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# Correlation and path coefficient analysis for morphological characters and yield in cotton (*Gossypium hirsutum*)*

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Cotton (*Gossypium hirsutum* L.) constitutes more than 70% of the total world consumption of fibres. Among the 4 cultivated species, *G. hirsutum* L. is widely grown, since it has a very high adaptability and rich diversity for yield and yield related morphological and physiological characters. Cotton is the worlds leading agronomic fibre crop, providing about 55% of all fibres used in textile and fueling (Tomkins *et al.* 2001). 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. Considerable emphasis has been given placed on the inter relationships between yield and yield components in cotton. The 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 in seed cotton yield.

Correlation between seed cotton yield and traits is reflected from direct effect of that trait which will help for identifying the traits that contribute directly to improve seed cotton yield. Ahuja *et al.* (2006) reported that the phenoptypic correlation coefficient between boll number and seed cotton yield was strong and positive. Yield generally decreased as determinacy increase and rate of maturity accelerated, monopodial branches/plant, boll/plant and boll weight were positively and significantly correlated with yield while bolls/plant and boll weight had maximum direct positive effect on yield of seed cotton (Iqbal *et al.* 2003). The present studies were conducted to investigate the direct and indirect effect of various yield components on seed cotton yield through path coefficient analysis for identification of traits and will be helpful for selection in segregating generations for high seed cotton yield.

The experiment was conducted at Institute of Science, Nagpur. The 90 number of cross were made in 2005 involving parent having wide genetic diversity. The $F_1$ generation was raised during 2006 in non-replicated design. The $F_1$ populations of each cross occupied 8 rows with 9 m long keeping plant-to-plant distance 30 cm and row-to-row 75 cm. The sowing was done on furrow beds manually. All the recommended/agronomic practices were adopted and pesticides/chemicals were used for the management of insects as required after pest scouting. The data was recorded of 160 guarded plants in each cross for the following traits (a) node of fruiting branch (b) monopodial branches/plant (c) bolls/plant (d) Boll weight (g), (e) yield/plant (g), (f) ginning out turn percentage (GOT %) % and (g) Staple length (mm). The interrelationships among these traits were analyzed by computing simple correlation coefficient by suing the computer programme Excel-2000. The correlations were further analyzed by the path coefficient method given by Dewey and Lu (1959).

The simple correlation coefficients were determined for all the possible character combinations with the objective to drive information about the relationship and intensity among different character combinations (Table 1).

Node of first fruiting branch was positively and significantly correlated with the number of monopodial branches and boll number. Significant positive correlation was observed for monopodial branches/plant with boll number and seed cotton yield/plant while no. of bolls/plant is negatively correlated with boll weight and positively correlated with the seed cotton yield/plant and ginning out turn (GOT) (Table 1). Ahuja *et al.* (2006) found highly positive and significant correlation of boll number and boll weight with seed cotton yield.

The correlation of number of fruiting bolls (NFB) with seed cotton yield/plant (Table 2) was positive and significant

*Short note

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Table 1 Correlation among different characters

| | Monopodia/ plant | Boll no. | Boll weight (g) | Yield/plant (g) | GOT (%) | Staple length (mm) |
|---|---|---|---|---|---|---|
| NFB | 0.897* | 0.141* | 0.015 | 0.194* | –0.094 | 0.067 |
| Monopodial | | 0.199* | 0.022 | 0.244* | –0.098 | 0.119 |
| Boll no. | | | –0.320* | 0.211* | 0.161* | 0.074 |
| Boll weight | | | | 0.211* | –0.049 | –0.136 |
| Yield /plant | | | | | –0.033 | –0.002 |
| GOT | | | | | | 0.054 |

*Significant; GOT(%), ginning out turn percentage; NFB, number of fruiting bolls

Table 2 Direct and indirect effect of 6 characters towards seed cotton yield

| | NFB | Monopodia/ plant | Boll no. | Boll weight (g) | GOT (%) | Staple length (mm) | Correlation with seed cotton yield |
|---|---|---|---|---|---|---|---|
| NFB | 0.120 | 0.033 | 0.004 | 0.0003 | 0.162 | –0.125 | 0.194 |
| Monopodial branches/ plant | 0.007 | 0.067 | 0.271 | 0.0040 | 0.015 | –0.120 | 0.244 |
| Boll no. | 0.015 | 0.017 | 0.034 | –0.0060 | –0.025 | –0.130 | 0.211 |
| Boll weight | 0.001 | 0.008 | –0.017 | 0.0210 | 0.007 | 0.191 | 0.211 |
| GOT | –0.011 | –0.003 | 0.245 | –0.0010 | –0.160 | –0.100 | 0.033 |
| Staple length | 0.008 | 0.005 | 0.007 | –0.0160 | 0.002 | –0.008 | –0.002 |

and its direct effect on yield of seed cotton was also positive (0.12). The positive indirect effects were contributed through monopodial branches/plant (0.033), bolls/plant (0.004), boll weight (0.0003) and GOT (0.162). The negative indirect effects were produced via staple length (–0.125). The positive indirect effect via NFB, GOT was maximum while other characters are negligible. The negative indirect effect (–0.125) via staple length indicated that for improving the seed cotton yield breeder should also be conscious for the quality of fibre (Table 2). Therefore, positive correlation and direct effect of NFB on seed cotton yield indicated that selection based on this trait will be helpful for improving seed cotton with earliness in segregating generation of breeding material under study.

Although the correlation of monopodial branches/plant with seed cotton yield was significantly positive (Table 1), but its direct effect on seed cotton yield/plant was very small (0.067). It was further observed that positive indirect effect contributed by node of first fruiting branch, bolls/plant, boll weight and GOT. The contribution of node of first fruiting branch (0.007) and boll weight (0.004) was negligible (Table 2). The negative indirect effects were produced via staple length (–0.12). The positive indirect effect bolls/plant, boll weight and GOT. The contribution of node of first fruiting branch (0.007) and boll weight (0.004) was negligible (Table 2). The negative indirect effects were produced via staple length (–0.12). The positive indirect effect of bolls/plant showed that this traits can be helpful in selection of genotypes with improved seed cotton yield/plant from present genetic material. Ahuja and Verma (2003) also reported similar results.

It is clearly indicated that positive correlation (0.211) exists between bolls/plant and seed cotton yield/plant. The direct effect of bolls/plant was positive (0.034). The positive indirect effect was contributed through node of first fruiting branch and no. of monopodial branches/plant. Negative indirect effects were produced via boll weight, GOT, staple length (Table 2). The positive indirect effect via NFB and monopodial branches showed that as the NFB lies a lower level, then number of sympodial branches which bear bolls directly will be recorded earlier, due to the reason the lower NFB value of genotype might bear more bolls and contributed for seed cotton yield. The positive correlation (0.211) of no. of bolls/plant with seed cotton yield/plant and the value of its direct effect in seed cotton yield indicated a picture of association between these two characters. Therefore, the positive direct effect of bolls/plant on seed cotton yield reflected that selection of no. of bolls/plant for the improvement of seed cotton yield in material under study is possible. Iqbal *et al.* (2003) also provide same results.

The correlation of average boll weight with seed cotton yield (Table 1) was positive (0.211) and the direct effect of boll weight was also positive (0.021) (Table 2). The positive direct effect were contributed through node of first fruiting branch, No. of monopodial branches/plant, GOT and staple length. The negative indirect effects were produced via no.

of bolls/plant. The positive direct effect of average boll weight reflected its effectiveness in a selection. On the basis of greater boll size in the present research material for improving seed cotton yield will not be useful as the negative association between bolls no. and boll weight exist and both these traits has direct positive effect on seed cotton which indicated that selection for these traits should be made carefully. Iqbal *et al.* (2003) also found that boll weight contributed directly to improve seed cotton yield.

The correlation of GOT with seed cotton yield/plant was negative but not significant and its direct effect on yield of seed cotton was negligible (–0.16). The only positive indirect effect produced via number bolls/plant (0.245) indicated that no. of bolls can be helpful in direct selection to improve GOT. Negative indirect effects were produced through node of first fruiting branches, no. of monopodial branches/plant, boll weight and staple length (Table 2). On the basis of GOT, direct selection in the segregating material using parents studies will not be useful. It was further concluded that seed cotton yield/plant and GOT were not effected each other and either trait could be considered in breeding material under study. The results suggested that genotype could be selected with high GOT with other economic traits, ie seed cotton yield and fibre quality character. Ahuja and Verma (2003) reported similar results.

A critical view revealed that the simple correlation of staple length with seed cotton yield (Table 1) was negative. The direct effect of staple length on seed cotton yield was also negative (–0.08). The indirect effect via node of first fruiting branch/plant (0.005), bolls/plant (0.007) and GOT (0.002) was positive but negligible. The staple length has its major influence via negative effect of GOT (–0.016). The correlation and the direct effect of staple length in seed cotton yield was negative which indicated true relationship between these traits and selection through this trait will affect the seed cotton yield negatively, under genetic material to be studied. Russell and Kranthi (2006) also provided same results.

The traits node of first fruiting branch, number of monopodial branches/plant, number of bolls/plant and boll weight contributed directly towards seed cotton yield. As they have direct and positive effects on it, whereas the staple length is being important component of quality traits of fibre has negative direct effect. The progress in breeding by selection for component of seed cotton yield/plant may be limited due to the strong negative association of quality traits of fibre with seed cotton yield and yield components. As the fibre traits should be at acceptable level of textile industry. From this study, it is concluded that for improving the yield of cotton, breeder should focus for improving the boll number per unit area and boll weight. The NFB at low node and less number of monopodial branches/plant for selection of genotype having earliness.

## SUMMARY

The present study was conducted to determine correlation and path coefficient analysis of morphological parameter and yield components of cotton (*Gossypium hirsutum* L.) The result showed that node of first fruiting branch, monopodial branches/plant, boll number and boll weight was positively and significantly correlated with yield in present genetic material understudy. Similarly, path coefficient analysis revealed that node of first fruiting branch, monopodial branches/ plant, boll number and boll weight had maximum direct positive effect on seed cotton yield, whereas the traits ginning out turn percentage (GOT%) and staple length had the direct negative effect on seed cotton yield. The results indicated that for evolving a superior genotype possessing all the 3 basic characteristics, ie morphological characters, high yield and improved fibre quality of international standard, breeder had to use reciprocal recurrent selection method or modified back cross or 3 way cross within genetic material under study.

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