RECURRENT SELECTION FOR LINT YIELD AND ITS COMPONENTS OF SOME EGYPTIAN COTTON GENOTYPES

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Abstract

All possible mating among four F_2 selections of the highest lint percentage and four F_2 selections of the highest seed index were made for three populations (G. 45 x G. 75 (I), G. 87 x G. 89 (II) and G. 86 (III) grown from open-pollinated bulks for four years) to produce desirable recombinations. The 28-hybrids resulted from each population gave the highest means of lint yield/plant, bolls/plant and seeds/boll compared with the means of the better parent for populations I and II. In addition, the 28 hybrids means performance were higher than Giza 86 pure line mean for lint/seed, lint percentage and seed index in population III. The highest predicted genetic advance was achieved for lint yield/plant, bolls/plant, lint/seed and seed index in the three populations. High to low genetic advances were found to associated with high to low values of GCA most studied characters in the three populations.

INTRODUCTION

Recurrent selection aims to increase the genetic recombinations and desirable gene frequencies in plant population. Al-Jibouri *et al.* (1958) reported that the breeder may succeed in breaking up undesirable linkage, nevertheless the probability of obtaining the most desirable character combinations from one generation of segregation and recombination is still very small if a large number of loci is involved. In such case, the breeder might follow recurrent selection , where a selection index might prove very helpful in this respect. Opondo and Pathak (1982) mentioned that using recurrent selection in each population to increase the frequency of favourable genes so that the populations and population crosses are improved with each selection cycle. In this phase recombination of desirable characters should be increased. Ahmmed and Mehra (2000) suggested moderate values of genotypic and phenotypic coefficients of variation and moderate heritability and expected genetic gain for economic yield and bolls/plant suggested possibilities of genetic improvement in yield through recombination breeding and recurrent selection. The purpose of this study was to obtain information regarding , magnitudes of the phenotypic and genotypic correlations, and to produce desirable recombinations from all possible mating among four selections of the highest lint percentage and four selections of the highest seed index.

MATERIALS AND METHODS

Field procedures

The present investigation was carried out at Sakha Agricultural Research Station, Agricultural Research Center, Egypt, during 2000, 2001 and 2002 growing seasons. In 2000, the F_2 of both populations (G. 45 x G. 75) I and (G. 87 x G. 89) II, and the S_0 of population (G. 86 open-pollinated) III were grown in non replicated rows 7.5 meters long and 60 cm wide, with one skipped row between each two consecutive planted rows. Each row contained 15 single plants spaced 50 cm apart. All plants were self pollinated and 300 guarded plants from each population were selected in the field mainly on the basis of number of retained open bolls and productivity. Four plants superior in lint percentage as well as, four elite plants in seed index of each population were chosen as parents to produce the first cycle of recurrent selection in 2001 season. In 2001, selfed seeds of the eight parents of recurrent selection were sown and a half diallel hybridization procedure was made to produce 28 hybrids. In 2002, the 28 hybrids and their eight selected parents were evaluated with the two original parents and two random samples of F_4 and S_2 (bulked seeds), in a randomized complete block design with three replications for each population. Each replication consisted of 40 rows. One row for each genotype. Row was 4.5 meter in length and 60 cm in width. Seeds were sown in hills spaced 30 cm, and two plants were left per hill at thinning time. The following characters were recorded: Lint yield/plant (g), bolls/plant, seeds/boll, lint/seed (g), lint percentage and seed index (g).

Method of Analysis

Analysis of variance was calculated on plot mean basis. The data from each experiment was analyzed according to Snedecor and Cochran (1967).

The phenotypic (PCV) and genotypic (GCV) coefficients of variation were estimated according to Burton (1952).

Predicted genetic advance was estimated as outlined by Miller and Rawlings (1967).

Phenotypic and genotypic correlation coefficients were calculated among the studied characters as outlined by Dewey and Lu (1959). Significance of correlation coefficients was tested according to the formula of Steel and Torrie (1960).

RESULTS AND DISCUSSION

1. Mean performance and mean square estimates

All possible matings among four selections of the highest lint percentage and four selections of the highest seed index were made of each population to produce better recombinations. Mean performance of the eight selected plants used in recurrent selection for lint yield and its components in the three populations are presented in Table (1). In population I, selection for lint percentage gave high means for both lint percentage and lint/seed, but the mean of selected parents for seed index was higher for lint yield/plant, bolls/plant, seeds/boll and seed index. Concerning population II, selection for lint percentage gave high means for lint yield/plant, bolls/plant, lint/seed and lint percentage, the mean of selected parents for seed index was high for seeds/boll and seed index. In population III, selection for lint percentage gave high means for lint yield/plant, bolls/plant and lint percentage, the mean of selected parents for seed index was high for seeds/boll, lint/seed and seed index.

Table 1. Mean performance of the eight selected plants used in recurrent selection for the studied characters of populations I, II and III.

Populations	Parents	No.	Lint yield/ plant (g)	Bolls /plant	Seeds/ boll	Lint/seed (g)	Lint percentage	Seed index (g)
Population I (G. 45 x G. 75)	Selected for lint percentage	1	32.6	35	18.6	0.050	38.0	8.2
		2	22.1	21	17.8	0.059	39.7	8.9
		3	38.4	39	18.6	0.053	38.1	8.6
		4	13.9	15	16.8	0.055	38.6	8.8
	Mean		26.8	28	18.0	0.054	38.6	8.6
	Selected for seed index	1	33.8	31	18.8	0.058	34.7	10.9
		2	25.7	30	18.2	0.047	30.3	10.9
		3	23.2	18	20.8	0.062	35.2	11.4
		4	46.4	58	18.2	0.044	33.9	10.9
	Mean		32.3	34	19.0	0.053	33.5	11.0
Population II (G. 87 x G. 89)	Selected for lint percentage	1	46.6	44	19.6	0.054	38.4	8.6
		2	20.9	20	18.0	0.058	40.5	8.5
		3	23.9	21	19.6	0.058	38.5	9.3
		4	43.5	39	18.6	0.060	40.1	8.9
	Mean		33.7	31	19.0	0.058	39.4	8.8
	Selected for seed index	1	37.9	37	21.8	0.047	31.7	10.1
		2	19.0	23	19.2	0.043	30.1	10.1
		3	30.1	26	18.4	0.063	37.1	10.6
		4	24.3	28	17.0	0.051	33.3	10.2
	Mean		27.8	29	19.1	0.051	33.1	10.3
Population III (G. 86 open-pollinated)	Selected for lint percentage	1	26.4	29	14.0	0.065	41.3	9.2
		2	25.6	23	17.4	0.064	41.2	9.2
		3	38.9	33	17.6	0.067	41.3	9.5
		4	30.6	30	18.2	0.056	41.7	7.8
	Mean		30.4	29	16.8	0.063	41.4	8.9
	Selected for seed index	1	18.2	18	15.8	0.064	37.7	10.6
		2	17.9	14	18.8	0.068	39.3	10.5
		3	35.8	30	17.8	0.067	38.8	10.5
		4	22.0	18	17.2	0.071	40.1	10.6
	Mean		23.5	20	17.4	0.068	39.0	10.6

Table (2) shows mean square estimates for lint yield and its components of recurrent selection in the three populations. Mean squares of genotypes were highly significant for lint yield and its components at the three populations except seeds/boll in population III. Original parents mean squares were significant for lint percentage in both population I and II, and lint/seed in population I. Mean squares of selected parents were

Table 2. Mean square estimates for the studied characters of recurrent selection in the three populations.

Populations	S.O.V.	d.F	Lint yield/plant (g)	Bolls/plant	Seeds/boll	Lint/seed (g)	Lint percentage	Seed index (g)
	Replications							
	Genotypes	2	6.408	54.610	4.325	0.00001	0.316	0.158
	Original parents	(39)	37.460**	144.222**	4.588**	0.00015**	15.629**	3.279**
	Selected parents	1	54.602	3.082	0.240	0.00052**	54.602**	0.540
	Random samples	7	64.627**	152.410**	8.188**	0.00007*	11.640**	3.726**
	Hybrids	1	0.135	22.427	2.282	0.00003	1.500	0.007
Population I	Hybrid Vs. original	27	31.243*	153.318**	3.992**	0.00014**	16.716**	3.070**
(G. 45 x G.	parent	1	92.449*	312.107**	5.041	0.00042**	13.620**	3.878*
75)	Hybrid Vs. selected	1	16.427	1.886	1.761	0.00020*	0.097	7.714**
	parent Hybrid Vs.	1	1.380	78.700	4.524	0.00060**	6.894	6.761**
	random sample	78	15.859	42.837	1.928	0.00003	1.930	0.965
	Error							
	Replications							
	Genotypes	2	9.944	12.104	1.810	0.00001	0.421	0.048
	Original parents	(39)	70.9923**	194.038**	3.378**	0.00013**	9.847**	3.066**
	Selected parents	1	0.082	12.327	0.015	0.00007	8.882*	0.082
	Random samples	7	100.412**	269.317**	4.832**	0.00022**	16.192**	3.984**
	Hybrids	1	0.882	0.482	0.082	0.000002	5.607	0.540
Population II	Hybrid Vs. original	27	73.910**	204.845**	3318**	0.00012**	9.133**	3.170**
(G. 87 x G.	parent	1	10.902	49.207	1.844	0.00005	1.170	0.622
89)	Hybrid Vs. selected	1	45.296	2.156	5.622*	0.000018**	4.159	3.710**
	parent Hybrid Vs.	1	13.085	87.269	0.783	0.00009*	4.276	1.134
	random sample	78	32.677	67.328	1.370	0.00002	1.979	0.425
	Error							
	Replications							
	Genotypes	2	49.017	55.715	1.001	0.00005	1.226	0.383
	Original parents	(39)	74.506**	67.985**	2.215	0.00009**	2.802**	2.507**
	Selected parents	1	9.627	61.440	0.002	0.00007	0.882	1.127
	Random samples	7	25.690	28.930	2.687	0.00004	4.536**	1.652**
	Hybrids	1	51.627	13.202	1.815	0.00001	2.535	0.082
Population III	Hybrid Vs. original	27	80.200**	71.262**	2.411	0.00011**	2.693*	3.087**
(G. 86 open-	parent	1	17.620	20.983	0.138	0.000002	0.912	0.075
pollinated)	Hybrid Vs. selected	1	480.208**	420.006**	0.427	0.0000004	0.465	0.167
	parent Hybrid Vs.	1	1.440	9.189	0.086	0.00004	0.008	1.393
	random sample	78	24.645	26.264	1.524	0.000023	1.473	0.558
	Error							

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

highly significant for lint yield and its components in populations I and II, while these mean squares were highly significant for lint percentage and seed index in population III. Random samples mean squares were not significant for all studied characters at the three populations.

Hybrid mean squares were highly significant for lint yield and its components in the three populations except seeds/boll in population III. Mean squares of hybrid vs. original parents as an indication to average heterosis overall hybrids were significant for lint yield/plant, bolls/plant, lint/seed, lint percentage and seed index in population I only. Mean squares of hybrid vs. selected parents were significant for lint/seed and seed index in population I, seeds/boll, lint/seed and seed index in population II, lint yield/plant and bolls/plant in population III. Hybrid vs. random sample mean squares were significant for lint/seed in populations I and II, and seed index in population I only. These results may be due to some hybrids which were superior while others were inferior compared to the original parents, selected parental lines and random samples.

2. Genetic variability and predicted genetic advance

Estimates of variance components, phenotypic and genotypic coefficients of variation and predicted genetic advances for lint yield and its components of recurrent selection in the three populations are presented in Table (3). Both phenotypic and genotypic variances were significant and large in magnitude for all studied characters in the three populations except seeds/boll in population III. The increase in phenotypic and genotypic variances in the three populations is due to new recombinants which create substantial genetic variation. These results are in agreement with those obtained by Ahmmed and Mehra (2000).

The estimates of phenotypic and genotypic coefficients of variation (PCV % and GCV%) were large in magnitude for all the studied characters in the three populations except for seeds/boll and lint percentage in population III. This indicates that the magnitude of the genetic variability which persisted in these materials was sufficient for providing substantial amount of improvement through the selection of superior hybrids. The data also indicated slight discrepancy between PCV and GCV for seeds/boll, lint/seed, lint percentage and seed index in the three populations, as well as lint yield and bolls/plant in population III. Similar results were recorded by Al-Jibouri *et al.* (1958) and Gooda (2001).

Table (3). indicates that the highest predicted genetic advances were achieved for lint yield/plant, bolls/plant, lint/seed and seed index in the three populations. On the other hand, moderate to low predicted genetic advances as percentage of hybrids mean were detected for both seeds/boll and lint percentage in the three populations.

High to low genetic advances were found associated with high to low values of GCV in most studied characters in the three populations.

Table 3. Estimates of phenotypic (σ^2_p) and genotypic (σ^2_g) variances, phenotypic (PCV) and genotypic (GCV) coefficients of variation and predicted genetic advance for studied characters of recurrent selection according to hybrids data in the three populations.

Populations	Characters	σ^2_p	σ^2_g	PCV %	GCV %	Predicted (unit)	Predicted (%)
Population I (G. 45 x G. 75)	1. Lint yield/plant (g)	10.414*	4.939	18.54	12.76	3.15	18.09
	2. Bolls/plant	51.106**	35.628	32.67	27.28	10.27	46.94
	3. Seeds/boll	1.331*	0.595	7.03	4.70	1.06	6.46
	4. Lint/seed (g)	0.000045**	0.000037	13.15	11.93	0.01	19.61
	5. Lint percentage	5.572**	4.946	7.02	6.61	4.32	12.85
	6. Seed index (g)	1.023**	0.808	10.08	8.96	1.65	16.45
Population II (G. 87 x G. 89)	1. Lint yield/plant (g)	24.637*	11.723	26.57	18.33	4.87	26.07
	2. Bolls/plant	68.282**	40.327	34.39	26.43	10.05	41.82
	3. Seeds/boll	1.106**	0.656	6.52	5.02	1.28	7.94
	4. Lint/seed (g)	0.000041**	0.000036	12.81	12.00	0.01	20.00
	5. Lint percentage	3.044**	2.389	5.09	4.51	2.82	8.23
	6. Seed index (g)	1.057**	0.950	10.65	10.10	1.90	19.69
Population III (G. 86 open-pollinated)	1. Lint yield/plant (g)	26.733**	18.272	22.01	18.20	7.28	30.99
	2. Bolls/plant	23.754**	14.989	21.54	17.11	6.34	28.02
	3. Seeds/boll	0.804	0.217	5.63	2.92	0.50	3.14
	4. Lint/seed (g)	0.000037**	0.000030	9.22	8.30	0.01	15.15
	5. Lint percentage	0.898*	0.374	2.46	1.59	0.81	2.10
	6. Seed index (g)	1.029**	0.844	9.62	8.71	1.71	16.21

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

3. Evaluation of recurrent selection hybrids

Table (4) shows means of original parents, selected parental lines, random samples, 28-hybrids, 6-hybrids for lint percentage, 6-hybrids for seed index and 16-hybrids between lint percentage and seed index for lint yield and its component characters in the three populations.

In population I, the 28-hybrids resulted in higher means of lint yield/plant, bolls/plant and seeds/boll compared with the better parent. Six-hybrids for lint percentage resulted in higher means of seeds/boll and lint percentage compared with 6-hybrids for seed index and 16-hybrids between lint percentage and seed index. Six-hybrids for seed index exceeded means for lint yield/plant, lint/seed and seed index compared with 6-hybrids for lint percentage and 16-hybrids between lint percentage and seed index. Sixteen-hybrids between lint percentage and seed index resulted in higher means of bolls/plant compared with the rest of the hybrids. These results indicated that selection for seed index in this population was more important than selection for lint percentage in improving lint yield.

In population II, mean performance of 28-hybrids was higher than that of the better parent for lint yield/plant, bolls/plant and seeds/boll. Six-hybrids for lint percentage showed high means of seeds/boll, lint/seed and lint percentage, while 6-hybrids for seed index exhibited high mean of seed index only. Both lint yield and bolls/plant showed high means in 16-hybrids between lint percentage and seed index. These results indicated that selection from hybrids between lint percentage and seed index in this population was more efficient than selection from both hybrids for lint percentage and for seed index. Meredith and Bridge (1973) found that a modified form of recurrent selection for lint percentage, which is also highly correlated with yield, can result in yield increases.

Table 4. Means of the studied characters of recurrent selection in the three populations.

Populations	Estimate \ Character	Lint yield/ plant (g)	Bolls/plant	Seeds/boll	Lint/seed (g)	Lint percentage	Seed index (g)
Population I (G. 45 x G. 75)	P_1 (Giza 45)	10.33	13.70	15.27	0.050	32.17	10.57
	P_2 (Giza 75)	16.37	15.13	15.67	0.069	38.20	11.17
	F_4 Random samples	16.92	18.13	15.52	0.061	34.73	11.13
	8- Selected parental lines	16.48	22.20	16.11	0.048	33.70	9.39
	28-Hybrids	17.41	21.88	16.42	0.051	33.62	10.03
	6-Hybrids for lint percentage	14.71	17.81	16.64	0.050	35.01	9.36
	6-Hybrids for seed index	18.29	21.07	16.49	0.055	33.12	10.98
	16- Hybrids between lint percentage and seed index	18.10	23.72	16.30	0.050	33.30	9.93
Population II (G. 87 x G. 89)	P_1 (Giza 87)	17.40	22.50	15.50	0.050	33.50	9.87
	P_2 (Giza 89)	17.17	19.63	15.60	0.057	35.93	10.10
	F_4 Random samples	17.15	20.08	15.75	0.055	35.13	10.10
	8- Selected parental lines	17.12	24.37	15.58	0.047	33.79	9.20
	28-Hybrids	18.68	24.03	16.12	0.050	34.26	9.65
	6-Hybrids for lint percentage	17.65	19.59	17.33	0.053	35.92	9.38
	6-Hybrids for seed index	18.01	24.12	15.65	0.049	32.88	9.95
	16- Hybrids between lint percentage and seed index	19.31	25.66	15.85	0.050	34.15	9.64
Population III (G. 86 open-pollinated)	P_1 (Giza 86 pure)	26.53	27.77	16.07	0.062	37.70	10.23
	P_2 (Giza 86 open-pollinated)	24.00	21.37	16.10	0.069	38.47	11.10
	S_2 Random samples	24.00	21.35	16.05	0.069	38.45	11.05
	8- Selected parental lines	18.42	17.89	15.78	0.066	38.33	10.65
	28-Hybrids	23.49	22.63	15.93	0.066	38.49	10.55
	6-Hybrids for lint percentage	23.48	23.41	16.07	0.063	38.83	9.93
	6-Hybrids for seed index	25.37	24.01	15.90	0.067	38.34	10.79
	16- Hybrids between lint percentage and seed index	22.79	21.83	15.88	0.067	38.41	10.69

In population III, the 28-hybrids resulted in higher means of lint/seed, lint percentage and seed index compared with Giza 86 pure line. Six-hybrids for lint percentage showed high means of seeds/boll and lint percentage, while 6-hybrids for seed index exhibited high means of lint yield/plant, bolls/plant, lint/seed and seed index. These results indicate that selection for seed index in population III was more efficient than selection for lint percentage in improving lint yield.

Generally, this could explain that the superiority of hybrids in lint yield and its components is due to the existence of average heterosis contributed by the particular set of parents used in hybrids and specific heterosis that occurs when a given parent is mated (hybrid) to other parent. Also, using recurrent selection in each population increased the frequency of favourable genes so that the populations and population crosses were improved with each selection cycle. In this phase recombination of desirable characters could be increased (Opondo and Pathak, 1982).

Mean performances of lint yield and its components for recurrent selection hybrids in the three populations are presented in Tables (5, 6 and 7). The superior parental lines for lint percentage were P_1 to P_4 and those for seed index were P_5 to P_8.

Regarding population I (Table 5), only one hybrid (P_3 x P_7) showed significant positive increase for lint yield/plant over selected parents mean and better parent mean. The hybrids P_2 x P_8, P_3 x P_7, P_4 x P_7 and P_7 x P_8 exhibited significant positive increases for bolls/plant over selected parents mean and better parent mean. The best hybrids which exhibited the high performance for both lint yield and bolls/plant were combinations among selections for lint percentage and selections for seed index, except the hybrid P_7 x P_8. Three hybrids (P_2 x P_4, P_2 x P_7 and P_4 x P_5) exhibited significant positive increases for seeds/boll over the better parent, while only two hybrids out of them showed significant positive increases for this character over selected parents mean. Regarding lint/seed, seven out of the twenty eight hybrids exhibited significant positive increases for such trait over selected parents mean only. Three hybrids (P_1 x P_2, P_1 x P_8 and P_2 x P_3) showed significant positive increases for lint percentage over the selected parents mean only. With regard to seed index, seven out of the twenty eight hybrids surpassed the selected parents mean and manifested significant positive increases.

Table 5. Mean performances of recurrent selection hybrids for lint yield and its components in population I (G. 45 x G. 75).

Hybrids \ Characters	Lint yield/ plant (g)	Bolls/ plant	Seeds/ boll	Lint/ seed (g)	Lint percentage	Seed index (g)
$P_1 \times P_2$	16.50	18.23	16.57	0.055	36.97*	9.27
$P_1 \times P_3$	12.50	19.73	14.70	0.045	33.33	8.97
$P_1 \times P_4$	13.03	14.50	15.33	0.058*	34.57	11.00*
$P_1 \times P_5$	18.10	25.47	15.07	0.053	34.20	10.07
$P_1 \times P_6$	15.07	15.17	17.27	0.058*	33.93	11.33*
$P_1 \times P_7$	17.13	24.63	15.63	0.047	33.60	9.40
$P_1 \times P_8$	16.70	22.83	15.17	0.050	36.13*	8.73
$P_2 \times P_3$	14.03	15.30	17.70	0.052	36.90*	8.83
$P_2 \times P_4$	16.10	18.30	18.97*+	0.047	35.43	8.57
$P_2 \times P_5$	19.47	19.73	16.33	0.061*	35.87	10.90
$P_2 \times P_6$	17.33	21.63	16.07	0.050	34.37	9.57
$P_2 \times P_7$	20.57	22.50	18.57*+	0.049	35.87	8.83
$P_2 \times P_8$	20.63	34.13*+	16.43	0.037	26.13	10.37
$P_3 \times P_4$	16.10	20.77	16.60	0.047	32.83	9.53
$P_3 \times P_5$	13.47	15.57	15.53	0.055	32.87	11.20*
$P_3 \times P_6$	13.80	16.53	16.57	0.052	31.97	10.93
$P_3 \times P_7$	25.73*+	34.20*+	16.37	0.047	33.70	9.30
$P_3 \times P_8$	16.33	19.73	16.00	0.052	34.13	10.00
$P_4 \times P_5$	20.73	21.57	18.17+	0.053	34.30	10.13
$P_4 \times P_6$	13.60	18.17	17.10	0.045	31.73	9.50
$P_4 \times P_7$	22.73	45.57*+	14.87	0.035	30.00	8.10
$P_4 \times P_8$	18.17	22.03	15.67	0.054	33.93	10.57
$P_5 \times P_6$	15.93	16.57	17.20	0.056	33.53	11.10*
$P_5 \times P_7$	15.97	15.93	16.73	0.060*	35.13	11.00*
$P_5 \times P_8$	16.47	16.30	17.60	0.057*	35.30	10.57
$P_6 \times P_7$	20.27	21.33	16.27	0.057*	33.23	11.47*
$P_6 \times P_8$	22.07	22.87	16.83	0.058*	32.70	11.87*
$P_7 \times P_8$	19.03	33.40*+	14.33	0.040	28.80	9.87
$\bar{X}$	17.41	21.88	16.42	0.051	33.62	10.03
Selected parents mean	16.48	22.20	16.11	0.048	33.70	9.39
$\bar{X}$ of better parent	16.37	15.13	15.67	0.069	38.20	11.17
L.S.D. 0.05	6.47	10.63	2.26	0.009	2.26	1.60

* Significant at 0.05 level of probability was of the difference among the hybrid mean and selected parents mean.

\+ Significant at 0.05 level of probability was of the difference among the hybrid mean and original better parent mean.

In population II (Table 6), only two hybrids ($P_3 \times P_4$ and $P_3 \times P_7$) showed significant positive increases for lint yield/plant over selected parents and better parent means. The hybrid $P_2 \times P_5$ exhibited significant positive increase for bolls/plant over the selected parents mean and better parent. Concerning seeds/boll, the three hybrids ($P_1 \times P_2$, $P_2 \times P_4$ and $P_4 \times P_8$) showed significant positive increases over the selected parents mean and the better parent. Eleven out of the twenty eight hybrid combinations exhibited significant positive increases for lint/seed over the selected parents mean. Five hybrids ($P_1 \times P_4$, $P_2 \times P_3$, $P_2 \times P_4$, $P_3 \times P_4$ and $P_3 \times P_7$) were over the selected parents mean and manifested significant positive increases for lint percentage. These results indicated that selecting for lint percentage in this population was more effective than selection for seed index in improving lint percentage. With regard to seed index, eight out of the twenty eight hybrid combinations exhibited significant positive increases over the selected parents mean, while only two hybrids (P_4 x P_7 and P_5 x P_7) out of them recorded significant positive increases for this character over the better parent.

Table 6. Mean performances of recurrent selection hybrids for lint yield and its components in population II (G. 87 x G. 89).

Characters / Hybrids	Lint yield/ plant (g)	Bolls/ plant	Seeds/ boll	Lint/ seed (g)	Lint percentage	Seed index (g)
$P_1 \times P_2$	22.63	24.27	18.57*+	0.050	33.40	10.03
$P_1 \times P_3$	18.07	20.00	16.60	0.054*	35.80	9.73
$P_1 \times P_4$	7.33	9.23	17.17	0.048	36.13*	8.40
$P_1 \times P_5$	12.00	15.47	15.40	0.051	35.00	9.47
$P_1 \times P_6$	15.67	18.47	15.73	0.055*	33.57	10.83*
$P_1 \times P_7$	14.37	16.00	15.83	0.057*	35.60	10.27*
$P_1 \times P_8$	23.90	31.17	17.27	0.045	35.93	8.00
$P_2 \times P_3$	13.63	14.30	16.97	0.056*	36.20*	9.87
$P_2 \times P_4$	14.67	14.43	17.60*+	0.057*	37.40*	9.60
$P_2 \times P_5$	22.07	49.00*+	14.27	0.032	31.77	6.93
$P_2 \times P_6$	23.60	28.17	16.60	0.051	33.60	10.10
$P_2 \times P_7$	18.17	21.53	15.73	0.055*	33.23	10.93*
$P_2 \times P_8$	21.10	28.30	16.93	0.045	34.07	8.80
$P_3 \times P_4$	29.57*+	35.30	17.10	0.050	36.57*	8.63
$P_3 \times P_5$	19.23	31.63	15.00	0.040	33.20	8.13
$P_3 \times P_6$	18.10	22.27	15.37	0.055*	34.47	10.37*
$P_3 \times P_7$	29.47*+	34.33	15.13	0.058*	36.30*	10.20
$P_3 \times P_8$	19.40	21.93	16.03	0.055*	35.40	10.10
$P_4 \times P_5$	18.13	28.43	14.33	0.045	32.97	9.17
$P_4 \times P_6$	17.77	27.93	15.87	0.041	30.87	9.07
$P_4 \times P_7$	23.47	23.40	16.50	0.061*	34.97	11.40*+
$P_4 \times P_8$	12.60	12.57	17.57*+	0.058*	35.53	10.47*
$P_5 \times P_6$	19.03	25.77	15.70	0.048	31.50	10.30*
$P_5 \times P_7$	18.50	24.93	14.73	0.051	30.87	11.33*+
$P_5 \times P_8$	12.67	16.43	16.70	0.047	33.63	9.23
$P_6 \times P_7$	20.00	26.27	15.33	0.051	34.50	9.63
$P_6 \times P_8$	17.87	25.60	15.23	0.046	33.03	9.30
$P_7 \times P_8$	20.00	25.73	16.20	0.051	33.77	9.90
$\overline{X}$	18.68	24.03	16.12	0.050	34.26	9.65
Selected parents mean	17.12	24.37	15.58	0.047	33.79	9.20
$\overline{X}$ of better parent	17.40	22.50	15.60	0.057	35.93	10.10
L.S.D. 0.05	9.29	13.33	1.90	0.007	2.29	1.06

* Significant at 0.05 level of probability was of the difference among the hybrid mean and selected parents mean.

\+ Significant at 0.05 level of probability was of the difference among the hybrid mean and original better parent mean.

In population III (Table 7), seven out of the twenty eight hybrids showed significant positive increases for lint yield/plant relative to the selected parents mean, while only one hybrid (P_5 x P_7) out of them exhibited significant difference over the better parent. Regarding bolls/plant, five hybrids (P_1 x P_5, P_2 x P_4, P_2 x P_8, P_4 x P_8 and P_5 x P_7) showed significant positive increases over the selected parents mean only. Slight increases were found over the better parent and selected parents mean for both seeds/boll and lint percentage. The best hybrids which exhibited significant positive increases for lint/seed (P_1 x P_8) and lint percentage (P_4 x P_7) were the combinations among selections of lint percentage and seed index.

Table 7. Mean performances of recurrent selection hybrids for lint yield and its components in population III (G. 86 open-pollinated).

Characters / Hybrids	Lint yield/ plant (g)	Bolls/ plant	Seeds/ boll	Lint/ seed (g)	Lint percentage	Seed index (g)
P_1 x P_2	22.87	24.27	17.00	0.056	39.40	8.70
P_1 x P_3	15.23	15.70	16.47	0.059	39.60	9.00
P_1 x P_4	24.50	24.47	17.10	0.060	38.77	9.43
P_1 x P_5	23.10	32.17*	14.13	0.051	36.80	8.80
P_1 x P_6	19.07	18.40	17.50	0.060	38.73	9.47
P_1 x P_7	31.17*	26.20	16.43	0.072	38.73	11.50
P_1 x P_8	30.73*	25.80	16.10	0.074*	38.63	11.70
P_2 x P_3	25.07	24.20	15.80	0.065	38.57	10.37
P_2 x P_4	25.63	26.37*	15.13	0.065	38.47	10.37
P_2 x P_5	22.37	21.03	15.97	0.068	39.27	10.50
P_2 x P_6	9.63	9.60	16.20	0.063	37.83	10.43
P_2 x P_7	27.47*	24.23	16.50	0.068	39.00	10.63
P_2 x P_8	29.43*	27.63*	16.10	0.067	39.27	10.30
P_3 x P_4	27.60*	25.43	14.93	0.072	38.20	11.70
P_3 x P_5	23.87	22.90	15.13	0.069	39.17	10.70
P_3 x P_6	16.87	15.27	16.43	0.068	40.10	10.10
P_3 x P_7	21.67	17.97	16.47	0.073	38.57	11.53
P_3 x P_8	20.33	18.57	16.27	0.067	38.47	10.77
P_4 x P_5	24.47	21.63	15.43	0.072	38.17	11.73
P_4 x P_6	20.03	18.13	15.53	0.072	38.73	11.30
P_4 x P_7	21.87	21.50	15.23	0.069	36.57	11.93*
P_4 x P_8	22.60	28.17*	14.67	0.056	36.57	9.70
P_5 x P_6	22.23	23.97	14.27	0.066	36.73	11.33
P_5 x P_7	35.43*+	29.60*	16.77	0.071	38.73	11.27
P_5 x P_8	21.10	25.37	14.77	0.056	39.03	8.77
P_6 x P_7	21.97	19.47	16.37	0.070	37.17	11.70
P_6 x P_8	22.87	19.83	15.87	0.073	38.77	11.60
P_7 x P_8	28.63*	25.80	17.37	0.066	39.60	10.10
$\overline{X}$	23.49	22.63	15.93	0.066	38.49	10.55
Selected parents mean	18.42	17.89	15.78	0.066	38.33	10.65
$\overline{X}$ of better parent	26.53	27.77	16.10	0.069	38.47	11.10
L.S.D. 0.05	8.07	8.33	2.01	0.008	1.97	1.21

* Significant at 0.05 level of probability was of the difference among the hybrid mean and selected parents mean.

\+ Significant at 0.05 level of probability was of the difference among the hybrid mean and original better parent mean.

Generally, the examination of the individual hybrids for lint yield and its components revealed that certain hybrids significantly exceeded their respective and better parents. Similar findings were reported by Singh *et al.* (1989).

4. Phenotypic and genotypic correlations

Estimates of phenotypic (r_p) and genotypic (r_g) correlation coefficients between studied characters of recurrent selection for the three populations are presented in Table (8).

Table 8. Estimates of phenotypic (r_p) and genotypic (r_g) correlation coefficients between studied characters of recurrent selection according to hybrids data for the three populations.

Relationships / Populations	Population I (G. 45 x G. 75)		Population II (G. 87 x G. 89)		Population III (G. 86 open-pollinated)	
	r_p	r_g	r_p	r_g	r_p	r_g
1. Lint yield (g)/plant and bolls/plant	0.739**	0.711**	0.785**	0.646**	0.799**	0.773**
2. Lint yield (g)/plant and seeds/boll	0.027	0.071	-0.077	-0.012	0.060	-0.039
3. Lint yield (g)/plant and lint (g)/seed	-0.236	-0.348	-0.069	-0.019	0.359	0.470*
4. Lint yield (g)/plant and lint percentage	-0.244	-0.379*	-0.038	-0.037	0.086	0.113
5. Lint yield (g)/plant and seed index (g)	-0.080	-0.069	-0.054	-0.005	0.305	0.408*
6. Bolls/plant and seeds/boll	-0.403*	-0.496**	-0.433*	-0.558**	-0.314	-0.420*
7. Bolls/plant and lint (g)/seed	-0.744**	-0.870**	-0.605**	-0.716**	-0.192	-0.165
8. Bolls/plant and lint percentage	-0.611**	-0.720**	-0.387*	-0.510**	-0.190	-0.196
9. Bolls/plant and seed index (g)	-0.402*	-0.442*	-0.465*	-0.538**	-0.123	-0.124
10. Seeds/boll and lint (g)/seed	0.258	0.554**	0.342	0.494**	0.147	0.196
11. Seeds/boll and lint percentage	0.365	0.598**	0.515**	0.761**	0.596**	1.318**
12. Seeds/boll and seed index (g)	0.007	0.155	0.047	0.105	-0.096	-0.162
13. Lint (g)/seed and lint percentage	0.657**	0.680**	0.582**	0.572**	0.144	0.039
14. Lint (g)/seed and seed index (g)	0.663**	0.640**	0.805**	0.838**	0.924**	0.960**
15. Lint percentage and seed index (g)	-0.114	-0.128	-0.018	0.009	-0.261	-0.250

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

Phenotypic and genotypic correlations between lint yield/plant and bolls/plant were positive and significant, indicating that bolls/plant was more important in improving lint yield.

Both lint yield/plant with seeds/boll and seeds/boll with seed index in the three populations showed insignificant positive or negative r_p and r_g. El-Okkiah (1979) showed weak negative and inconsistent phenotypic and genotypic associations between lint yield and seeds/boll characters for the three studied generations.

Lint yield/plant with lint/seed and seed index exhibited weak negative phenotypic and genotypic associations in populations I and II, while r_g was significant and positive in population III. These results indicated that seed index was associated with lint/seed in influencing lint yield in the three populations. El-Harony (1999) found that phenotypic and genotypic correlation coefficients of lint yield had high to moderate positive values with all characters except seed index. On the other hand, Zeina (2002) found that r_p and r_g of lint yield had high positive values with seed index. Table (4) indicates that selection for seed index in population III was more important to improve lint yield.

Bolls/plant was significant or insignificant and negatively associated with seeds/boll, lint/seed, lint percentage and seed index for the three populations. Singh *et al.* (1985) also reported similar findings.

In populations I and II, the genotypic correlations between seeds/boll and lint/seed were positively and highly significant, but in population III it was positive and insignificant.

Generally, seeds/boll exhibited positive and significant associations with lint percentage in the three populations. The pseudo-genotypic correlation coefficient (1.318) between seeds/boll and lint percentage in population III was due to lower values of genotypic variance for seeds/boll and lint percentage than the genotypic covariances. Thus, breeding procedures (recurrent selection) which have been successful in breaking negative linkage between seeds/boll and lint percentage, can be adopted. Similar conclusion was reached by Smith and Coyle (1997). The correlations of seeds/boll with lint/seed and lint percentage in recurrent selection hybrids tended to increase compared to any other selection procedure.

Lint/seed showed positive and highly significant associations with lint percentage and seed index in the three populations. These results indicated that selection for both lint percentage and seed index was more important in improving lint/seed. Our results are similar to those obtained by Singh *et al.* (1985).

Lint percentage was insignificantly and negatively associated with seed index in the three populations except r_g in population II. Zeina (2002) found that lint percentage with seed index showed highly significant negative values for both phenotypic and genotypic correlation coefficients.

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الانتخاب الدوري لمحصول الشعر ومكوناته لبعض التراكيب الوراثية من القطن المصري

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يهدف هذا البحث إلى تحسين محصول القطن الشعر ومكوناته عن طريق الاتحادات الجديدة الناجمة عن الانتخابات الدوري لصفتى معدل الحليج ومعامل البذرة .

ولتحقيق ذلك تم في عام ٢٠٠٠م اختيار أربع نباتات متفوقة في صفة معدل الحليج وأربع نباتات متفوقة في صفة معامل البذرة من الجيل الثاني لكل من(جيزة ٤٥ × جيزة ٧٥)،(جيزة ٨٧ × جيزة ٨٩) وجيل الأساس (So) في العشيرة (جيزة ٨٦ المفتوح التلقيح) وفى عام ٢٠٠١م تم إجراء كل التهجينات الممكنة بين الثمانية أباء وكان عدد الهجن الناتجة ٢٨ هجين فردى لكل عشيرة ، في عام ٢٠٠٢م قيمت الهجن الثماني والعشرين مع الأباء المنتخبة والأبوين الأصليين وعينة عشوائية من الجيل الرابع للعشيرتين الأولى والثانية ومن الجيل الثاني الذاتي (S2) للعشيرة الثالثة في تجربة قطاعات كاملة العشوائية ذات ثلاث مكررات بمحطة البحوث الزراعية بسخا

– ويمكن تلخيص النتائج المتحصل عليها فيما يلي :

١- أظهرت متوسطات الثماني والعشرين هجين قيماً أعلى لصفات محصول القطن الشعر / نبات ، عدد اللوز /نبات وعدد البذور / لوزة مقارنه بأفضل الأباء في العشيرتين الأولى والثانية ، بينما في العشيرة الثالثة أظهرت متوسطات الـ ٢٨ هجين قيما أعلى لصفات وزن الشعر / بذرة ، معدل الحليج ومعامل البذرة مقارنة بالصنف جيزة ٨٦ النقي .

٢- أظهرت النتائج قيماً عالية للتحسين الوراثي المتوقع بالانتخاب لصفات محصول القطن الشعر / نبات ، عدد اللوز / نبات ، وزن الشعر /بذرة ومعامل البذرة في الثلاث عشائر ، لوحظ أيضاً توافقاً لمعاملات الاختلاف الو راثية العالية والمنخفضة مع التحسينات الوراثية المتوقعة العالية والمنخفضة لمعظم الصفات المدروسة في الثلاث عشائر .

٣- أوضحت النتائج أن التلازم المظهري والوراثي بين صفتي محصول القطن الشعر / نبات وعدد اللوز / نبات كان قوياً وموجباً ، بينما التلازم المظهري والوراثي بين صفة محصول القطن الشعر / نبات وكل من صفتي وزن الشعر / بذرة ومعامل البذرة كان ضعيفاً وسالباً في العشيرتين الأولي والثانية ، لوحظ أيضاً أن معاملات التلازم المظهرية والوراثية بين صفتي محصول القطن الشعر / نبات وعدد البذور / لوزة كذلك بين صفتي عدد البذور / لوزة ومعامل البذرة كانت ضعيفة وسالبة أو موجبة في الثلاث عشائر .