70 (P_4), Giza 77 x Pima S_6 (P_6). F_2 Were used to produce 45 possible double cross. F_2 double crosses were sown in season 2010 in randomized complete block design experiment with three replications at Sakha Agricultural Research Station. Each plot consisted of three rows. The row was 4 meter long and 65 cm apart. Hill spacings were 20 cms. within rows and two seedlings were left / hill. Conventional cultural practices were followed through the growing season. The measurements were recorded on ten individual guarded plants from the middle row of each plot.

The studied traits:

1- Seed cotton yield estimated as the weight of seed cotton yield in kentar/Feddan (k/fed).
2- Lint yield, estimated as the weight of lint cotton yield in kentar/Feddan (k/fed)
3- lint percentage: Ratio of lint cotton yield to seed cotton yield sample expressed as percentage using the formula

$$L\% = \frac{\text{weight of lint in sample}}{\text{weight of seed cotton in the same sample}} x100$$

4- Fiber length (Upper half mean): measured by HVI in (mm).

Statistical analysis: The analysis of variance of the quadriallel crosses was made for all studied traits according to the procedures outlined by Singh and Chudhary (1985). as follows:

Combining Ability Effects:

1- Average effect of line i = $g_i = [Y_{i....} / (r\ p_1\ p_2\ p_3/2)] - \mu$
Where, $\mu = Y_{....} / (p_1\ p_2\ p_3/8)$ **Check:** $\sum g_i = 0$

2- The two line interaction effect of lines i and j appearing together irrespective of arrangement. $= S^2_{ij} = [Y_{ij...}/(3r\ p_2p_3/2)] - \mu - g_i - g_j$
Check: $\sum S^2_{(ij)} = 0$

3- The three line interaction effect of lines i, j and k appearing together irrespective of arrangement. $= S^3_{ijk} = (Y_{ijk...} / 3r\ p_3) - \mu - g_i - g_j - g_k - S_{ij} - S_{ik} - S_{jk}$ **Check:** $\sum S^3_{ijk} = 0$

4- The 4-line interaction effect of lines i, j, k and l appearing together irrespective of arrangement. $= S^4_{(ijkl)} = S_{ijkl} = [(Y_{ijkl..} / (3r)] - \mu - g_i - g_j - g_k - g_l - S_{ij} - S_{ik} - S_{il} - S_{jk} - S_{jl} - S_{kl} - S_{ijk} - S_{ijl} - S_{jkl} - S_{jkl}$
Check: $\sum S_{ijkl} = 0$

5- The 2- line interaction effect of lines i and j due to particular arrangement.(ij) (--)
$t_{(ij)(--)} = t^2_{(ij)(..)} = [Y_{(ij)(..)}. /(r\ p_2p_3/2)] - \mu - g_i - g_j - S_{ij}$ **Check:** $\sum t_{(ij)(..)} = 0$

6- The 2- line interaction effect of lines i and j due to particular arrangement.(i -) (j -)
$t_{(i-)(j-)} = t^2_{(i-)(j-)} = [Y_{(i.)(j.)}. / r\ p_2p_3] - \mu - g_i - g_j - S_{ij}$ **Check:** $\sum t^2_{i.j.} = 0$

7- The 3- line interaction effect of lines i, j and k due to particular arrangement.(i j) (k -) $t^3_{ij.k} = t_{(ij)(k-)} = [Y_{(ij)(k.)}. / r\ p_3] - \mu - g_i - g_j - g_k - S_{ij} - S_{ik} - S_{jk} - S_{ijk} - t^2_{ij} - t^2_{i.k} - t^2_{j.k}$

8- The 4- line interaction effect of lines i, j, k and l due to particular arrangement.(i j) (k l) $t^4_{ij\ kl} = t_{(ij)(kl)} = [Y_{(ij)(kl)}. / r] - \mu - g_i - g_j - g_k - g_l - S_{ij} - S_{ik} - S_{il} - S_{jk} - S_{jl} - S_{kl} - S_{ijk} - S_{ijl} - S_{ikl} - S_{jkl} - S_{ijkl} - t^2_{ij} - t^2_{kl} - t^2_{i.k} - t^2_{i.l} - t^2_{j.k} - t^2_{j.l} - t^3_{ij.k} - t^3_{ij.l} - t^3_{kl.i.} - t^3_{kl.j}$ **Check:** $\sum t^4_{ijkl} = 0$

9- **Check:**

a) $t^2_{ij} + 2t_{i.j.} = 0$
b) $t^3_{ij.k} + t^3_{ik.j} + t^3_{jk.i} = 0$
c) $t^4_{ij.kl} + t^4_{ik.jl} + t^4_{il.jk} = 0$

10- Narrow sense heritability was estimated by the following equations

$$h^2 ns = \frac{1/4\,A + 1/8\,AA + 1/16\,AAA}{1/4\,A + 1/8\,AA + 1/16\,AAA + 1/8\,D + 1/16\,AD + 1/32\,DD + E/3}$$

Where, A = Additive, D= Dominance and E= Error variance

RESULTS AND DISCUSSION

The analysis of variance show that the 1-line general, 2- line specific and 2,3and 4line arrangement effects were significant (Table1). The effects arising owing to arrangements of lines are exclusively the results of dominance and interaction involving dominance components (Rawling and Cockerham1962). Obviously, there seemed to be the predominance of non-additive gene effects in the present material. The significance of 1-line general effects however indicated the importance of additive gene effects also.

Table (1): Analysis of variance of double cross hybrids for yield characters

Source	d.f	Seed cotton yield k/fed.	Lint cotton yield k/fed.	Lint %	Fiber length
Replications	**2**	0.337	0.694	0.585	0.004
Hybrid	**44**	6.362**	9.580**	10.710**	1.215*
1-line general	**5**	9.161**	12.029**	4.300**	3.177**
2- line specific	**9**	6.342**	9.488**	18.743**	1.151*
2- line arrangement	**9**	8.957**	14.151**	8.048*	1.699**
3- line arrangement	**16**	5.253**	8.777**	10.124*	0.579
4- line arrangement	**5**	2.478**	1.637*	9.330**	0.526
Error	**88**	0.542	0.700	1.024	0.378
Total	**134**	2.450	3.616	4.198	0.647

***,** significantly different at the 0.05 and 0.01 levels of probability, respectively**

Genetic parameters of F_2 double hybrids and heritability.

The components of genetic variance are presented in Table (2). For seed cotton and lint yield, the data indicated that the additive, dominance and epistasis of additive x additive variances were negative; these variances can be neglected and equivalent zero. The other types of epistasis as additive x dominance were significant for seed cotton yield and lint yield. These variances were considerable amount for determing inheritance of seed cotton and lint yield. The heritabilities were 42.33% and 55.34% for seed cotton and lint yield respectively. Same results were obtained by Patel *et al* 2005 using triallel analysis for six diverse they found that the estimates of genetic components showed predominance of additive x dominance type of epistatic interaction followed by additive, dominance x dominance and dominance gene action for seed cotton yield. El-Hoseiny 2009 and Said 2011, with respect to lint percentage the considerable amount of genetic components were dominance, additive x additive, dominance x dominance and additive x additive x additive.

Table (2): The estimates of genetic variance to its components and genetic ratio for yield characters in double cross hybrids

Source	Seed cotton yield k/fed.	Lint cotton yield k/fed.	Lint %	Fiber length
Additive (A)	-13.590 ± 0.408	-22.902 ± 0.505	-41.858 ± 0.756	-2.022 ± 0.158
Dominance (D)	-1.790 ± 0.150	-13.89 ± 0.223	13.157 ± 0.262	0.726 ± 0.082
A X A	11.853 ± 0.207	30.006 ± 0.255	14.702 ± 0.369	3.429 ± 0.084
A X D	0.503 ± 0.087	21.637 ± 0.125	-39.654 ± 0.127	0.276 ± 0.035
D X D	37.451 ± 0.097	15.001 ± 0.111	169.916 ± 0.166	0.480 ± 0.034
A X A X A	-1.340 ± 0.104	-57.698 ± 0.128	105.745 ± 0.183	-0.184 ± 0.043
Heritability	42.33	55.34	50.28	63.25

The heritability was 50.28% for lint percentage. With regard to the upper half mean the genetic components were dominance, additive x additive, additive x dominance and dominance x dominance. These component were considerable amount for inheritance this trait. The heritability for upper half mean was 63.25% Same results were obtained by Said 2011.

Line general effects:

The 1-line general effects are given in Table (3). Data indicated that seed cotton and lint yield, in case of the parent (P_5), must be used as one parent, because it provides the highest effect. As four line are needed to produce a double crosses hybrid, all lines can be used with same efficiency except parent (P_6), which gave negative values of the general effect, however, these values were high. With respect the lint percentage the data indicated that parent (P_1) must be used as one parent, because it provides the highest effects. As four lines needed to produce a double crosses hybrids all parent can be used with same efficiency except parents (P_3) and (P_4), because they have general effects, not only negative but also highest. Patel *et al* 2005 using triallel analysis for six diverse they found that the general line effects indicted AKH – 9302 and AKH – 081 to be the best general combiners as grand parents as well as immediate parents.

With respect to upper half mean, the data in Table (3) indicated that the parent P_2 must be used as one parent, because it provides the highest effect. As four parents are needed to produce a double-cross hybrid, all lines can be used with same efficiency except parent P_5, which its general effect is not only negative but also highest

Table (3): Estimates of 1-line general combining ability effects of double cross hybrids for yield characters and fiber length

Parents	Seed cotton yield k/fed.	Lint cotton yield k/fed.	Lint %	Fiber length
Australian (p_1)	-0.044	0,020	0,228	-0.022
BBB (p_2)	0.174	0,176	-0,039	0.192
Karshenky (p_3)	-0.026	-0,057	-0,121	0.068
Giza 70 (p_4)	0.027	-0,015	-0,144	-0.072
Suvin (p_5)	0.219	0,273	0,081	-0.152
Giza 77 x Pima S_6 (p_6)	-0.350	-0,397	-0,006	-0.013

***,** significantly different at the 0.05 and 0.01 levels of probability, respectively**

II. The 2-line general and 2-line arrangement effects

As regard 2-line general effect parents (P_2) and (P_3) in various combination did the best followed parent (P_1) and (P_5) and parent (P_2) and (P_3) for seed cotton and lint yield.

The data of 2-line specific effects indicated that the combination of (P1 x P4) (- -) had the highest 2-line specific effects of (ij) (--) type, followed by (P_3 x P_5) (--) for seed cotton and lint yield while the 2-line specific effects of (i -)(j) was the highest in case of (P_1 -)(P_3 -) type followed by (P_4 -)(P_5 -). It is obvious that parents (P_1), (P_2),(P_3),(P_5) which did well in 2-line general effects were also included in the best 2-line specific combination. Obviously the order in which the parents were involved in double-crosses was important. This means that due to consideration should be given to this parameters while attempting multiple crosses. Patel *et al* 2005 with respect the two-lines specific effects they identified some combinations to be used for exploitation of heterosis.

For lint percentage, as regard 2-line general effects, the parent P_1 and P_3 in various combinations did the best followed by parent P_4 and P_5. in most cases the 2-line general effects were small and negative in most cases.

The specific combination (P_2 x P_5) had the highest 2-line specific effect of (ij) (--) type followed by (P_1 x P_5)(--) and (P_1 x P_6)(--) while specific effect of (i-)(j-) type was highest in the case of (1 -)(3 -). Same conclusion of importance of the order in which parent was involved in double crosses was noted for lint percentage.

For Fiber length, the results of 2-line general effect in Table (4) show that P_1 and P_2 in various combinations did the best, followed by (P_2 x P_4) and (P_2 x P_6). The specific combination (P_1 x P_2)(--) and (P_4 x P_6)(--) had the highest 2-line specific effect of (i -)(j -) type. The 2-line specific effect of (i -)(j) type was the highest in cases of (P_1 -)(P_4 -) followed by (P_1 -)(P_6 -) and (P_2 -)(P_3 -). It is obvious that lines P_1,P_2,P_4 and P_6 which did well in 2 line general effect, were also included in the best specific combination. The order in which the parents were involved in double crosses was important (Singh and Chaudhary 1977).

Table (4): 2-line interaction effect of lines i and j due to particular arrangement (ij)(..) i.e. t ij , i.j. and specific effects correspond to s ij effect i.e. effect of i and j irrespective of arrangement for yield characters and Fiber length.

2-line interaction	Seed cotton yield k/fad.			Lint cotton yield k/fad.			Lint %			Fiber length		
	ij	(ij)(--)	(i.)(j.)	ij	(ij)(--)	(i.)(j.)	ij	(ij)(--)	(i.)(j.)	ij	(ij)(--)	(i.)(j.)
P_1 x P_2	-0.095	0.322	-0.161	-0,134	0,084	-0,042	-0,111	-0,974	0,487	0.086	0.580	-0.290
P_1 x P_3	-0.163	-1.288	0.644	-0,086	-1,650	0,825	0,336	-0,694	0,347	-0.041	-0.169	0.084
P_1 x P_4	0.078	1.028	-0.514	0,128	1,256	-0,628	0,139	0,387	-0,194	0.010	-0.363	0.181
P_1 x P_5	0.222	-0.083	0.041	0,258	0,108	-0,054	-0,009	0,670	-0,335	-0.075	0.219	-0.109
P_1 x P_6	-0.086	0.020	-0.010	-0,147	0,201	-0,100	-0,128	0,611	-0,306	-0.001	-0.267	0.133
P_2 x P_3	0.260	0.209	-0.105	0,304	0,339	-0,169	0,040	0,352	-0,176	0.055	-0.207	0.104
P_2 x P_4	-0.085	-0.272	0.136	-0,108	-0,308	0,154	-0,003	-0,004	0,002	0.069	-0.059	0.030
P_2 x P_5	0.144	0.354	-0.177	0,155	0,634	-0,317	-0,016	0,817	-0,408	-0.079	-0.165	0.082
P_2 x P_6	-0.051	-0.613	0.307	-0,042	-0,749	0,374	0,051	-0,191	0,095	0.060	-0.148	0.074
P_3 x P_4	0.006	0.203	-0.102	-0,152	0,248	-0,124	-0,566	0,052	-0,026	0.010	0.091	-0.045
P_3 x P_5	-0.015	0.546	-0.273	-0,019	0,587	-0,293	0,000	-0,022	0,011	0.057	0.146	-0.073
P_3 x P_6	-0.114	0.330	-0.165	-0,105	0,476	-0,238	0,069	0,313	-0,156	-0.013	0.139	-0.069
P_4 x P_5	-0.003	-1.019	0.510	0,050	-1,299	0,649	0,195	-0,583	0,292	-0.079	-0.072	0.036
P_4 x P_6	0.031	0.061	-0.030	0,067	0,103	-0,051	0,090	0,148	-0,074	-0.083	0.404	-0.202
P_5 x P_6	-0.130	0.203	-0.101	-0,171	-0,031	0,015	-0,089	-0,881	0,441	0.023	-0.128	0.064

Australian (p_1), BBB (p_2), Karshenky (p_3), Giza 70 (p_4), Suvin (p_5) and (Giza 77 x Pima S_6) (p_6)

III. The specific order of three out of four parents

Considering (ij)(k -) type particular arrangement in double crosses for seed cotton and lint yield we found that (P_4 x P_5) (P_1 -) , (P_4 x P_5)(P_2 -), (P_4 x P_5)(P_6 -) and (P_2 x P_6)(P_5 -) combinations were the best (Table 5). However, on the basis of the overall performance of any three parents in all possible combinations, without to respect of arrangement (Sijk), the best triplet was P_2 x P_3 x P_6 followed by P_1 x P_4 x P_5 and P_2 x P_3 x P_6. How the order of these parents in cross matters can be seen by showing in arrangement of parents of particular cross.

Particular arrangement in double crosses for lint percentage was shown in Table (5). The data showed that (P_1 x P_2)(P_6 -), (P_1 x P_3)(P_6 -), (P_3 x P_4)(P_5 -), (P_3 x P_5)(P_1 -) and (P_4 x P_5)(P_2 -) were the best. Considering the specific order effects of three out of four parents without respect to arrangement the best triplet was (P_1 x P_4 x P_5) followed by P_1 x P_2 x P_3 and P_1 x P_3 x P_5. The data show that another combination in which the same three parents were involved but in same other order had differed a specific combination effect. Patel *et al* 2005 with respect the three lines specific effects they identified some combinations to be used for exploitation of heterosis.

Table (5): Three-line interaction effect of lines I, j and k due to the particular arrangement (ij)(k-) i.e. t ijk and specific effect irrespective s ijk i.e. 3-line effect irrespective of the arrangement for yield characters and Fiber length of cotton

3-line interaction	Seed cotton yield k/fed.		Lint cotton yield k/fed.		Lint %		Fiber length	
	(ij)(k-)	i,j and k	(ij)(k-)	i,j and k	(ij)(k-)	i,j and k	(ij)(k-)	i,j and k
(P_1xP_2) (P_3.).	-0.069	-0,033	-0,480	0,039	0,769	0,243	-0.123	0.020
(P_1xP_2) (P_4.).	0.124	-0,154	0,972	-0,174	0,418	0,010	-0.383	0.132
(P_1xP_2) (P_5.).	0.089	0,155	-0,141	0,123	1,006	-0,226	0.040	-0.074
(P_1xP_2) (P_6.).	0.044	-0,158	-0,434	-0,255	-1,219	-0,249	-0.113	0.093
(P_1xP_3) (P_2.).	-0.052	-0,065	0,081	-0,093	-0,617	-0,078	-0.068	-0.013
(P_1xP_3) (P_4.).	0.167	-0,006	0,776	0,075	0,751	0,264	0.262	-0.024
(P_1xP_3) (P_5.).	0.004	-0,223	-0,386	-0,193	-0,285	0,243	-0.023	-0.067
(P_1xP_3) (P_6.).	-0.052		1,178		0,845		-0.003	
(P_1xP_4) (P_2.).	0.052		-0,724		-0,591		0.397	
(P_1xP_4) (P_3.).	-0.122		-1,003		-0,449		-0.213	
(P_1xP_4) (P_5.).	0.120	0,229	0,646	0,343	-0,306	0,271	0.003	-0.062
(P_1xP_4) (P_6.).	0.106	0,145	-0,175	0,179	0,959	0,076	0.176	-0.038
(P_1xP_5) (P_2.).	-0.117		0,297		-0,116		-0.274	
(P_1xP_5) (P_3.).	0.248		0,404		-0,599		0.274	
(P_1xP_5) (P_4.).	-0.235		-0,341		0,324		-0.025	
(P_1xP_5) (P_6.).	0.111		-0,469		-0,280		-0.194	
(P_1xP_6) (P_2.).	0.022		0,388		0,836		0.234	
(P_1xP_6) (P_3.).	-0.091		0,255		-0,069		-0.022	
(P_1xP_6) (P_4.).	-0.133		-0,779		-1,299		-0.035	
(P_1xP_6) (P_5.).	-0.217		-0,064		-0,080		0.090	
(P_2xP_3) (P_1.).	0.120		0,399		-0,153		0.191	
(P_2xP_3) (P_4.).	-0.398	0,064	-0,897	-0,025	-0,535	-0,327	-0.014	0.010
(P_2xP_3) (P_5.).	-0.056	0,123	0,546	0,010	-0,006	-0,428	0.028	0.072
(P_2xP_3) (P_6.).	0.233	0,267	-0,388	0,310	0,343	0,050	0.003	-0.002
(P_2xP_4) (P_1.).	-0.176		-0,247		0,173		-0.014	
(P_2xP_4) (P_3.).	0.269		0,883		0,231		0.086	
(P_2xP_4) (P_5.).	0.209	0,162	-0,850	0,250	-0,720	0,216	-0.004	0.020
(P_2xP_4) (P_6.).	-0.106	-0,083	0,524	-0,048	0,319	0,210	-0.009	-0.077
(P_2xP_5) (P_1.).	0.028		-0,156		-0,891		0.234	
(P_2xP_5) (P_3.).	-0.061		-0,333		-0,370		-0.181	

Australian (p_1), BBB (p_2), Karshenky (p_3), Giza 70 (p_4), Suvin (p_5) and (Giza 77 x Pima S_6)(p_6)

Cont. Table (5)

3-line interaction	Seed cotton yield k/f		Lint cotton yield k/f		Lint %		Fiber length	
	(ij)(k-)	i,j and k	(ij)(k-)	i,j and k	(ij)(k-)	i,j and k	(ij)(k-)	i,j and k
(P_2xP_5) (P_4.).	-0,077	-0,056	-0,069	-0,004	-0,018	0,201	0.066	0.011
(P_2xP_5) (P_6.).	-0,178	-0,051	-0,076	-0,076	0,462	-0,066	0.045	-0.004
(P_2xP_6) (P_1.).	-0,049		0,046		0,383		-0.121	
(P_2xP_6) (P_3.).	0,190		0,100		-0,455		0.114	
(P_2xP_6) (P_4.).	-0,163		-0,161		0,133		0.302	
(P_2xP_6) (P_5.).	0,635		0,763		0,129		-0.146	
(P_3xP_4) (P_1.).	0,288		0,227		-0,302		-0.049	
(P_3xP_4) (P_2.).	-0,072		0,014		0,304		-0.072	
(P_3xP_4) (P_5.).	-0,003	-0,085	0,201	-0,188	0,753	-0,310	0.020	0.041
(P_3xP_4) (P_6.).	-0,416	0,039	-0,690	-0,033	-0,806	-0,316	0.010	-0.080
(P_3xP_5) (P_1.).	-0,262		-0,018		0,884		-0.251	
(P_3xP_5) (P_2.).	-0,265		-0,213		0,377		0.153	
(P_3xP_5) (P_4.).	-0,175		-0,493		-1,014		-0.107	
(P_3xP_5) (P_6.).	0,156	-0,206	0,137	-0,234	-0,225	-0,005	0.059	0.100
(P_3xP_6) (1.).	-1,070		-1,433		-0,777		0.025	
(P_3xP_6) (2.).	0,209		0,287		0,112		-0.117	
(P_3xP_6) (P_4.).	0,457		0,738		0,824		-0.095	
(P_3xP_6) (P_5.).	0,074		-0,068		-0,472		0.048	
(P_4xP_5) (P_1.).	-0,247		-0,305		-0,018		0.022	
(P_4xP_5) (P_2.).	0,626		0,919		0,738		-0.062	
(P_4xP_5) (P_3.).	0,178		0,292		0,261		0.087	
(P_4xP_5) (P_6.).	0,462	-0,067	0,393	-0,008	-0,398	0,220	0.025	-0.059
(P_4xP_6) (P_1.).	0,755		0,954		0,340		-0.141	
(P_4xP_6) (P_2.).	-0,202		-0,363		-0,453		-0.293	
(P_4xP_6) (P_3.).	-0,041		-0,048		-0,018		0.085	
(P_4xP_6) (P_5.).	-0,572		-0,646		-0,018		-0.056	
(P_5xP_6) (P_1.).	0,374		0,533		0,359		0.104	
(P_5xP_6) (P_2.).	-0,457		-0,687		-0,591		0.101	
(P_5xP_6) (P_3.).	-0,230		-0,069		0,697		-0.107	
(P_5xP_6) (P_4.).	0,110		0,253		0,416		0.031	

Australian (p_1), BBB (p_2), Karshenky (p_3), Giza 70 (p_4), Suvin (p_5) and (Giza 77 x Pima S_6) (p_6)

With regard to Fiber length the specific order effect of three out of four parents i.e (ij)(k-) type was showed in the Table (5). The data showed that (P_1 x P_3)(P_4 -), (P_1 x P_4)(P_2 -), (P_1 x P_5)(P_3 -), (P_1 x P_6)(P_2 -) and (P_2 x P_5)(P_1 -) were the best. On the basis of the overall performance of any three parents in all possible combinations, without respect to arrangement S(ijk), the best triplet was P_3 x P_5 x P_6 followed by P_1 x P_2 x P_4 and P_2 x P_3 x P_5. This observation clearly shows the significance of the order in which the parents are involved in multiple crosses

IV. The four-line interaction:

The 4-line interaction with and without respect to particular arrangements of the parents in double crosses are given in Table (6). The data in this table show that involvement of the parents in crosses in particular arrangements such as (P_1 x P_3)(P_2 x P_6), (P_1 x P_3)(P_4 x P5), (P_1 x P_4)(P_2 x P_3), (P_1 x P_4)(P_5 x P_6) and (P_2 x P_3)(P_5 x P_6) provided the maximum interaction effect.

Table (6): Four-line interaction effect of lines I, j, k and l due to the particular arrangement (ij) (kl) i.e. t ijkl and 4-lin effect irrespective of their arrangement for yield characters and Fiber length of cotton.

4-line interaction	Seed cotton yield k/fed.		Lint cotton yield k/fed.		Lint %		Fiber length	
	(ij) (kl)	ijkl	(ij) (kl)	ijkl	(ij) (kl)	ijkl	(ij) (kl)	ijkl
(P_1xP_2) (P_3xP_4)	-0,098	-0,258	0,039	-0,389	0,587	-0,342	-0.031	0.236
(P_1xP_2) (P_3xP_5)	0,029	0,414	0,126	0,614	0,254	0,421	-0.139	-0.162
(P_1xP_2) (P_3xP_6)	0,068	-0,254	-0,166	-0,109	-0,841	0,648	0.169	-0.012
(P_1xP_2) (P_4xP_5)	0,068	0,034	-0,166	0,140	-0,841	0,334	0.169	-0.094
(P_1xP_2) (P_4xP_6)	0,029	-0,237	0,126	-0,273	0,254	0,038	-0.139	0.256
(P_1xP_2) (P_5xP_6)	-0,098	0,017	0,039	-0,384	0,587	-1,432	-0.031	0.036
(P_1xP_3) (P_2xP_4)	-0,449		-0,382		0,334		-0.111	
(P_1xP_3) (P_2xP_5)	-0,019		-0,107		-0,191		0.272	
(P_1xP_3) (P_2xP_6)	0,468		0,489		-0,144		-0.161	
(P_1xP_3) (P_4xP_5)	0,468	0,023	0,489	0,095	-0,144	0,199	-0.161	
(P_1xP_3) (P_4xP_6)	-0,019	0,041	-0,107	0,015	-0,191	-0,091	0.272	0.002
(P_1xP_3) (P_5xP_6)	-0,449	-0,455	-0,382	-0,484	0,334	0,173	-0.111	-0.276
(P_1xP_4) (P_2xP_3)	0,547		0,343		-0,921		0.142	0.088
(P_1xP_4) (P_2xP_5)	-0,155		-0,086		0,234		-0.261	
(P_1xP_4) (P_2xP_6)	-0,392		-0,258		0,687		0.119	
(P_1xP_4) (P_3xP_5)	-0,392		-0,258		0,687		0.119	
(P_1xP_4) (P_3xP_6)	-0,155		-0,086		0,234		-0.261	
(P_1xP_4) (P_5xP_6)	0,547	0,631	0,343	0,794	-0,921	0,279	0.142	-0.094
(P_1xP_5) (P_2xP_3)	-0,010		-0,020		-0,063		-0.133	
(P_1xP_5) (P_2xP_4)	0,087		0,251		0,606		0.092	
(P_1xP_5) (P_2xP_6)	-0,076		-0,232		-0,544		0.042	
(P_1xP_5) (P_3xP_4)	-0,076		-0,232		-0,544		0.042	
(P_1xP_5) (P_3xP_6)	0,087		0,251		0,606		0.092	
(P_1xP_5) (P_4xP_6)	-0,010		-0,020		-0,063		-0.133	
(P_1xP_6) (P_2xP_3)	-0,537		-0,323		0,984		-0.008	
(P_1xP_6) (P_2xP_4)	0,363		0,131		-0,941		0.019	
(P_1xP_6) (P_2xP_5)	0,174		0,192		-0,044		-0.011	
(P_1xP_6) (P_3xP_4)	0,174		0,192		-0,044		-0.011	
(P_1xP_6) (P_3xP_5)	0,363		0,131		-0,941		0.019	
(P_1xP_6) (P_4xP_5)	-0,537		-0,323		0,984		-0.008	
(P_2xP_3) (P_4xP_5)	-0,537	0,136	-0,323	-0,062	0,984	-0,606	-0.008	0.032
(P_2xP_3) (P_4xP_6)	-0,010	0,490	-0,020	0,482	-0,063	-0,335	-0.133	-0.051
(P_2xP_3) (P_5xP_6)	0,547	0,251	0,343	0,378	-0,921	0,334	0.142	0.123
(P_2xP_4) (P_3xP_5)	0,363		0,131		-0,941		0.019	
(P_2xP_4) (P_3xP_6)	0,087		0,251		0,606		0.092	
(P_2xP_4) (P_5xP_6)	-0,449	-0,419	-0,382	-0,221	0,334	0,901	-0.111	-0.170
(P_2xP_5) (P_3xP_4)	0,174		0,192		-0,044		-0.011	
(P_2xP_5) (P_3xP_6)	-0,155		-0,086		0,234		-0.261	
(P_2xP_5) (P_4xP_6)	-0,019		-0,107		-0,191		0.272	
(P_2xP_6) (P_3xP_4)	-0,076		-0,232		-0,544		0.042	
(P_2xP_6) (P_3xP_5)	-0,392		-0,258		0,687		0.119	
(P_2xP_6) (P_4xP_5)	0,468		0,489		-0,144		-0.161	
(P_3xP_4) (P_5xP_6)	-0,098	-0,414	0,039	-0,596	0,587	-0,522	-0.031	0.088
(P_3xP_5) (P_4xP_6)	0,029		0,126		0,254		-0.139	
(P_3xP_6) (P_4xP_5)	0,068		-0,166		-0,841		0.169	

Australian (p_1), BBB (p_2), Karshenky (p_3), Giza 70 (p_4), Suvin (p_5) and (Giza 77 x Pima S_6) (p_6)

The results again confirm that the order in which the parents go into a double hybrid is deciding factor for its high or low performance. Considering the general effect of set of anyfour parents in various combinations, irrespective of the order its obvious that parents P_1, P_4, P_5 and P_6 followed P_2, P_3, P_4 and P_6

For lint percentage the data in Table (6) show that the combination (P_1 x P_6)(P_2 x P_3) and (P_2 x P_3)(P_4 x P_5)was the best. With respect to particular arrangement. While the four parents P_2 , P_4 , P_5 and P_6 were formed the best combination with irrespective of order.

For Fiber length, the data in Table (6) showed that involvement of the parents in crosses in particular arrangements such as (P_1 x P_3)(P_2 x P_5), (P_1 x P_3)(P_4 x P_6), (P_1 x P_2)(P_3 x P_6) and (P_1 x P_2)(P_4 x P_5) provided the maximum interaction effect. The best 4-line combination (P_1 x P_3)(P_2 x P_5) in this order when combined in another order such as (P_1 x P_5)(P_2 x P_3) produced negative effect (-0.133). These results confirm that the order in which the parents go into a double crosses in deciding factor for its higher or low performance. Considering the general effect of set of any four parents in various combination, irrespective of the order it is obvious that the parents P_1,P_2,P_4 and P_6 followed by P_1, P_2,P_3 and P_4 formed the best combinations.

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تحسين القطن المصرى باستخدام الجيل الثانى للهجن الزوجية

طلعـــت احمـــد الفقـــي ، حســـن أمـــين الحســـيني ، عزيـــزة محمـــد ســـلطان و مصطفى حسنى محمد عرابى
معهد بحوث القطن – مركز البحوث الزراعية

يهدف هذا البحث إلى دراسة القدرة العامة والخاصة على التآلف واستخدام الجيل الثانى للهجن الزوجية في تحسين صفات القطن المصرى وقد استخدمت في ذلك ستة اصناف وهي استرالي ، BBB ، كارشنكي ، جيزة ٧٠، سيوفين و جيزة ٩٣ وقد تم زراعة الجيل الثانى للهجن الزوجية موسم ٢٠١٠ فى تجربة قطاعات كاملة عشوائية من ثلاث مكررات احتوت القطعة على ثلاث خطوط طول الخط ٤م وقد زرعت النباتات على مسافة ٢٠ سم تمثل الزراعة العادية وتم خف التجربة على نباتين فى الجورة وأجريت عليها العمليات الزراعية العادية لمحطة بحوث سخا وكانت الصفات المدروسة كالأتي :

١- محصول القطن الزهر قنطار/فدان ٢- محصول القطن الشعر قنطار/فدان
٣- تصافى الحليج ٤- طول التيلة (متوسط طول الربيع الاعلى) مقدرا بجهاز HVI

ويمكن تلخيص النتائج المتحصل عليها فيما يلي :

١. كانت الأباء سيوفين ، استرالي ، BBB، ذو قدرة تالف عامة لصفات محصول القطن الزهر والشعر وتصافى الحليج بالاضافة الى صفة طول التيلة على التوالى.
٢. كانت افضل قدرة تالف عامة ثنائية للابوين (BBB × كارشنكى)، (استرالي × سيوفين) ، (استرالي × كارشنكى) فى هجين فردى واحد مع صرف النظر عن الهجين الفردى الاخر في صفات المحصول وصفة طول التيلة ، بينما كان قدرة التالف الخاصة عالية للتفاعل الثنائى مع الترتيب للهجن (استرالي × جيزة ٧٠) (- -) ،(استرالي × كارشنكى) (- -) و (BBB × سيوفين) (- -) لنفس الصفات على الترتيب. والهجين (استرالى × -) (كارشنكى × -) بدون ترتيب لصفات محصول القطن الزهر والشعر وتصافى الحليج والهجين (استرالى × -) (جيزة ٧٠ × -) لصفة طول التيلة.
٣. كانت أفضل قدرة تالف عامة ثلاثية الترتيب للهجن (جيزة ٧٠ × سيوفين) × (استرالى × -) ، (استرالى × BBB) (سيوفين× -) و(استرالى × جيزة ٧٠) (جيزة ٩٣× -) بينما كانت الهجن (استرالي × جيزة ٧٠) (ســـيوفين × -) , (اســـترالي × كارشـــنكى)(جيزة ٧٠ × -) و (كارشـــنكى × ســـيوفين) (جيزة ٩٣ ×-) بصرف النظر عن الترتيب.
٤. كانت أفضل مجموعة رباعية بالترتيب او بدون ترتيب (استرالى × جيزة ٧٠) (سيوفين × جيزة ٩٣) لصفتى محصول القطن الزهر والشعر اما بالنسبة لصفة تصافى الحليج بالترتيب كانت المجموعة (استرالي × جيزة ٩٣) (BBB × كارشنكى) وبدون ترتيب المجموعة (BBB × جيزة ٧٠)(سيوفين ×جيزة ٩٣) اما بالنسبة لصفة طول التيلة بالترتيب فكانت المجموعة (استرالى × كارشنكى) (BBB × سيوفين) و (BBB × سيوفين) (جيزة ٧٠ × جيزة ٩٣) وبدون ترتيب المجموعة (استرالى × BBB) (جيزة ٧٠ × جيزة ٩٣)

قام بتحكيم البحث

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