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SELECTION EFFICIENCY FOR LINT PERCENTAGE AND THE EXTENT OF ITS INFLUENCE ON THE OTHER TRAITS IN GIZA 83 EGYPTIAN COTTON VARIETY

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ABSTRACT

The present study was carried out at Mallawy Agricultural Research Station on 500 plants from Giza 83 cotton variety nursery field during 2005 and 2006 seasons. Direct selection for high lint percentage and its indirect effect were used at 10% selection intensity. Between families mean squares were highly significant for all studied traits in 2005 and 2006 growing seasons. Positive direction (high lint percentage) was accompanied by insignificant increase for all studied traits at the two years except, lint index which revealed significant increase in 2005 season. While the negative direction was accompanied by insignificant decrease for all the studied traits both seasons. Most traits revealed high predicted genetic gain compared with the actual gain in both seasons. High values of heritability in broad sense were detected for all the studied traits at both seasons and lint percentage at 2005 season. The estimates of genotypic and phenotypic coefficients of variation were higher for boll weight, seed index, lint index and pressely (fiber strength) exhibited than the other traits. However, the remaining studied traits indicated a small differences between them, revealing that environmental effects were not of great importance on these trait. These results were assured by heritability values in broad sense.

Key words: ***Selection efficiency, Heritability, Genotypic and phenotypic cofficient of variation, Giza 83, Egyptian cotton, Gossypium barbadense*** L.

INTRODUCTION

Direct selection for lint percentage is common procedure used by plant breeders for improving lint yield in cotton, whereas indirect selection may be superior for choosing lines that possess high inherited lint yielding capacity. Maintenance of Egyptian cotton (*Gossypium barbadense* L.) varieties play a major role in the breeding program with the fact that high quality is the principle merit of the Egyptian cotton.

Many cotton researchers such as Kittock and Pankes (1975) found in Pima cotton (*G. barbadense* L.) that an increase in number of seeds/boll was associated with a decrease in seed mean weight, fiber length, unformity ratio increase in lint weight/seed and micronaire value. Seyam *et al* (1984) found that the boll weight had significant positive correlation with lint percentage in F_2 population. Rahoumah *et al.* (1989) mentioned that the heritability values in broad sense were 54.55, 92.52, 76.56, 78.46.34.38 and 80% for boll weight, lint percentage, seed index, lint index, fiber strength and fiber fineness, respectively, in Giza 45 x 108 F hybrid. Also, Lasheen and Abo-Sen (1998)

found that positive direction for pressely value was accompanied by increasing values of boll weight and lint percentage in two seasons.

El-Disouqi (2000) found that positive direction (high boll weight) was accompanied by insignificant increase for all studied traits at two years, while the negative direction was accompanied by significant decrease for seed index and lint index. Abdel-Zaher et al. (2006) found that the genotypes mean squares were highly significant for seed index, lint percentage and lint index in both seasons and in combined analysis. However, insignificant mean squares were obtained in both seasons among the pure nuclei for all yield traits.

The main objective of the present study was to determine selection efficiency for lint percentage and its effect on the other traits.

MATERIALS AND METHODS

The procedure of direct and indirect selection was used in Giza 83 cotton variety population in the breeding nursery. The breeding nursery grown at Mallawy Agricultural Research Station in 2005 season. The breeding nursery consisted of 60 families, each family was planted in four ridges were 75 cm apart and 7.5 meters long, each ridge consisted ten hills. Each family comprised 40 hills later thinned to one plant per hill. The data were taken on 10 plants selected at random from 50 families only. Plants of both high and low values (positive and negative directions) for lint percentage were selected from the breeding nursery and the other traits of these plants such as boll weight, seed index, lint index, fiber fineness and fiber strength were determined. In 2006 season, the same procedures were repeated in the breeding nursery.

Selection efficiency was estimated in nursery population of Giza 83 using the formula outlined by Becker (1975). The analysis of variances was used on individual plant basis and presented in Table (1).

Table 1. Analysis of variance for all studied traits.

S.O.V.	D.f.	M.S.	F	Expectations of mean squares
Between families	F-1	M_1	M_1/M_2	$\sigma^2_e + S\sigma^2_f$
Within families	F(S-1)	M_2		σ^2_e
Total	FS-1			

$$\text{Genotypic variance} = \frac{M_1 - M_2}{S}$$

$$\text{Environmental variance} = \frac{M_2}{S}$$

$$\text{Phenotypic variance} = VG + VE$$

where :

σ^2_e = Sampling error.

σ^2_f = Variance due to families.

F = Number of families.

S = Number of plants in each family.

M_1 = The mean square between families

M_2 = The mean square within families.

Heritability estimate h^2b in broad sense was computed as the ratio between the genotypic variance to the phenotypic variance by the following formula :

$$h^2b\ \% = \frac{VG}{VP} \times 100$$

Predicted genetic gain = K. h^2b. σp

where:

K = The standardized selection differential (at 10% selection intensity and equal to 1.76).

h^2b = The broad sense heritability.

σP = The phenotypic standard deviation.

The actual genetic gain was also calculated as the following equation adopted by Becker (1975).

Actual genetic gain = $\overline{X}P - \overline{X}O$

where:

$\overline{X}P$ = The mean of selected plants (positive direction) at 10% intensity.

$\overline{X}O$ = The mean of the population.

RESULTS AND DISCUSSION

Between and within families mean squares are shown in Table (2). Mean squares between families were highly significant in 2005 and 2006 growing seasons for all studied traits, suggesting presence of considerable amount of genetic variation. Therefore, it could be concluded that under optimum environments the tested families were fully expressed leading to an enlargement of variation.

Table 2. Analysis of variance for all studied traits in 2005 and 2006 seasons.

S.O.V.	D.f	Boll weight (g)		Lint percentage (%)		Seed index (g)	
		2005	2006	2005	2006	2005	2006
Between families	49	0.168**	0.299**	9.062**	2.658**	1.643**	1.396**
Within families	450	0.078	0.100	2.395	1.420	0.574	0.532

Table 2. Cont.

S.O.V.	D.f	Lint index (g)		Micronaire		Pressely	
		2005	2006	2005	2006	2005	2006
Between families	49	1.576**	0.683**	0.262**	0.256**	1.202**	4.153**
Within families	450	0.413	0.321	0.097	0.126	0.439	0.722

** Significant at 0.01.

Positive direction (high lint percentage) was illustrated in Table (3). It was accompanied by insignificant increase for all studied traits in both seasons except, lint index that revealed significant increase in 2005 season, while the negative direction was accompanied by insignificant decrease for all studied traits in both seasons.

In this respect, Abdel-Zaher and Nagib (2002) found significant positive correlation between lint percentage and lint index, while, it was negatively correlated with seed index which may be attributed to linkage or pleiotropy effects (lasheen *et al* 2003).

The predicted genetic gain at 10% selection intensity, as well as the actual gain in nursery field plants are shown in Table (3). Most traits revealed high predicted genetic gain compared with the actual gain in both seasons. It is of great interest to mention that expected genetic advance under 10% selection intensity varied from trait to another depending on the values of heritability and standard deviation. Miller and Rawlings (1967) reported that there was generally close agreement between predicted and observed responses to selection.

Table 3. Direct effect of selection for high and low lint percentage and its indirect effect on the other traits.

Parameters	Boll weight (g)		Lint percentage (%)		Seed index (g)		Lint index (g)		Micronaire		Pressely	
	2005	2006	2005	2006	2005	2006	2005	2006	2005	2006	2005	2006
Population mean (P)	2.5	2.6	41.2	40.9	8.8	8.9	6.2	6.2	3.9	4.0	9.7	10.2
Positive direction (+d)	2.4	2.5	43.6**	42.9**	8.9	8.7	6.9*	6.6	4.0	4.0	9.7	10.2
Negative direction (-d)	2.5	2.7	38.8**	39.2**	9.0	9.0	5.7	5.9	3.9	4.0	9.7	10.2
Actual	0.10	0.1	2.4	2.0	0.1	0.2	0.7	0.4	0.1	0.0	0.0	0.0
Predicted	0.123	0.203	1.233	0.423	0.464	0.407	0.516	0.244	0.179	0.143	0.387	0.937
$LSD_{0.05}$	0.24	0.28	1.36	1.04	0.66	0.64	0.56	0.50	0.27	0.31	0.58	0.74
$LSD_{0.01}$	0.32	0.36	1.78	1.37	0.87	0.84	0.74	0.65	0.36	0.41	0.76	0.98

* and ** Significant at 0.05 and 0.01, respectively.

Heritability, genotypic and phenotypic coefficients of variation are presented in Table (4). High values of heritability in broad sense were detected for all studied traits in both seasons and lint percentage in 2005 season. These results coincided with those obtained by El-Okkia *et al* (1989), while low values were noticed for lint percentage and micronaire reading in 2006 season. These results were in harmony with those obtained by Ahmed (2004). Johanson *et al* (1955) reported that heritability along with genetic gain are usually more useful than the heritability values alone in predicting the resultant effect for selecting the best individuals.

The estimates of genotypic (G.C.V. %) and phenotypic (P.C.V. %) coefficients of variation and appeared to be higher for boll weight, seed index, lint index and pressely (fiber fineness) than the other traits. However, the remaining studied traits exhibited small differences between genotypic and phenotypic coefficients of variation, revealing that environmental effects were not of great importance on these traits. These results were assured by heritability values in broad sense.

Table 4. Heritability (h^2b), genotypic (G.C.V.) and phenotypic (P.C.V.) coefficients of variation for studied traits.

Parameters	Boll weight (g)		Lint percentage (%)		Seed index (g)	
	2005	2006	2005	2006	2005	2006
h^2b %	53.78	66.56	73.57	46.60	65.06	61.89
G.C.V. %	3.80	5.43	1.98	0.86	3.72	3.30
P.C.V. %	5.19	6.65	2.31	1.26	4.61	4.20

Table 4. Cont.

Parameters	Lint index (g)		Micronaire		Pressely	
	2005	2006	2005	2006	2005	2006
h^2b %	73.81	53.00	62.98	50.78	68.48	82.61
G.C.V. %	5.50	3.07	3.29	2.85	2.85	5.74
P.C.V. %	6.41	4.22	4.15	4.00	3.57	6.32

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كفاءة الانتخاب لمعدل الحليج ومدى تأثيرها على الصفات الأخرى في صنف القطن جيزه 83

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أجريت هذه الدراسة فى محطة البحوث الزراعية بملوى على 500 نبات من حقل السلالات لصنف القطن جيزه 83 خلال موسم2005 و2006 .

كان الانتخاب فى الإتجاه الموجب (معدل الحليج العالى) مصحوباً بزيادة غير معنوية لكل الصفات المدروسة فى كلا الموسمين ماعدا صفة معامل الشعركان هناك زيادة معنوية بينما كان الإنتخاب فى الإتجاه السالب (معدل الحليج المنخفض) مصحوباً بنقص غير معنوى لكل الصفات تحت الدراسة.

لوحظ إرتفاع قيم التحسين الوراثى المتوقع لمعظم الصفات المدروسة مقارنـة بالتحسين الفعلى أو الحقيقى فى كلا الموسمين .

كانت درجة التوريث بالمعنى الواسع مرتفعة بالنسبةلكل الصفات المدروسة فى كلا الموسمين وصفة معدل الحليج فى موسم2005

كانت قيم معامل التباين الوراثى والمظهرى عالية لصفات وزن اللوزة ومعامل البذرة ومعامل الشعر ومتانة الشعرمقارنة بالصفات الاخرى مما يدل على قلة أهمية التأثير البيئى على هذه الصفات وهذا يؤكده قيم درجة التوريث بالمعنى الواسع .