association between characters. This might, perhaps, be due to recombination of those genes found in parents controlling the characters under study.

The grain yield was significantly and positively associated with plant height in parent Co 41 and in all the six cross combinations, with ear bearing tillers in all the parents and crosses, with ear length in ADT 37 and Co 41 and in all the crosses except cross B, with grain number in all the parents but one and in all the crosses and with 100-grain in ADT 37 and in four crosses. The positive and significant association of plant height, ear bearing tillers, grain number and 100-grain weight with grainyield was confirmed by previous workers like Kalaimani and Kadambavana sundaram (1988) in rice verieties in F_2 generations. Mahajan *et al.*, (1981) in rice varieties observed the association between ear length and grain yield to be significantly positive.

The correlation studies thus revealed that the grain yield was positively related to ear bearing tillers in all the parents and F_2 generations and to grain number in all the F_2 generations and parents except one. So, ear bearing tillers and grain number had established a strong correlation with correlation with grain yield as observed by Kalaimani and Kadambavanasundaram (1988).

For other traits, the trend was not uniform. In some cases, the plant height, ear length and 100-grain weight had positive association with grain yield, while in other cases no such definite correlation could be seen. Therefore, it is suggested that the characters ear bearing tillers and grain number should be given importance while selection for the improvement of grain yield in rice.

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COMBINING ABILITY FOR YIELD AND FIBRE PROPERTIES OF COTTON (*G. HIRSUTUM* L.) WITH DIFFERENT FUZZ GRADES

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ABSTRACT

Combining ability analysis was conducted in a line X tester model with seven lines and four testers for yield characters (seed cotton yield) and fibre characters (ginning outturn, seed index, lint index and mean halo length). The seven lines belong to *G. hirsutum* but differ in fuzz grades ranging from full fuzz to sparsely fuzz and a naked one. The fuzzed lines (TCH.104/1, TCH 70/7) and the tester LRA 5166 are good combiners for seed cotton yield. The sparsely fuzzed lines (TCH 65/8) and naked line (TCH 89/7) are good combiners for ginning out turn. The sparsely fuzzed line TCH 96/6 and the testers MCU 5 and MCU 9 are good combiners for seed index. The sparsely fuzzed line TCH 65/8 and the testers MCU 9 and LRA 5166 are good combiners for lint index. The naked line TCH 89/7 and the testers MCU 5 and MCU 9 are good combiners for mean halo length.

The combining ability analysis has been utilized to know the gene action regarding yield and fibre properties in cotton. However, relatively little is known regarding the combining ability studies involving lines differing in fuzz grades in *G. hirsutum*. The present study reports the combining ability of yield and fibre properties of **G. hirsutum** lines differing in fuzz grades.

MATERIALS AND METHODS

Seven lines of **G. hirsutum** differing in fuzz grades such as full fuzzed (TCH 63/1, TCH 63/4, TCH 104/1, TCH 70/7) sparsely fuzzed (TCH 65/8, TCH 96/6) and naked (TCH 89/7), (Hutchinson and Ramaiah, 1938) were crossed with each of the four tester cultivars namely, MCU 5, MCU 7, MCU 9 and LRA 5166, in a line x tester mating design

Table 1. General Combining Ability effects of parents for different characters.

Parent	Characters				
	Seec cotton yield	Ginning outturn	Seed index	Lint index	Mean halo length
Lines					
TCH 63/1	-2.44*	-0.84*	-0.10	-0.03	0.26
TCH 63/4	-4.01*	-1.36*	-0.15*	-0.31	-0.36
TCH 104/1	5.49*	0.60*	0.11	0.02	-1.33*
TCH 65/8	0.86	0.69*	0.02	0.12*	0.38
TCH 96/6	-0.30	-1.61*	0.26*	0.03	0.05
TCH 70/7	3.09*	1.46*	0.07	0.11*	-0.21
TCH 89/7	-2.68*	1.07*	0.01	0.05	1.22*
Testers					
MCU 5	-1.98*	-0.26	0.01*	-0.06*	1.19*
MCU 7	1.05	-0.55*	-0.09*	-0.18*	-1.95*
MCU 9	-0.51	0.04	0.12*	0.18*	0.70*
LRA 5166	1.44*	0.78	-0.03*	0.06*	0.06
SE (lines)	0.51	0.18	0.05	0.03	0.20
SE (testers)	0.39	0.14	0.03	0.02	0.15

during Winter 1989. In Summer 1989, a trial, comprising 28 F1s was laid out in a randomized block design with three replications. F1s were grown in a single row of 3 m length with the spacing of 30 cm and 60 cm within and between rows, respectively. Leaving the border plants, data were recorded on randomly taken five competitive plants in each of the F1s for single plant yield, ginning outturn, seed index, lint index and mean halo length. Combining ability analysis estimates were based on the Kemthorne (1957) model.

RESULTS AND DISCUSSION

Anova for combining ability revealed that significant differences due to males, females and males X females existed for all the traits indicating an appreciable amount of differences in the genetic contribution of the parents and genetic interaction in hybrids.

General Combining Ability Effects

The fully fuzzed lines TCH 104/1 and TCH 70/7 and the tester LRA 5166 were good general combiners for seed cotton yield. In respect of ginning outturn, among the lines tested TCH 104/1, TCH 70/7, TCH 65/8 (Sparsely fuzzed) and TCH 89/7 (naked) among lines were the best general combiners. In the case of seed index TCH 91/6 a sparsely fuzzed line and the tester MCU 9 were the best general combiners. In respect of lint index, TCH 70/7 (fully fuzzed) and TCH 65/8 (sparsely fuzzed) among lines and MCU 9 and LRA 5166 among testers were the good general combiners. In the case of mean halo length, TCH 89/7 (naked) and MCU 5 and MCU 9 were the good general combiners. There was no correspondence between *per se* peformance and gca effects of the parents. Thus selection of parents for their good general combining ability cannot be based on their *per se* performance.

TCH 104/1 (fully fuzzed line) for seed cotton yield and ginning outturn; TCH 65/8 (sparsely fuzzed) for ginning outturn and lint index, TCH 70/7 (full/fuzzed) for seed cotton yield, ginning outturn, and lint index, TCH 89/7 (naked) line for ginning outturn and mean halo length were good general combiners. The internating population involving all possible crosses among these genotypes and simultaneously subjected to biparental mating in early generations will offer maximum promise in breeding less fuzzy and high yielding varieties with high fibre characters.

Specific Combining Ability Effects

The good specific cross combinations were MCU 5 x TCH 96/6, MCU 5 x TCH 89/7, MCU 9 X TCH 70/7, IRA 5166 X TCH 104/1 for seed cotton yield; MCU 5 X TCH 63/1, MCU 7 X TCH 63/4, MCU 7 X TCH 89/7, MCU 9 X TCH 65/8, MCU 9 X TCH 96/6, MCU 9 X TCH 70/7, LRA 5166 X TCH 89/7 for ginning outturn; MCU 5 x TCH 65/8, MCU 5 X TCH 96/6, MCU 7 X TCH 96/6, MCU 7 X TCH 70/7, MCU 9 X TCH 63/1, MCU 9 X TCH 63/4, MCU 7 X TCH 104/1, MCU 9 X TCH 89/7, LRA 5166 X TCH 63/4 for seed index; MCU 5 X TCH 65/8, MCU 5 X TCH 96/6, MCU 7 X TCH 65/8, MCU 9 X TCH 63/1, LRA 5166 X TCH 63/4 for lint index, MCU 5 x TCH 63/1, LRA 5166 x TCH 89/ 7 for mean halo length.

None of the crosses exhibited specific combining ability (sca) effect for all the characters. The crosses involving sparsely fuzzed lines and naked seed line exhibited high sca effects for seed cotton yield and other fibre properties. The best F_1 is not from the crosses which showed maximum gca effects. The discrepancy may be explained by

Table 2. **Specific Combining Ability effects of hybrids for different characters.**

Crosses	Seed cotton yield	Ginning outturn	Seed index	Lint index	Mean halo length
MCU 5 x TCH 63/1	-0.80	2.42*	-0.51*	-0.12	2.85*
MCU 5 x TCH 63/4	-0.65	-0.66	-0.61*	-0.39	-1.23*
MCU 5 x TCH 104/1	-3.73*	-0.89	-0.16	0.01	-0.53
MCU 5 x TCH 65/8	-1.63	-0.18	0.60*	0.26*	0.30
MCU 5 x TCH 96/6	4.61*	-0.41	0.56*	0.19*	-0.07
MCU 5 x TCH 70/7	-1.78	0.95	-0.54*	-0.06	0.72
MCU 5 x TCH 89/7	3.97*	-1.22*	0.65	0.10	-2.04*
MCU 7x TCH 63/1	0.87	-1.22*	-0.13	-0.44*	-0.22
MCU 7 x TCH 63/4	0.002	1.03*	0.01	0.42*	-0.23
MCU 7 x TCH 104/1	0.91	0.26	-0.09	-0.02	0.84
MCU 7 x TCH 65/8	0.83	-0.34	-0.42*	0.18*	-0.50
MCU 7 x TCH 96/6	0.95	0.01	0.40*	-0.29*	-0.02
MCU 7 x TCH 70/7	1.29	-1.20*	0.57*	0.05	0.89
MCU 7 x TCH 89/7	-4.85*	1.46*	-0.34*	0.10	-0.78
MCU 9 x TCH 63/1	-1.28	-1.35*	0.56*	0.48*	-0.37
MCU 9 x TCH 63/4	-0.07	0.05	0.28*	-0.26*	1.02
MCU 9 x TCH 104/1	-3.57*	-0.33	0.56*	0.07	0.82
MCU 9 x TCH 65/8	3.48	1.18*	-0.51*	-0.31*	0.25
MCU 9 x TCH 96/6	-4.63*	1.52*	-0.65	0.02	-0.25
MCU 9 x TCH 70/7	5.06*	1.04*	-0.11	0.07	-1.86*
MCU 9 x TCH 89/7	1.00	-2.10*	0.42*	-0.07	0.38
LRA 5166 x TCH 63/1	1.22	0.15	0.06	0.09	-2.26*
LRA 5166 x TCH 63/4	0.72	-0.40	0.87*	0.23*	0.43
LRA 5166 x TCH 104/1	6.38*	0.96	-0.30	-0.06	-1.14*
LRA 5166 x TCH 65/8	-2.68	-0.65	0.33	-0.13	-0.05
LRA 5166 x TCH 96/6	-0.94	-1.12	-0.31*	0.09	0.32
LRA 5166 x TCH 70/7	-4.58*	-0.80	0.07	-0.06	0.25
LRA 5166 x TCH 89/7	-11.9*	1.86*	-0.72*	-0.14	2.45*
	1.02	0.36	0.09	0.06	0.40

the fact that the comparison of these two estimates is a comparison of an absolute value with a relative value. The absolute values (performance of F_1) being similar the relative values (sca effect) would increase with decrease in the performance of base population. The crosses showing significant sca effects invovled one good and the other poor combiners or even both poor general combiners in this study (Table 2). Thus, the choice of the parents should be based on their general combining ability test. The crosses exhibiting high sca effect involving one good and one poor general combiners could produce desirable transgressive segregants.

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