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CORRELATION AND PATH COEFFICIENT ANALYSIS IN COTTON

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ABSTRACT

An experiment was conducted on correlation and path coefficient analysis for fibre characters, yield and yield contributing characters in upland cotton with 11genotypes for ten characters at college farm, college of Agriculture, Rajendranagar, Hyderabad during Kharif 2007-08 to 2008-09. Correlation studies revealed significant desired association with yield for boll weight and bundle strength. Bundle strength made highly significant contribution to yield. Path matrix revealed that boll number, boll weight and 2.5% span length had maximum direct positive effect on yield.

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INTRODUCTION

Cotton (*Gossypium species*), is the worlds most utilized natural textile fibre. The fruit of the plant, better known as the cotton boll, provides the fiber – the fiber of a thousand faces and almost as many uses, the fibers which the ancients called "white gold" because it was so valuable. In India, cotton is grown on about 12.19 million ha which represents 30 per cent of the world cotton area. Selection may not lead to desired genetic gain if it has unfavorable association with other yield attributes. Knowledge on the association between yield and yield component traits is, therefore, essential in any crop improvement programme for efficient selection. Yield is a complex character, which is highly influenced by the environment, hence, selection based on yield alone may limit the improvement, whereas the yield component characters are less complex in inheritance and influenced by the environment to a lesser extent. Thus, effective improvement in yield may be brought about through selection of yield component characters. Yield component characters show association among themselves and also with yield. So the present study was carried out utilizing parents and F_1's to understand the associations between inter and intra specific crosses.

MATERIALS AND METHODS

The present investigation was carried out at college farm, college of Agriculture, Rajendranagar, Hyderabad during *Kharif* 2007-08 to 2008-09. In the present study, correlation coefficients were worked out for 11 genotypes (includes seven *Gossypium hirsutum* lines *viz*., Narasimha, Galama, L 604, L 389, LK 861, CPD 420 and AKH 9331, four testers out of which two (2) are *G.barbadense viz*., Suvin, Pima and the rest two (2) *viz*., HAG 1055 and MCU 17) and 28 hybrids derived from 7 x 4; line x tester programme. The material was sown in Randomized Block Design replicated thrice. Parents and hybrids were sown in two rows with spacing of 90 x 60 cm for parents and 120 x 60 cm for hybrids. Five randomly selected plants for each treatment in each replication were chosen and labeled for recording observations and the means were taken into consideration for statistical analysis.

The data on fiber quality, yield and yield components were recorded. The data on 11 characters were utilized for the computation of correlation coefficients between quality, yield and yield component characters for all the genotypes. The formula suggested by Snedecor and Cochran (1967) was followed. Based on the data recorded on twenty eight (28) hybrids and their eleven (11) parents of the present study, the phenotypic and genotypic correlations were employed to determine direct and indirect effects of fibre quality, yield and yield components in cotton. Contribution of 11 component characters towards dependent character were calculated through path coefficient analysis as suggested by Wright (1921) and elaborated by Dewey and Lu (1959) at both phenotypic and genotypic levels.

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Table 1. Phenotypic and Genotypic correlation coefficients among seed cotton yield per plant and other characters in cotton

Character	No. of monopodia/ plant	No. of Sympodia/ plant	No. of bolls /Plant	boll weight	Ginning percentage	2.5% span length	Uniformity ratio	Micro-naire value	Bundle strength	Seed Cotton yield/ plant
Days to 50% flowering	-0.842** (-0.1117)	0.0058 (0.0013)	-1.067 (-0.1727)	-0.040 (-0.0394)	0.1598 (0.2490)	-0.2274* (-0.2421)	0.0163 (-0.0803)	0.1911* (0.2762*)	-0.2128* (-0.3366**)	0.0126 (0.0326
No. of monopodia/ plant	1.0000	0.1069 (0.0799)	0.0479 (-0.0004)	0.1060 (0.3317**)	0.1839* (0.4285**)	0.1312 (0.2674*)	-0.0392 (-0.1499)	-0.0386 (-0.2857*)	0.1049 (0.0946)	-0.1463 (-0.0465)
No. of sympodia/ plant		1.0000	0.3408** (0.5083**)	0.0658 (0.0752)	0.2335* (0.3828**)	0.2174* (0.3996**)	-0.0692 (0.2154)	0.0140 (0.0357)	0.1060 (0.1242)	-0.1243 (-0.1337)
No. of bolls /plant			1.0000	0.1966* (0.2475)	-0.1131 (-0.0988)	0.1979* (0.3002*)	-0.0869 (0.1555)	-0.1079 (-0.1485)	0.0570 (0.0880)	0.1322 (0.1273)
Boll weight				1.0000	0.2396** (0.3438**)	-0.1845* (-0.2704*)	0.1439 (0.3816**)	0.1394 (0.3816**)	-0.1762 (-0.3499**)	0.3722** (0.4819**)
Ginning percentage					1.0000	-0.1544 (-0.2497)	0.0736 (0.1919)	0.2416** (0.4443**)	0.1403 (0.2650*)	0.0450 (0.0903)
2.5% span length						1.0000	-0.5700 (-0.8444**)	0.6169** (-0.8688**)	0.5905** (0.7613**)	-0.1517 (-0.2465)
Uniformity ratio							1.0000	0.4659** (0.7276**)	-0.2704** (-0.4739**)	-0.0333 (0.1021)
Micronaire value								1.0000	-0.5875** (-0.7828**)	0.1536 (0.4390**)
Bundle strength									1.0000	-0.4188** (-0.6389**)

* Significant at 5 per cent level; ** Significant at 1 per cent level
The values in the parenthesis are genotypic correlations

Table 2. Phenotypic and Genotypic path coefficients of quality, yield and yield components in cotton

Character	Days to 50% flowering	No. of monopodia/ plant	No. of sympodia/ plant	No. of bolls / Plant	boll weight	Ginning Per-centage	2.5% span length	Uniformity ratio	Micro-naire value	Bundle strength	Seed cotton yield/ plant
Days to 50% flowering	-0.019 (-4.9829)	-0.0016 (-0.5566)	-0.0001 (-0.0064)	0.0021 (0.8604)	0.0008 (0.1963)	-0.0031 (-1.2407)	0.0044 (1.2061)	0.0003 (0.4001)	-0.0037 (-1.3761)	0.0042 (1.6773)	0.0126 (0.0326)
No. of monopodia/ plant	-0.0122 (0.9522)	-0.1453 (8.5238)	-0.0155 (0.6812)	-0.0070 (-0.0037)	-0.0154 (2.8270	-0.0267 (3.6524)	-0.0191 (2.2789)	0.0057 (-1.2781)	0.0056 (-2.4354)	-0.0152 (0.8061)	-0.1463 (-0.0465)
No. of sympodia/ plant	-0.0009 (0.0116)	-0.0172 (0.7195)	-0.1613 (9.0029)	-0.0550 (4.5759)	-0.0106 (0.6773)	-0.0377 (3.4459)	-0.0351 (3.5978)	0.0112 (-1.9395)	-0.0023 (0.3212)	-0.0171 (1.1184)	-0.1243 (-0.1337)
No. of bolls /plant	-0.0124 (0.0398)	0.0056 (0.0001)	0.0397 (-0.1171)	0.1165 (-0.2305)	0.0229 (-0.0570)	-0.0132 (0.0228)	0.0231 (-0.0692)	-0.0101 (0.0358)	-0.0126 (0.0342)	0.0066 (-0.0203)	0.1322 (0.1273)
Boll weight	-0.0134 (0.0609)	0.0355 (-0.5127)	0.0221 (-0.1163)	0.0659 (-0.3826)	0.3355 (-1.5459)	0.0804 (-0.5316)	-0.0619 (0.4180)	0.0483 (-0.4110)	0.0468 (-0.5899)	-0.0591 (0.5409)	0.3722 (0.4819)
Ginning percentage	0.0021 (-1.9491)	0.0024 (-3.3543)	0.0031 (-2.9962)	-0.0015 (0.7736)	0.0032 (-2.6916)	0.0132 (-7.8280)	0.0020 (1.9549)	0.0010 (-1.5021)	0.0032 (-3.4779)	-0.0018 (2.0741)	0.0450 (0.0903)
2.5% span length	-0.0273 (6.8304)	0.0157 (-7.5443)	0.0261 (-11.2768)	0.0237 (-8.4712)	-0.0221 (7.6302)	-0.0185 (7.0470)	0.1199 (-28.2186)	-0.0683 (23.8291)	-0.0740 (24.5155)	0.0708 (-21.432)	-0.1517 (-0.2465)
Uniformity ratio	0.0023 (1.3304)	0.0054 (2.4842)	0.0096 (3.5691)	0.0120 (2.5757)	-0.0199 (-4.4046)	-0.0102 (-3.1791)	0.0790 (13.9904)	-0.1386 (-16.5675)	-0.0646 (-12.0542)	0.0375 (7.8520)	-0.0333 (0.1021)
Micronaire value	-0.0018 (0.5855)	0.0004 (-0.6057)	-0.0001 (0.0756)	0.0010 (-0.3147)	-0.0013 (0.8089)	-0.0022 (0.9419)	0.0057 (-1.8418)	-0.0043 (1.5425)	-0.0092 (2.1200)	-0.0054 (-1.6595)	0.1536 (0.4390)
Bundle strength	0.0958 (-2.8462)	-0.0472 (0.7996)	-0.0477 (1.0503)	-0.0257 (0.7444)	0.0793 (-2.9586)	0.0631 (-2.2403)	-0.2657 (6.4371)	0.1217 (-4.0072)	0.2644 (-6.6184)	-0.4500 (8.4552)	-0.4188 (-0.6389)

Bold values are direct effects; Phenotypic residual effect = 0.48; Genotypic residual effect = 0.34; The values in the parenthesis are genotypic path coefficient.

RESULTS AND DISCUSSION

Analysis of variance indicated highly significant differences among the genotypes for all the characters studied indicated existence of sufficient amount of variability in the material. Genotypic correlations in general are higher than phenotypic correlations. This may be due to relative stability of genotypes as majority of them have been subjected to certain amount of selection (Johnson *et al.* 1955). The estimates of genotypic and phenotypic correlations were presented in Table 1 and Figure 1. The yield attributing traits were evaluated for their inter relationship with yield and among themselves. Days to 50 per cent flowering exhibited significant positive phenotypic and genotypic correlation with the micronaire value.

Number of monopodia per plant registered significant positive association phenotypically with ginning percentage and significant positive association with boll weight, ginning percentage and 2.5% span length at genotypic level. The trait no of sympodia per plant exhibited significant and positive association with no of bolls, ginning percentage and 2.5% span length similar results were obtained by Muthuswamy and Vivekanandan (2004) and Iqbal *et al.* (2006). Number of bolls per plant exhibited significant positive association with boll weight and 2.5% span length both at phenotypic and genotypic level. The results are in agreement with the findings of Ahmad and Azar (2000) and Preetha and Raveendran (2007)). Boll weight registered significantly positive correlation with ginning percentage and seed yield per plant both at phenotypic and genotypic level. Ginning percentage exhibited significant positive association with micronaire value at phenotypic and genotypic level (Muthu *et al.* 2004) and positive association with bundle strength at genotypic level.

The trait 2.5% span length exhibited Significant and positive correlations with bundle strength both at phenotypic and genotypic level and with micronaire value at phenotypic level. Uniformity ratio exhibited significant positive association with micronaire value both at phenotypical and genotypic level, Micronaire value registered positive significant association with seed cotton yield per plant at genotypic level. Significant negative association of uniformity ratio with bundle strength was observed by Preetha and Raveendran (2007), whereas positive association with micronaire value was reported by Muthu *et al.* (2004), Rathore *et al.* (2004) and Preetha and Raveendran (2007). Seed cotton yield per plant exhibited highest significant positive association with boll weight at both at phenotypic and genotypic levels followed by microniare value at genotypic level while significant and negative correlation with bundle strength both at phenotypic and genotypic levels.

However, seed cotton yield per plant had no association with ginning percentage. Positive significant association of boll weight with seed cotton yield per plant obtained in the present study is in agreement with the results reported by Muthu *et al.* (2004) and Preetha and Raveendran (2007). The results pertaining to the path coefficient analysis are presented in table 2 and figures 2&3. The path coefficient analysis revealed that boll weight and no of bolls registered high positive direct effects whereas 2.5% span length and ginning percentage exhibited low to negligible levels of direct effect on seed yield per plant at phenotypic level. Bundle strength, no of sympodia per plant, no of monopodia per plant, uniformity ratio, days to 50% flowering and micronaire value recorded negative direct effect on seed cotton yield per plant at phenotypic level. Micronaire value, bundle strength, no of monopodia per plant and no of sympodia per plant exhibited medium levels of direct effect on seed cotton yield per plant at genotypic level, where as low to negligible negative direct effects were exhibited on seed cotton yield per plant by no of bolls, boll weight, days to 50% flowering, ginning percentage, uniformity ratio and 2.5% span length.

Boll weight, no of bolls per plant and 2.5% span length were found to have maximum direct positive effect on seed cotton yield per plant. These results are in agreement with the results reported by Rauf *et al.* (2004), Kaushik *et al.* (2005), Iqbal *et al.* (2006) and Preetha and Raveendran (2007). In the present study no of bolls per plant exhibited indirect effect on seed cotton yield via no of sympodia (Iqbal *et al.* (2003b)), 2.5 % span length, no of seeds per boll and no of monopodia per plant (Iqbal *et al.* (2006)). Among the fibre quality traits, uniformity ratio showed positive indirect effect on yield via 2.5 % span length, while micronaire exhibited indirect effect via no of bolls per plant and 2.5% span length on seed cotton yield per plant.

Conclusion

Critical analysis of the results obtained from character association and path analysis revealed that selection of the traits viz., boll weight, bundle strength, boll number and 2.5% span length would bring improvement in yield and yield attributes as they possessed high positive significant associations and positive direct effects.

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