MISRA,R.C. and SAHU,B.C. (1985). Genetic parameters, correlation and path coefficient analysis in green gram *Vigna radiata* (L.) Wilczek). **Andhra Agric. J., 32** : 87-91

RAMANA,M.V. and SINGH,D.P. (1987). Genetic parameters and character association in green gram. **Indian J. Agric. Sci. 57** : 661-3.

ROBINSON,H.F., COMSTOCK,R.B. and HARVEY,P.H. (1951). Genotypic and phenotypic correlation in corn and their implication in selection. **Agron. J., 43** : 283-287.

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COMBINING ABILITY STUDIES FOR QUANTITATIVE CHARACTERS IN COTTON (*Gossypium hirsutum*).

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ABSTRACT

In a combining ability analysis of 40 F_1 hybrids developed by line X tester method in cotton, non-additive gene action was predominant for all the seven quantitative characters, *viz.*, plant height, number of internodes, first sympodia emergence, number of sympodia per plant, number of bolls per plant, boll weight and seed cotton yield. Half X Half, CRH-68 and Laxmi among the pollen parents, proved to be the best general combiners and Kampala X MCU - 7 among the hybrids recorded the best specific combining ability effect for most of the characters studied. The crosses involving these parents should provide potential breeding material for further exploitation through selection.

KEY WORDS : *Gossypium hirsutum*, Combining ability, Quantitative Characters.

For a systematic breeding programme, it is essential to identify parents as well as crosses which could be exploited to bring about further genetic improvement in both yield and its related components. Line X tester approach proposed by Kempthorne (1957) is the most convenient model to test a large number of genotypes for their combining ability. Accordingly, the present study was undertaken to have an insight into the nature of combining ability for yield and its related characters in selected cotton genotypes.

MATERIALS AND METHODS

Fifty four genotypes comprising ten ovule parents (Acala hopi, Gregg, Hancock, Half X Half, Rex, Bobdel, Reba-B50, Kampala, CRH-68 and Laxmi), four pollen parents (MCU-5, MCU-7, MCU-9 and LRA-5166) and forty F_1s obtained by combining the above parents were grown in randomised block design with three replications at the Cotton Breeding Station, Tamil Nadu Agricultural University, Coimbatore during summer, 1990. Each genotype was raised in single row of 4.5 m length in each replication. A spacing of 75cm between rows and 30cm between plants was adopted. Data were recorded from five randomly selected competitive plants in each plot for quantitative characters, *viz.*, plant height, boll weight and seed cotton yield per plant. The data were subjected to analysis of variance based on the line X tester model (Kempthorne, 1957).

Table 1. Analysis of variance

Source	df	Mean sum of squares						
		Plant height	No. of internode per plant	First sympodial emergence	No. of sympodia per plant	No. of bolls per plant	Boll weight	Seed cotton yield/plant
Replication	2	241.27**	37.74*	0.14	53.57**	11.40	0.08	4.60
Treatment	53	195.93**	20.22	0.73	10.22	14.10**	0.39**	156.57**
Error	106	63.69	8.30	0.59	8.39	6.43	0.17	8.65
GCA		9.52	0.03	0.0006	0.04	0.03	0.002	0.29
SCA		25.36	0.21	0.18	1.14	3.09	0.02	53.24
GCA : SCA		0.37:1	0.14:1	0.003:1	0.03:1	0.009:1	0.10:1	0.005:1

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

Table 2. Estimates of General Combining ability effects.

Parents	Plant height	No. of internodes	First sympodial emergence	No. of sympodia per plant	No. of bolls per plant	Boll weight	Seed Cotton yield per plant
Ovule parents							
Acalahopi	-7.90*	-0.88	-0.05	-1.01	-0.55	-0.12	-1.12
Gregg	-0.01	0.07	-0.22	-0.79	-0.10	-0.16	-1.15
Hancock	-4.59	-0.73	-0.39	-0.27	-0.14	-0.28*	-2.25
Half x Half	7.51*	1.86*	0.12	1.42	-0.31	0.36*	5.04**
Rex	-0.75	-0.67	-0.07	0.31	-0.54	-0.03	-3.90**
Bobdel	4.29	-0.47	0.05	0.18	-0.05	-0.15	-1.57
Reba-850	2.38	1.51	0.38	0.22	-1.95*	0.18	-3.45**
Kampala	2.19	0.56	-0.31	-0.78	0.95	0.22	0.72
CRH-68	-3.01	-0.90	0.52	-0.17	1.35	-0.22	4.01**
Laxmi	-0.11	-0.92	-0.02	0.88	1.36	0.20	3.68**
SE (gi)	2.30	0.83	0.22	0.83	0.73	0.12	0.84
Pollen parents							
MCU-5	0.74	-0.61	-0.01	-0.78	-0.53	0.08	-2.24**
MCU-7	-2.85	0.87	0.04	-0.91	-0.07	-0.04	0.89
MCU-9	-1.66	-0.64	-0.08	0.59	0.34	-0.23*	0.27
LRA-5166	3.77*	0.41	0.05	1.10*	0.26	0.97*	1.07*
SE (gj)	1.45	0.53	0.14	0.52	0.46	0.07	0.53

* Significant at 5% level ** Significant at 1% level.

RESULTS AND DISCUSSION

Analysis of variance for specific combining ability (SCA) were higher than variances due to general combining ability (GCA) for all the seven characters studied, indicating operation of non-additive gene actions (Table 1). Several workers (Lather, 1985;Deshpande *et al.*, 1991) have also reported non-additive genetic variance for yield and other characters.

Among the ten ovule parents, Half X Half, CRH-68 and Laxmi were good general combiners for seed cotton yield. Half X Half was a good general combiner for important quantitative characters like plant height, number of internodes, number of sympodia per plant, boll weight and seed cotton yield per plant. CRH-68 and Laxmi were good general combiners for seed cotton yield per plant. Among the pollen parents, LRA-5166 had favourable general combining ability effects for plant height, number of sympodia per plant, boll weight and seed cotton yield per plant (Table 2).

The best cross combinations for different characters did not combine the best ovule and pollen parents.. Three cross combinations i.e. Kampala X MCU-7, Gregg X MCU-7 and Rex X LRA-5166 showed conspicuous specific combining ability effects for seed cotton yield. However in only one combination, Kampala X MCU - 7, the *sca* was significant for boll weight (Table 3).

The most crucial phase in a pedigree breeding programme is selection of suitable parents. For selection of suitable parents, genetic variance plays an important role. In most cases, all good combining parents for yield should also be good combiners for yield components *i.e.*., boll number, or boll weight (Bhandari, 1978). In the present study in all hybrid combinations except Kampala X MCU - 7, the *sca* were not significant. So also parents with *gca* did not produce crosses with *sca* and those crosses with *sca* did not involve parents with *gac*. The above inference shows the involvement of epistatic genes and complexity of seed cotton yield in this crop.

REFERENCES

BHANDARI,D.R. (1978). Line X Tester analysis of combining ability and its interactions with environment in American cotton. **Madras Agric. J., 64** : 218-225.

DESHPANDE,L.A., DEOSARKAR,D.B. and DESH MUKH,R.C. (1991). Combining ability for economic traits

Table 3. Estimates of Specific combining ability effects .

Hybrids			Plant height	No. of internodes	1st sympodial emergence	No. of sympodia per plant	No. of bolls per plant	Boll weight	Yield/plant
Acalahopi	x	MCU-5	-6.43	-0.39	-0.50	-0.93	-2.40	0.20	-0.33
	x	MCU-7	0.95	-1.86	0.63	-1.13	-0.86	-0.12	-6.44**
	x	MCU-9	0.26	1.23	0.26	0.52	2.87	0.04	10.47**
	x	LRA-5166	5.21	1.02	-0.38	1.54	0.40	-0.12	-3.68
Gregg	x	MCU-5	10.83	1.25	-0.32	2.34	1.47	-0.16	-0.35
	x	MCU-7	-2.39	0.09	1.11	-0.02	2.51	0.04	10.95**
	x	MCU-9	-2.96	0.95	-0.42	-1.28	-2.15	0.05	-6.41**
	x	LRA-5166	-5.47	-2.28	-0.36	-1.03	-1.83	0.06	-4.19
Hancock	x	MCU-5	7.27	0.42	0.46	-0.44	0.74	0.06	5.02*
	x	MCU-7	5.26	1.12	-1.05	1.20	0.80	0.23	4.12
	x	MCU-9	-2.53	-1.30	0.13	-0.55	-1.17	-0.04	-8.09**
	x	LRA-5166	-10.01	-0.21	0.45	-0.20	-0.37	-0.24	-1.04
Half x Half	x	MCU-5	4.18	0.79	0.18	-0.52	1.03	0.00	0.21
	x	MCU-7	-4.06	0.36	-0.06	0.24	-2.77	0.11	4.68
	x	MCU-9	5.29	-1.41	0.08	0.27	2.63	-0.41	1.47
	x	LRA-5166	-5.41	0.26	-0.21	0.004	-0.88	0.29	-6.36**
Rex	x	MCU-5	-1.19	-2.09	0.18	0.73	-1.07	-0.25	-5.28*,
	x	MCU-7	-1.31	0.73	-0.12	0.94	0.71	-0.29	0.73
	x	MCU-9	4.23	-0.96	-0.16	-0.04	-2.04	0.31	-5.93*
	x	LRA-5166	-1.71	2.36	0.11	-1.63	2.41	0.23	10.49**
Bobdel	x	MCU-5	1.37	1.33	0.41	0.34	1.99	0.09	8.74**
	x	MCU-7	-14.40*	-2.29	0.30	-2.43	-2.56	-0.12	-14.61**
	x	MCU-9	0.72	0.26	0.36	1.06	-1.04	-0.07	-0.56
	x	LRA-5166	12.30	0.73	-0.48	1.35	1.61	0.10	6.43**
Reba-850	x	MCU-5	-4.43	-0.50	0.21	-0.20	1.24	0.60	6.54**
	x	MCU-7	6.09	-0.45	-0.39	-0.17	-0.63	-0.05	-2.19
	x	MCU-9	-1.77	0.99	-0.27	0.60	-0.12	-0.40	-1.21
	x	LRA-5166	0.11	-0.02	0.46	-0.22	-0.48	-0.13	-3.13
Kampala	x	MCU-5	-0.54	-0.42	-0.27	-0.53	-2.31	-0.04	-6.74**
	x	MCU-7	2.99	3.41	0.19	1.79	5.79**	0.21	11.29**
	x	MCU-9	1.59	-0.69	-0.17	-1.04	-2.79	0.21	-5.16*
	x	LRA-5166	-4.03	-2.27	0.25	-0.21	-0.68	-0.46	0.62
CRH-68	x	MCU-5	-2.54	0.83	-0.33	0.33	-0.53	-0.27	-5.01*
	x	MCU-7	4.54	-0.42	0.02	-0.11	-1.02	-0.01	-5.74*
	x	MCU-9	-9.47	-2.16	0.31	-1.65	0.96	0.06	6.13*
	x	LRA-5166	7.47	1.78	-0.01	1.43	0.59	0.23	4.62
Laxmi	x	MCU-5	-8.51	-1.15	-0.02	-0.80	-0.15	-0.32	-2.77
	x	MCU-7	2.32	-0.65	-0.01	-0.29	-1.95	0.02	-2.78
	x	MCU-9	4.63	3.16	-0.12	2.11	2.87	0.24	8.30**
	x	LRA-5166	1.55	-1.33	0.17	-1.02	-0.76	0.04	2.62
	S.E. (S_{ij})		4.50	1.66	0.44	1.67	1.46	0.24	1.69

in interspecific crosses of *deshi* cotton. **J. Indian Soc. Cott. Improv., 16** : 19-24.

KEMPTHORNE,O. (1957). **An Introduction of Genetic Statistics.** Jon Wiley and Sons., Inc., New York.

LATHER,B.P.S. (1985). Heterosis and combining ability studies in upland cotton. (*G.hirsutum* L.). **Cotton Develop., 15** (2-3) : 37-42.