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Selection For Earliness Index And Correlated Response In Egyptian Cotton

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ABSTRACT:

This study was carried out during the three summer seasons of 2009 to 2011 at Cotton Research Institute Experimental Field, El-Mania. Two cycles of selection for earliness index restricted by yield were completed using two populations in the F_3 generation i.e., Population I (Giza 83 x Dandara) and Population II (Giza 83 x Giza 80). The selected families showed highly

significant differences for earliness index and the other correlated traits in the two populations except for boll weight and seed index of pop. I which were significant. The genotypic coefficient of variability (G C V) retained after the second cycle of selection for earliness index accounted for 16.73and 14.73% in pop. I and II, respectively, and sufficient G C V was found for seed cotton yield/ plant, lint yield/plant and number of bolls/plant. Over estimates of broad sense heritability were obtained for earliness index which were 90.80 and 85.96% in pop. I and II, respectively, and the other traits were 96.52 and 94.95 % for seed cotton yield/plant, 94.88 and 94.35% for lint yield/plant and 94.87 and 93.29%, for number of bolls/plant of the two respective populations. Positive and significant or highly significant observed direct response from the better parent in earliness index was found in pop. I and ranged from 15.10% for family No. 5 to 22.65% for family No. 13. Families No. 3, No 19, No 30 and No 35 showed positive and significant or highly significant observed direct and correlated response, but they were inferior in lint percentage and lint index. Five families from pop. II No. 4, No 9, No 12, No 26 and No 35 showed positive and significant or highly significant direct response in earliness index which were more than 20.23%. Three of them showed positive and highly significant indirect response in seed cotton yield/plant and number of bolls/plant. These results indicate that selection for earliness index restricted by yield in population I and II could result in early high yielding families with large number of bolls/plant, but accompanied with adverse correlated responses in lint percentage and lint index.

Introduction

Early maturing cotton (*Gossypium barbadense L.*), varieties are desirable for number of reasons; as they require relatively less inputs like fertilizers, irrigation water and labor. Thus, early maturing varieties provide comparatively increased economic returns on account of reduced cost of inputs and crop management. Besides, early maturing

cottons are exposed to unfavorable environmental conditions for a relatively shorter period, hence provides an escape to late season pest attack. Short season cottons are also of immense importance in the countries where sequence of other crops precede or succeed cotton crop, thus fitting very well in cropping pattern of wheat followed by cotton crop for intensive agriculture. Developing early and high yielding varieties has been one of the main objectives in Egyptian cotton breeding programs **Mahdy *et al*. (2006), Mahrous (2008)**. Early crop maturity in cotton is a complex trait influenced by a number of morphological, physiological and environmental attributes. Earliness is the plant ability to develop rapidly and mature early **Mahdy *et al.* (2001) and Mohamed (2001)**. Earliness index (the percentage of the first pick to the total yield of plant) is the most common way for estimating earliness in cotton because it must involve; short periods of bud and boll development, high rates of flowering and boll opening, low fruit shedding and heavier bolls, all contribute to improve the yield potential **El-Defrawy and El-Ameen (2004)** and **Miller and Rawlings (1967)**. Plant breeders are continuously searching for more effective and efficient selection method. Although several selection methods were used for improving several traits in cotton, pedigree selection method has become the most common plant breeding procedure. Most of Egyptian cotton varieties were produced by this method. The main objectives of this work were: (1) Improve earliness and yielding ability in two F_3 populations of Egyptian cotton using pedigree selection method. (2) Determine the effects of selection on genetic and phenotypic variation in the two populations.

MATERIALS AND METHODS

The field experiments were conducted in 2009, 2010 and 2011 seasons at Cotton Research Institute Experimental Field, El-Mania. The experimental materials included two F_3 populations stemmed from crosses between three Egyptian cotton varieties i.e., Population I (Giza 83 x Dandara) and Population II (Giza 83 x Giza 80), each population represented by 50 families in the first season. The experimental design was a randomized complete block design with three replications. The plot size was one row, 4 m long, 60 cm width and 40 cm between hills within a row. After full emergence, seedlings were thinned to one plant per hill (10 plants/row). The recommended cultural practices were adopted throughout the growing season. At the end of the first growing season two pickings were done on individual plant basis. The 20 superior families in earliness index restricted by yield in each population were selected (the earliest families which gave seed cotton yield/plant more than the average). The best plant of each family was saved to reform the second cycle of pedigree se-

lection for earliness index. After the two pickings of the second cycle of selection, the best plant in earliness index restricted by yield of each family was selected to evaluate the second cycle of selection in the next season. The following characters were recorded on each individual plant: earliness index, seed-cotton yield/plant, g., lint yield/plant, g., lint percentage, number of bolls /plant, boll weight, g., seed index, g. and lint index.

Statistical analysis:

1- Estimates of genotypic and phenotypic variances were calculated from the EMS components of the selected families.

2- The phenotypic and genotypic coefficients of variation were estimated using the formula developed by **Burton (1952).**

a) - The phenotypic coefficient of variability (P C V) = (σp / mean) x 100

b) - The genotypic coefficient of variability (G C V) = (σg / mean) x 100

3- Heritability: The following equation was used for estimating broad sense heritability: (H) = ($\sigma^2 g$ / $\sigma^2 p$) x 100.

4- Mean comparisons were calculated by using revised L.S.D where, L.S.D = least significant differences, and was calculated as:

R L S D_{α} = (t^{-}) $*$ $\sqrt{}$ (2MSE / r) **(El Rawi and Khalafalla 1980)**

5-Observed direct and correlated response to selection measured in percentage of the better parent calculated by using L. S. D. where, L.S.D = least significant differences between better parent value and mean of the selected family, and was calculated as:

L. S. D = ($\sqrt{}$ 2MSE / r) * tα.

Results and Discussion

Giza-83 was a common parent in the two populations; with Dandara (pop. I) and with Giza-80 (pop. II). Dandara cultivar is the earliest one in Egyptian cottons followed by Giza-83, while Giza-80 is the high yielding one. Fifty F_3-families from population I, and fifty F_3-families from population II were planted in the same season 2009, to start the first cycles of selection for earliness index restricted by yield and correlated response in the two populations. Mean squares of the selected families from pop. I (Table 1) was highly significant for earliness index indicating the presence of variability in the criterion of selection. Moreover, the selected families showed significant or highly significant differences for the other correlated traits except boll weight. The selected families from pop. II showed highly significant differences for earliness index and the other correlated traits except lint percentage.

Table 1. Mean squares of pedigree families selected for earliness index in pop. I and II for all studied traits in season 2009.

Populations	S O V	Mean squares							
		Earliness index	Seed cotton yield/p	Lint yield/p	Lint percentage	No. of bolls/p	Boll weight	Seed index	Lint index
Pop. I (Giza-83 x Dandara)	Reps	10.20	2.609	0.316	5.297	15.664	0.230	2.144	0.279
	Families	855.65**	588.9**	74.134**	6.580*	90.58**	0.072	1.821*	0.801**
	Error	50.50	11.248	2.952	4.367	8.594	0.060	1.157	0.368
Pop. II (Giza-83 x Giza-80)	Reps	25.66	3.625	1.814	4.727	5.633	0.161	0.680	0.079
	Families	790.22**	785.6**	88.087**	5.908	113.8**	0.213**	2.09**	0.525**
	Error	50.40	10.707	2.279	4.225	7.957	0.119	0.527	0.191

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

Wide range of variability as measured by P C V and G C V (Table 2) was found for the criterion of selection; earliness index for the two populations, indicating sufficient variability for further cycles of selection. The G C V values for earliness index were 27.07and 25.12% in pop. I and II, respectively. High G C V was also observed in the correlated traits; seed cotton yield/plant, lint yield/plant and number of bolls/plant in the two populations. This could be due to the large number of genes, which control these traits and their sensitivity to environment. However, lint percentage, showed very narrow variability for pop. I, also, narrow variability was found in seed and lint indices in the two populations. This could be mainly due to the narrow variability in these traits between the original parents of the studied populations

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Table 2. Heritability (H%) in broad sense, P C V and G C V in the two populations selected for earliness index in season 2009.

Populations	Traits	Earliness index	Seed cotton yield/p	Lint yield/p	Lint percentage	No. of bolls/p	Boll weight	Seed index	Lint index
Pop. I (Giza-83 x Dandara)	PCV	28.10	25.12	26.31	4.39	24.06	-	5.10	10.01
	GCV	27.07	24.88	25.79	2.55	22.89	-	4.54	7.35
	H %	93.10	98.09	96.02	33.65	90.51	-	36.41	53.93
Pop. II	PCV	25.85	30.33	29.19	-	26.88	11.34	8.87	8.38

(Giza-83 x Giza-80)	**GCV**	25.12	30.12	28.81	-	25.92	7.49	7.67	6.68
	H %	96.15	98.64	97.41	-	93.01	43.66	74.78	63.43

- Insignificant families mean squares.

Over estimates of broad sense heritability were obtained for earliness index, seed cotton yield, lint yield and number of bolls/plant which exceeded in most cases 90% in the two populations. This could be due to two main causes. Firstly, evaluation of the selected families at one location for one year leads to inflate the genetic variance; because of the confounding effects of years, locations and their interactions with families. Secondly, broad sense heritability includes all types of the genetic variance; additive, dominance and epistasis. On the other hand, seed index and lint index in the two populations and lint percentage in pop. I gave low or moderate broad sense heritability estimates because of the large experimental error associated with them. **Lewis and Richmond (1957)** reported that, the high estimates of heritability of broad sense could mainly be due to the high estimates of dominance and over dominance obtained relative to small estimates of additive effects. So, the expected gain from selection for earliness could be small because of the effect of dominance and over dominance on selection. **Mahdy *et al.* (2001) and Mohamed (2001)** noted that, heritability estimates in broad sense were generally high for days to first flower and ranged from 90.8 to 93.14% in a population, and from 84.91 to 94.45% in another population.

Means of the best 20 families selected from the 50 families of pedigree selection for earliness index restricted by yield in pop. I are presented in Table 3. Mean earliness index (E.I) of the 50 families from pop. I was 60.50% and all the best 20 families were better than the grand mean.

Table.3. Means of the best 20 families selected for earliness index from the base population I (Giza 83 x Dandara); season 2009.

Families No.	Earli-ness in-dex %	Seed cotton yield/ p	Lint yield/ p	Lint per-centage	No. of bolls/ p	Boll weight , g.	Seed in-dex, g.	Lint in-dex
2	**81.80**	65.00	22.50	34.60	25.00	2.60	11.00	5.80
3	**67.54**	56.30	18.40	32.60	22.50	2.50	10.60	5.03
5	**60.55**	47.36	16.20	34.20	19.30	2.46	10.13	5.23
10	**77.40**	77.20	29.20	37.90	27.00	2.86	10.30	6.20
11	**90.60**	59.40	20.80	34.60	22.85	2.60	10.70	5.60
13	**75.00**	55.00	20.06	36.50	20.40	2.70	10.80	6.22
14	**70.77**	50.00	17.30	34.60	19.20	2.60	11.30	6.00
16	**79.80**	60.13	20.70	34.83	16.90	2.30	10.90	5.70
17	**60.74**	56.20	19.50	34.67	22.53	2.50	11.50	6.13
19	**80.58**	47.30	16.30	34.40	17.50	2.70	10.70	5.60
20	**76.67**	60.30	22.30	35.30	33.50	1.80	10.10	5.50
22	**69.80**	50.70	17.50	34.60	20.70	2.50	10.50	5.50
27	**60.52**	61.77	21.70	35.10	26.23	2.73	9.83	5.27
28	**90.78**	55.03	18.63	33.63	22.27	2.47	10.17	5.13
30	**84.62**	54.60	19.37	35.37	21.33	2.56	9.43	5.17
35	**88.70**	46.80	17.27	36.83	18.17	2.60	10.37	6.04
39	**92.20**	65.17	22.73	34.83	17.90	2.43	10.77	5.70
43	**75.55**	68.47	23.80	34.80	25.40	2.70	10.50	5.60
46	**74.35**	51.40	17.70	34.40	20.87	2.50	9.60	5.01
48	**78.92**	62.30	22.47	36.10	24.10	2.60	9.70	5.33
Gr. Mean	**60.50**	**55.78**	**18.89**	**33.68**	**22.84**	**2.44**	**10.12**	**5.16**
Giza-83	66.80	51.40	18.00	35.00	22.30	2.30	10.20	5.50
Dandara	70.00	49.83	17.03	34.27	20.47	2.43	10.23	5.33
R.LSD$_{0.05}$	10.12	4.76	2.48	5.61	4.38	-	2.89	1.26
R.LSD$_{0.01}$	13.20	6.16	3.24	8.12	5.74	-	4.18	1.69

- Insignificant families mean squares.

From the best 20 families there were 16 families surpassed the earliest parent Dandara in earliness index, seven of them (No. 2, 11, 19, 28, 30, 35 and 39) were significantly earlier than Dandara. Moreover, families No. 2, 11, 28, 30 and 39 out yielded the high yielding parent Giza-83 in seed cotton yield/plant, lint yield/plant, number of bolls/plant and boll weight. However, several promising families in seed cotton yield which out yielded the better parent tended to be earlier or comparable with the earliest parent in earliness index. It could be noticed that the differences within the same population were large enough, and selection for earliness index restricted by yield could be feasible.

Table.4. Means of the best 20 families selected for earliness index from the base population II (Giza 83 x Giza 80); season 2009.

Families No.	Earli-ness index %	Seed cotton yield/ p	Lint yield/ p	Lint per-cent.	No. of bolls/ p	Boll weigh t	Seed in-dex	Lint in-dex
1	73.50	52.70	18.90	35.90	21.10	2.50	10.43	5.83
4	84.50	71.00	23.40	33.00	28.03	2.50	10.73	5.23
6	80.00	51.57	18.00	34.90	20.40	2.53	10.50	5.60
9	70.00	47.93	16.43	34.30	20.87	2.30	9.20	4.83
10	84.88	71.67	25.00	34.93	26.57	2.70	10.77	5.77
11	90.00	56.84	19.85	35.00	22.34	2.56	10.48	5.64
12	76.00	46.00	15.69	34.10	19.65	2.36	10.35	5.25
14	77.25	70.00	23.26	34.00	30.20	2.33	10.33	5.37
17	68.22	49.70	17.53	35.37	18.97	2.83	9.33	5.73
18	78.55	53.70	19.20	35.77	21.30	2.53	10.67	6.00
19	90.52	58.97	20.50	34.80	22.33	2.67	11.86	5.70
21	75.84	56.67	19.57	34.60	22.10	2.07	11.17	5.47
26	77.00	46.66	16.20	34.70	19.07	2.20	10.80	5.63
30	74.55	54.70	18.67	34.10	20.80	2.63	11.10	5.77
33	88.90	61.40	21.90	35.70	20.80	2.97	10.83	6.03
35	79.55	50.67	18.27	35.80	20.00	2.53	9.77	5.47
37	88.00	85.20	28.77	33.80	33.63	2.53	10.10	5.13
42	87.88	65.03	24.13	37.03	26.50	2.47	10.03	5.90
45	80.55	73.47	25.27	34.30	24.57	3.00	11.30	5.87
50	82.55	59.73	22.10	37.03	20.47	2.93	10.07	5.93
Gr.Mean	62.50	53.36	18.56	34.72	22.92	2.35	9.42	4.99
Giza-83	70.20	53.63	19.00	35.4	19.30	2.80	10.00	5.60
Giza-80	65.50	55.70	18.90	34.00	21.70	2.60	10.13	5.23
$R.LSD_{0.05}$	10.11	4.65	2.14	-	4.21	0.79	1.28	0.82
$R.LSD_{0.0}$	14.30	6.01	2.77	-	5.53	1.10	1.69	1.10

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Mean earliness index (E.I) of the 50 families from pop. II was 62.50% and all the best 20 families were better than the grand mean. 19 families from pop. II (Table 4) surpassed the earliest parent Giza-83 in earliness index, and nine of them No. 4, 10, 11, 19, 33, 37, 42, 45 and50 were significantly earlier than the earliest parent, and six of these nine families (No. 4, 10, 33, 37, 42 and 45) significantly out-yielded the high yielding parent Giza-80.

Moreover, several families (No. 14, 21 and 50) exceeded the better parent in both earliness and all yield traits. These promising families could be subjected to further cycles of pedigree selection to isolate elite early high yielding lines from Egyptian cotton. In general, selection for earliness index restricted by yield among these lines could be fruitful in accumulating favorable genes for yield and earliness. These results are in line with those reported by **El-Defrawy and El-Ameen (2004)** who found that, selection for earliness in Egyptian cotton produced simultaneous increase in yield. **Miller and Rawlings (1967)** indicated that, selection for yield in upland cotton produced simultaneous increase in earliness.

Evaluation of the second cycle of selection

Mean squares of the selected families for earliness index in pop. I and II for all the studied traits in season 2011 are presented in Table 5.

Table 5. Mean squares of the pedigree families selected for earliness index in pop. I and II for all the studied traits in season 2011.

Populations	S O V	Mean squares							
		Earliness index	Seed cotton yield/p	Lint yield/p	Lint percentage	No. of bolls/p	Boll weight	Seed index	Lint index
Pop. I (Giza-83 x Dandara)	Reps	5.55	28.88	3.60	0.15	1.62	0.08	1.66	0.40
	Families	440.00**	323.59**	40.01**	4.32**	55.59**	0.08*	0.40*	0.33**
	Error	40.35	11.26	2.05	1.05	2.85	0.04	0.19	0.08
Pop. II (Giza-83 x Giza-80)	Reps	30.50	26.44	3.48	0.04	4.88	0.01	0.17	0.03
	Families	360.40**	246.41**	30.52**	2.24**	38.75**	0.09**	0.65**	0.30**
	Error	50.65	12.34	1.72	0.72	2.60	0.02	0.10	0.07

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

Families mean squares were highly significant for earliness index, seed cotton yield/plant, lint yield/plant, lint percentage, number of bolls/plant and lint index, and were significant for

boll weight and seed index of pop. I. Furthermore, the families mean squares of pop. II was highly significant for earliness index and all the other correlated traits.

Variability and broad sense heritability in the second cycle of pedigree selection for earliness index are presented in Table 6. Generally; the phenotypic coefficient of variability was slightly higher than G C V for all the studied traits. Sufficient genetic variability for further cycles of selection measured as G C V was retained after the second cycle selection for earliness index and accounted for 16.73and 14.73% in pop. I and II, respectively. Furthermore, sufficient G C V was found for seed cotton yield/ plant, lint yield/plant and number of bolls/plant, which accounted for 19.98 and 17.53, 20.20 and 17.78, and 21.09 and 17.62% in pop. I and II, respectively. After two cycles of selection for earliness index, there was a great decrease in G C V in the second cycle compared to the base populations (Table 2) either in the criterion of selection or in the other related traits. The G C V decreased from 27.07 and 25.12 in the base population to 16.73and 14.73% in the second cycle for earliness index in pop. I and II, respectively. Similar trend was also found in the other correlated traits.

Table 6. Heritability (H%) in broad sense, P C V and G C V of the second cycle of pedigree families in the two populations, selected for earliness index in season 2011.

Populations	Traits	Earliness index	Seed cotton yield/p	Lint yield/p	Lint percentage	No. of bolls/p	Boll weight	Seed index	Lint index
Pop. I (Giza-83 x Dandara)	**PCV**	17.56	20.34	20.47	3.48	21.65	6.10	3.57	6.17
	GCV	16.73	19.98	20.20	3.03	21.09	4.57	2.57	5.33
	H %	90.80	96.52	94.88	75.61	94.87	56.00	51.49	74.77
Pop. II (Giza-83 x Giza-80)	**PCV**	15.88	17.98	18.31	2.50	18.24	6.63	4.48	5.74
	GCV	14.73	17.53	17.78	2.06	17.62	5.77	4.11	5.00
	H %	85.96	94.95	94.35	68.00	93.29	75.86	84.26	75.76

Over estimates of broad sense heritability were obtained for earliness index which were 90.80 and 85.96% in pop. I and II, respectively, and the other traits were 96.52 and 94.95 % for seed cotton yield/plant, 94.88 and 94.35% for lint yield/plant and 94.87 and 93.29%, for number of bolls/plant of the two populations because of the evaluation of the selected families in one location

for one season. Broad sense heritability which obtained for the other traits were moderate or slightly high in the two populations. **Lewis and Richmond (1957)** noted that, the high estimates of heritability in broad sense could mainly due to the high estimates of dominance and over dominance obtained relative to small estimates of additive effects. So, the expected gain from selection for earliness could be small because of the effect of dominance and over dominance on selection.

The observed direct and correlated response to selection

Dandara cultivar has been known as the earliest Egyptian cotton cultivar since 1942 till now and Giza-83 is the highest lint yield, lint percentage and lint index, whereas Giza-80 is the highest seed cotton yield and seed index. Two cycles of pedigree selection for earliness index restricted by yield in pop. I (Dandara x Giza-83) resulted in 6 families No. 3, 5, 13, 19, 30 and 35 which were earlier than the earlier parent and gave positive and significant or highly significant observed direct response from the better parent in earliness index which ranged from 15.10% for family No. 5 to 22.65% for family No. 13 (Table 7). Four of these families No. 3, 19, 30 and 35 showed positive and significant or highly significant correlated response in seed cotton yield/plant, lint yield/plant and number of bolls/plant. These promising families were significantly better than the two parents in both earliness and yield traits but, they were inferior in lint percentage and lint index indicating that earliness is more correlated with seed size and number than lint characteristics. Also, families No.11 and 16 were better than the earliest parent in earliness index and significantly out yielded the high yielding parent in seed cotton yield/plant, lint yield/plant and number of bolls/plant. These promising results indicate to the possibility of selection for early high yielding lines. Moreover, selection for earliness index restricted by yield among these lines could be fruitful in accumulating favorable genes for yield and earliness. These results are in agreement with those reported by Mahdy *et al*. (2006), Mahrous (2008) and Mohamed (2001)

Table.7. The observed direct and correlated response in percentage from the better parent after the second cycle of selection for earliness index in population I (Giza 83 x Dandara).

Families No.	Earliness index	Seed cotton yield/p	Lint yield/p	Lint percent.	No. of bolls/p	Boll weight g.	Seed index g.	Lint index
2	8.67	-6.42	-16.51**	-11.21**	-16.68*	10.12	-3.31	-19.35**
3	21.25**	33.95**	27.80**	-4.85*	22.45**	7.78	-4.87	-11.77**
5	15.10*	-13.10*	-19.35**	-7.85**	-12.24	-2.72	4.19	-8.06*
10	-20.69**	-8.77	-18.28**	-10.60**	-6.84	-4.28	-3.60	-19.35**
11	10.90	30.63**	19.35**	-8.83**	30.10**	-1.56	-0.97	-14.03**
13	22.65**	-15.04**	-22.96**	-9.54**	-8.67	-7.78	-0.39	-14.52**
14	-13.283	19.98**	6.45	-11.48**	27.19**	-6.61	-2.63	-19.35**
16	12.93	24.70**	18.44**	-5.30*	18.37**	3.89	3.21	-4.35
17	-17.06*	-16.94**	-24.73**	-9.81**	-18.37**	0.00	1.27	-12.90**
19	17.06*	28.81**	19.89**	-7.16**	35.56**	-6.61	-4.87	-14.52**
20	-21.67**	-14.43**	-23.49**	-10.87**	-16.17*	0.00	-2.34	-17.74**
22	-8.67	-14.11*	-23.82**	-11.48**	-20.92**	6.23	-2.63	-18.87**
27	-17.06*	-20.10**	-29.57**	-12.01**	-11.22	-11.67	2.53	-15.65**
28	-17.06*	-17.00**	-17.85**	-1.40	-23.32**	6.23	-1.36	-3.23
30	17.06*	27.94**	15.59*	-9.81**	22.81**	2.33	-2.34	-16.61**
35	17.90*	24.35**	11.67	-10.50**	30.61**	-6.61	-0.97	-16.61**
39	-20.69**	11.60*	2.31	-8.56**	0.15	10.12	5.45	-8.06*
43	-16.08*	-10.53	-19.19**	-10.07**	-19.54**	8.95	8.08*	-8.55*
46	-14.68*	44.74**	28.87**	-10.76**	44.23**	-1.56	5.16	-11.77**
48	-24.05**	-9.37	-19.35**	-10.50**	-16.33*	6.23	1.56	-14.52**
Mean	**-2.38**	**5.06**	**-5.32**	**-9.11****	**3.06**	**0.77**	**0.68**	**-13.55****
Giza-83	**68.60**	**49.40**	**18.60**	**37.73**	**19.60**	**2.57**	**10.20**	**6.20**
Dandara	**71.50**	**48.03**	**16.33**	**34.03**	**18.87**	**2.57**	**10.20**	**5.30**
$LSD_{0.05}$	**14.22**	**10.90**	**12.30**	**4.34**	**13.77**	**12.45**	**6.86**	**7.20**
$LSD_{0.01}$	**18.60**	**14.30**	**16.10**	**5.60**	**18.06**	**16.34**	**8.92**	**9.20**

Respect to pop. II, two cycles of pedigree selection for earliness index (Table 8) resulted in 5 promising families No. 4, 9, 12, 26 and 35 which were significantly better than the earlier parent and showed positive and significant or highly significant direct response in earliness index higher than 20.23%. Three of them No. ٤, 9 and 35 showed positive and highly significant indirect response in seed cotton yield/plant and number of bolls/plant and showed insignificant positive correlated response in lint yield/plant.

Table 8. The observed direct and correlated response in percentage from the better parent after the second cycle of selection for earliness index in population II (Giza 83 x Giza 80).

Fami-lies No.	Earli-ness index	Seed cotton yield/p	Lint yield/p	Lint per-cent.	No. of bolls/p	Boll weight	Seed index	Lint index
1	-18.33*	34.16**	24.26**	-7.66**	40.88**	-8.52*	-3.57	-14.33**
4	22.14**	16.45**	11.29	-4.49*	32.99**	-16.30**	-4.53	-11.04**
6	7.04	-9.81	-12.48	-3.33	-14.43*	1.11	-2.89	-8.24*
9	21.70**	21.17**	11.99	-7.77**	22.53**	-5.19	-1.64	-13.34**
10	-13.05	22.50**	20.80**	-1.71	15.26*	2.59	-2.60	-4.94
11	11.44	26.20**	19.23**	-5.77**	28.87**	-6.30	-1.64	-9.88**
12	25.12**	-4.76	-10.32	-6.04**	-6.03	-3.70	0.96	-8.40*
14	-21.85**	-2.90	-8.00	-5.58**	-8.92	2.59	2.89	-6.10
17	-9.09	-13.79*	-16.80*	-4.52*	-3.81	-13.70**	5.11*	-1.15
18	-19.79*	-8.14	-15.34*	-7.47**	-1.70	-10.00*	-4.53	-15.49**
19	-12.02	-13.85*	-21.83**	-9.48**	-9.43	-8.52*	-4.24	-17.63**
21	13.34	13.01*	4.97	-7.31**	11.13	-2.59	0.00	-11.04**
26	20.23*	-6.49	-14.10	-8.48**	-3.97	-6.30	8.00**	-5.60
30	-12.46	-10.47	-13.56	-5.23**	-14.95*	2.22	7.33**	-1.15
33	11.88	26.08**	15.99*	-7.31**	15.46*	3.70	6.08**	-5.60
35	25.66**	20.51**	10.59	-8.48**	19.90**	-3.70	8.00**	-6.10
37	-17.89*	-15.98**	-21.88**	-7.12**	-15.82*	-3.70	-4.82*	-14.83**
42	-5.13	-7.96	-15.72*	-8.83**	1.91	-13.70**	-2.60	-15.98**
45	-8.06	-16.24**	-23.12**	-8.39**	-7.94	-12.22**	-1.93	-14.33**
50	7.04	-27.12**	-33.01**	-8.29**	-24.59**	-7.41	0.29	-12.19**
Mean	**1.40**	**2.10**	**-4.30**	**-6.60****	**3.90**	**-5.55**	**0.10**	**-9.90****
Giza-83	**68.20**	**50.26**	**18.51**	**36.93**	**19.40**	**2.60**	**10.37**	**6.07**

Giza-80	**64.50**	**46.30**	**15.63**	**33.70**	**17.14**	**2.70**	**10.10**	**5.13**
$LSD_{0.05}$	**16.70**	**11.20**	**14.80**	**3.70**	**13.30**	**8.50**	**4.90**	**6.90**
$LSD_{0.01}$	**21.80**	**14.70**	**18.20**	**4.80**	**17.40**	**11.10**	**6.40**	**9.10**

Furthermore, there were 3 families (No. 11, 21 and 33) were insignificantly earlier than the earlier parent and showed significant or highly significantly correlated response in seed cotton yield , lint yield/plant and number of bolls/plant. However, most of the selected families showed negative and significant correlated response in lint percentage and lint index. Generally, pop. I was more responsive to pedigree selection for earliness index than pop. II. These results confirm that selection for earliness index restricted by seed cotton yield/plant might be better than single trait selection in developing early and high yielding lines. These results are in agreement with those reported by **El-Ameen (1999), Mahdy et al (2001) and Mohamed (2001).**

CONCLUSION:

These results indicate that selection for earliness index restricted by yield in population I and II could result in early high yielding families with large number of bolls/plant, but accompanied with adverse correlated responses in lint percentage and lint index. These results also reflect the important role of negative correlation between earliness and yield, and the restricted selection could overcome this negative correlation and isolate early high yielding families from Egyptian cotton.

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الإنتخاب لمعامل التبكير والاستجابة المرتبطة فى القطن المصرى

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اجريت هذه الدراسة فى حقل تجارب معهد بحوث القطن بالمنيا خلال ثلاثة مواسم صيفية من ٢٠٠٩ الى ٢٠١١ . وكانت المواد المستخدمة عبارة عن عشيرتين قاعديتين فى الجيل الثالث ناتجة من التهجين بين ثلاثة اصناف من القطن المصرى وهما العشيرة الاولى (جيزة-٨٣ *دندرة) والعشيرة الثانية (جيزة-٨٣ *جيزة-٨٠) وتم عمل دورتين من الانتخاب المنسب لمعامل التبكير المقيد بالمحصول حيث يتم الانتخاب للنباتات المبكرة ذات المحصول العالى فى نفس الوقت والاستجابة المرتبطة فى الصفات الاخرى فى كلا العشيرتين وكانت اهم النتائج المتحصل عليها بعد الدورة الثانية من الانتخاب كالتالى:

١- كان التباين بين عائلات العشيرة الاولى وعائلات العشيرة الثانية عالي المعنوية لصفة معامل التبكير ومعظم الصفات الاخرى .

٢- كان معامل الإختلاف الوراثى بالنسبة لصفة معامل التبكير ١٦.٧٣ و ١٤.٧٣ ٪ فى العشيرة الأولى والثانية على التوالى، كذلك كان معامل الإختلاف الوراثى عاليا للصفات المرتبطة الأخرى مثل محصول القطن الزهر للنبات ومحصول القطن الشعر للنبات وعدد اللوز فى كلا العشيرتين.

٣- كانت درجة التوريث العامة عالية بالنسبة لصفة معامل التبكير و محصول القطن الزهر للنبات ومحصول القطن الشعر وعدد اللوزفى العشيرتين وكانت اعلى من ٨٥% فى كل الحالات ومن ناحية أخرى أظهرت صفة وزن اللوزة ووزن المئة بذرة فى العشيرة الاولى درجة توريث متوسطة

٤- تفوقت ستة عائلات من العشيرة الاولى معنويا عن ابكر الابوين دندرة فى صفة معامل التبكير بالاضافة الى بعض العائلات الاخرى التى كانت ابكر من ابكر الابوين ولكن تبكير غير معنوى.

٥- الاستجابة المباشرة للانتخاب والمحسوبة من ابكر الابوين كانت معنوية لافضل اربعة عائلات من العشيرة الاولى وهى رقم ٣ و١٩ و٣٠ و٣٥ لصفة معامل التبكيروكانت مصحوبة باستجابة معنوية مرتبطة وموجبة لصفة محصول القطن الزهر و محصول القطن الشعر وعدد اللوز على النبات.

٦- الانتخاب لمعامل التبكير فى العشيرة الثانية اعطى خمسة عائلات والتى تفوقت معنويا على ابكر الابوين (جيزة ٨٣) في صفة معامل التبكير.

٧- ثلاثة عائلات من العشيرة الثانية هى ٤ و٩ و ٣٥ تفوقت معنويا على افضل الابوين واعطت استجابة موجبة ومباشرة ومعنوية لمعامل التبكير وغير مباشرة ومعنوية اوغير معنوية فى محصول القطن الزهر و محصول القطن الشعر وعدد اللوز على النبات.

٨- اكدت هذه الدراسة ان الانتخاب للتبكير المقيد او المرتبط بالمحصول افضل كثيرا عن الانتخاب للتبكير المطلق فى الحصول على تراكيب وراثية متفوقة فى التبكير وعالية فى المحصول معا.