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# Path Coefficient Analysis of Some Advanced Generation Progenies of *Gossypium hirsutum* L.

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## ABSTRACT

The results of genotypic correlation analysis revealed that plant height, monopodial branches and number of bolls had positive and significant association with seed cotton yield. Plant height was positively and significantly correlated with sympodial branches, number of bolls and ginning percentage. Path coefficient analysis showed that number of bolls had maximum positive direct effect on yield of seed cotton. The present studies suggest that direct selection for greater number of bolls may increase yield of seed cotton in the plant material studied.

**Key Words:** Genotypic correlation; Upland cotton; Plant yield; Direct effect

## INTRODUCTION

The development of cultivars of *Gossypium hirsutum* L. having greater yield potential with acceptable fibre characteristics is one of the objectives of cotton breeder. Yield of seed cotton is affected by genetic and environmental factors, and thus interaction between them makes it difficult to select the plants with increased yield. The selection for a desirable genotype may be facilitated if the research worker knows the nature of relationship between seed cotton yield and its components. The crucial task of selection becomes easier if some information about the relative contribution of each of the components towards plant yield is also available. The previous reports showed that plant height, number of monopodial and sympodial branches had positive correlation with seed cotton yield (Giri & Upadhyay, 1980; Arshad *et al.*, 1993; Akbar *et al.*, 1994). Number of bolls per plant were positively and significantly correlated with yield of seed cotton (Soomro *et al.*, 1982; Azhar *et al.*, 1984, 1997). Similarly, ginning outturn displayed positive association with yield of seed cotton (Khan *et al.*, 1991). Path coefficient analysis done by Khan *et al.* (1991) and Hussain *et al.* (1998) revealed that number of bolls contributed more than other components of yield towards final productivity of plant. This paper examines degree of genotypic correlation among plant yield and its components, and the nature of direct and indirect contribution to seed cotton yield in the plant material developed at the campus.

## MATERIALS AND METHODS

In the present study, 12 genotypes/elite lines i.e., B868, B869, B870, B871, B872, B873, B874, B875, B876, B877, B878, B879 originated from different pedigrees, and the two commercial cultivars NIAB 78 and FH 682 were involved. The seeds of the 12 entries were field-planted in single row plot having 14 plants in a row. The seeds were spaced at a distance of 75 cm between the rows and 30 cm within the row. The experimental lay out was randomized complete block design with three replications.

During the growth and development of plants, appropriate plant protection measures and agronomic practices were followed. At maturity, data on ten consecutive plants were taken, one plant on either end of each row was treated as guarded plant. The data on plant height, number of monopodial branches, number of sympodial branches, number of bolls per plant, ginning outturn and yield of seed cotton per plant in each replication were collected.

The mean values of the six characters were subjected to ordinary analysis of variance technique in order to determine whether the genotypic differences were significant. The coefficient of genotypic correlation "$r_g$" among six traits were computed following the formula given by Kwon and Torrie (1964). The "$r_g$" were partitioned into causal components by path coefficient technique developed by Dewey and Lu (1959).

## RESULTS AND DISCUSSION

The mean squares obtained from analysis of variance showed that all the genotypes were significantly different for all the characters (Table I).

The genotypic correlation coefficient showed that plant height had positive correlation with number of sympodial branches, number of bolls per plant, ginning outturn and seed cotton yield, and "$r_g$" being 0.236, 0.254, 0.145 and 0.186 respectively were significant (Table II). Number of monopodial branches were negatively correlated with plant height ($r_g$ = -0.313). The association of monopodial branches with number of bolls (0.397), and seed cotton yield (0.444) was positive and significant. However, number of sympodial branches appeared to be negatively correlated with number of bolls, ginning outturn and seed cotton yield. The association between plant yield and number of bolls was strong and complete, "$r_g$" being 1.0 . The similar nature of correlation of plant height with number of bolls, ginning outturn and seed cotton yield had been observed in previous studies (Dhanda *et al.*, 1984 & Arshad *et al.*, 1993). However, evidence to support negative correlation of sympodial branches with number of bolls per plant, ginning outturn and plant height is not available in the literature. Similar was the case about correlation between number of bolls and ginning outturn. The association between number of bolls and plant yield is in agreement with the studies of Dhanda *et al.* (1984) & Azhar *et al.* (1997). Similarly positive correlation existing between plant yield and ginning outturn is in line with those of Azhar *et al.* (1984) and Hussain *et al.* (1998). Although plant height showed positive association with seed cotton yield (Table II), it had no direct effect upon yield (-0.064, Table III). Maximum indirect effect of plant height upon seed cotton yield was through number of bolls per plant (0.264). Direct effect of monopodial branches on plant yield was very little (0.00045), but these affected indirectly via number of bolls (0.413) and plant height (0.199). Number of sympodial branches contributed indirectly to yield through ginning percentage, but to a lesser extent (0.035). The direct effect of number of bolls on seed cotton yield was greater than all the other characters (1.041). The direct effect of ginning percentage on plant yield appeared to be negative (-0.085), it increased plant productivity through number of bolls (0.1007).

The present study revealed some information which may be advantageous to a cotton breeder looking for plant having greater yield potential. Amongst other plant characters studied here contribution of number of bolls towards seed cotton yield, directly and indirectly, was the greatest, and this effect may clearly be due to the significant positive association existing between the two characters (Table II). Similar behaviour of characters had been noted previously by Azhar and Hussain (1998). Some other workers also reported similar results about direct and indirect effect of different components of seed cotton yield (Khan *et al.*, 1991; Azhar *et al.*, 1997 & Hussain *et al.*, 1998).

Number of bolls contributed the most towards seed cotton yield, and some other characters like plant height, monopodial branches, ginning percentage also had considerable contribution upon yield through number of bolls, therefore selection of plants having increased number of bolls may lead to the development of genotypes having greater yield potential.

**Table I. Mean squares obtained from analysis of variance of different traits in *Gossypium hirsutum* L.**

| Source of variation | df | Plant height | Monopodial branches | Sympodial branches | No. of bolls | Ginning outturn | Seed cotton yield |
|---|---|---|---|---|---|---|---|
| Replications | 2 | 0.580 | 0.01 | 0.288 | 0.03 | 2.935 | 72.134 |
| Genotypes | 13 | 455.931** | 1.25** | 6.546** | 8.719** | 3.529** | 117.534** |
| Error | 26 | 3.181 | 0.04 | 0.429 | 0.475 | 1.219 | 12.454 |

**Table II. Genotypic correlation coefficients among seed cotton yield and its components**

| Traits | Monopodial branches | Sympodial branches | No. of bolls | Ginning outturn | Seed cotton yield |
|---|---|---|---|---|---|
| Plant height | -0.313 | 0.236* | 0.254* | 0.145* | 0.186* |
| Monopodial branches | | -0.377 | 0.397* | -0.092NS | 0.444* |
| Sympodial branches | | | -0.208NS | -0.418NS | -0.203NS |
| No. of bolls | | | | 0.097NS | 1.018* |
| Ginning outturn | | | | | 0.009NS |

*, ** denotes differences significant and highly significant respectively, while NS shows non-significant.

**Table III. Direct (Parenthesis) and indirect effects of components on seed cotton yield**

| Traits | Plant height | Monopodial branches | Sympodial branches | Bolls per plant | Ginning outturn |
|---|---|---|---|---|---|
| Plant height | (-0.064) | -0.00014 | -0.0017 | 0.264 | -0.012 |
| Monopodial branches | 0.199 | (0.00045) | 0.0027 | 0.413 | 0.0078 |
| Symopodial branches | -0.015 | -0.00017 | (-0.00734) | -0.216 | 0.035 |
| No. of bolls | -0.016 | 0.00018 | 0.0015 | (1.041) | -0.0082 |
| Ginning outturn | -0.0093 | -0.0004 | 0.0031 | 0.1007 | (-0.085) |

## REFERENCES


Akbar, M., J. Ahmed and F.M. Azhar, 1994. Genetic correlation, path coefficient and heritability estimates of some important plant traits in Upland cotton. *Pak. J. Agri. Sci.*, 31: 47–50.

Arshad, M., M. Hanif, I. Noor and S.M. Shah, 1993. Correlation studies on some commercial cotton varieties of *Gossypium hirsutum* L. *Sarhad J. Agri.*, 9: 49–53.

Azhar, F.M., A.R. Abid and M.A. Khan, 1984. Association of yield with various economic characters in *Gossypium hirsutum* L. *The Pak. Cottons*, 28: 134–7.

Azhar, F.M. and S.S. Hussain, 1998. Genetic relationship and path coefficient analysis of yield and its components in *G. hirsutum* L. J. *Pure & Appl. Sci.*, 17: 1–4.

Azhar, F.M., T.M. Khan and A.M. Khan, 1997. Genetic correlation and path coefficient analysis of yield and its components in Upland cotton. *J. Anim. Pl. Sci.*, 7: 69–71.

Dewey, R.D. and K.H. Lu, 1959. A correlation and path coefficient analysis of components of crested wheat grass seed production. *Agron. J.*, 51: 515–8.

Dhanda, S.S., A.A. Tyagi and D.S. Jatasra, 1984. Character association among quantitative and qualitative attributes of Upland cotton. *Ind. J. Agri. Sci.*, 54: 24–9.

Giri, A.N. and U.C. Upadhyay, 1980. Correlation and path coefficient analysis of yield components in Upland cotton. *Crop Impr.*, 8: 23–7.

Hussain, S.S., F.M. Azhar and M. Sadiq, 1998. Genetic correlation, path coefficient and heritability estimates of some important plant traits of Upland cotton. *Sarhad J. Agri.*, 14: 57–60.

Khan, M.A., H.A. Sadaqat and M. Tariq. 1991. Path coefficient analysis in cotton (*Gossypium hirsutum* L.). *J. Agri. Res.*, 29: 177–84.

Kown, S.H. and J.H. Torrie, 1964. Heritability and interrelationship among traits of two soybean populations. *Crop Sci.*, 4: 194–8.

Soomro, B.A., M.M. Channa and M. Ahmad, 1982. Correlation studies in *Gossypium hirsutum* L. *The Pak. Cottons*, 26: 39–51.


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