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CORRELATION AND PATH COEFFICIENT ANALYSIS FOR YIELD AND ITS COMPONENTS IN EGYPTIAN COTTON

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ABSTRACT

The present study was carried out at Cotton Research Institute experiment field at El-Minia Governorate during ٢٠١٠ and ٢٠١١ seasons. The study aimed to obtain the information on genotypic correlations, direct and indirect effects of most yield components on seed cotton yield. The genotypic correlation coefficient between seed cotton yield with the other six yield components in the first cycle of selection were worked out and showed that, seed cotton yield was significant positively correlated with three traits namely number of bolls / plant (٠.٩١), lint yield / plant (٠.٨٩) and seed index (٠.٣٧). Very high positive direct effect was observed for number of bolls per plant (١.٠٣) and high positive effect for boll weight (٠.٤١). After one cycle of selection for seed cotton yield/plant, the genotypic correlation between this trate and all the studded traits was highly significant and positively, which was high with number of bolls/plant (٠.٨٦) and boll weight (٠.٨٨), and moderate with lint yield (٠.٤٨), lint percentage (٤٥), lint index (٠.٥٥) and seed index (٤٤). In the second cycle of selection for seed cotton yield/plant, high and positive direct effect was observed for number of bolls per plant (٠.٦٤) and moderate positive effect for lint yield /plant (٠.٤١), followed by lint index (٣٩). The results of the present study revealed that the main effect

on seed cotton yield/plant was the number of bolls/ plant which positively correlate with genotypic in the two cycles of selection

INTRODUCTION

Seed cotton yield is a complex trait and highly susceptible to environment and genetic factors. These factors contribute to seed cotton production both directly and indirectly, and the breeder is naturally interested in explaining the extent and type of association of such traits. Expression of various traits is often changed as the changing breeding material and environment. Therefore the information of character associations between the traits themselves and with the yield is important for the breeding material subjected to selection for high yielding genotypes. Correlation coefficient analysis measures the magnitude of relationship between various plant characters and determine the component character on which selection can be based for improvement in seed cotton yield. The true picture of correlation between seed cotton yield and traits is reflected from direct effect of that trait which will help for identifying the trait that contribute directly to improve seed cotton yield.

Path coefficients have been used to develop selection criteria for complex traits in several crop species (Bhatt, ١٩٧٣; Kang *et al.,* ١٩٨٣; Kotaiah, ١٩٧٣ and Tariq, *et al*. ١٩٩٢). Path coefficients are the subdivision of genotypic correlation coefficients of individual characters with seed cotton yield. Study of path coefficients enable breeders to concentrate on the variable which shows high direct effect on seed cotton yield. Ultimately we can reduce the time in looking for more number of component traits by restricting selection to one or few important traits (Dewey and Lu, ١٩٥٩). The present study was carried out to obtain the information on genotypic correlations, direct and indirect effects of different factors effect on seed cotton yield for utilization in the improvement of cotton yield.

MATERIALS AND METHODS

Correlation and path coefficient analysis

The present study was carried out at experiment field of Cotton Research Institute, El-Minia Governorate, during ٢٠١٠ and ٢٠١١ seasons. The basic materials consisted of ٥٠ $F_{٤}$ families from Egyptian cotton Population (Giza ٨٣ x Dandara). The experimental design was a randomized complete block design with three replications. The plot size was one row, ٤ m long, ٦٠ cm width and ٤٠ cm between hills within a row. After full emergence, seedlings were thinned to one plant per hill (١٠ plants/row). The recommended cultural practices were adopted throughout the growing season. At the end of the growing season two pickings were done on individual plant basis to select the best plant from the best families in seed cotton yield/plant to reform the second cycle of pedigree selection. The following characters were recorded on each family mean: seed cotton yield/plant, g. (SCY), lint yield/plant, g. (LY), lint percentage (LP), number of bolls /plant (NB), boll weight, g. (BW), seed index, g (SI), and lint index (LI).

The genotypic correlation between pairs of traits was estimated as the following formula: $(r\ g_{١٢}) = (Cov.\ g_{١٢}) / \sqrt{(\sigma^{٢}g_{١} \times \sigma^{٢}g_{٢})}$ **Al-Jibouri *et al.* (١٩٥٨)**

Whereas: $\sigma^{٢}g_{١}$ is the genotypic variance for trait ١.

$\sigma^{٢}g_{٢}$ is the genotypic variance for trait ٢.

The path analysis was estimated according to the method suggested by **Deway and Lu (١٩٥٩),** to estimate the direct and indirect effect.

RESULTS AND DISCUSSION

The genotypic correlation coefficient between seed cotton yield with the other six yield components and also among the traits themselves were worked out and presented in Table ١. Seed cotton yield was significant and positively correlated with three traits namely number of bolls / plant (٠.٩١), followed by lint yield / plant (٠.٨٩) and seed index (٠.٣٧). However, boll weight and lint index recorded positive and low correlation with yield. But, seed cotton yield was

significant and negatively correlated with lint percentage (- ٠.٥٠). Selection for the first three characters will help in selecting families with high seed cotton yield / plant. Moreover, number of bolls / plant was significant and positively correlated with lint yield /plant, and boll weight showed significant and positive correlation with lint index (٠.٦٩) and with seed index (٠.٤٩). These results are in line with the findings of Kang *et al.*, (١٩٨٣) and Tariq, *et al.* (١٩٩٢)

Table ١. Genotypic correlation coefficients between seed cotton yield with the studied traits of yield components in season ٢٠١٠.

Traits	N B	B W	L P	L I	S I	SCY
L Y	٠.٨٧**	-٠.٠٧	-٠.٤٦**	-٠.٠١	٠.٣٢**	٠.٨٩**
N B		-٠.٣١**	-٠.٥٠**	-٠.٢١*	٠.١٨	٠.٩١**
BW			٠.١١	٠.٦٩**	٠.٤٩**	٠.٠٣
L P				٠.٣١**	-٠.٦٣**	-٠.٥٠**
L I					٠.٥٦**	٠.٠٢
S I						٠.٣٧**

*, ** Significant and highly significant at ٠.٠٥ and ٠.٠١ level probability, respectively

Path coefficient analysis is done in order to study the direct and indirect effects of individual component characters on the dependent variable, seed cotton yield /plant. The genotypic correlation coefficients of seed cotton yield with other yield component traits were further partitioned into direct and indirect effects and the results are presented in Table ٢. With this conection very high positive direct effect was observed for number of bolls per plant (١.٠٣) and high positive effect for boll weight (٠.٤١). The remaining characters namely lint yield/ plant (٠.٠٥), lint percent (٠.٠٤), seed index (٠.٠٣), and lint index recorded negative effect on seed cotton yield/ plant (-٠.٠٩). These results are in agreement with the results obtained by Kotaiah,

(١٩٧٣) and Tariq, *et al.*(١٩٩٢). The direct and indirect effect of number of bolls per plant, boll weight, seem to be the major yield contributing traits and should be considered for improving yield in Egyptian cotton. The component of residual effect of path analysis in yield traits was ٠.١٢٦. The lower residual effect indicated that the characters chosen for path analysis were adequate and appropriate.

Table ٢. Path coefficients between seed cotton yield with the studied traits of yield components in season ٢٠١٠.

Traits	L Y	N B	B W	L P	L I	S I	Correlations with S C Y
L Y	٠.٠٥	٠.٨٩	-٠.٠٣	-٠.٠٢	٠.٠٠١	٠.٠١	٠.٨٩
N B	٠.٠٥	١.٠٣	-٠.١٣	-٠.٠٢	٠.٠٢	٠.٠١	٠.٩١
BW	-٠.٠٠٤	-٠.٣٢	٠.٤١	٠.٠٠٤	-٠.٠٦	٠.٠٢	٠.٠٣
L P	-٠.٠٣	-٠.٥٢	٠.٠٤	٠.٠٤	-٠.٠٣	-٠.٠٢	-٠.٥٠
L I	-٠.٠٠١	-٠.٢١	٠.٢٨	٠.٠١	-٠.٠٩	٠.٠٢	٠.٠٢
S I	٠.٠٢	٠.١٩	٠.٢٠	-٠.٠٣	-٠.٠٥	٠.٠٣	٠.٣٧

Residual effect = ٠.١٢٦

After one cycle of selection for seed cotton yield/plant the genotypic correlation was highly significant and positively between seed cotton yield/plant and all the studded traits (Table ٣),which was high with number of bolls/plant (٠.٨٦) and boll weight (٠.٨٨), and moderate with lint yield (٠.٤٨), lint percentage (٤٥), lint index (٠.٥٥) and seed index (٤٤). These results of correlations indicated that seed cotton yield was greatly affected by number of bolls/plant, followed by boll weight. The main and may be the only contributor to yield was number of bolls/plant, which showed positive and high significant genotypic correlation with seed cotton yield. These results are in agreement with the results obtained by Azhar and Khan (١٩٩٢), Hussain (١٩٩٨) and Mahrous (٢٠٠٤).

Table ٣. Genotypic correlation coefficients between seed cotton yield with the studied traits of yield components in season ٢٠١١.

Traits	N.B	B W	L P	L I	S I	S C Y
L Y	٠.٣٣*	٠.٥٨**	٠.٣٣*	٠.١٢	٠.٢٨	٠.٤٨**
N B		٠.٤٥**	٠.٣٢*	٠.٢١	-٠.١٦	٠.٨٦**
B W			٠.٧١**	٠.٨١**	٠.١٨	٠.٨٨**
L P				٠.٥٢**	-٠.١٢	٠.٤٥**
L I					٠.٨١**	٠.٥٥**
S I						٠.٤٤**

*,** Significant and highly significant at ٠.٠٥ and ٠.٠١ level probability, respectively

The results of the second cycle of selection for seed cotton yield/plant are presented in Table ٤ and showed that, high and positive direct effect was observed for number of bolls per plant (٠.٦٤) and moderate positive effect for lint yield /plant (٠.٤١), followed by lint index (٣٩). The other traits namely boll weight and seed index showed low and positive direct effect on seed cotton yield. However, lint percentage recorded negative effect on seed cotton yield/ plant (-٠.٠٩). These results indicated that the direct and indirect effect of number of bolls / plant, lint yield /plant lint index are the major yield contributing traits and should be considered for improving yield in Egyptian cotton. This is in accordance with the findings of Kang *et al.*, (١٩٨٣), Mahdy et al (٢٠٠٧) , Mahrous (٢٠٠٤) and Tariq, *et al.* (١٩٩٢) .

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Table ٤. Path coefficients between seed cotton yield with the studied traits of yield components in season ٢٠١١.

Traits	L Y	N.B	B W	L P	L I	S I	Correlations with S C Y
L Y	٠.٤١	٠.١٤	٠.٢٤	٠.١٤	٠.٠٥	٠.١٢	٠.٤٨
N B	٠.٢٢	٠.٦٤	٠.٢٩	٠.٢٠	٠.٢٤	٠.١١	٠.٨٦
B W	٠.٠٢	٠.٠١٤	٠.٠٣	٠.٢١	٠.٠٢	٠.٠٢	٠.٨٨
L P	-٠.٠٣	-٠.٠٣	-٠.٠٦	-٠.٠٩	-٠.٠٤	٠.٠١	٠.٤٥
L I	٠.٠٥	٠.١٥	٠.٣٢	٠.٠٢	٠.٣٩	٠.٣٢	٠.٥٥
S I	٠.٠٠٣	٠.٠٠٢	٠.٠١	-٠.٠٠١	٠.٠١	٠.٠١	٠.٤٤

Residual effect = ٠.٢١٩

The component of residual effect of path analysis in yield traits was ٠.٢١٩. The value of residual effect indicated that there were another characters may be chosen for path analysis like fiber traits.

CONCLOSION

It is clearly understood from the present study that the character of most influence, the main and may be the only contributor on seed cotton yield/plant was higher number of bolls/ plant. It showed positive and highly significant genotypic correlation with seed cotton yield in the two seasons. Also, it recorded the highest direct effect in the first and second cycle of selection, followed by boll weight which showed high direct effect on seed cotton yield in the first season only. However, in the second cycle of selection lint yield and lint index showed the highest direct effect on seed cotton yield.

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تحليل الارتباط ومعامل المرور للمحصول ومكوناته فى القطن المصرى

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أجريت هذه الدراسة فى حقل تجارب معهد بحوث القطن بالمنيا خلال موسمى ٢٠١٠ و ٢٠١١ . وكانت المواد المستخدمة عبارة عن خمسون عائلة فى الجيل الرابع من العشيرة (جيزة-٨٣ *دندرة) وتم عمل دورتين من الانتخاب المنسب لمحصول القطن الزهر حيث يتم الانتخاب للنباتات ذات المحصول العالى لدراسة الارتباط الوراثى ومعامل المرور للمحصول ومكوناته.

وكانت اهم النتائج المتحصل عليها خلال الدورة الاولى والثانية من الانتخاب كالتالى:

١- كان الارتباط الوراثى موجب وعالى المعنوية بين صفة محصول القطن الزهر وكلا من عدد اللوز على النبات (٠.٩١) ومحصول القطن الشعر على النبات (٠.٨٩) وذلك فى الدورة الاولى من الانتخاب لمحصول القطن الزهر.
٢- ايضا فى الدورة الاولى من الانتخاب لمحصول القطن الزهر كان التأثير المباشر لمعامل المرورموجب وعالى جدا لصفة عدد اللوز على النبات (١.٠٣) ثم يليه التأثير المباشر لصفة وزن اللوزة (٠.٤١).
٣- فى الدورة الثانية من الانتخاب لمحصول القطن الزهر كان الارتباط الوراثى موجب وعالى المعنوية بين صفة محصول القطن الزهر وكل الصفات الاخرى. حيث كانت اعلى القيم هى (٠.٨٦) لصفة عدد اللوز على النبات و (٠.٨٨) لصفة وزن اللوزة.
٤- ايضا فى الدورة الثانية من الانتخاب لمحصول القطن الزهر كان التأثير المباشر لمعامل المرورموجب وعالي المعنوية لصفة عدد اللوز على النبات (٠.٦٤) ثم يليه التأثير المباشر لصفة محصول القطن الشعر للنبات (٠.٤١) ثم يليه لصفة معامل الشعر (٠.٣٩).

٥- اكدت الدراسة ان صفة عدد اللوز على النبات هى اهم الصفات المؤثرة فى المحصول التى يمكن الانتخاب لها لتحسين صفة محصول القطن الزهر على النبات، تليها كلا من صفتى وزن اللوزة ومحصول القطن الشعر على النبات.