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A Study of Phenotypic and Genotypic Correlations and Path Analysis of Seed Cotton Yield Components in Egyptian Cotton Varieties (*G. barbadense* L)

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Abstract

Two sets of Egyptian cotton varieties were evaluated under early and late plantings. The first set included 16 cultivated and obsolete varieties and were evaluated for two seasons at Assiut Univ. Exper. Farm. The second set was selected from the first one; four varieties tolerant to late planting and four susceptible. The second set of varieties was evaluated in the third season at Shandaweel Res. Stn. Cott. Res. Ins. ARC. The combined analysis of variance of each set indicated insignificant interaction of years × dates, years × varieties and years × varieties × dates. However, the main effects of dates and varieties were significant ($p \leq 0.01$). The genotypic and phenotypic correlations were estimated among seed cotton yield / plant, lint yield / plant, boll weight, number of bolls / plants and seed index. Phenotypic and genotypic correlations coefficients were very close and sometimes similar. Under early planting of the first set of varieties; lint yield / plant showed the highest genotypic correlation (0.989) with seed cotton yield / plant followed by number of bolls / plant (0.856) and boll weight (0.296). However, the genotypic correlation of seed index with seed cotton yield / plant was very small (0.042). The results indicated negative correlation between number of bolls and boll weight. The phenotypic and genotypic correlations under late planting and for the second set of varieties showed nearly the same trend. The study of path analysis in the two sets of varieties under early and late plantings indicated that lint yield / plant mostly showed the large direct effect on seed cotton yield, and when its direct effect was negative, it affected seed cotton yield via number of bolls and boll weight. The direct effect of number of bolls / plant on seed cotton yield / plant was high, and followed by boll weight. The results revealed that simultaneous selection based on lint yield / plant, number of bolls / plant and boll weight could be promising to breakthrough in seed cotton yield / plant.

***Keywords**: Egyptian cotton, phenotypic and genotypic correlations, seed cotton yield, path analysis.*

Introduction

Cotton crop is the first important fiber crop worldwide because it provides the raw material to the entire textile industry (Abd El-Mohsen and Amein 2016). The Egyptian cotton "*Gossypium barbadense* L." is a peculiar type of cotton that is characterized by softness, strength, superior characteristics, high quality, and gained a world-wide reputation for more than a century and half as being of the highest lint quality among world cottons (Abdel-Salam *et al* 2009).

Presently, the area devoted to cotton cultivation are decreasing leading to reduced cotton productivity and projected cotton production. One of the biggest cotton farming problems is the delaying of sowing date after 31st March, which is the latest recommended date for sowing Egyptian in determinant and full-season genotypes. For that, the long duration winter crops are not encouraged to sow before cotton. Many research reports show that cotton genotypes are greatly affected in both yield and fiber traits by delaying planting date. With this unavoidable problem, Egyptian cotton breeders must look for generating a new wave of Egyptian genotypes adapted to late planting (Abdalla, 2013). Seed cotton yield is a resultant product of all its component traits and it could be improved by exploiting the positive influence of yield components. To enhance the yield potential of cotton varieties especially under late planting dates, an understanding of the nature, mean performance, extent of the relationship among different yield contributing characters is of more importance, besides, knowledge about the direct contribution of different characters to seed cotton yield would be highly important for an effective selection procedure for improving the yield indirectly (Thiyagu, *et al.* 2010; Wadeyar and Kajjidoni, 2014).

Correlation coefficient analysis measures the magnitude of relationship between various plant characters and determines the component character on which selection can be based for improvement of seed cotton yield. Furthermore, the true picture of correlation between seed cotton yield and traits is reflected from direct and indirect effects to perceive the most influencing characters to be utilized as selection criteria in cotton breeding program (Tulasi *et al.* 2012). Path coefficient analysis provides an effective means of partitioning correlation coefficients into unidirectional pathways and alternate pathways thus permitting a critical examination of specific factors that produce a given correlation which can be successfully (Salahuddin *et al.* 2010). Both techniques have been extensively used by cotton breeders under optimum and stress conditions (Iqbal *et al.* 2003, Wang *et al.* 2004, and Latif *et al.* 2015) but lesser extent under late plantings. DeGui *et al.* (2003) studied yield and yield components and found that the higher yield in cotton cultivars was mainly due to more number of bolls per plant. Abdel-Salam *et al*. (2009) and Salahuddin *et al.* (2010) reported that bolls per plant, boll weight and lint index were correlated positively with yield per plant. In addition, after partitioning the correlation coefficients into direct and indirect path ways, they found that bolls per plant and boll weight were the most influencing characters on seed cotton yield, which should be taken care of while selecting for higher yields in further breeding program. The present study was designed to provide information and understand the relationship of seed cotton yield and its components and to partition the genotypic and phenotypic correlations into their direct and indirect effects under early and late planting dates.

Materials and Methods

The present study was carried out at Assiut Univ. Exper. Farm in seasons of 2014 and 2015, and at Shandaweel Research Station. Sohag, Cotton Res. Inst., ARC, in the third season (2016). The basic materials were sixteen divergent Egyptian cotton varieties belong to *G. barbadense* L. These varieties are shown in Table 1. The pure seeds of these varieties were obtained from Cotton Research Institute, Agricultural Research Center at Giza, Egypt. The name, pedigree and the main characteristics of these varieties are presented in Table1.

First season (2014): The sixteen genotypes shown in Table 1 were sown at Assiut Univ. Exper. Farm on the 29th March (early plating date) and on the 28th April (late plating date) in a randomized complete blocks design of three replications for each date. Each plot consisted of two rows, four-meter-long, 0.6 m apart and 40 cm between hills within a row. After full emergence, seedlings were thinned to one plant per hill. The recommended cultural practices were adopted throughout the growing season. The characters recorded on each plot were seed cotton yield/ plant; g (SCY/P), lint yield/plant; g (LY/P), number of bolls /plant (NB/P), boll weight; g (BW) and seed index; g (SI). In 2015 the two experiments of the first season were repeated. Four varieties tolerant to late plating (Giza 95, Giza 90, Giza 80, and Giza 90 × Australian) and four sensitive to late plating (Giza 92, Giza87, Giza86, and Giza45) were crossed in a nursery in all possible combinations excluding reciprocals to produce twenty-eight hybrid seeds. In the third season (2016), the eight parents with their 28 F_1 hybrids were sown on the 29th of March (early) and 1st May (late planting date)as in the first season. All cultural practices were followed throughout the growing season as usually done with ordinary cotton cultivation. The characters were recorded as in the previous seasons except that the plot size was one row. The analysis of variance was performed for a randomized complete block design as outlined by Steel and Torrie (1980). The phenotypic and genotypic correlations between pairs of traits were estimated as Al-Jibouri *et al.* (1958). The path coefficient analysis was done as outlined by Dewey and Lu (1959). The path analysis and path coefficient were done on the parents only.

Table 1. The name, pedigree and the main characteristics of the varieties

Genotype	Pedigree	Characteristics
Giza 95	**[(G.83 × (G.75 × 5844)) × G.80]**	A new long staple cotton variety, characterized by high yielding ability, high lint percentage, early maturity and heat tolerance (cultivated).
Giza 92	**G84(G74 x G68)**	An extra-long staple variety, (cultivated).
Giza 90	**Giza83× Dandara**	Long staple variety for upper Egypt, high yield and lint percentage (cul-tivated).
Giza 90 × Aus	**Giza90 × Australian**	Characterized by high yielding and earliness (cultivated).
Giza 88	**G77 x G45B**	An extra-long staple variety, (cultivated).
Giza 87	**(G.77×G.45A)**	An extra-long staple (cultivated).
Giza 86	**(G.77×G.45B)**	Long staple variety, characterized by high yield and extra fineness of fiber (cultivated).
Giza 85	**G. 67×CB 58**	A long staple variety, characterized by high yield and earliness variety (obsolete).
Giza 81	**G67× (5844)**	Long stable variety (cultivated).
Giza 80	**G. 66×G. 73**	Long staple variety. It is high yield and lint percentage (cultivated).
Giza 77	**G77×G68**	An extra-long staple variety (obsolete).
Giza 69	**G51أ×G30**	Long stable variety (obsolete).
Giza 45	**G. 7×G. 28**	An extra-long staple variety, (obsolete).
Ashmouni	**G1**	Long stable variety (obsolete).
Menoufi	**G.12×Shaka 3**	An extra-long staple, characterized by high lint percentage and compact (obsolete).
Dandara	**Selected from Giza-3**	Long stable variety(obsolete).

Results and Discussion

A. Analysis of variance

The present study is a part of work designed to study the genetic parameters in Egyptian cottons and to identify populations adapted to late planting. Two sets of Egyptian cottons varieties were evaluated for two seasons in one location under early and late planting dates. The first set (16 varieties) included the cultivated and some obsolete varieties. The second one included four susceptible and for tolerant to late planting were evaluated for three seasons and crossed in all possible combinations to study the genetic analysis of cotton yields and correlated traits. The combined analysis of each set (not included) indicated insignificant interactions of years × dates, years × varieties and years × varieties × dates of planting. However, the main effects of dates and varieties were significant ($p \leq 0.01$). Therefore, the combined analyses of varieties over years under early and under late planting were done separately (Table 2). The differences among varieties under early and late planting of two set of varieties were significant ($p \leq 0.01$).

Table 2. Mean squares of the combined analysis of the studied traits of the 16 and 8 varieties over years under early and late plantings

		Early planting (16 varieties)					Late planting (16 varieties)				
S.O.V	**d.f**	**SCY/P**	**LY/P**	**BW**	**NB/P**	**SI**	**SCY/P**	**LY/P**	**BW**	**NB/P**	**SI**
Years(Y)	**1**	17.69	1.92	0.02	0.03	0.06	16.06	2.53	0.07	1.55	0.18
Reps/ Y	**4**	94.58	10.78	0.13	22.51	0.15	8.70	1.53	0.03	3.29	0.05
Varieties(v)	**15**	1608.70**	374.70**	0.50**	198.23**	3.74**	1299.43**	277.33**	0.10**	264.11**	3.24**
V× Y	**15**	3.52	1.11	0.01	1.48	0.22	3.98	0.54	0.01	4.25	0.02
Error	**60**	61.07	9.32	0.04	11.31	0.10	50.55	7.01	0.02	13.24	0.04
		Early planting (8 varieties)					**Late planting (8 varieties)**				
S.O.V	**d.f**	**SCY/P**	**LY/P)**	**BW**	**NB/p**	**SI)**	**SCY/P**	**LY/P**	**BW**	**NB/p**	**SI**
Years(Y)	**1**	5.56	0.85	0.00	1.21	0.05	26.50	6.94	0.03	3.29	0.12
R × Y	**4**	57.85	6.17	0.02	6.89	0.19	16.71	2.46	0.04	10.04	0.01
Varieties(v)	**7**	3908.97**	963.33**	0.87**	483.01**	4.04**	2793.65**	652.61**	0.14**	603.84**	2.22**
V× Y	**7**	6.14	2.16	0.02	1.63	0.02	1.79	0.49	0.01	3.87	0.02
Error	**28**	82.89	12.26	0.04	14.59	0.08	64.34	9.32	0.03	14.53	0.04

** Significant at 0.01 level of probability.

B. Phenotypic and genotypic correlations

Study the correlation coefficients among contributing traits of seed cotton yield provides a reliable measure of associations useful in breeding for seed cotton yield. The genotypic and phenotypic correlations among seed cotton yield / plant and its contributing traits for the first set of varieties (16 varieties) under early and late planting dates are shown in Table 3. Phenotypic and genotypic correlation coefficients were very close together and some limes were similar. This could be due to the small error variance. Under early and late planting seed cotton yield /plant showed the highest genotypic correlation (0.989) with lint yield / plant followed by the correlation with number of bolls/plant (0.856) and boll weight (0.296). However, the genotypic correlation of seed cotton yield / plant and seed index was very small (0.042). The genotypic correlation of lint yield / plant was high with number of bolls / plant (0.820), followed by the correlation with boll weight (0.345). The genotypic correlation between boll weight and seed index was positive, high and expected (0.736). Another genotypic correlation worthy of attention were the negative correlation between number of bolls /plant and each of boll weight (-0.241) and seed index (-0.357). Therefore, simultaneous improvement of boll weight and number of bolls in Egyptian cotton is difficult because of this unfavorable negative correlation. The small boll size of Egyptian cotton is an obstacle to improve yield. The high yielding plants produced high number of bolls rather than heavy bolls. Recurrent selection could be effective in breaking up such unfavorable linkage groups for simultaneous improvement of boll weight and number of bolls / plant.

Table 3. Phenotypic (above diagonal) and genotypic (below diagonal) correlation coefficients among the studied traits of sixteen and eight varieties under early and late planting dates

	16 varieties over two seasons									
	Early planting date					Late planting date				
	SCY/p	LY/p	BW	NB/p	SI	SCY/p	LY/p	BW	NB/p	SI
SCY/p		0.989	0.298	0.852	0.037		0.986	0.283	0.957	0.216
LY/p	0.989		0.344	0.817	0.040	0.986		0.312	0.935	0.200
BW	0.296	0.345		-0.252	0.718	0.284	0.312		0.043	0.385
NB/p	0.856	0.820	-0.241		-0.347	0.965	0.942	0.054		0.074
SI	0.042	0.045	0.736	-0.357		0.215	0.200	0.385	0.074	
	Eight varieties over three seasons									
	Early planting date					Late planting date				
	SCY/P	LY/P	BW	NB/P	SI	SCY/P	LY/P	BW	NB/P	SI
SCY/P		0.993	0.255	0.898	-0.057		0.992	0.056	0.968	0.191
LY/P	0.993		0.324	0.860	0.000	0.992		0.125	0.947	0.277
BW	0.266	0.339		-0.186	0.801	0.079	0.176		-0.220	1.021
NB/P	0.900	0.862	-0.187		-0.440	0.971	0.949	-0.208		-0.023
SI	-0.057	0.000	0.845	-0.438		0.195	0.283	1.021	-0.023	

Under late planting the genotypic and phenotypic correlations among traits of the 16 varieties were very close together. The genotypic correlations between seed cotton yield and lint yield was high (0.986) followed by number of bolls / plant (0.965), boll weight (0.284) and seed index (0.215). Otherwise, the negative correlations between number of bolls and each of boll weight and seed index obtained under early planting changed to very small positive of 0.054 and 0.074; respectively under late planting.

The phenotypic and genotypic correlations among traits of eight varieties (Table3) evaluated for three years under early planting showed the same trend and lend support to the conclusion from that of the sixteen varieties. However, under late planting, the genotypic correlations of boll weight with yields decreased than those under early planting. Ahuja *et al.* (2006) found positive correlations between seed cotton yield and each of number of bolls /plant and boll weight at genotypic and phenotypic levels of three sets of genotypes. Farooq *et al.* (2014), Wadeyar and Kajjidoni(2014) and Latif *et al.*(2015) came to the same conclusion.

C. Path - coefficient analysis of the first set of varieties

Path - coefficient analysis is an effective method to study direct and indirect effects of characters on the dependent variable; seed cotton yield / plant. Study of path - coefficient enable the breeder to identify few characters of high direct effects on seed cotton yield. This helps the breeder to restrict selection for few important traits and reduce time and effort (Wadeyar and Kajjidoni, 2014). The genotypic and phenotypic correlation coefficients of seed cotton yield with its contributing traits were partitioned to direct and indirect effects and shown in Table4 for the first set of cotton varieties. Figures 1,2,3 and 4 facilitate the understanding of the cause and effect system, in which seed cotton yield / plant isa result of lint yield / plant, boll weight, number of bolls / plant and seed index.

Under early planting of the first set of genotypes, the correlations coefficient of lint yield / plant with seed cotton yield /plant (Table 4) was positive and very large in magnitude (0.989) under phenotypic and genotypic levels. However, it showed negative direct effect of (-1.949) at phenotypic and (-0.186) at genotypic level. Otherwise, lint yield showed high positive indirect effects via number of bolls / plant of 2.313 and 0.951, and via boll weight of 0.635 and 0.224 at phenotypic and genotypic levels; respectively.

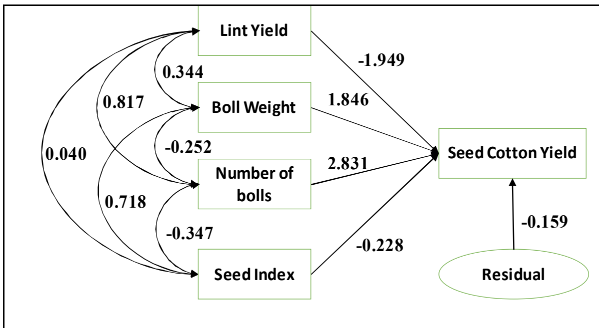

Fig.1.Path analysis of SCY and its components of the 16 varieties calculated based on phenotypic corrlation under early planting dates

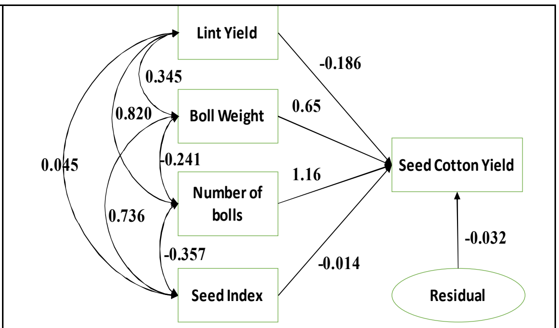

Fig.2. Path analysis of SCY and its components of the 16 varieties calculated based on genotypic correlation under early planting dates

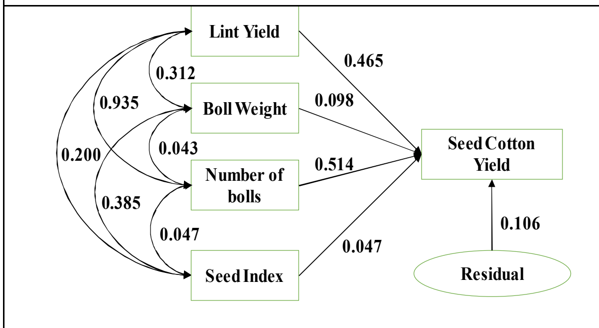

Fig.3. Path analysis of SCY and its components of the 16 varieties calculated based on phenotypic correlation under late planting dates

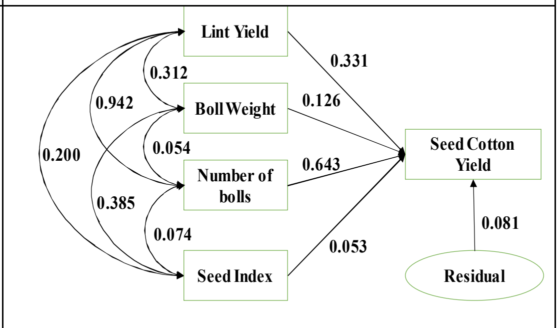

Fig.4. Path analysis of SCY and its components of the 16 varieties calculated based on genotypic correlation under late planting dates

Partitioning the correlation coefficients of boll weight, number of bolls / plant and seed index with seed cotton yield to their direct and indirect effects indicated that the direct effect of number of bolls / plant was the highest followed by boll weight. However, the direct effect of seed index on seed cotton yield / plant was negative and negligible. Study the correlation coefficients (Table 3) under early planting indicated that the highest correlation with seed cotton yield /plant was recorded to lint yield / plant followed by number of bolls / plant and boll weight. However, the path analysis showed somewhat different picture. The direct effect of lint yield / plant was the highest and negative (-1.949) at genotypic level, and the effect of lint yield / plant was indirect effects via number of bolls / plant and boll weight. Rauf *et al.* (2004) and Farooq *et al.* (2014) found positive direct effect of boll weight on seed cotton yield / plant. Wadeyar and Kajjidoni, (2014) and latif *et al.* (2015) noted that the correlation and path analysis together indicated that number of bolls/plant and boll weight should be considered when selection practiced for seed cotton yield / plant.

Under late planting, the correlation coefficients of lint yield / plant with seed cotton yield / plant was (0.986) in both phenotypic and genotypic levels. The direct effect of lint yield / plant was (0.465) at phenotypic and (0.331) at genotypic level. However, the indirect effects of lint yield on seed cotton yield via number of bolls / plant was the highest one. Phenotypic (0.283) and genotypic (0.284) correlation of boll weight with seed cotton yield showed low direct effects on seed cotton yield. The highest direct effects on seed cotton yield were for number of bolls/ plant, which scored phenotypic (0.514) and genotypic (0.643) direct effects.

Table 4. Direct and indirect effects based on phenotypic and genotypic correlations of lint yield (LY), boll weight (BW), number of bolls per plant (NB) and seed index (SI) with seed cotton yield (SCY) under early and late planting dates for 16 varieties over two seasons.

Effect	**Early planting**		**Late planting**	
	Phenotypic	**Genotypic**	**Phenotypic**	**Genotypic**
Correlation between SCY and LY	0.989	0.989	0.986	0.986
Direct effect of LY on SCY	-1.949	-0.186	0.465	0.331
Indirect effect of LY via BW	0.635	0.224	0.03	0.039
Indirect effect of LY via NB	2.313	0.951	0.481	0.606
Indirect effect of LY via SI	-0.009	-0.0006	0.009	0.011
Total effect	0.989	0.989	0.986	0.986
Correlation between SCY and BW	0.298	0.296	0.283	0.284
Direct effect of BW on SCY	1.846	0.65	0.098	0.126
Indirect effect of BW via LY	-0.671	-0.064	0.145	0.103
Indirect effect of BW via NB	-0.713	-0.28	0.022	0.035
Indirect effect BW via SI	-0.164	-0.01	0.018	0.02
Total effect	0.298	0.296	0.283	0.284
Correlation between SCY and NB	0.852	0.856	0.957	0.965
Direct effect of NB	2.831	1.16	0.514	0.643
Indirect effect of NB via LY	-1.593	-0.152	0.435	0.311
Indirect effect of NB via BW	-0.465	-0.157	0.004	0.007
Indirect effect of NB via SI	0.079	0.005	0.004	0.004
Total effect	0.852	0.856	0.957	0.965
Correlation between SCY and SI	0.037	0.042	0.216	0.215
Direct effect of SI	-0.228	-0.014	0.047	0.053
Indirect effect of SI via LY	-0.078	-0.008	0.093	0.066
Indirect effect of SI via BW	1.325	0.478	0.038	0.048
Indirect effect of SI via NB	-0.982	-0.414	0.038	0.048
Total effect	0.037	0.042	0.216	0.215
Residual effect	-0.159	-0.032	0.106	0.081

It could be concluded that, respect to the sixteen varieties evaluated for two seasons under late planting; the highest direct effect was for number of bolls / plant followed by lint yield and boll weight, while, the effect of seed index in improving seed cotton yield was low and negligible. These results are in agreement with those reported by Ahuja *et* *al.*(2006), Tulasi *et al.*(2012), Farooq *et al.*(2014), Wadeyar and Kajjidoni (2014) and latif *et al.* (2015).

D. Path- coefficient analysis of the second set of varieties

The phenotypic and genotypic correlation coefficients of seed cotton yield/ plant with its contributing traits of the eight selected varieties evaluated for three seasons were partitioned to direct and indirect effects and presented in Table 5. Figures 5,6,7 and 8 facilitates the understanding of the cause and effect system in which seed cotton yield / plant is a result of lint yield / plant, boll weight, number of bolls /plant and seed index. Under early planting the phenotypic and genotypic correlation of lint yield / plant with seed cotton yield / plant were similar (0.993).

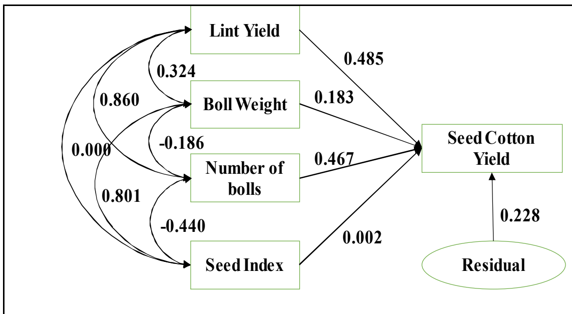

Fig.5. Path analysis of SCY and its components of the 8 varieties calculated based on phenotypic correlation under early planting dates

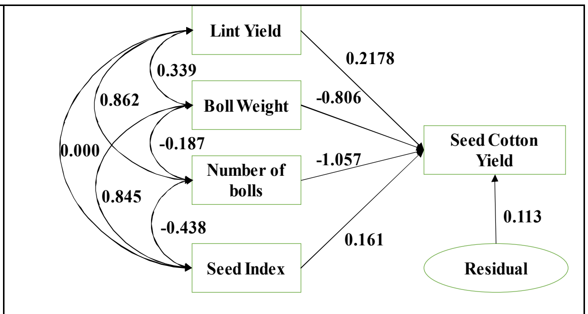

Fig.6. Path analysis of SCY and its components of the 8 varieties calculated based on genotypic correlation under early planting dates

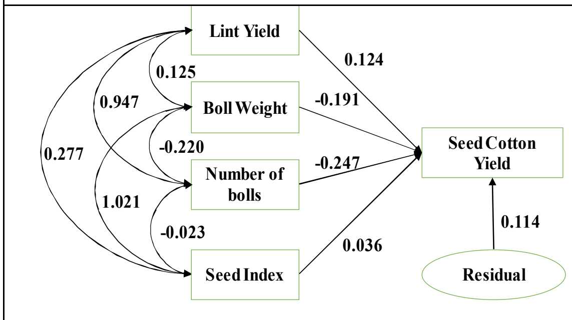

Fig.7. Path analysis of SCY and its components of the 8 varieties calculated based on phenotypic correlation under late planting dates

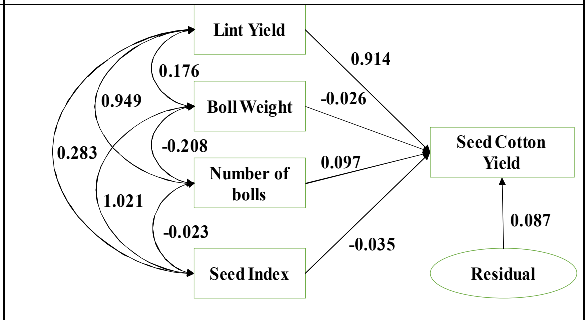

Fig.8. Path analysis of SCY and its components of the 8 varieties calculated based on genotypic correlation late planting dates

However, the direct effect of lint yield / plant was positive and differed greatly at phenotypic (0.485) and genotypic (2.178) levels. Furthermore, it differed from those negative direct effects in the first set of varieties. At phenotypic levels the effects of lint yield on seed cotton yield were through direct effects (0.485) and indirect effects via number of bolls / plant (0.449) and little via boll weight (0.059). The effect of lint yield via seed index was zero. At phenotypic levels, lint yield / plant worked through its direct effects on seed cotton yield / plant only, since its indirect effects were negative via number of bolls / plant (-0.911) and boll weight (-0.273). The phenotypic and genotypic correlation coefficients of the other traits; boll weight, number of bolls / plant and seed index were very close together or similar. Otherwise, their direct and indirect effects on seed cotton yield / plant mostly differed in sign and magnitude from phenotypic to genotypic level. The direct effects of boll weight were (0.183) and (-0.806), of number of bolls/ plant were (0.466) and (-1.057) and of seed index were (0.002) and (0.161) for phenotypic and genotypic levels; respectively. Under late planting the direct effects were (1.24) and (0.914) for lint yield / plant, (-0.191) and (-0.026) for boll weight, (-0.247) and (0.097) for number of bolls / plant and (0.036) and (-0.035) for seed index at phenotypic and genotypic levels; respectively.

Table 5. Direct and indirect effects based on phenotypic and genotypic correlations of lint yield (LY), boll weight (BW), number of bolls per plant (NB) and seed index (SI) with seed cotton yield (SCY) under early and late planting dates for 8 varieties over three seasons.

Effect	Early planting		Late planting	
	Phenotypic	Genotypic	Phenotypic	Genotypic
Correlation between SCY and LY	0.993	0.993	0.992	0.992
Direct effect of LY on SCY	0.485	2.178	1.24	0.914
Indirect effect of LY via BW	0.059	-0.273	-0.024	-0.005
Indirect effect of LY via NB	0.449	-0.911	-0.234	0.092
Indirect effect of LY via SI	0.0	0.0	0.01	-0.01
Total effect	0.993	0.993	0.992	0.992
Correlation between SCY and BW	0.255	0.266	0.056	0.079
Direct effect of BW on SCY	0.183	-0.806	-0.191	-0.026
Indirect effect of BW via LY	0.157	0.738	0.155	0.161
Indirect effect of BW via NB	-0.087	0.198	0.054	-0.02
Indirect effect BW via SI	0.001	0.136	0.037	-0.036
Total effect	0.255	0.266	0.056	0.079
Correlation between SCY and NB	0.898	0.90	0.968	0.971
Direct effect of NB	0.467	-1.057	-0.247	0.097
Indirect effect of NB via LY	0.466	1.877	1.174	0.868
Indirect effect of NB via BW	-0.034	0.151	0.042	0.005
Indirect effect of NB via SI	-0.00073	-0.07	-0.00084	0.0008
Total effect	0.898	0.9	0.968	0.971
Correlation between SCY and SI	-0.057	-0.057	0.191	0.195
Direct effect of SI	0.002	0.161	0.036	-0.035
Indirect effect of SI via LY	0.0	0.0	0.343	0.259
Indirect effect of SI via BW	0.147	-0.681	-0.195	-0.026
Indirect effect of SI via NB	-0.206	0.463	0.006	-0.002
Total effect	-0.057	-0.057	0.191	0.195
Residual effect	0.228	0.113	0.114	0.087

It is obvious that both direct and indirect effects differed under late planting from that under early planting.

Generally, it could be concluded that either under early or under late planting the direct effects of lint yield / plant on seed cotton yield / plant was the highest one. Furthermore, the effects of boll weight, number of bolls /plant and seed index on seed cotton yield / plant were via lint yield /plant, which was positive in all cases except with seed index under early planting.

The study of path analysis in the two sets of varieties under early or late planting indicated that lint yield / plant showed large direct effects on seed cotton yield / plant, and when its direct effects was negative it affected seed cotton yield / plant via number of bolls / plant and boll weight. The direct effects of number of bolls / plant on seed cotton yield / plant was high followed by boll weight, and the two traits affected seed cotton yield via lint yield / plant. Otherwise, the effect of seed index on seed cotton yield / plant was low and negligible.

Conclusion

Study of genotypic and phenotypic correlations and path analysis revealed that simultaneous selection based on lint yield, number of bolls / plant and boll weight could be promising to breakthrough in seed cotton yield / plant.

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دراسة الارتباط المظهري و الوراثي و معامل المرور لمحصول القطن الزهر ومكوناته في أصناف القطن المصري (جوسبيم باربادنس)

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الملخص

تم تقييم مجموعتين من اصناف القطن المصري في ميعاد مبكر وميعاد متأخر. شملت المجموعة الاولى ١٦ صنف مزروعة ومستبعده من الزراعة ، قيمت لمدة عامين بمزرعة كلية الزراعة جامعة أسيوط. المجموعة الثانية عباره عن ٨ اصناف انتخبت من المجموعة الاولى فمنها اربعة اصناف حساسة لميعاد الزراعة المتأخر واربعة اصناف متحمله ، وقيمت الثمانية اصناف للسنه الثالثة بمزرعة محطة بحوث شندويل – مركز البحوث الزراعية. واظهر التحليل المشترك في المجموعتين عدم معنوية السنوات × المواعيد والسنوات × الاصناف، السنوات × المواعيد× الاصناف. وكانت التأثيرات الرئيسية وهى مواعيد الزراعة والاصناف معنويه جدا. حسبت الارتباطات الوراثية والمظهرية بين محصول القطن الزهر وكل من محصول القطن الشعر و وزن اللوزة وعدد اللوز ومعامل البذرة. وكانت قيم الارتباط المظهري والوراثي متقاربه ومتطابقة في بعض الاحيان. وفى الميعاد المبكر للمجموعة الاولى كان الارتباط الوراثي للمحصول القطن الزهر وكل من محصول الشعر (٠,٩٨٩) وعدد اللوز (٠,٨٥٦) و وزن اللوزة (٠,٢٩٦)، وكان الارتباط صغير مع معامل البذرة (٠,٠٤٢). كما اظهرت النتائج ارتباط سالب بين عدد اللوز وزن اللوزة. وكانت الارتباط المظهري والوراثي في الميعاد المتأخر وكذلك في المجموعة الثانية لها نفس الاتجاه السالب. وتشير نتائج معامل المرور لمجموعتي الاصناف تحت ظروف الزراعة المبكرة والمتأخرة تشير الى ان محصول الشعر له اكبر تأثير مباشر على محصول الزهر، واذا كان تأثيره المباشر سالبا فان تأثيره غير المباشر عاليا من خلال عدد اللوز و وزن اللوزة. وتشير النتائج الى ان الانتخاب الذى يعتمد على محصول الشعر / نبات وعدد اللوز على النبات و وزن اللوزة يكون ذو فائدة كبيره في زيادة محصول القطن الزهر / نبات.