

ECONOMIC VALUES EFFECTS ON GENETIC GAINS OF LINT COTTON YIELD AND ITS COMPONENTS USING SELECTION INDICES

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ABSTRACT: *Ten selection indices were investigated to improve cotton yield and yield components based upon different combinations of four traits (lint yield/plant, bolls/plant, seeds/boll and lint/seed) through two applications of relative economic values - according to Walker's (WEV) and equally important (UEV). This study was carried out in early segregating generations F_2 and F_3 of the cotton cross Giza 86 x Russian variety 6022. The results showed that means and the minimum values of F_3 were higher than those of F_2 generation for most lint yield and lint components. This attributed to the efficiency of selection indices application in this study. The coefficient of genotypic correlations revealed that bolls/plant (in both generations), seeds/boll and boll weight (in F_2) had positive and significant correlation with lint yield. The prediction gains in lint yield of WEV were highest than those of UEV for all selection indices except index I_{23} (seeds/boll with lint/seed). Because the economic values of inserted traits (WEV) were assigned to be weights for each trait, while the UEV considered equally one. Thus, the index weights (b 's) for traits considered in WEV were higher than those in UEV. However, predictions of genetic gain based on UEV showed relatively association with realized genetic gain for lint yield. The index involving lint yield and seeds/boll (I_{w2}) may be better buffered and have much to offer in improving lint yield and stabilizing gains of both predicted and realized in the WEV and UEV applications. The lowest predicted and realized advances from WEV and UEV for lint yield were achieved when selecting for seeds/boll with lint/seed (I_{23}). Because the correlation between seeds/boll and lint/seed was not significant, whilst lint yield had negative association with them in F_3 generation. Generally, Smith-Hazel index with WEV was found to be the most efficient in improving lint/seed, boll weight, lint percentage, seed index and micronaire reading. On the other hand, UEV index proved to be relatively more efficient as compared to WEV in improving lint yield, seeds/boll, pressley index and fiber length.*

Key words: *Economic values, Genetic gains, Selection indices, Cotton.*

INTRODUCTION

Yield in cotton crop has a very complex control mechanism and direct selection is not much effective on it. Therefore, the most desirable approach

to improve characteristics such as lint yield is simultaneous selection based on related traits (Bos and Caligari, 2007). Index selection is one of three fundamental methods of selecting to improve more than one trait (the other techniques being independent culling levels and tandem selection). Taking advantage of selection indices was first proposed by Smith (1936) in order to improve the plants. Hazel (1943) extended the index procedure for the selection of individuals in animal population. Construction of the $S_{SMITH} - H_{HAZEL}$ index involves economic weightings of each trait along with genotypic and phenotypic variances and covariances between each pair of traits ; and coefficients of phenotypic weights (b's).

Vast information on the genetic variation and genotypic correlation between different plant characters is available in literature. The studies of Khan (2003) showed that the yield was found positively correlated with bolls/plant and boll weight. Further studies in this respect also indicated that 99% of both genotypic and phenotypic variation in lint yield could be explained by the three component traits. These results suggested that selection for these three component traits could be effective in improving lint yield. Indeed, it has been recommended that bolls/plant be used as the primary selection trait, followed by boll weight and lint percentage (Huang *et al.*, 2003 ; Li *et al.*, 2009). However, bolls/plant is negatively correlated with boll weight , a balanced selection for bolls/plant and boll weight might be needed (Li *et al.*, 2009).

The net genetic improvement which can be brought about by selection indices is the sum of the gains made for the several traits which have economic importance (Hazel, 1943). It is ,therefore, logical to weigh the gain made for each trait by the relative economic importance of that trait. Selection indices have been used in numerous studies in order to determine the most valuable genotypes as well as the most suitable combination of traits with the intention of indirectly improving the yield in cotton (Kamalanathan, 1967; El-Okkia, 1979; Mahdy, 1983; Al-Rawi and Ahmed, 1984; Hassaballa *et al.*,1987; Mahdy *et al.*, 1987; Younis, 1999; El-Lawendey, 2003 ; El-Lawendey *et al.*, 2008 ; Kassem *et al.*, 2008 ; Soliman and El-Lawendey, 2008; El-Mansy,2009).

The objectives of this study were to: (i) explore the effects of two different economic values (WEV and UEV) for the component traits on genetic gain in lint yield. (ii) determine the correlated response between selected and unselected traits in both WEV and UEV. (iii) investigate how heritability , genotypic correlation and selection parameters influence the outcomes of index selection in both WEV and UEV. (iv) evaluate the correlation coefficients among predicted and realized gains resulting from selection indices for yield and its components in both WEV and UEV.

MATERIALS AND METHODS

Genetic materials and selection procedures

The present investigation was carried out at Sakha Agricultural Research Station Kafr El-Sheikh Governorate. F₂ generation of the cotton cross Giza 86 x Russian variety 6022 with original parents were grown in no replicated rows 6.0 meter long with 40 cm hill space, while row to row width was 70 cm apart in 2009 season. One plant was left per hill at thinning time. Self pollination was practiced for all F₂ plants. Selfed as well as open pollinated bolls/plant of 354 F₂ guarded plants were picked up separately. Observations were recorded on lint cotton yield (g)/plant (x_w) , bolls/plant (x₁) , seeds/boll (x₂) , lint (g)/seed (x₃) , boll weight (BW) , lint percentage (L%) and seed index (SI).

Ten selection indices (I_{w12} , I_{w13} , I_{w23} , I₁₂₃ , I_{w1} , I_{w2} , I_{w3} , I₁₂ , I₁₃ and I₂₃) on basis of Walker's (WEV) and unit (UEV) economic values were applied. These gave a total of 46 F₃ selected progenies by using 5% selection intensity the plants having the highest performance in each selection index (seventeen superior progenies of each index selection).

In 2010 season, selfed seeds of 46 selected progenies were evaluated with the two parents and a random sample of bulked seed of F₃ generation in a randomized complete blocks design with three replicates. Experimental plot was of a single row as carried in 2009. Recommended agronomic practices and need based plant protection measures were followed.

Data were recorded on F₃ guarded plants for the following characters: lint yield (g)/plant (LCY/P) , bolls/plant (B/P) , seeds/boll (S/B) , lint (g)/seed (L/S) , boll weight (BW) , lint percentage (L%) and seed index (SI) , micronaire reading (MR) , pressley index (PI) and fiber length at 2.5% span length (2.5%SL).

Statistical and genetic analysis

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

$$h_b^2 \text{ (in } F_2 \text{ generation)} = \frac{VF_2 - (VP_1 + VP_2)/2}{VF_2} \times 100$$
$$h_b^2 \text{ (in } F_3 \text{ generation)} = \frac{\sigma^2_g}{\sigma^2_p} \times 100 \quad (\text{Walker 1960})$$

Where:

- VF₂ = The phenotypic variance of the F₂ generation.
- VP₁ = The variance of the first parent (Giza 86).
- VP₂ = The variance of the second parent (Russian variety 6022).
- σ²_g = The genotypic variance of the F₃ generation.
- σ²_p = The phenotypic variance of the F₃ generation.

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

Genotypic correlation coefficients between studied characters in F₂ and F₃ generations were estimated as outlined by Miller *et al.*, (1958) and Dewey and Lu (1959).

With each selection index score (I) was calculated the formula (Smith, 1936 ; Hazel, 1943):

$$I = b_1X_1 + b_2X_2 + \dots + b_nX_n$$

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

$$(b) = (P)^{-1} \cdot (G) \cdot (WEV) \dots\dots\dots\text{Application (I)}$$

$$(b) = (P)^{-1} \cdot (G) \cdot (UEV) \dots\dots\dots\text{Application (II)}$$

Where:

(b) =Vector of relative index coefficients,

(P)⁻¹ = Inverse phenotypic variance-covariance matrix,

(G) = Genotypic variance-covariance matrix,

(WEV) =Vector of relative economic values according to Walker (1960)

where :

$$(WEV)_w \text{ (lint yield/plant)} = \bar{x}_1 \cdot \bar{x}_2 \cdot \bar{x}_3$$

$$(WEV)_1 \text{ (bolls/plant)} = \bar{x}_2 \cdot \bar{x}_3$$

$$(WEV)_2 \text{ (seeds/boll)} = \bar{x}_1 \cdot \bar{x}_3$$

$$(WEV)_3 \text{ (lint/seed)} = \bar{x}_1 \cdot \bar{x}_2$$

(UEV) =Vector of relative economic values on the basis of equally important, i.e., (UEV)_w = (UEV)₁ = (UEV)₂ = (UEV)₃ = 1

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

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

Where:

SD denotes selection differential in standard units.

b_i denotes index weights for characters considered in an index.

σg_{iw} denotes genotypic covariances of the characters with yield.

Economic values effects on genetic gains of lint cotton yield and its.....

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 in F_3 was calculated as deviation of F_3 mean for each character from index mean of that character.

RESULTS AND DISCUSSION

Genetic variation

The development of an effective plant breeding program and the efficiency of selection largely depend upon the magnitude of variability, heritability and correlation coefficients in the segregating generations under study. Table (1) shows the different traits of the parental genotypes, indicating that the two parents are closely-related. Hence, for many varieties, yield improvements have come from mating of closely-related parents. Van Esbroeck and Bowman (1998) observed that parental genetic diversity, as estimated by coefficient of parentage, was not imperative for cotton improvement. Successful cultivars were most frequently developed from closely-related parents, with a level of diversity similar to the average genetic relationship among regionally-adapted cultivars. These indicated that there was sufficient variability or mechanisms to create variability, to make breeding progress in a narrow germplasm base.

Table 1. Characteristics of the cotton parental genotypes under this study.

Variety	LCY/P (x_w)	B/P (x_1)	S/B (x_2)	L/S (x_3)	BW (g)	L%	SI (g)	MR	PI	2.5% SL
Giza 86	27.45	18.44	20.04	0.074	3.81	38.99	11.60	4.90	10.50	34.5
Russian variety 6022	20.17	15.92	20.04	0.063	3.45	36.67	10.90	4.50	10.90	31.6

The phenotypic and genotypic coefficients of variation, means, ranges, heritability in broad sense in both F_2 and F_3 generations for the studied characters are shown in Table (2).

The PCV was generally higher than the GCV for all the characters. High PCV and GCV values were observed for lint yield and yield components except lint percentage and seed index in both F_2 and F_3 generations. This suggested sufficient amount of variation among the accessions selected traits under this investigation. This agrees with the report of Meena *et al.*, (2001) and El-Lawendey *et al.*, (2008). However, the fiber traits indicated low PCV and GCV in F_3 generation. The PCV in F_3 generation was lower than those of F_2 generation for lint and its components. Also, with an exception for lint percentage and seed index, estimates of GCV in F_3 for lint and its components were lower than those of F_2 generation. It was due to reduction in heterozygosity as compared to F_2 generation. Similar result has been reported by Preetha and Raveendren (2008).

Table 2. Phenotypic (PCV%) and genotypic (GCV%) coefficients of variation, means, standard errors($S_{\bar{X}}$), ranges and heritability in broad sense (h_b^2) for the traits studied in both F_2 and F_3 generations.

Character	Generation	PCV%	GCV%	Mean \pm $S_{\bar{X}}$	Range	h_b^2
Lint yield (g)/plant (X_w)	F_2	39.57	26.49	23.73 \pm 0.50	6.40 – 67.30	55.19
	F_3	17.23	10.51	25.43 \pm 3.47	18.77 – 35.00	37.21
Bolls/plant (x_1)	F_2	38.32	26.11	20.62 \pm 0.42	6.58 – 53.13	53.56
	F_3	23.74	18.67	21.22 \pm 3.11	14.70 – 33.43	61.85
Seeds/boll (x_2)	F_2	11.05	8.28	18.55 \pm 0.11	9.78 – 23.81	43.83
	F_3	7.80	6.17	19.49 \pm 0.93	15.40 – 23.65	62.58
Lint (g)/seed (x_3)	F_2	9.83	5.04	0.063 \pm 0.0003	0.038 – 0.080	73.67
	F_3	9.23	8.72	0.064 \pm 0.0019	0.049 – 0.078	89.11
Boll weight (g)	F_2	10.68	9.41	3.06 \pm 0.02	1.64 – 4.00	22.22
	F_3	8.83	7.55	3.28 \pm 0.15	2.62 – 4.01	73.02
Lint percentage	F_2	4.42	2.22	37.68 \pm 0.09	30.61 – 41.72	74.79
	F_3	3.55	3.29	37.63 \pm 0.50	34.83 – 40.40	85.84
Seed index (g)	F_2	6.57	3.24	10.31 \pm 0.04	7.56 – 12.30	75.72
	F_3	5.51	5.09	10.50 \pm 0.22	9.21 – 12.30	85.58
Micronaire reading	F_3	2.73	1.98	4.92 \pm 0.09	4.48 – 5.15	52.50
Pressley index	F_3	4.77	4.37	10.21 \pm 0.20	9.30 – 11.07	83.86
Fiber length at 2.5% span length	F_3	2.47	1.89	34.31 \pm 0.54	32.60 – 36.00	58.78

Comparing means and the minimum of F_3 generation with those F_2 , it is apparent that the means and the minimum of F_3 were higher than those of F_2 generation for most lint yield and lint components (Fig.1 for lint yield). This attributed to the efficiency of selection indices application in this study. The same trend was obtained by Meena *et al.*, (1991) and El-Lawendey *et al.*, (2008).

Except lint yield/plant, estimates of heritability for lint components exceeded from F_2 to F_3 generation. High to moderate broad sense heritability estimates were observed for most studied characters. These estimates show that genetic variance justifies a great amount from phenotypic variation. It should be noticed that in both F_2 and F_3 generations carried out in individual year and genotype x environment may lead to over-estimation of heritability for some aforementioned traits.

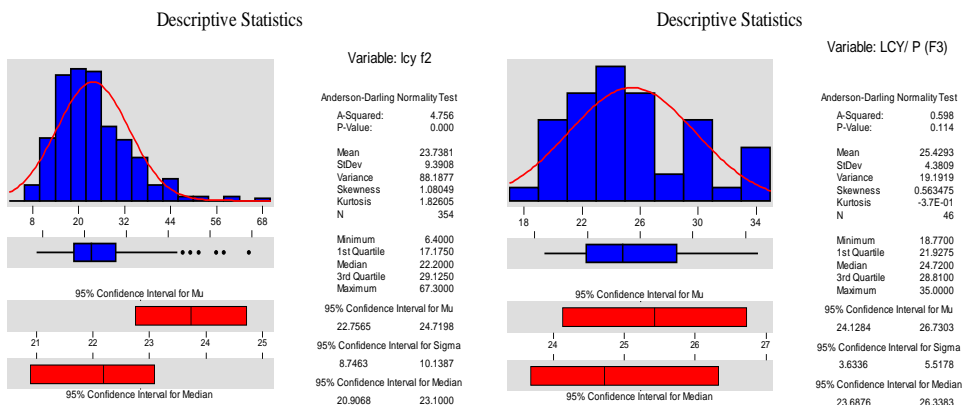


Fig.1. frequency distribution curves of lint yield in F₂ and F₃ generations.

Genotypic correlation

A strong correlation and heritability of economically-important traits are highly desirable in breeding and interpretation selection work. The genetic variability of most characteristics is correlated with changes in other characteristics. Coefficient of genotypic correlations among different character combinations are given in Table (3). The coefficient of genotypic correlations revealed that bolls/plant (in both generations) , seeds/boll and boll weight (in F₂) had positive and significant correlation with lint yield. Also, boll weight exhibited positive association with seeds/boll, lint/seed and seed index in both F₂ and F₃ generations. The same nature of association occurred between lint/seed and both lint percentage and seed index. Similar results were obtained by Khan and Azhar (2000).

The stability relationships from F₂ to F₃ generations between some traits e.i. lint yield with each of bolls/plant , lint percentage ; bolls/plant with each of lint/seed , lint percentage and seed index ; seeds/boll with boll weight ; lint/seed with each of boll weight , lint percentage and seed index ; and boll weight with seed index may have been governed by linkage , where the selection indices can not to break these associations, but it could be cause gene frequency changes. However, the high discrepancy of r_g between F₂ and F₃ generation appeared for both lint yield and bolls/plant with seeds/boll and boll weight. This discrepancy may be due to crossing-over and reduced size of F₃ generation.

The r_g revealed that micronaire reading had positive and significant correlation with both lint yield and bolls/plant ,but it showed negative relationship with seeds/boll , lint/seed , boll weight , lint percentage and fiber length. Pressley index was positively and significantly correlated with fiber length. These results are in agreement with those obtained by Desalegn *et al.*, (2009).

Table 3. Estimates of genotypic correlation coefficients (r_g) in both F_2 and F_3 generations between all pairs of studied traits.

Character	LCY/P (x_w)	B/P (x_1)	S/B (x_2)	L/S (x_3)	BW	L%	SI	MR	PI
B/P (x_1)	0.94** 0.91**								
S/B (x_2)	0.30** -0.59**	0.04 -0.60**							
L/S (x_3)	-0.03 -0.32*	-0.20** -0.59**	0.07 -0.16						
BW	0.24** -0.61**	-0.08 -0.85**	0.93** 0.63**	0.31** 0.64**					
L%	-0.16** -0.51**	-0.31** -0.74**	-0.05 0.14	0.55** 0.85**	0.10 0.65**				
SI	-0.07 -0.01	-0.23** -0.25	0.02 -0.39**	0.48** 0.84**	0.36** 0.44**	-0.001 0.43**			
MR	0.77**	0.78**	-0.54**	-0.32*	-0.63**	-0.46**	-0.09		
PI	-0.02	-0.07	0.14	-0.01	0.11	0.01	-0.01	0.08	
2.5%SL	0.13	0.02	0.37*	-0.12	0.23	-0.10	-0.07	-0.44**	0.67**

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

Relative efficiency of the different selection indices in WEV and UEV for lint yield

In current study, ten selection indices were investigated based upon different combination of four traits (x_w , x_1 , x_2 and x_3) and their economic values through the two applications of WEV and UEV. Table (4) and Fig. (2) show predicted and realized gains according to WEV and UEV for improving lint yield (g) /plant in F_2 and F_3 generations. The prediction gains of WEV were highest than those of UEV for all selection indices except index I_{23} . Because the economic values of inserted traits (WEV) were assigned to be weights for each trait, while the UEV considered equally one. Thus, the index weights (b's) for traits considered in WEV were higher than those in UEV. However, predictions of genetic gain based on UEV showed relatively association with realized genetic gain for lint yield (Table 7).

The lowest predicted and realized advances from WEV and UEV for lint yield were achieved when selecting for seeds/boll with lint/seed (I_{23}). Because the correlation between seeds/boll and lint/seed was not

Economic values effects on genetic gains of lint cotton yield and its.....

significant, whilst lint yield had negative association with them in F_3 generation. The index I_{w12} gave the highest predicted efficiencies (240.4%) relative to index selection I_{123} in WEV. This may be attributed to coefficient of genetic correlations that showed strongly and positively correlated for yield with bolls/plant and seeds/boll in F_2 generation. Abouzaid *et al.*, (1997) , Khan *et al.*, (2009) and Makhdoom *et al.*, (2010) reported variable bolls/plant is the key independent yield component and play prime role in managing yield. The maximum of both predicted and realized efficiencies from WEV were fluctuated. However, index selection I_{w2} may be better buffered and have much to offer in improving lint yield and stabilizing gains of both predicted and realized in the WEV and UEV applications (Fig.2)

Deviations (D) of the realized advance from the predicted of lint yield (Table 4) were positive for 7 selection indices in WEV and for 2 in UEV. The close agreement between predicted and realized responses to I_{w2} in both WEV and UEV and I_{w3} in WEV may be due to the non additive effects which were relatively of minor importance and the additive genetic effects would appear to be predominant for seeds/boll (x_2) and lint/seed (x_3).

Table 4. Predicted and realized gains from the different selection indices according to WEV and UEV for improving lint yield (g)/plant (x_w) in F_2 and F_3 generations.

Selection indices	WEV						D	UEV						D
	Predicted gain F_2			Realized gain F_3				Predicted gain F_2			Realized gain F_3			
	i	ii%	iii%	i	ii%	iii%		i	ii%	iii%	i	ii%	iii%	
I_{w12}	5.12	21.6	240.4	0.94	3.9	23.4	4.18	2.62	11.0	127.2	0.94	3.9	29.4	1.68
I_{w13}	5.03	21.2	236.2	0.74	3.1	18.5	4.29	2.57	10.8	124.8	0.74	3.1	23.1	1.83
I_{w23}	5.03	21.2	236.2	4.32	18.1	107.7	0.71	2.28	9.6	110.7	3.49	14.6	109.1	-1.21
I_{123}	2.13	9.0	100.0	4.01	16.8	100.0	-1.88	2.06	8.9	100.0	3.20	13.4	100.0	-1.14
I_{w1}	5.08	21.4	238.5	4.16	17.5	103.7	0.92	2.60	11.0	126.2	3.58	15.0	111.9	-0.98
I_{w2}	5.01	21.1	235.2	4.51	18.9	112.5	0.50	4.13	17.4	200.5	4.66	19.6	145.6	-0.53
I_{w3}	5.01	21.1	235.2	4.56	19.1	113.7	0.45	2.27	9.6	110.2	4.46	18.7	139.4	-2.19
I_{12}	2.13	9.0	100.0	4.16	17.5	103.7	-2.03	2.05	8.6	99.5	4.16	17.5	130.0	-2.11
I_{13}	2.12	8.9	99.5	4.56	19.1	113.7	-2.44	2.03	8.6	98.5	3.20	13.4	100.0	-1.17
I_{23}	0.91	3.8	42.7	-1.35	-5.7	-33.7	2.26	1.03	4.3	50.0	-2.09	-8.8	-65.3	3.12

$\bar{F}_2 = 23.73$

$\bar{F}_3 = 25.43$

Check mean (F_3) = 23.83

(i) Predicted and realized gains as lint (g)/plant.

(ii%) Predicted and realized gains percentage as estimated from generation mean and check means, respectively.

(iii%) Predicted and realized gains as a percentage of the response to truncation index selection I_{123} .

(D) Deviations of realized gains from predicted gains are given as lint (g)/plant.

Simple correlation coefficient between WEV and UEV deviations = 0.767**

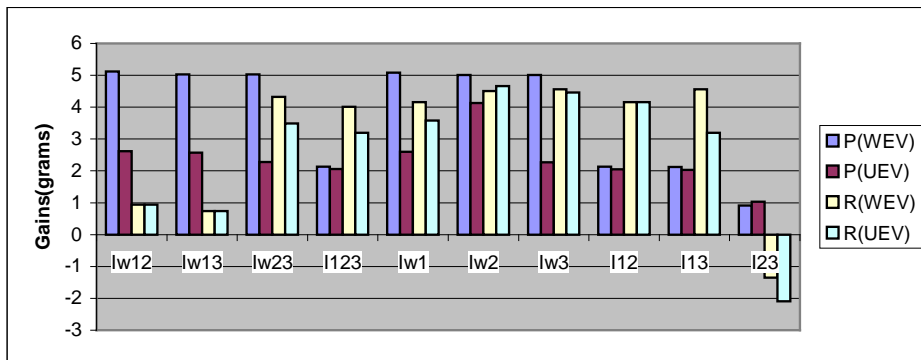


Fig.2. Predicted and realized gains for lint yield from F_2 and F_3 , respectively in both WEV and UEV.

Gain from selection in WEV and UEV for selected bolls/plant, seeds/boll and lint/seed

Predicted and realized to selection by using 10 indices in WEV and UEV for selected bolls/plant, seeds/boll and lint/seed are given in Table 5. Index selection I_{w1} had stabilizing and satisfactory of genetic gains in both WEV and UEV for bolls/plant. The index involving seeds /boll and lint/seed (I_{23}) showed the lowest predicted and realized responses from F_2 and F_3 generations, respectively in both WEV and UEV for bolls/plant. These agreements suggest that selection for decreased lint yield will result in a decrease in the bolls/plant. On the contrary, this index (I_{23}) gave high values of predicted and realized responses in both WEV and UEV for seeds/boll and lint/seed. The large discrepancy in behavior I_{23} may be due to negative correlations of each seeds/boll and lint/seed with bolls/plant. Deviations of the realized advance from the predicted were negative in most indices in both WEV and UEV for bolls/plant, while seeds/boll and lint/seed were positive in most selection indices. These results are in agreement with those obtained by El-Lawendey *et al.*, (2008).

Gain from selection in WEV and UEV for unselected boll weight , lint percentage and seed index

Predicted gains exceeded realized gains from most indices for boll weight , lint percentage and seed index in both WEV and UEV (Table 6). The gains from I_{23} in WEV for boll weight, lint percentage and seed index were similar, where these were surprising in view of the fact that the genotypic correlation between them and lint/seed (x_3) were positive and significant in F_3 generation. The highest realized advances for boll weight , lint percentage and seed index in UEV were obtained by using I_{23} , I_{w13} and I_{w13} , respectively. Similar results were obtained by Culp and Harrell (1975).

Economic values effects on genetic gains of lint cotton yield and its.....

Table 5. Predicted and realized responses to selection by using different selection indices which estimated from F₂ and F₃ means for selected bolls/plant , seeds/boll and lint/seed.

Selection indices	Bolls/ plant (x ₁)									
	WEV				D	UEV				D
	Predicted response F ₂		Realized response F ₃			Predicted response F ₂		Realized response F ₃		
	i	ii%	i	ii%	i	ii%	i	ii%		
I _{w12}	4.48	21.7	1.63	7.6	2.85	2.39	11.6	1.63	7.6	0.76
I _{w13}	4.57	22.2	1.45	6.7	3.12	2.43	11.8	1.45	6.7	0.98
I _{w23}	4.58	22.2	5.48	25.5	-0.90	2.04	9.9	5.27	24.5	-3.23
I ₁₂₃	2.12	10.3	5.51	25.6	-3.39	2.04	9.9	5.16	24.0	-3.12
I _{w1}	4.56	22.1	5.55	25.8	-0.99	2.42	11.7	5.36	24.9	-2.94
I _{w2}	4.54	22.0	5.10	23.7	-0.56	2.59	12.6	4.89	22.7	-2.30
I _{w3}	4.48	21.7	5.32	24.7	-0.84	2.03	9.8	5.46	25.4	-3.43
I ₁₂	2.13	10.3	5.55	25.8	-3.42	2.05	9.9	5.55	25.8	-3.50
I ₁₃	2.12	10.3	5.37	25.0	-3.25	2.05	9.9	5.16	24.0	-3.11
I ₂₃	-0.85	-4.1	-3.33	-15.5	2.48	0.79	3.8	-2.53	-11.8	3.32

$\bar{F}_2 = 20.62$

$\bar{F}_3 = 21.22$

Check mean (F₃) = 21.52

Simple correlation coefficient between WEV and UEV deviations = 0.865**

Table 5. Continued.

Selection indices	Seeds/boll (x ₂)									
	WEV				D	UEV				D
	Predicted response F ₂		Realized response F ₃			Predicted response F ₂		Realized response F ₃		
	i	ii%	i	ii%	i	ii%	i	ii%		
I _{w12}	0.017	0.1	0.74	3.9	-0.72	0.061	0.3	0.74	3.9	-0.68
I _{w13}	0.031	0.2	-1.40	-7.4	1.43	-0.008	0.0	-1.40	-7.4	1.39
I _{w23}	0.035	0.2	-0.92	-4.8	0.96	0.124	0.7	-0.70	-3.7	0.82
I ₁₂₃	0.008	0.0	-0.91	-4.8	0.92	0.000	0.0	-0.67	-3.5	0.67
I _{w1}	0.088	0.5	-0.83	-4.4	0.92	0.058	0.3	-0.81	-4.3	0.87
I _{w2}	0.062	0.3	-0.93	-4.9	0.99	1.184	6.4	-0.61	-3.2	1.79
I _{w3}	0.079	0.4	-0.78	-4.1	0.86	0.079	0.4	-0.84	-4.4	0.92
I ₁₂	0.002	0.0	-0.83	-4.4	0.83	-0.011	-0.1	-0.83	-4.4	0.82
I ₁₃	-0.006	0.0	-0.88	-4.6	0.87	-0.055	-0.3	-0.67	-3.5	0.62
I ₂₃	0.393	2.1	0.41	2.2	-0.02	2.051	11.1	1.30	6.8	0.75

$\bar{F}_2 = 18.55$

$\bar{F}_3 = 19.49$

Check mean (F₃) = 18.99

Simple correlation coefficient between WEV and UEV deviations = 0.814**

Table 5. Continued.

Selectio n indices	Lint (g)/seed (x_3)									
	WEV				D	UEV				D
	Predicted response F_2		Realized response F_3			Predicted response F_2		Realized response F_3		
	i	ii%	i	ii%	i	ii%	i	ii%		
I_{w12}	0.000001	0.00	-0.0048	-8.1	0.005	-0.000005	-0.01	-0.0048	.1	0.005
I_{w13}	0.000019	0.03	0.0029	4.9	-0.003	0.000008	0.01	0.0029	.9	-0.003
I_{w23}	-0.000024	-0.04	-0.0026	-4.4	0.003	-0.000005	-0.01	-0.0045	.6	0.004
I_{123}	0.000036	0.06	-0.0032	-5.4	0.003	0.000012	0.02	-0.0049	.3	0.005
I_{w1}	-0.000006	-0.01	-0.0032	-5.4	0.003	-0.000006	-0.01	-0.0042	.1	0.004
I_{w2}	-0.000012	-0.02	-0.0008	-1.4	0.001	0.000075	0.12	-0.0012	.0	0.001
I_{w3}	0.000027	0.04	-0.0020	-3.4	0.002	0.000025	0.04	-0.0024	.1	0.002
I_{12}	0.000001	0.00	-0.0032	-5.4	0.003	0.000000	0.00	-0.0032	.4	0.003
I_{13}	0.000059	0.10	-0.0018	-3.1	0.002	0.000004	0.01	-0.0049	.3	0.005
I_{23}	0.001221	1.97	0.0055	9.3	-0.004	0.000392	0.63	-0.0018	.1	0.002

$\bar{F}_2 = 0.062$ $\bar{F}_3 = 0.064$ Check mean (F_3) = 0.059
 Simple correlation coefficient between WEV and UEV deviations = 0.740*

Table 6. Predicted and realized responses to selection by using different selection indices which estimated from F_2 and F_3 means for unselected boll weight , Lint percentage and seed index.

Selectio n indices	Boll weight (g)									
	WEV				D	UEV				D
	Predicted response F_2		Realized response F_3			Predicted response F_2		Realized response F_3		
	i	ii%	i	ii%	i	ii%	i	ii%		
I_{w12}	0.005	0.2	-0.04	-1.3	0.05	0.006	0.2	-0.04	-1.3	0.05
I_{w13}	0.009	0.3	-0.11	-3.6	0.12	0.003	0.1	-0.11	-3.6	0.11
I_{w23}	0.004	0.1	-0.23	-7.5	0.23	0.012	0.4	-0.26	-8.5	0.27
I_{123}	0.005	0.2	-0.24	-7.9	0.25	0.004	0.1	-0.26	-8.5	0.26
I_{w1}	0.010	0.3	-0.24	-7.9	0.25	0.006	0.2	-0.27	-8.9	0.28
I_{w2}	0.008	0.3	-0.17	-5.6	0.18	0.170	5.6	-0.14	-4.6	0.31
I_{w3}	0.013	0.4	-0.18	-5.9	0.19	0.013	0.4	-0.21	-6.9	0.22
I_{12}	0.001	0.0	-0.24	-7.9	0.24	0.000	0.0	-0.24	-7.9	0.24
I_{13}	0.004	0.1	-0.19	-6.2	0.19	0.002	0.1	-0.26	-8.5	0.26
I_{23}	0.251	8.2	0.26	8.5	-0.01	0.022	0.7	0.14	4.6	-0.12

$\bar{F}_2 = 3.06$ $\bar{F}_3 = 3.28$ Check mean (F_3) = 3.05
 Simple correlation coefficient between WEV and UEV deviations = 0.931**

Economic values effects on genetic gains of lint cotton yield and its.....

Table 6. Continued.

Selection indices	Lint percentage									
	WEV				D	UEV				D
	Predicted response F ₂		Realized response F ₃			Predicted response F ₂		Realized response F ₃		
	i	ii%	i	ii%	i	ii%	i	ii%		
I _{w12}	0.02	0.1	-0.94	-2.6	0.96	-0.04	-0.1	-0.94	-2.6	0.90
I _{w13}	-0.06	-0.2	0.19	0.5	-0.25	-0.04	-0.1	0.19	0.5	-0.23
I _{w23}	-0.09	-0.2	-0.64	-1.7	0.55	-0.06	-0.2	-1.05	-2.9	0.99
I ₁₂₃	-0.09	-0.2	-0.78	-2.1	0.69	-0.03	-0.1	-1.16	-3.2	1.13
I _{w1}	-0.05	-0.1	-0.77	-2.1	0.72	-0.03	-0.1	-0.98	-2.7	0.95
I _{w2}	-0.09	-0.2	-0.34	-0.9	0.25	-0.25	-0.7	-0.24	-0.7	-0.01
I _{w3}	-0.07	-0.2	-0.55	-1.5	0.48	-0.08	-0.2	-0.61	-1.7	0.53
I ₁₂	0.04	0.1	-0.77	-2.1	0.81	0.01	0.0	-0.77	-2.1	0.78
I ₁₃	-0.07	-0.2	-0.52	-1.4	0.45	-0.01	0.0	-1.16	-3.2	1.15
I ₂₃	1.79	4.8	1.10	3.0	0.69	0.55	1.5	-0.17	-0.5	0.72

$\bar{F}_2 = 37.68$ $\bar{F}_3 = 37.63$ Check mean (F₃) = 36.63
 Simple correlation coefficient between WEV and UEV deviations = 0.786**

Table 6. Continued.

Selection indices	Seed index (g)									
	WEV				D	UEV				D
	Predicted response F ₂		Realized response F ₃			Predicted response F ₂		Realized response F ₃		
	i	ii%	i	ii%	i	ii%	i	ii%		
I _{w12}	-0.01	-0.1	-0.38	-3.7	0.37	0.00	0.0	-0.38	-3.7	0.38
I _{w13}	0.00	0.0	0.38	3.7	-0.38	-0.01	-0.1	0.38	3.7	-0.39
I _{w23}	-0.01	-0.1	-0.14	-1.4	0.13	0.00	0.0	-0.28	-2.7	0.28
I ₁₂₃	-0.01	-0.1	-0.17	-1.7	0.16	-0.01	-0.1	-0.30	-2.9	0.29
I _{w1}	0.00	0.0	-0.19	-1.9	0.19	0.00	0.0	-0.26	-2.6	0.26
I _{w2}	-0.01	-0.1	0.01	0.1	-0.02	0.02	0.2	-0.09	-0.9	0.11
I _{w3}	0.00	0.0	-0.08	-0.8	0.08	0.00	0.0	-0.13	-1.3	0.13
I ₁₂	-0.01	-0.1	-0.19	-1.9	0.18	0.00	0.0	-0.19	-1.9	0.19
I ₁₃	-0.01	-0.1	-0.07	-0.7	0.06	-0.01	-0.1	-0.30	-2.9	0.29
I ₂₃	0.34	3.3	0.42	4.1	-0.08	0.17	1.6	-0.22	-2.2	0.39

$\bar{F}_2 = 10.31$ $\bar{F}_3 = 10.50$ Check mean (F₃) = 10.19
 Simple correlation coefficient between WEV and UEV deviations = 0.780**

Finally, correlation coefficients between WEV and UEV deviations for lint yield and its components (Tables 4, 5 and 6) were positive and significant, indicating that both WEV and UEV took the same direction in improving lint

yield and its components . Furthermore, they gave the trust in index selection.

Means of studied characters in both WEV and UEV scored by each selection index in F_3 generation are shown in Table (7). Performances of WEV application gave the highest value than those of UEV application for lint/seed , boll weight , lint percentage and seed index. Also, the desirable value (low) of micronaire reading was obtained when applying selection index I_{23} in WEV. On the other hand, performances of UEV application were higher than those of WEV for lint yield (I_{w2}) and seeds/boll , pressley index and fiber length (I_{23}). However, both WEV and UEV gave the equal performance for bolls/plant.

Evaluate the correlation coefficients among predicted and realized gains

This study summarized the influence of economic value kinds as important selection indices for improving lint yield. Correlation coefficients among predicted and realized gains resulting from selection indices in both WEV and UEV for yield and its components are presented in Table 8. Predicted gains had positive and significant with realized gains in WEV for lint/seed , boll weight , lint percentage and seed index, but small positive correlations for lint yield , bolls/plant and seeds/boll. Although association of predicted and realized gains in UEV was positive and significant for seeds/boll only, the magnitude was relatively large as compared with the WEV for lint yield and bolls/plant.

Generally, Smith-Hazel index with WEV was found to be the most efficient in improving lint/seed , boll weight , lint percentage , seed index and micronaire reading . UEV index proved to be relatively more efficient as compared to WEV in improving lint yield , seeds/boll, pressley index and fiber length. For handling this deficiency, the use of a recurrent selection that overcomes undesirable linkage through inter-mating and that produces new recombination. Then just like that selection index may be more effective to improve the yield and its components together.

Economic values effects on genetic gains of lint cotton yield and its.....

Table 7

Table 8. Estimates of simple correlation coefficients between predicted and realized gains resulting from selection indices in both WEV and UEV for yield and yield components.

Character	WEV	UEV
LCY/P (x_w)	0.235	0.553
B/P (x_1)	0.526	0.613
S/B (x_2)	0.499	0.662*
L/S (x_3)	0.764*	0.226
BW	0.909**	0.145
L%	0.840**	0.219
SI	0.653*	-0.082

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

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تأثير القيم الاقتصادية علي التحسين الوراثي لمحصول القطن الشعير ومكوناته باستخدام أدلة الانتخاب

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يهدف هذا البحث إلى دراسة تأثير تطبيق طريقتين لحساب القيم الاقتصادية في نموذج دليل الانتخاب (SMITH - HAZEL index) علي التحسين الوراثي لمحصول القطن الشعير، والتجاوب المتلازم لمكونات المحصول، كيفية تأثير درجة التوريث بمعناها العام والارتباط الوراثي علي حصيلة أدلة الانتخاب، دراسة التلازم بين التحسين الوراثي المتوقع والتحسين الوراثي الفعلي لمحصول الشعير ومكوناته في كل من التطبيقين.

ولتحقيق ذلك تم استخدام الجيلين الثاني والثالث لعشيرة من القطن (جيزة ٨٦ X الصنف الروسي ٦٠٢٢) وتم تطبيق طريقتين في نموذج دليل الانتخاب هما طريقة (Walker, 1960) حيث أعطت أهميه نسبية لكل صفة (WEV) وطريقة مساواة الأهمية النسبية لكل صفة بالوحدة (UEV). وأظهرت النتائج مايلي:

١- أعطت المتوسطات والحد الأدنى للمدى قيما اعلي في الجيل الثالث مقارنة بالجيل الثاني لمعظم صفات المحصول ومكوناته. ويرجع ذلك إلي كفاءة تطبيق أدلة الانتخاب في هذه الدراسة.

٢- أظهرت معاملات الارتباط الوراثية معنوية عالية وموجبة بين محصول القطن الشعير/نبات وكل من عدد اللوز/نبات (في الجيلين الثاني والثالث) ، عدد البذور/لوزة ووزن اللوزة (في الجيل الثاني).

٣- أظهر تطبيق القيم الاقتصادية WEV قيما اعلي من UEV للتحسين الوراثي المتوقع لمحصول الشعير لكل أدلة الانتخاب عدا الدليل المتضمن عدد البذور/لوزة ووزن الشعير/بذرة (I23). ويرجع ذلك إلي ارتفاع قيم معاملات الانحدار الجزئية في نموذج الدليل عند

- تطبيق WEV بالمقارنة عند تطبيق UEV. ومع ذلك أظهر التطبيق UEV توافقا ما للتحسين الوراثي المتوقع بالانتخاب مع التحسين الوراثي الفعلي لمحصول القطن الشعير.
- ٤- أظهر دليل الانتخاب المتضمن لصفتي المحصول وعدد البذور/لوزة (I_{w2}) قيم عالية وموثوق بها (به ثبات) لكل من التحسين الوراثي المتوقع بالانتخاب والتحسين الفعلي في كل من التطبيقين WEV و UEV .
- ٥- أظهر دليل الانتخاب المتضمن عدد البذور/لوزة ووزن الشعير/بذرة (I_{23}) أقل قيم للتحسين في محصول الشعير ويرجع ذلك إلي أن التلازم الوراثي بين عدد البذور/لوزة ووزن الشعير/بذرة كان غير معنوي بينما كانت صفة المحصول مرتبطة ارتباطا سالبا ومعنويا مع كل منهما. كما أوضحت تقديرات معاملات الانحدار الجزئية انه عند حذف صفتي محصول القطن الشعير وعدد اللوز/نبات من أدلة الانتخاب فإن صفتي مكونات المحصول الاخرى (عدد البذور/لوزة ووزن الشعير/بذرة) لا تستطيع تعويض الفقد الناتج من حذفهما.
- ٦- أظهرت النتائج أن تطبيق WEV كان أكثر كفاءة من تطبيق UEV في تحسين وزن الشعير/بذرة ، وزن اللوزة ، معدل الحليج ، معامل البذرة وقراءة الميكرونيير. بينما تطبيق القيم الاقتصادية المساوية للوحدة (UEV) كان أكثر كفاءة في تحسين محصول الشعير ، عدد البذور/لوزة ، معامل البريسلي وطول التيلة.
- ٧- لتعظيم الاستفادة من نتائج هذه الدراسة يجب استخدام طريقة الانتخاب الدوري عقب دورة أدلة الانتخاب للتغلب علي التلازمات الغير مرغوبة بين الصفات وإنتاج تراكيب وراثية جديدة تعمل عليها أدلة الانتخاب لتحسين محصول القطن الشعير ومكوناته معا.

تقدير القدرة على الائتلاف والفعل الجيني للجيل الأول والثاني
في بعض هجن قمح الخبز

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الجيزة – مصر

الملخص العربي

يهدف هذا البحث إلى دراسة القدرة على الانتلاف وتقدير الفعل الجيني للمحصول ومكوناته. ثم تقييم الهجن الناتجة من التهجين أحادي الاتجاه لسبعة أصناف وسلالات من قمح الخبز في الجيل الأول والثاني وذلك بمحطة البحوث الزراعية بالجميزة خلال ثلاث مواسم هي ٢٠٠٧ / ٢٠٠٨ ، ٢٠٠٨ / ٢٠٠٩ ، ٢٠٠٩ / ٢٠١٠ لدراسة بعض معايير التربية في تصميم قطاعات كاملة العشوائية ذات ثلاث مكررات لدراسة صفات عدد الأيام حتى طرد السنابل وطول النبات وعدد السنابل في النبات وعدد الحبوب في السنبل ووزن ١٠٠٠ حبة ومحصول النبات الفردي

وكانت أهم النتائج المتحصل عليها كالتالي :

كان التباين الراجع إلي كل من التراكيب الوراثية والآباء والهجن في معظم الصفات معنويا في كل من الجيل الأول والثاني ويبين ذلك وجود اختلافات بين هذه التراكيب .

كان التباين الراجع للقدرة العامة و الخاصة علي التآلف معنويا لكل الصفات المدروسة في الجيل الأول والثاني مما يدل على أهمية كل من الفعل الجيني المضيف و السيادي في وراثه هذه الصفات.

كما كانت نسبة القدرة العامة علي القدرة الخاصة تزيد عن الوحدة في معظم الصفات مما يدل علي أهمية الفعل الجيني المضيف وكذا غير المضيف .

أظهرت الآباء رقم ٢، ٤ تأثير سالب ومعنوي لصفات عدد الأيام حتى طرد السنابل وطول النبات في كل من الجيل الأول والثاني يستفاد بها في الحصول علي تراكيب وراثية مبكرة وذات طول مناسب وكذا الأب رقم ٤ ذات قدرة انتلاف عالية لصفات محصول النبات وعدد الحبوب في السنبله ويمكن الاستفاده به في تحسين هذه الصفات في برامج التربية. وكان الهجين (P1xP6) من أفضل الهجن لغرض تحسين محصول الحبوب حيث أنها أعطت قدرة انتلاف خاصة عالية في كل من الجيل الأول و الثاني.

كان التباين الراجع للتأثر السيادي معنويا لكل الصفات في كلا الجيلين أكثر من التأثير المضيف كما أوضحت الدراسة أن توزيع الجينات الموجبة والسالبة كانت غير منتظمة في الجيلين.

أوضحت النتائج أن درجة التوريث بمعناها الضيق كانت منخفضة في معظم الصفات في كلا الجيلين ماعدا صفة عدد الأيام حتى طرد السنابل في الجيل الأول وعدد السنابل في النبات في الجيل الثاني كانت عالية .

أظهر تحليل التباين وجود سيادة جزئية لصفة عدد الأيام حتى طرد السنابل ووزن ١٠٠٠ حبة في الجيل الأول وطول النبات في الجيل الأول و الثاني أما السيادة الفائقة كان لها دور مهم في وراثة عدد السنابل علي النبات وعدد الحبوب في السنبلة بينما أظهر محصول الحبوب للنبات سيادة تامة في كل من الجيل الأول والثاني .

Table 7. Means of traits studied in both WEV and UEV scored by each selection index in F₃ generation.

Indices	LCY/P (x _w)		B/P (x ₁)		S/B (x ₂)		L/S (x ₃)		BW (g)		L%		SI (g)		MR		PI		2.5%SL (mm)	
	WEV	UEV	WEV	UEV	WEV	UEV	WEV	UEV	WEV	UEV	WEV	UEV	WEV	UEV	WEV	UEV	WEV	UEV	WEV	UEV
I _{w12}	26.37	26.37	22.86	22.86	20.23	20.23	0.059	0.059	3.24	3.24	36.69	36.69	10.12	10.12	4.94	4.94	10.22	10.22	34.24	34.24
I _{w13}	26.16	26.16	22.67	22.67	18.09	18.09	0.066	0.066	3.17	3.17	37.82	37.82	10.88	10.88	4.95	4.95	10.20	10.20	34.19	34.19
I _{w23}	29.75	28.92	26.70	26.50	18.57	18.79	0.061	0.059	3.05	3.02	36.99	36.58	10.37	10.22	4.98	5.00	10.12	10.12	34.23	34.30
I ₁₂₃	29.44	28.63	26.73	26.39	18.58	18.82	0.060	0.059	3.03	3.01	36.85	36.47	10.33	10.20	4.99	5.00	10.16	10.19	34.32	34.31
I _{w1}	29.59	29.01	26.78	26.59	18.65	18.68	0.060	0.059	3.04	3.01	36.86	36.65	10.31	10.24	5.00	5.00	10.13	10.11	34.31	34.30
I _{w2}	29.94	30.09	26.33	26.12	18.55	18.88	0.063	0.062	3.11	3.14	37.29	37.39	10.51	10.41	4.97	4.96	10.12	10.14	34.20	34.21
I _{w3}	29.99	29.89	26.54	26.68	18.71	18.64	0.062	0.061	3.10	3.07	37.08	37.02	10.42	10.38	4.98	4.99	10.16	10.12	34.26	34.27
I ₁₂	29.59	29.59	26.78	26.78	18.65	18.65	0.060	0.060	3.04	3.04	36.86	36.86	10.31	10.31	5.00	5.00	10.13	10.13	34.31	34.31
I ₁₃	29.99	28.63	26.60	26.39	18.61	18.82	0.062	0.059	3.09	3.01	37.11	36.47	10.44	10.20	4.96	5.00	10.14	10.19	34.24	34.31
I ₂₃	24.07	23.34	17.90	18.69	19.90	20.79	0.069	0.062	3.53	3.42	38.73	37.46	10.92	10.29	4.88	4.89	10.20	10.28	34.35	34.40
S \bar{x} (F ₃)	3.47		3.11		0.93		0.0019		0.15		0.50		0.22		0.09		0.20		0.54	

