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APLICATION OF SOME SELECTION INDICES IN EARLY SEGREGATING GENERATIONS OF BARBADENSE COTTON.

El-Fesheikawy, A.B.A; M.E. Abd El-Salam and B.M. Ramdan
Cotton Research Institute, Agricultural Research center, Giza, Egypt

ABSTRACT

Some selection procedures i.e. selection index involving 11 indices and direct selection for four separately traits (lint yield/plant, bolls/plant, seeds/boll and lint/seed) were used to improve lint yield, yield components and fiber properties in early segregating generations; F_2, F_3 and F_4 of the cotton cross;(Giza 85 x Dandara). Means of F_4 generation were higher than those of$F_2$and F_3 generations for all studied characters except for fiber fineness (desirable)and fiber length .The heritability estimates obtained in F_2,F_3 and F_4 generations were ranged from moderate to high (56.18 to 92.2%) for most traits. These estimates indicate a possible success in the selection of the early generations that were evaluated . Estimates of PCV and GCV in F_4 for most traits were higher than those of F_2 and F_3 generations. It was due to the application of several procedures that having various performance in selection. Phenotypic variances (V_p) were found to be greater than the corresponding genotypic variances (V_g) for all studied characters indicating that the expressions of these characters were influenced by the environmental factors.

Deviations of the realized advance from the predicted of lint yield determined in F_3 to F_4 generations were positive and high for most selection procedures. Data showed that indices; $I._{w1}$, $I._{w2}$, $I._{w123}$,$I._{w12}$, $I._{w23}$, $I._{w13}$, $I._{w3}$ and $I._{xw}$ gives high value of improvement in lint yield as predicted and actual advance . However, The data also indicated that predicted advance from F_3 had high value of gains relative to actual advance for most indices . Also, the gains were higher in F_3 and F_4 than those F_2 generation. This may be attributed to the efficiency of selection procedures application in this study. After two cycles of selection, the genetic gains from selection isolated it isolation best ten families on base of the highest value in selected and unselected traits; it my be very important in cotton improvement programs .

Keywords: Predicted gain, Realized gain, Selection procedures, Barbadense cotton.

INTRODUCTION

Improving lint yield, yield components and fiber quality are important objectives in breeding cotton. Gain from selection in a breeding program depends on genetic variation within a population for a given trait, heritability of that trait, and selection intensity (Falconer ,1981).

Selection index technique was proposed by Smith (1936) and Hazel (1943) to be used in the simultaneous improvement of several traits and to select for relatively more heritable correlated traits. Many of studies have reported on the selection index in cotton Kamalanathan (1967), El-Kilany (1976), El-Okkia (1979), Mahdy (1983), Al-Rawi and Ahmed(1984), Hassaballa *et al*(1987), Mahdy et al(1987), Younis (1999), Gooda (2001), El-Lawendey *et al* (2008) and El-Lawendey and El-Dahan(2012). Numerous cotton research workers reported that lint yield, the most important economic trait in cotton, is a complex character and depends upon the action and interaction of a number of factors, hence Mahdy(1983)found that the modified selection index was more efficient in improving lint yield and its components than the conventional index and single character selection. Also, he found that the selection index which involves lint yield, bolls/plant and lint/seed may be recommended .Al-Rawi and Ahmed(1984) indicated increases in efficiency of selection for yield from 1.4 to 34.0% for various indices. The index incorporated yield, bolls/plant and seeds/boll(I_{w12}) was superior to all other selection indices in the predicted advance and is recommended therefore. Mahdy et al (1987) compared several indices of selection. They reported that the selection index involving lint yield /plant , bolls/plant and lint/seed (Iw_{13})was the only one that gave significant increase of lint yield/plant (28.63%) and bolls/plant (20.08%) over mid-parent. Younis (1999) mentioned that the highest realized response obtained in the F_5 generation was 15.1%over the high parent in lint yield (index I_{w13}) and 21.5% in bolls/plant (index I_{12}).There were large discrepancies between predicted and realized gains. These results were expected because genotypic variances and covariance's used to calculate predicted gains were likely biased by certain genotypic x environment interaction. On the other hand, El-Okkia (1979) and El-Lawendey(2003)showed that the highest predicted genetic advance for lint yield was achieved when selecting for yield alone. Selection for yield and the other two yield components (seeds/boll and lint/seed) resulted in reduction of predicted advance.

Pedigree line selection is preferred by plant breeders because it is versatile and makes the possibility of conducting genetic studies along with the plant breeding work. Thus, pedigree line selection with selection by independent culling levels has been utilized for cotton varietals maintenance in Egypt.

Smith and Coyle(1997) found that the cotton lint production and fiber quality are complex in nature. Linkage plays a role in the association of low fiber length and/or strength, and increased within-boll lint yield. Thus, breeding procedures that have been successful in breaking linkages of other characters should be successful in breaking these linkages also. The objectives of this study were to determine the predicted and realized gains from different selection procedures for improving lint yield and to determine the correlated response between selected and unselected traits.

MATERIALS AND METHODS

Genetic materials and selection procedures

The present study was carried out at Sids Agricultural Research Station, during 2009, 2010 and 2011 growing seasons. The materials used were the F_2, F_3 and F_4 generations of an intraspecific cotton cross (Giza 85 x Dandara) (Gossypium barbadense, L.). Self pollination was practiced for all F_2 plants. Selfed as well as open pollinated bolls/plant of 300 guarded plants were picked up separately and the total seed cotton yield/plant was ginned and lint yield /plant ,bolls/plant, seeds/boll ,lint/seed, boll weight, seed index and lint percentage were determined.

Using 5% selection intensity the plants having the highest performance in each selection procedures were saved. These gave a total of 50 F_3 selected progenies. (fifteen superior progenies from each selection procedure).

In 2010 season, part of selfed seeds of 50 selected progenies were evaluated with a random sample of bulked seed of F_3 generation in a Randomized Complete Blocks Design(RCBD) with three replicates. Experimental plot was of single row. The 50 progenies were ranked using fifteen selection procedures. The three superior progenies of each selection procedures were selected using 5 % selection intensity. In 2011 season, selfed seeds of selected progenies (19 progenies) were evaluated with a random sample of bulked seed of F_4 generation and two original parents in a Randomized Complete Blocks Design with three replicates. Experimental plot was lay out as same as carried out in 2010.The planting dates were first April in 2009, 2010 and 2011seasons.

Selection procedures were as follows:

I_{w123}= Selection index involving lint yield/plant(w), bolls/plant(1) and seeds/boll (2)and lint/seed(3).
I_{w12} = Selection index involving lint yield/plant, bolls/plant and seeds/boll.
I_{w13} = Selection index involving lint yield/plant, bolls/plant and lint/seed.
I_{w23} = Selection index involving lint yield/plant, seeds/boll and lint/seed.
I_{123} = Selection index involving bolls/plant, seeds/boll and lint/seed.
I_{w1} = Selection index involving lint yield/plant and bolls/plant.
I_{w2} = Selection index involving lint yield/plant and seeds/boll.
I_{w3} = Selection index involving lint yield/plant and lint/seed.
I_{12} = Selection index involving bolls/plant and seeds/boll.
I_{13} = Selection index involving bolls/plant and lint/seed.
I_{23} = Selection index involving seeds/boll and lint/seed.
$I._{xw}$ = Phenotypic selection for lint yield/plant.
I_{x1} = Phenotypic selection for bolls/plant.
I_{x2} = Phenotypic selection for seeds/ boll.
I_{x3} = Phenotypic selection for lint/ seed.

The studied characters were boll weight (g), bolls/plant (x_1), seed cotton yield (g)/plant, lint cotton yield (g)/plant (X_w), seeds/boll (x_2), lint /seed(g) (x_3), seed index (g), lint percentage, Micronaire reading ,Pressely index(fiber strength), fiber length at 2.5% span length (mm), and uniformity ratio.

Statistical and genetic analysis

Heritability in broad sense was calculated according to the following expressions.

$$h_b^2 \text{ (in } F_2 \text{ generation)} = \frac{VF_2 - (VP1 + VP_2)/2}{VF_2} \times 100$$

$$h_b^2 \text{ (in } F_3 \text{ and } F_4 \text{ generation)} = \frac{\sigma^2 g}{\sigma^2 p} \times 100$$ (Walker 1960)

Where:

VF_2 = The phenotypic variance of the F_2 population.

VP_1 = The variance of the first parent (Giza 85).

VP_2 = The variance of the second parent (Dandara).

σ^2_g = The genotypic variance of the F_3 and F_4 generations.

σ^2_p = The phenotypic variance of the F_3 and F_4 generations.

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

The relative importance or economic values(a_i) was calculated according to Walker (1960).

a_w(lint yield/plant)=$\bar{X}_1.\bar{X}_2.\bar{X}_3$

a_1(bolls/plant)=$\bar{X}_2.\bar{X}_3$

a_2 (seeds/boll)=$\bar{X}_1.\bar{X}_3$

a_3(lint/seed)=$\bar{X}_1.\bar{X}_2$

Where: X's represent the mean values of the studied characters.

The appropriate index weights (b's) were calculated from the following formula postulated by Smith(1936) and Hazel(1943):

$(b)=(P)^{-1}.(G).(a)$

Where:

(b)=Vector of relative index coefficients,

$(P)^{-1}$=Inverse phenotypic variance-covariance matrix,

(G)=Genotypic variance-covariance matrix and

(a)=Vector of relative economic values.

The formula suggested by Smith (1936) and Hazel (1943) was used in calculating various selection indices:

$$I=b_1x_1+b_2x_2+\ldots\ldots\ldots\ldots+b_nx_n$$

Predicted improvement in lint yield on the basis of an index was estimated according to the following expression:

Selection advance(SA)=SD$(\sum b_i.\sigma g_{iw})^{1/2}$ (Walker, 1960)

Where:

SD denotes selection differential in standard units.

b_i denotes index weights for characters considered in an index.

σg_{iw} denotes genotypic covariance's of the characters with yield.

Predicted genetic advance in lint yield based on pedigree selection was estimated from the following expression:

(ΔG_w)due to selection for $X_i=K.\sigma g_{wi}/\sigma p_i$

Means, range, phenotypic (PCV) and genotypic (GCV) coefficients of variation; phenotypic(VP) and genotypic(VG) variances and heritability values in broad-sense for all traits are presented in Table (1) .

Table1: Means, range, phenotypic (PCV) and genotypic (GCV) coefficients of variation, phenotypic(VP) and genotypic(VG) variances and heritability(h^2_b) values in broad-sense for all traits .

Traits	Generation	(X)	Range	PCV	GCV	VP	VG	h2b
BW	F2	2.7	1.5 - 3.5	15.62	13.09	0.179	0.126	70.28
	F3	3.23	2.4-4.55	21.1	17.7	0.464	0.327	70.4
	F4	3.57	3.04-3.36	18.2	16.74	0.4212	0.3563	84.95
B/P	F2	21.6	5.2 - 38.1	51.77	38.8	125.42	70.461	56.18
	F3	26.3	15.0-38.6	26.06	21.8	46.9	32	69.95
	F4	27.68	22.0-34.3	24.45	22.37	45.81	38.3327	83.68
SCY/P	F2	59.3	10 - 167.3	55.32	48.42	1077.4	825.425	76.61
	F3	84.9	48.2-137.3	34.6	29.79	862.3	636.1	73.8
	F4	99.16	67.4-131.8	35.71	34.27	1253.6	1154.6	92.1
LCY/P	F2	21.1	4 - 59.3	55.04	42.74	135.5	81.689	60.29
	F3	31.4	17.1-52.2	37.72	31.98	132.9	100.8	75.9
	F4	37.52	24.9-51.5	37.76	36.54	200.77	188	93.64
L.P.%	F2	35.8	32.1 - 41.3	4.84	4.5	2.993	2.584	86.33
	F3	36.9	34.0-41.98	6.32	5.69	5.445	4.401	80.81
	F4	37.79	35.57-41.8	6.66	6.39	5.839	6.3332	92.2
S.I. g	F2	10.3	7.4 - 12.7	9.31	8.23	0.916	0.715	78.12
	F3	10.7	7.7-12.5	8.14	6.51	0.758	0.486	64.03
	F4	11.95	10.42-12.6	7.96	6.77	0.906	0.655	72.26
L.I. g	F2	5.7	3.9 - 7.4	10.82	9.92	0.3839	0.322	83.99
	F3	6.26	4.8 - 7.8	11.4	9.91	0.509	0.384	75.58
	F4	7.27	6.51-8.84	13.15	12.14	0.9135	0.7795	85.33
L./S.	F2	0.057	.028 - .086	12.2	10.46	0.00005	3.59E-05	73.62
	F3	0.063	0.05-0.08	11.4	9.91	5.09E-05	3.85E-05	75.58
	F4	0.073	0.065-0.088	13.15	12.14	0.00009	0.00008	85.33
S/B	F2	17.2	10.8 - 24.3	13.2	11.51	5.173	3.936	76.1
	F3	19.3	14.1 -26.2	19.6	16.3	14.2	9.53	67.21
	F4	21.1	18.0-23.8	13.14	10.45	7.6878	4.8611	63.23
MIC.	F2	3.9	2.8 - 4.8	8.28	7.59	0.1017	0.085	83.92
	F3	4.7	4.0 -5.4	6.75	5.25	0.1	0.061	60.8
	F4	3.88	3.37-4.63	24.19	22	0.8787	0.7263	82.65
P.I.	F2	9.8	8.3 - 11.3	6.39	5.49	0.3885	0.287	73.87
	F3	10.2	9.1 -11.3	7.14	5.05	0.529	0.265	49.99
	F4	10.41	9.80-11.13	9.07	7.9	0.8912	0.6768	75.95
F.L.	F2	32.2	28.9 - 35.1	3.07	2.74	0.9752	0.78	79.99
	F3	32	29.4 -34.5	4.12	2.86	1.73	0.837	48.23
	F4	31.67	31.16 -32.59	4.62	3.84	2.1417	1.4786	69.04
UR. %	F2	85.45	82.5 - 88.8	1.18	1.08	1.0178	0.847	83.22
	F3	86.5	82.2 -91.0	2.39	1.58	4.29	1.87	43.59
	F4	87.09	85.73 -88.33	2.5	2.01	4.7354	3.0624	64.67

Comparing means (X) of F_4 with those F_2 and F_3 it is apparent that the means of F_4 were higher than those of F_2 and F_3 generations for seed and lint cotton yields and its components. Also, strength fiber and uniformity ratio were increased in F_4. However, micronaire reading was constant in F_4 as F_2 generation. This may be attributed to the progress in selection from F_2 to F_4 generation was interested for improving lint cotton yield and its components, as well as, micronaire reading. On the other hand, the range of values in F_4

generation was smaller than those of F_2 and F_3 generations for all studied traits,which enhancing the efficiency of selection procedures application from F_2 to F_4 generations for improving these characters in this study . Results are in harmony with those obtained by Gooda (2001) and El-Lawendey and El-Dahan (2012).

Regarding the phenotypic (PCV) and genotypic (GCV) coefficients of variation, the data showed that PCV was generally higher than the GCV for all studied traits, but in many cases, the values of PCV and GCV differed only slightly. Also, the estimates of PCV and GCV in F_4 for most traits were higher than those of F_2 and F_3 generations. It was due to the application of several procedures that having various performance in selection. This indicates that, the magnitude of the genetic variability persisted in these material was sufficient for providing rather substantial amounts of improvement through the selection of superior progenies. Similar results were obtained by Meena *et al.,* (2001) and El-Lawendey *et al*., (2011)

Phenotypic variances (Vp) were found to be greater than the corresponding genotypic variances (Vg) for all studied characters, indicating that the expressions of these characters were influenced by the environmental factors.

Knowledge of heritability is important as it indicates the possibility and extent to which improvement can be brought through selection. Heritability values in F_4 generation were higher than those of both F_2 and F_3 generations for pressely index (PI) and for all yield components traits, except seed index (SI) and seeds/boll(S/B). However. the heritability estimates obtained in F_2, F_3 and F_4 generations were ranged from moderate to high (56.18 to 92.2%) for all traits. These estimates indicate a possible success in the selection of the early generations that were evaluated. The similar results obtained by El-Okkia (1979) ,El- Kilany (1986) and Asad *et al*., (2002).

Correlations between traits are used to build several models for selection procedures. To develop these models for commonality analysis, genotypic correlations would be preferred, because these relationships would indicate the potential for improvement by selection. The genotypic correlation coefficients (r_g) in F_3 and F_4 generations between all pairs of studied traits are presented in Tables (2 and 3).In both F_3 and F_4 generations, lint cotton yield and bolls/plant showed positive correlations with each other and with all yield components, except seed index in F_3 and F_4 generations. However, the information about the degree of association among different generations of cotton is a great important to breeding program designed to combine the desirable expression of several characters. The data indicated that phenotypic (r_p) and genotypic(r_g)correlation coefficients between lint yield and boll weight, bolls/plant ,seed cotton yield/plant, lint percentage, lint index, seeds/boll, lint/seed and micronaire were positive and significantly for F_3 generation, while they were insignificantly negative with pressely and fiber length and were significantly negative with uniformity ratio. Also, the correlation for micronaire reading and fiber strength were negative and significant while negative and insignificant for fiber length. However, correlation between fiber strength was negative and significant for yield and

(Miller and Rawlings 1967).

Also, the predicted response in any selected and unselected character was calculated as suggested by Robinson et al (1951) and Walker (1960).

The realized gains was calculated as deviation of generation mean for each character from procedure mean of that character.

RESULTS AND DISCUSSION

yield components gave positive and significant associations except for seed index. In case of negative phenotypic and genotypic association for traits the breeder should use some kind of modified selection procedure to improve the population mean.

Table 2: The phenotypic (r_p)and genotypic(r_g) correlations of F_3generation between studied traits.

		BW	B/P	SCY/P	LY	LP	SI	LI	L/S	S/B	Mic	PI	FL
B|P	r p	0.090											
	rg	0.153											
SCY/P	r p	0.56**	0.64**										
	rg	0.55**	0.59**										
LY	r p	0.53**	0.65**	0.82**									
	rg	0.51**	0.63**	0.76**									
LP	r p	0.014	0.283	0.233	0.375*								
	rg	0.010	0.39*	0.304*	0.44**								
SI	r p	0.154	-0.165	-0.016	-0.053	-0.209							
	rg	0.156	-0.181	-0.013	-0.049	-0.192							
LI	r p	0.128	0.130	0.196	0.298*	0.63**	0.368*						
	rg	0.121	0.229	0.270	0.368*	0.66**	0.250						
L/S	r p	0.128	0.130	0.196	0.298*	0.65**	0.368*	0.84**					
	rg	0.121	0.229	0.270	0.368*	0.69**	0.250	0.79**					
S/B	r p	0.72**	0.074	0.49**	0.45**	-0.112	-0.057	-0.144	-0.144				
	rg	0.67**	0.084	0.46**	0.40*	-0.148	0.047	-0.103	-0.103				
Mic	r p	0.29*	0.172	0.297*	0.301*	0.128	0.040	0.139	0.139	0.260			
	rg	0.41**	0.279	0.44**	0.43**	0.147	0.065	0.147	0.174	0.40*			
PI	r p	-0.137	-0.183	-0.205	-0.223	-0.179	0.091	-0.094	-0.094	-0.117	-0.319		
	rg	-0.191	-0.283	-0.30*	-0.33*	-0.283	0.204	-0.125	-0.125	-0.232	-0.225		
FL	r p	-0.129	0.057	-0.03	-0.061	-0.254	0.244	0.009	0.008	-0.154	-0.019	0.185	
	rg	-0.150	0.224	0.07	0.018	-0.426	0.367*	-.0004	-.0004	-0.220	-0.031	-0.064	
UR%	r p	-0.201	-0.185	-0.270	-0.280	-0.159	0.118	-0.048	-0.048	-0.176	0.020	0.079	0.077
	rg	-0.37*	-0.32*	-0.47**	-0.49**	-0.32*	0.211	-0.135	-0.135	-0.335	0.046	-0.077	-0.211

*** and ** significant and hieghly significant at 0.05 and 0.01 propability respectively**

The phenotypic and genotypic correlation for F_4 generation were positive and significantly for boll weight, bolls/plant, seed cotton yield/plant, seed index, lint index and seeds/boll and insignificantly negative for pressely index, fiber length and uniformity ratio.

The pervious results reported that there are change in significant and direction in F_3 and F_4 generations for seed index with lint yield(r_p in F_3=-0.053 and r_g=-0.049)and (r_p inF_4=0.410** and r_g=0.46**). Same trend found in lint yield with micronaire reading. Also the relation between lint yield with fiber strength change from negative to positive. These results indicated that the correlation coefficient differ between F_3 and F_4 generations, this may be that different selection indices have created substantial amount of genetic variability during generation of selection due to the values genotypes scored by each selection index. Similar conclusion reported by MeCarthy *et al,* (1996) and Abd El-Salam (2005). Positive correlation between lint yield with fiber strength gave a chance to selection of some families which recorded high yield and fiber strength. If they are inversely associated ,desirable and undesirable genes are linked together, (lint yield with fiber length were -0.061, 0.018 in F_3 and -0.063 and -0.079 in F_4 , respectively). Intermating would dissipate the negative correlation as observed in our study and reported earlier by Meredith and Bridge (1973).

Table (3): The phenotypic (r_p) and genotypic (r_g) correlations of F_4 generation of studied traits.

Traits		BW	B/P	SCY/P	LY/P	LP%	SI	LI	L/S	S/B	Mic	PI	FL
B/P	r p	0.241											
	rg	0.43*											
SCY/P	r p	0.72**	0.85**										
	rg	0.79**	0.88*										
LY/P	r p	0.706	0.83**	0.98**									
	rg	.773**	0.88**	0.99**									
LP%	r p	0.109	0.151	0.157	0.331*								
	rg	0.137	0.264	0.235	0.40**								
SI	r p	0.71**	0.060	.436**	0.41**	-0.091							
	rg	0.74**	0.179	0.51**	0.46**	-0.102							
LI	r p	0.57**	0.157	0.42**	0.53**	0.74**	0.60**						
	rg	.582**	0.324	0.51**	0.62**	0.78**	0.541*						
L/S	r p	.564**	0.151	.412**	0.53**	0.74**	0.60**	.999**					
	rg	.579**	0.31*	0.50**	0.61**	.78**	0.54**	0.98**					
S/B	r p	.651**	0.281*	.563**	0.53**	-0.056	0.35*	0.189	0.184				
	rg	.802**	0.45**	0.73**	0.68**	-0.077	0.42*	0.191	0.190				
Mic	r p	-0.120	0.118	0.006	0.032	0.162	-0.066	0.077	0.081	-.154			
	rg	0.37*	0.093	-0.181	-0.031	-0.011	0.146	-0.047	0.093	0.111			
PI	r p	0.186	0.174	0.231	0.203	-0.068	0.264	0.126	0.120	0.27*	-.065		
	rg	0.283	0.275	0.342	0.31*	-0.017	0.303	0.179	0.161	0.230	-.120		
FL	r p	-0.117	0.032	-0.029	-0.063	-0.209	-0.079	-0.216	-.213	-.011	-.006	0.012	
	rg	-0.069	-0.013	-0.023	-0.079	-0.337	-0.001	-0.290	-0.282	0.160	0.176	-.022	
UR%	r p	-0.302	-0.069	-0.218	-0.199	0.046	-0.285	-0.162	-.147	-.113	0.098	-.071	0.097
	rg	-0.37*	-0.31*	-0.39*	-0.35*	0.085	-0.38*	-0.180	-.163	-.174	0.006	-.461	0.290

Predicted and actual advances in lint yield/ plant from selection based on individual traits and various selection indices in the population (Giza 85 x Dandara) are presented in Table (4), results indicated that selection indices which included X_w with both X_2 and X_3 gave the highest values of improvement in F_2 generation. The rank highly predict and actual were ; I_{w123} , I_{w12} ,I_{w13} ,I_{w23} , I_{w1} ,I_{w2} ,I_{w3} ,$I._{xw}$ and I_{X1} .The actual advance from F_3 generation were lower than predicted for most indices. However, the actual advance deviation from predicted gave differences as negative value for indices;I_{13} ,I_{x2} ,I_{123},I_{12} and I_{x3} which were higher in actual relative predicted while the other indices were the highest in predicted advance relative to actual gains. Comparing selection advance% with mean of F_2 generation, the indices included $I._{xw}$ recorded highest value of gains; I_{w123}(105.26%), I_{w12}(105.05%), I_{w13}(104.87%), I_{w23}(102.82%),I_{w1}(104.78%), I_{w2}(102.98%),I_{w3}(102.43%), $I._{xw}$ (100%) and I_{X1}(96.67%)these indices gave equal values of genetic gains either percent of selection advance or actual advance compare to generation mean or relative to selection for improvement of lint yield/plant individually ($I._{xw}$) while, the indices possessed high genetic actual advance% with exception of I_{w2} and I_{x3} which gave the lowest actual advance. Results are in harmony with those reported by Mahdy *et al* (1987) and Kassem *et al* (2008). Predicted and actual advances in F_3 and F_4 generations for lint yield/ plant and selection , actual advances are presented in Table (5). The data indicated that predicted advance from F_3 had higher values of gains relative to actual advance for most indices . Also, the gains were higher in F_3 and F_4 than those F_2 generation. The improvement in lint yield depend on high amounts of genetic variance , heritability in broad sense and highly significant positive genetic correlation between lint yield and its components i.e. bolls/plant , seeds/boll and lint/ seed. The data showed that indices $I._{w1}$, $I._{w2}$, $I.w_{123}$,$I._{w12}$, $I._{w23}$, $I.w_{13}$, $I._{w3}$ and $I._{xw}$ give highly value of improvement in lint yield as predicted and actual advance .These results were agreement with El-Okkia (1979) and El-Kilany (1976). The low gains after two cycles of selection indices were $I._{123}$, $I._{13}$, $I._{x1}$, $I._{x2,}$ and $I._{x3}$ give little predicted advance in lint yield due to its indices free from selection lint yield . The actual advances were lower than predicted advances in most indices . Also, the indices $I._{x1}$, $I._{x2}$ and $I._{x3}$ were less than other indices in actual advances . The deviation actual advance from predicted advance were higher for most indices, except $I._{123}$, $I._{23}$, $I._{12}$, ,$I._{13}$ and $I._{x2}$.

Table (4): Predicted and actual advance in lint yield / plant from F_2 and F_3 generations

NO.	Indices	Predicted From F_2	Actual From F_3	Deviations (Pr –AC.)	S.A.% Relative to F_2	S.A.% Relative to $I._{XW}$
1	$I._{W123}$	15.218	13.19	2.028	71.96	105.26
2	$I._{W12}$	15.187	11.55	3.637	71.81	105.05
3	$I._{W23}$	14.865	10.45	4.415	70.29	102.82
4	$I._{W13}$	15.161	9.68	5.481	71.69	104.87
5	$I._{123}$	3.030	9.84	-6.810	14.33	20.96
6	$I._{W1}$	15.148	9.94	5.208	71.63	104.78
7	$I._{W2}$	14.887	8.25	6.637	70.40	102.98
8	$I_{.W3}$	14.808	9.35	5.458	70.02	102.43
9	$I_{.12}$	2.953	9.05	-6.097	13.96	20.43
10	$I._{13}$	3.010	10.56	-7.550	14.23	20.82
11	$I._{23}$	4.376	11.77	-7.394	20.69	30.27
12	$I._{XW}$	14.457	12.05	2.407	68.36	100.00
13	$I_{.X1}$	13.976	11.04	2.936	66.09	96.67
14	$I._{X2}$	4.039	11.57	-7.531	19.10	27.94
15	$I._{X3}$	2.608	7.85	-5.242	12.33	18.04

Mean L.Y./P in F_2 = 21.148

Table 5: Predicted and actual advance in lint yield/ plant estimated from F_3 and F_4 generations.

no.	indices	Genetic advance for lint yield			SA % in F_3		ACT.% in F_4	
		Predicted F_3	Actual F_4	Deviation (pr-act.)	X w	Pre. Xw	X w	ACT. Xw
1	$I._{W123}$	23.09	11.96	11.13	73.53	128.12	38.09	65.57
2	$I._{W12}$	23.09	15.41	7.68	73.52	128.11	49.07	84.48
3	$I._{W23}$	22.81	12.51	10.30	72.63	126.56	39.84	68.58
4	$I._{W13}$	22.89	18.24	4.65	72.90	127.02	58.10	100.02
5	$I._{123}$	6.33	18.24	-11.92	20.15	35.11	58.10	100.02
6	$I._{W1}$	31.51	18.24	13.26	100.34	174.84	58.10	100.02
7	$I._{W2}$	24.86	15.59	9.27	79.16	137.94	49.64	85.45
8	$I._{W3}$	22.63	18.24	4.39	72.07	125.59	58.10	100.02
9	$I._{12}$	10.08	18.24	-8.16	32.11	55.96	58.10	100.02

10	$I_{.13}$	4.75	13.62	-8.87	15.13	26.37	43.39	74.69
11	$I_{.23}$	2.99	14.56	-11.57	9.53	16.61	46.37	79.83
12	$I_{.XW}$	18.02	18.24	-0.22	57.39	100.00	58.10	100.02
13	$I_{.X1}$	3.60	3.58	0.02	11.48	20.00	11.40	19.63
14	$I_{.X2}$	2.26	8.35	-6.09	7.19	12.53	26.59	45.77
15	$I_{.X3}$	2.21	4.10	-1.89	7.03	12.25	13.04	22.46
Mean L.Y./P (Xw) in F_3 = 31.4				**Check in F_3 = 19.23**				
Mean L.Y./P (Xw) in F_4= 37.52				**Check in F_4 = 23.38**				

Predicted and Actual advances in F_2, F_3 and F_4 generations for bolls/plant, seeds/boll and lint/seed. As shown; in Table (6), the results indicated that predicted advance estimated from F_2 generation were higher than predicted and actual advance estimated from F_3 generation .Also, selection advance in F_2 were higher than selection advance from F_3 and actual advance from F_4 generation, except I_{x3} which have higher actual advance in F_4 than predicted advance from F_3 generation. In general , selection indices which involving lint yield ($I_{.xw}$) with associated positive traits as I_{x1}, I_{x2} and I_{x3} recorded maximum genetic advance .In the same time, absent of lint yield gave minimum genetic advance indicating that improvement of lint yield basically depend on one or more cases i.e. selection for $I_{.xw}$, highly genetic variance, highly heritability and high significantly positive genetic correlation. However, both predicted in F_3 and actual advance in F_4 were higher than F_2 generation. Similar results were detected by Gooda (2001), El-Lawendey *et al*. (2011) and Ali *et al*,(2014).

Table (6): Genetic advance in three traits bolls/plant , seeds/boll and lint/seed in F_2, F_3 and F_4 generations.

Traits	Predicted F_2	Actual F_3	Deviation (Pre.-Act.)	Mean F_2	SA % F_2	Mean F_3	ACT. % F_3
$I.X_1$(B/P)	12.96141	8.690453	4.270952	21.63227	59.917	26.27748	33.07187
$I.X_2$(S/B)	3.565405	4.358543	-0.79314	17.2305	20.6924	19.26092	22.62894
$I.X_3$ (L/S)	0.010593	0.009594	0.000999	0.057268	18.4966	0.062618	15.32091
Generations	F_3	F_4		F3	F_3	F_4	F_4
$I.X_1$(B/P)	9.867264	8.042152	1.825113	26.27748	37.55027	27.68014	29.05387
$I.X_2$(S/B)	5.214896	4.511308	0.703589	19.26092	27.07501	21.102	21.37858
$I.X_3$ (L/S)	0.01111	0.025803	-0.01469	0.062618	17.74195	0.072706	35.48968

Selection is the most important activity in all plant breeding programs. The improvement in the mean genotypic value of selected plants over the parental population is known as genetic advanced under selection. Therefore , evaluation of the families in F_4 generation for studied characters the results in Table (7) show means of original parents and families in F_4 for yield, yield components and fiber properties. However, the results showed that the means of most families were higher than better parent (Dandara) for cotton yield and two families were higher than better parents (No. 12 and 18). Most families were higher than better parent for seed index, lint index , number of bolls/plant and seeds /boll. Also , there are six families were higher than better parent (Giza 85) for fiber length i.e. families :17, 11, 16, 8,7 and 10).

Miller and Rawlings (1967) indicated further progress selection for yield of 6.0 % while response for fiber length was decreased by 0.7%.

Table (7): Means of original parents and highest families in F_4 generation for yield, yield components and fiber properties

NO.	Fam.	BW	SC	LY	LP%	SI	LI	L/S	B/P	S/B	Mic.	PR.I	FL	UR
1	1	3.8	119.7	44.9	37.5	12.5	7.5	0.0749	31.8	22.0	4.0	10.5	31.2	86.4
2	2	3.2	91.3	34.1	37.3	12.3	7.3	0.0732	28.8	18.0	3.8	10.7	31.2	87.0
3	6	3.8	100.1	38.5	38.5	12.3	7.7	0.0770	26.3	21.3	3.4	10.6	31.2	87.4
4	11	4.0	125.9	47.0	37.4	12.6	7.5	0.0752	31.7	23.8	4.0	11.1	32.6	87.2
5	12	3.9	97.8	40.9	41.8	12.3	8.8	0.0884	25.0	20.3	4.1	10.4	31.3	87.1
6	13	4.0	121.7	46.6	38.3	12.4	7.7	0.0767	30.0	23.7	3.7	10.5	31.2	86.3
7	16	3.4	104.8	39.0	37.3	11.6	6.9	0.0688	30.9	20.0	4.3	10.8	32.0	86.2
8	17	4.1	131.8	50.4	38.2	12.2	7.5	0.0754	32.0	23.5	3.5	10.3	32.3	87.9
9	18	3.9	131.4	51.5	39.3	12.3	7.9	0.0794	34.3	22.3	3.6	10.4	31.4	86.3
10	19	3.3	108.6	42.6	39.3	11.4	7.4	0.0738	32.7	20.3	4.6	9.8	31.8	87.8
M.S.F.		3.7	113.3	43.6	38.5	12.2	7.6	0.0763	30.3	21.5	3.9	10.5	31.6	87.0
G.85		2.5	49.2	18.7	38.1	10.1	6.2	0.062	19.7	18.4	3.5	10.4	30.5	88.2
Dandara		2.7	58.4	21.5	36.8	11.2	6.5	0.065	21.6	17.3	4.4	10.0	30.0	87.5
LSD $_{0.05}$		0.42	16.46	5.91	1.15	0.83	0.60	0.010	4.52	2.79	0.65	0.94	1.46	2.14
LSD $_{0.01}$		0.57	22.07	7.93	1.54	1.12	0.81	0.010	6.06	3.74	0.87	1.26	1.95	2.87

Generally, the previous results reported that there are some families which have high values for yield and fiber length (families :17, 11, 8, 7 and 10) as well as fiber strength (families : 11 and 16). There forces, continuous of selection in these superior families(between and within) in the next generations and evaluation the behavior of these strains in breeding program can be useful for producing new promising genotype to general use.

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تطبيق بعض دلائل الانتخاب في الأجيال الانعزالية المبكرة من القطن الباربادنس

عرفة بدري عبدا لكريم الفشيقاوى ، محمد عزت عبدا لسلام و بدير مصطفى رمضان
معهد بحوث القطن ، مركز البحوث الزراعية

يهدف هذا البحث إلى تقدير التحسين الوراثي المتوقع بالانتخاب والتحسين الفعلي لمحصول الشعر والتجاوب المتلازم لمكونات المحصول وصفات التيلة. ومقارنة الكفاءة النسبية لطرق الانتخاب المستخدمة.

ولتحقيق ذلك الغرض فقد تم زراعه الأجيال الانعزالية المبكرة الثاني والثالث والرابع لعشيرة من القطن هجين (جيزة 85 * دندرة) بمحطة البحوث الزراعية بسدس وتم تطبيق طريقتين للانتخاب هما دليل الانتخاب (أحد عشر دليلا) وطريقة الانتخاب المباشر لأربع صفات: [محصول الشعر/نبات (wx)، عدد اللوز/نبات (x_1) ، عدد البذور/لوزة (x_2) ووزن الشعر/بذرة(x_3)].وأظهرت النتائج ما يلي:

أعطت متوسطات الجيل الرابع قيما أعلى من كلا الجيلين الثاني و الثالث لمحصول الزهر والشعر/نبات ومكوناته بالإضافة لمعامل البرسلى والانتظام مما يدل على كفاءة تطبيق الأدلة الانتخابية المستخدمة في الدراسة.

تراوحت قيم المكافئ الوراثي بالمعنى الواسع من متوسطة إلى عالية جداً للصفات محل الدراسة في الأجيال الانعزالية الثلاثة مما يدل على زيادة فرص نجاح الانتخاب لتحسين صفات العشيرة (جيزة 85* دندرة) كما أن معامل الاختلاف الوراثي والتباين الوراثي لم ينخفض كثيرا في الجيل الرابع عن الجيل الثاني ويرجع ذلك إلي تعدد أغراض الانتخاب في تلك الدراسة .

ساهم الارتباط الوراثي المعنوي الموجب بين الصفات المنتخبة الأربعة والصفات غير المنتخبة(وزن اللوزة ومحصول القطن الزهر ومعدل الحليج) فى رفع كفاءة الإنتخاب وزيادة متوسطات تلك الصفات مما أدى لزيادة التحسين الوراثى فى العشيرة.

أوضحت النتائج أيضاً أن الفرق بين التحسين الوراثي الفعلي المقدر من الجيل الثالث أعلي من التحسين الوراثي المتوقع من الجيل الرابع لصفة محصول الشعر/نبات لمعظم أدلة الانتخاب.

سجل دليل الانتخاب لصفة محصول الشعر وعدد اللوز($I._{w1}$) أعلي قيم التحسين الوراثي المتوقع والفعلي مقارنة بطريقة الانتخاب المباشر لمحصول الشعر (x_w) والكفاءة النسبية لهذا الدليل اعلي من باقي الأدلة و يلي هذا الدليل في الكفاءة النسبية(S.A.%) من التقدم الانتخابي في الجيل الثالث دليل الانتخاب لمحصول الشعر مع عدد البذور في اللوزة I_{w2} و دليل انتخاب المحصول الشعر وعدد اللوز وعدد البذرة وكمية الشعر علي البذرة I_{w123}.

كما أن التحسين الوراثي ΔG المتوقع فى الجيل الثاني كان أعلي قيما من التحسين الوراثي الفعلي فى الجيل الثالث لصفات عدد اللوز/ نبات وعدد البذرة / اللوزة وكمية الشعر / بذرة وأيضا كانت نفس النتيجة

في الجيل الثالث والرابع ولكن كانت الفروق أقل بين التحسين الفعلي والمتوقع لنفس الصفات لأدلة الانتخاب المباشرة $I._{X3}$, $I._{X2}$, $I._{X1}$.

أهم المكاسب الوراثية التي تم الحصول عليها في هذه الدراسة و بعد دورتين من الانتخاب وإمكانية عزل عدد عشرة عائلات متفوقة من الجيل الرابع هذه العائلات تحمل أعلي صفات محصول وجودة يمكن الاستفادة منها في برامج التربية لتحسين القطن المصري .