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GENETIC CORRELATION AND PATH COEFFICIENT ANALYSIS OF YIELD AND IT'S COMPONENTS IN COTTON.

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ABSTRACT

Ten divergent cotton varieties were crossed in a line x tester mating design. The F_1s (including parents) were evaluated in a Randomized Complete Block Design (RCBD) with three replications in two locations, for one year in Adamawa State. The objectives were to study the genotypic and phenotypic relationships among pairs of yield and yield components as well as their direct and indirect effects on lint and seed yield per plant. Results indicated that phenotypic correlation generally showed more significant associations between different pairs of characters than the genotypic correlations, indicating that the characters were more related phenotypically. The path analysis revealed that lint percentage and lint yield were significantly correlated and it also indicated that lint percentage has high direct effect on lint yield per plant. Days to boll opening and boll size had negative direct effect (-0.120) on lint yield but positive indirect effect via other characters, which more than counterbalanced the negative direct effects, resulting in positive correlation (0.947) of these characters with lint yield per plant.

Key words: *Cotton, varieties, correlation analysis, path coefficient analysis and yield components*
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INTRODUCTION

Cotton is an important fiber crop the world over; its utilization in the textile and oil industries is on the increase. Quality of cotton lint for instance is very important to the textile industry which determines the use to which it is put to. Whitehouse *et al.* (1958) and Grafius (1985) suggested that there is no single gene system for yield *per se;* rather it is an end product of multiplicative interaction among yield components. This implies that yield of cotton crop is highly dependent on the yield contributing traits. Despite the fact that correlation studies on yield and its component is helpful to breeders in selecting suitable plant types base on simultaneous selection of two or more characters, a better approach of character association is the path coefficient analysis (Wright,1968). Where as correlation is simply a measure of mutual association without regards to causation, path coefficient analysis specifies the cause and measures their relative importance. However, Dewey and Lu (1959) and Bello *et al.* (2001), opined that this technique is most useful when condition permit its application. In path coefficient analysis of some yield traits in cotton Haidar and Khan (1998) revealed that number of bolls per plant and boll weight had the maximum direct effect on yield of seed cotton per plant, number of bolls per plant had negative indirect effect on boll weight, while boll weight had positive indirect effect on ginning outturn percentage. Baloch *et al.* (2001) also reported that number of bolls per plant had significant direct effect on lint yield, whereas boll weight and lint percentage had negligible effects. This study is therefore, designed with the following objectives so as to furnished breeders with informations on the degree and pattern of relationships in this population of cotton varieties as an aid for further improvement such as yield. To determine

i. The interrelationships between important characters in cotton and
ii The direct and indirect effect of yield and yield components in cotton.

MATERIALS AND METHODS

Ten cotton varieties obained from the Institute for Agricultural Research, Ahmadu Bello University Zaria, were chosen for this study on the basis of divergence of characteristics ranging from days to maturity to yielding ability. Three varieties (SAMCOT- 8, SAMCOT-9 and SAMCOT-10) belong to the species *hirsutum* while the remaining 7 (TAMCOT–SP21S, BAR1, TAMCOT- CAMD-E, PIMAS2, TXCAP37HH-1-83, Ex-Benin and Giza 45) belong to the species *barbadense.*

Crosses were performed during the 2000/2001 rainy season using a line x tester mating design as described by kempthon (1957). In all there were 16 crosses (2 testers and 8 lines =16). During the 2001/2002 rainy season, the 26 entries (16 F_1 progenies and 10 parents) were sown in a Randomized Complete Block Design (RCBD), with three replications in two locations Yola and Gombi in Northern Nigeria. Each plot consisted of 30 plants, sown in five rows of six plants each, with 40 cm inter and intra spacings.

At maturity, 10 plants, from the middle rows were sampled for data collection on the following parameters; days to first flowering, days to boll opening, boll size, number of open bolls/plant, seed index, lint percentage, lint yield and seed yield.

To estimate the degree of relationship among traits of economic importance genotypic and phenotypic correlations were determined according to methods described by Paroda and Joshi, (1970) while matrix method of computing path coefficient analysis as shown by Singh and Chaudhary (1985) was used.

RESULTS AND DISCUSSION

Results of the study showed that phenotypic correlation coefficient were slightly higher than the genotypic coefficients indicating that the characters were more related phenotypically than genotypically. From the result also, it was observed that, lint yield showed significant positive correlation with lint percentage (Table1). Indicating that strains with high lint percentage and high lint yield are obtained from this population of cotton. On the other hand, number of bolls per plant showed a negative phenotypic correlation with seed yield. With similar results, Miller *et al.* (1958), Baloch *et al.* (2001) concluded that improvement in yield could be achieved by selecting cotton plants with higher number of bolls and more lint percentage. The phenotypic correlation results of this study (Table1) also showed that selection for seed index could increase lint percentage and subsequently lint yield, Kamel and Omran, (1991) also reported similar results in a cross between two Egyptian varieties of cotton that lint percentage and seed index were significantly correlated. There was strong positive correlation between some of the yield components, for example, number of bolls per plant and lint yield, boll size and lint yield, days to boll opening and seed index and lint yield and lint per cent and lint yield. Bowman *et al.* (1997) also reported significant positive genotypic correlations between two pairs of characters (lint yield and seed yield, lint yield and number of bolls per plant) and suggested that improvement in lint yield could be achieved by selecting cotton plants for large bolls and more lint per cent and number of seeds per boll; implying that whichever character is selected for, would lead to positive responses in the other. Bowman *et al.* (1997), Alabi (1982) and Kamel and Omran (1991), all have similar findings to the one obtained in this study.

The importance of path coefficient analysis is to provide an effective means of revealing direct and indirect effect or causes of association. It also helps to examine what is responsible for producing a given correlation and also help to measure the relative importance of each causal factor. In the path coefficient analysis of this study (Table 2), lint percentage and lint yield were significantly correlated phenotypically as well as having a positive correlation with lint yield. However, other indirect factors via lint percentage were negative, yet the correlation with yield was positive and significant, indicating that the high direct effect was the major contributor to the high positive correlation between these two characters. Days to boll opening and boll size had a negative direct effect on lint yield but positive indirect effect via other characters which more than counterbalanced the negative direct effects, resulting in positive correlation of these characters with lint yield. This is in agreement with Baloch *et.al* (2001) who reported similar results. On the other hand, days to 50% flowering and seed index had a negative but non significant genotypic correlation as well as weak positive direct effect on lint yield per plant. In view of this, selection for these characters will not be beneficial for yield improvement. This is so because these characters exhibited negative and non- significant genotypic correlation with lint yield. Haidar and Khan, (1998) also reported similar results. In conclusion, generally lint percentage was identified as the most important yield component; this is because apart from having significant genotypic correlation with lint yield, it also had high positive direct effect on lint yield. Selection for this character therefore, would result in tremendous yield increase in this population of cotton varieties.

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Table 1: Genotypic (upper right) and phenotypic (lower left) correlation between yield and yield components over the two locations.

Characters	Days to first Flowering	Days to Boll Opening	Boll size	Bolls/Plants	Lint%	Seed yield	Seed index	Lint Yield
Days to first Flowering		0.080	-0.110	-0.130	0.060	0.100	0.020	-0.077
Days to Boll Opening	-0.070		0.040	0.010	-0.120	-0.08	0.120	0.135
Boll size	-0.220	0.240		0.010	-0.180	0.010	-0.220	0.124
Bolls/Plants	-0.210	-0.060	-0.720*		-0.130	-0.700*	0.120	0.085
Lint%	0.230	-0.250	-0.370	-0.130		-0.080	0.140	0.947**
Seed yield	-0.86**	0.410	0.140	0.260	-0.750		0.160	-0.058
Seed index	0.130	-0.180	-0.350	-0.010	0.950**	-0.610		0.080
Lint Yield	0.11	-0.520	0.450	-0.520	- 0.010	0.560	0.210	

* Significant (p< 0.05)
** Highly significant (p< 0.01)

Table 2: Direct effects (bold figures) and indirect effect (regular figures) of yield components on yield per plant over the two locations.

Characters	Days to first Flowering	Days to Boll Opening	Boll size	Bolls/Plants	Lint%	Seed yield	Seed index	Lint Yield
Days to first Flowering	0.082	0.012	-0.030	-0.007	0.003	-0.141	0.004	-0.077
Days to Boll Opening	-0.010	-0.030	0.012	-0.002	0.174	-0.003	-0.006	0.135
Boll size	0.017	0.008	-0.052	-0.001	0.127	0.005	0.020	0.124
Bolls/Plants	0.010	-0.001	-0.001	-0.060	0.153	-0.003	-0.013	0.085
Lint%	-0.003	-0.017	-0.018	-0.009	1.021	-0.011	-0.016	0.947
Seed yield	-0.011	-0.020	0.010	-0.032	0.139	-0.120	-0.024	-0.054
Seed index	0.004	0.020	-0.034	0.009	-0.184	0.017	0.093	-0.080

Bold figures denotes direct effects while regular figures denotes indirect effects