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# COMBINING ABILITY ANALYSIS FOR SEED COTTON YIELD AND MEAN FIBRE LENGTH IN UPLAND COTTON [*G. HIRSUTUM* (L.)]

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ABSTRACT

**The line x tester analysis for combining ability of three lines and 17 testers of cotton (*G. hirsutum*) indicated predominance of nonadditive genetic variance for seed cotton yield and fibre length. The female parent, G. Cot. 14, though a good general combiner for seed cotton yield was a poor general combiner for fibre length. G-67 was an average general combiner and G. Cot. 10 a poor general combiner for both the traits. Out of the 17 males, PKV-072 Trianhpy-3, 0-356 and DP-90 had good combining ability for both characters. The crosses with high sca effects did not always involve high gca parents.**

**Key words:** *G. hirsutum*, combining ability.

In cotton, the high yielding parents may not necessarily be able to transmit their superiority to the progenies in crosses. It is therefore necessary to identify promising lines and crosses for appropriate mating design. The line x tester mating design is very useful and simple procedure for preliminary evaluation of genetic studies through hybridization programme. Accordingly, the present investigation has been undertaken to determine combining ability for seed cotton yield and mean fibre length in *G. hirsutum*.

## MATERIALS AND METHODS

The experimental materials comprised three female parents, G-67, G. Cot. 10 and and G. Cot. 14 and 17 male parents, i.e. IAN-6040, PKV-072, 71-IH-24, Deltapine, Trianhpy-3, E.P. 332, 0-170, 0-356, SA-847, 0-3080, G-3583, G-13426, JLH-102, DP-90, NCT-19 and Lankart which were obtained from different sources. They were crossed in line x tester mating design [1]. The complete set of 71 entries with 51 $F_1$s and 20 parents was sown at the Main Cotton Research Station, G.A.U., Surat and Regional Cotton Research Station, Bharuch in

randomized complete block design with three replications and plot of one row, 4.5 m long, spaced 1.20 m apart. The plant-to-plant spacing was 45 cm. Data were recorded for seed cotton yield per plant in each genotype and mean fibre length on plot basis. Mean data were used to estimate combining ability analysis using the procedure of [1].

## RESULTS AND DISCUSSION

The analysis of variance revealed highly significant differences among entries for both the characters showing sufficient genetic differences. The differences between parents were highly significants for both traits, indicating that the parents differed significantly for these characters (Table 1). The mean squares due to females were of higher magnitude in comparison with those due to the testers and line x testers, indicating greater diversity among females. The mean squares due to line x tester was of lower magnitude than that of both lines and testers, indicating that the hybrids were relatively more uniform.

**Table 1. Analysis of variance (M.S.S.) for combining ability analysis in upland cotton**

| Source | d.f. | Seed cotton yield/plant | Mean fibre length |
|---|---|---|---|
| Replications | 2 | 655.1 | 0.3 |
| Treatments | 70 | 990.7** | 10.9** |
| Parents | 19 | 729.5** | 4.3** |
| Parents vs. crosses | 1 | 13008.3** | 42.0** |
| Hybrids | 50 | 849.6** | 12.8** |
| Lines | 2 | 3370.9* | 182.1** |
| Testers | 16 | 773.4 | 6.4 |
| Lines x testers | 32 | 730.2** | 5.4** |
| Error | 140 | 277.3 | 0.3 |
| Gca | | 0.9 | 0.1 |
| Sca | | 443.1 | 21.0 |
| Gca/sca | | 0.002 | 0.003 |

*,**Significant at 5% and 1% levels, respectively.

The relative estimate of variance due to general combining ability (gca) and specific combining ability (sca) indicated that the latter were of higher magnitude for both characters, indicating predominance on nonadditive gene effects for these characters. Similar observations were reported by [2–5].

In the present study, the magnitude of nonadditive variance for both the traits was relatively high, therefore, per se performance of the parents may not be a real indication of their gca effects. However, several workers have reported a close association between per se performance of the parents and their gca effects [5]. Results almost similar to ours have been reported by [6, 7].

Considering the performance of the parents, $F_1$s and, gca effects in the materials studied, PKV-072, Trianhpy- 3, 0-356 and DP-90 are good for breeding high yielding cotton hybrids with long fibre (Table 2). Among the lines, the variety G. Cot. 14 is a good general combiner for seed cotton yield, but poor for fibre length. The female parents G. Cot. Hyb. 6

**Table 2. Per se performance and general combining ability effects of parent in upland cotton**

| Parent | Seed cotton yield/plant | | Mean fibre length | |
|---|---|---|---|---|
| | mean (g) | gca | mean (mm) | gca |
| **Lines:** | | | | |
| G-67 | 81.1 | 3.1 | 29.8 | 2.2** |
| G. Cot. 14 | 84.1 | 6.1** | 26.8 | -0.8** |
| G. Cot. 10 | 68.8 | -9.2** | 26.3 | 3.3** |
| S.E. | | 3.3 | | 0.1 |
| **Testers:** | | | | |
| IAN-6040 | 80.6 | 2.5 | 27.7 | 0.1 |
| PKV-072 | 88.8 | 10.8** | 28.6 | 0.9** |
| 71-IH-24 | 77.6 | -0.5 | 26.9 | -0.7** |
| Deltapine | 68.8 | -9.2** | 28.4 | 0.8** |
| Trianhpy-3 | 98.0 | 10.0** | 28.6 | 1.0** |
| F.P. 332 | 64.9 | -13.1** | 28.1 | 0.5** |
| 0-170 | 79.2 | 1.2 | 28.6 | 1.0** |
| 0-356 | 85.1 | 7.1** | 28.3 | 0.7** |
| SA-847 | 67.6 | -10.5** | 26.9 | -0.7** |
| G-3080 | 70.9 | -7.1** | 26.0 | -1.6** |
| G-3583 | 76.3 | -1.7 | 27.8 | 0.2** |
| G-13426 | 86.8 | 8.8** | 26.9 | -0.7** |
| JLH-59 | 82.7 | 4.7** | 26.3 | -1.4** |
| JLH-102 | 68.9 | -9.1** | 27.1 | -0.6** |
| DP-90 | 86.3 | 8.3** | 28.1 | 0.5** |
| NCT-19 | 66.7 | -11.8** | 27.2 | -0.5** |
| Lankart | 77.1 | -0.9 | 28.2 | 0.6** |
| S.E. | | 7.9 | | 0.3 |

*,**Significant at 5% and 1% levels, respectively.

absolute and a relative value. The absolute values (performance of F1s) being similar, the relative values (sca effects) increase if the performance of the base (mean of the two parents) population decreases. The crosses showing significant positive sca combined one good parent with the other poor, average or both parents average, or even both poor general combiners in the present study, and G. Cot. 10 exhibited significant negative gca for seed cotton yield, and the female parents, Hy-4 and G-67 were average general combiners for both these characters. Among the testers, PKV-072, Trianhpy-3, 0-356 and DP-90 were good general combiners for seed cotton yield and fibre length. Two male parents, viz., G. 13426 and JLH-59, though exhibited high positive gca for seed cotton yield, were poor general combiners for fibre length. Four male parents, i.e. SA-847, G-3080, JLH-102 and NCT-19, were poor general combiners for both the characters under study.

As regards the specific cross combinations, none of the F1s showed high sca effects. The discrepancy may be explained on the basis that the comparison of the two (mean performance and sca effects) estimates is based on the

**Table 3. Per se performance and specific combining ability effects of selected crosses in upland cotton**

| Cross | Seed cotton yield/plant | | Mean fibre length | |
|---|---|---|---|---|
| | mean (g) | sca | mean (mm) | sca |
| G-67 x 71 IH-24 | 88.3 | 7.7 | 30.3 | 1.2** |
| G-67 x F.P. 332 | 50.7 | -17.3 | 30.9 | 0.6** |
| G-67 x G-13426 | 84.3 | 4.9 | 30.6 | 0.6* |
| G-67 x JLH-102 | 76.0 | 4.0 | 30.4 | 1.2** |
| G-67 x DP-90 | 107.3 | 17.9 | 31.5 | 1.1** |
| G. Cot. 14 x Deltapine | 82.3 | 7.4 | 28.2 | 0.6* |
| G. Cot. 14 x Trianhpy-3 | 95.0 | -9.1 | 30.0 | 2.2** |
| G. Cot. 14 x G-170 | 99.3 | 14.0 | 29.1 | 1.3** |
| G. Cot. 14 x Lankart | 90.0 | 6.8 | 28.3 | 0.9** |
| G. Cot. 10 x Trianhpy-3 | 110.0 | 21.2** | 26.0 | -1.2** |
| G. Cot. 10 x F. P. 332 | 74.7 | 19.0** | 27.0 | 0.2 |
| G. Cot. 10 x 0-356 | 51.3 | -24.6 | 28.5 | 1.5** |
| G. Cot. 10 x G-13426 | 56.0 | -21.6 | 26.5 | 0.9** |
| G. Cot. 10 x JLH-59 | 68.3 | -5.1 | 28.8 | 3.8** |
| SE ($S_{ij}$) ± | | | | |

*,**Significant at 5% and 1%, levels, respectively.

indicating a limited utility of parental gca effects in identifying crosses with high sca effect. Almost similar results were reported by [7–9]. This means that parents, particularly for heterosis breeding, should be selected only on the basis of their specific combining ability.

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