J. Cotton Res. Dev. **28** (2) 207-210 (July, 2014)

Combining ability for seed cotton yield and fibre characters in upland cotton (*Gossypium hirsutum* L)

S.RAJAMANI*, M. GOPINATH AND K. H. P. REDDY
Acharya N. G. Ranga Agricultural Uiversity, Regional Agricultural Research Station, Guntur 522 034
**E-mail : mani_breeder@rediffmail.com*

ABSTRACT : Fifteen single crosses along with parents were evaluated for combining ability. The *gca* variances were significant for the character which includes boll weight, seed cotton yield/plant, harvest index, lint index, seed index, ginning outturn, 2.5 per cent span length, bundle strength, and uniformity ratio. The *sca* variances were significance for number of bolls/plant, boll weight, seed cotton yield/plant, harvest index, seed index, lint index, ginning outturn, 2.5 per cent span length and bundle strength. Cross 241-4-2 × Hyps 152 can directly be recommended for commercial cultivation. Superior performance of this particular cross may be attributed with best general combiners for boll weight, sympodia/plant with highest *per se* performance of seed cotton yield/plant.

Key words: Combining ability, cotton

Cotton (*Gossypium hirstum L.*) is one of the important commercial crops of the world and among the fibre crops it is considered as the "King". India is the second largest producer of the world with 371 lakh bales and productivity of 481 kg lint/ha and forms the backbone of Indian textile industry. Parents with good combining ability would be useful for hybrid development to exploit heterotic gene combination or for use in pedigree breeding to develop inbred lines with favourable gene combination to improve yield, oil content and fibre quality traits. Combining ability analysis helped in identification of parents with high general combining ability (GCA) and parental combinations with high specific combining ability (SCA) effects. It also aids in the selection of parental combinations with relatively better agronomic performance than expected based on the average performance of the parental lines. The need to further amplify efforts for continued genetic improvement of cotton for yield and fibre quality traits is even greater today than before in view of a low production/unit area and low fibre quality traits as compared to other advanced cotton growing countries of the world to meet the challenges of 21st century. Seed cotton yield and its quality parameters are quantitative traits, which are controlled by several genes thus showing a range of values in segregating generation.

The experiment consists of 6 diverse cotton cultivars *viz* , 241-4-2, G Cot 100, RFS 3438, 65-2(s) -3, Hyps 152 and Suvin were raised in *kharif,* 2009 in 6 rows of 10 hills in a crossing block. Two staggered sowings were taken up at weekly intervals to get synchronization of flowers for effective crossing .A spacing of 105 cm between rows and 60cm with in the row was adopted. Hand emasculation was followed for crossing work. A total of 15 single cross hybrids were produced by 6 parents in a half diallel fashion. Data was collected on 5 randomly selected plants in each replication on 13 characters *viz.*, monopodia, sympodia and bolls/plant, boll weight(g), seed cotton yield/plant (g), ginning outturn, seed index (g), lint index (g), 2.5 per cent span length (mm), bundle strength (g/tex), micronaire (10^{-6} g/inch), uniformity ratio and harvest index. Single row of 15 single crosses along with parents were evaluated in randomized block design in 3 replications to asses combining ability for seed cotton yield and fibre characters.

Analysis of variance for general combining abilities and specific combining ability indicated significant differences for the characters *viz.*, boll weight, seed cotton yield/plant, harvest index, seed index, lint index, ginning outturn, 2.5 per cent span length and bundle strength whereas it was non significant for monopodia/plant, sympodia/plant and micronaire for both GCA and SCA effects. How ever bolls/plant showed significance for sca effects and uniformity for gca effects.

Parents 241-4-2 (24.94) followed by Hyps

Table 1. General combining ability effects of seed cotton yield and other characters in cotton

Cultivars	Monopodia/ plant	Sympodia/ plant	Bolls/ plant	Boll weight (g)	Seed cotton yield	Harvest index (g)	Seed index (g)	Lint index (g)	GOT	2.5 per cent span length (mm)	Bundle strength (g/tex)	Micro-naire (10^{-6} g/ inch)	Uni-formity
241-4-2	-0.09	-0.394	2.028	0.271**	24.94**	0.012*	-0.55**	-0.411**	-0.753**	-0.847*	-1.106**	-0.031	-0.254
G Cot100	-0.065	-0.091	0.028	-0.038	-8.681	-0.007	-0.096	-0.003	0.422*	0.199	0.028	0.057	0.467
RFS 3438	-0.09	0.439	2.861*	-0.192*	-3.972	-0.004	-0.675**	-0.186**	0.531**	-1.935**	-1.376**	-0.001	-0.183
65-2(s)-3	0.006	-0.49	-3.306*	0.046	-8.972	0.002	-0.008	0.322**	0.126**	-1.681**	-1.043**	0.04	1.079**
Hyps 152	-0.615	0.21	-1.889	0.342**	22.65**	0.012**	0.592**	0.297**	-0.007	0.794	1.603**	-0.001	0.342
Suvin	0.264**	0.256	0.278	-0.429**	-25.97**	-0.014**	0.738**	-0.019	-1.319**	3.469**	1.894**	-0.064	-1.45**
s^2g	0.01	0.062	3.177	0.074	342.92	0.000	0.324	0.078	0.763	3.811	1.952	0.000	0.579
s^2s	0.048	-0.108	84.6	0.287	2110.37	0.000	2.168	0.374	0.844	5.084	1.362	-0.003	0.746
gca / sca	0.218	-0.579	0.038	0.258	0.162	0.162	0.150	0.209	0.904	0.750	1.433	-0.001	0.776
h^2 Narrow sense	0.157	0.197	0.059	0.293	0.213	0.213	0.225	0.289	0.559	0.537	0.626	0.001	0.362
h^2 Broad sense	0.516	0.027	0.838	0.861	0.867	0.867	0.978	0.981	0.869	0.895	0.845	-0.278	0.596

* Significance at 5 per cent level, ** Significance at 1 per cent level

Table 2. Specific combining ability effects in single cross hybrids for seed cotton yield and other characters in cotton

Crosses	Monopodia/ plant	Sympodia/ plant	Bolls/ plant	Boll weight (g)	Seed cotton yield	Harvest index (g)	Seed index (g)	Lint index (g)	GOT	2.5 per cent span length (mm)	Bundle strength (g/tex)	Micro-naire (10^{-6} g/ inch)	Uni-formity
241-4-2 × G cot 100	-0.296	-1.065	-1.262	0.395	24.72	0.01	1.17**	0.568**	0.404	2.147	-0.31	0.043	0.54
241-4-2 × RFS 3438	0.295	0.343	2.238	0.683*	68.35**	0.043**	0.415	0.118	-0.338	-0.92	-0.372	0.002	0.757
241-4-2 × 65-2 (s) -3	-0.201	-0.161	3.071	0.312	10.345	0.001	-0.385	-0.29**	-0.201	-1.84	-1.372	-0.107	2.261*
241-4-2 × Hyps 152	-0.313	-0.361	15.98**	-0.184	69.054**	0.04**	-0.485*	0.135	1.633**	-0.315	2.049*	0.035	1.265
241-4-2 × Suvin	-0.426	1.093	6.155	0.020	5.345	0.004	-1.83**	-0.615**	0.679	-5.19**	-2.443*	0.164	1.457
G Cot 100 × RFS 3438	0.029	0.435	14.23**	-0.742**	8.637	-0.015	-0.572*	-0.624**	-1.913**	-0.899	-0.639	-0.019	-0.764
G Cot 100 × 65-2 (s) -3	0.166	0.197	2.405	0.454	55.304**	0.000	-0.839**	-0.399**	-0.076	-1.92	-0.405	0.039	-1.993
G Cot 100 × Hyps 152	0.387	0.464	-6.345	-0.509*	-59.988**	-0.008	-1.872**	-0.907**	-0.309	-1.528	-0.05	-0.086	0.411
G Cot 100 × Suvin	-0.226	-0.415	13.48**	-0.338	35.970	0.009	3.082**	1.11**	0.037	3.197*	0.090	0.043	0.369
RFS 3438 × 65-2 (s) -3	0.191	1.305	-2.762	-0.526*	-20.405	-0.004	0.474	0.051	-0.617	-0.52	-0.535	-0.102	-0.210
RFS 3438 × Hyps 152	-0.521*	-0.361	-7.845	0.645*	20.304	-0.011	0.574*	-0.157	-1.151*	1.872	1.553	0.006	-0.106
RFS 3438 × Suvin	0.366	0.26	7.655	1.249**	38.595	0.002	-0.772**	0.093	1.462*	1.864	2.261*	-0.098	0.486
65-2 (s) -3 × Hyps 152	0.283	-0.332	8.988*	-0.026	42.304*	0.017	0.207	-0.032	-0.48	0.485	2.953	-0.102	-0.268
65-2 (2) -3 × Suvin	-0.296	-0.345	-4.512	-0.221	-25.405	-0.003	0.861**	0.185	-1.001	3.41**	1.561	0.093	1.090
Hyps 152 × Suvin	0.024	-0.811	-3.262	0.183	-3.030	0.003	2.695**	1.11*	-0.601	2.468*	0.549	-0.198	-1.773

*Significance at 5 per cent level, **Significance at 1 per cent level

152 (22.65) shown positive significant *gca* effects for seed cotton yield/plant. Four crosses had shown positive significant *sca* effects for yield *viz.*, 241-4-2 × Hyps 152 (69.054), 241-4-2 × RFS 3438 (68.35), G Cot 100 × 65-2(s)-3 (55.304) and 65-2(s)-3 × Hyps 152 (42.304). The first two crosses also exhibited significant heterosis for seed cotton yield/plant. Cross 241-4-2 × Hyps 152 can directly be recommended for commercial cultivation. Superior performance of this particular cross may be attributed with best general combiners for boll weight, sympodia/ plant with highest *per se* performance of yield/ plant (326.66). As this character governed by both additive and non additive gene actions either heterosis or pedigree method of breeding may be followed. Results of Panhwar *et al.,* (2008), Gamal Mohamed *et al.,* (2009), Patel *et al.,* (2009) and Wandhare *et al.,* (2010) were in agreed with present findings (Table 1).

Parent Suvin recorded positive significant *gca* effects (3.469) as this parent is the best general combiner for 2.5 per cent span length. Suvin contributed mostly for the fibre improvement in diallel crosses. Positive significant *sca* effects were shown by crosses 65-2(s)-3 × Suvin (3.410), G Cot 100 × Suvin (3.197) and Hyps 152 × Suvin (2.468). These crosses also exhibited significant relative heterosis for 2.5 per cent span length indicated that these crosses were the best F_1 hybrids to produce superior fibre characters. This character is governed by both additive (*gca*=31.989) and non additive (*sca*=6.583) gene effects, hence either pedigree or heterosis method of breeding may be adopted for improvement of the character. Several workers *viz.*, Rao and Reddy (2002) and Sundarvadivelu *et al.,* (2005) also supported the present findings.

Parents Suvin (1.894) and Hyps 152 (1.603) shown significant positive *gca* effects for the character bundle strength. Whereas cross RFS 3438 × Suvin had shown significant positive *sca* effects (2.261) as well as relative heterosis (13.89) for bundle strength. This character was governed by additive gene action (*gca*=16.581) as well as non additive gene action (*sca*=2.330), hence pedigree method of breeding or heterosis breeding may also be considered for improvement of this trait. Neither parents nor crosses had shown significant positive *gca* and *sca* effects for the character micronaire. None of the crosses also shown heterotic effects for this character. Parent 65-2(s)-3 shown positive significant *gca* effects (1.079) and crosses 241-4-2 × 65-2(s)-3 exhibited significant positive *sca* effects (2.261) as well as relative heterotic effects (d_i=8.55) for the character uniformity ratio. This character is governed by additive gene effects (*gca*=5.920) hence simple selection would be most effective for improvement of this trait. Reports by earlier worker *viz.*, De Aguiar *et al.,* (2007) was in accordance with present findings (Table 2).

Cross 241-4-2 × Hyps 152 had positive and significant *sca* effects for seed cotton yield, number of bolls ,ginning outturn and fibre strength. This cross had shown highest *sca* effect for yield and bundle strength. This would be the best cross combination with highest *per se* performance for seed cotton yield/plant (326 g) when compared to parental means (241-4-2=171g; Hyps 152=221 g). The highest *sca* effect for yield in this cross may resulted from high × high general combiners for seed cotton yield ,boll weight and harvest index. This cross would be directly recommended for commercial exploitation of hybrid vigour. Cross 241-4-2 × RFS 3438 also exhibited high *sca* effect for seed cotton yield ,boll weight and harvest index. This cross shows positive *sca* effects for monopodia, sympodia and bolls/plant, seed index, lint index, micronaire and uniformity. The highest *sca* effects resulted from high × low general combiners for seed cotton yield, boll weight, harvest index and ginning out turn. This cross would also be directly recommend for commercial exploitation of hybrid vigour.

REFERENCES

De Aguiar, P.A., Penna, J.C.V., Freire, E.C. and Melo,L.C 2007. Diallel analysis of upland cotton cultivars. *Crop Breed. Appl. Biotech.* **7**: 353-59.

Gamal Mohamed, I.A., Abd-El-Halem and Ibrahim, E.M.A. 2009. Genetic analysis of yield and its components of Egyptian cotton (*Gossypium barbadense* L.) under divergent environments. *American Eurasian Jour. Agri. Environ. Sci.* **5** : 5-13.

Panhwar, S.A., Baloch, M.J., Jatoi W.A., Veesar, N. F. and Majeedano, M.S. 2008. Combining ability estimates from line x tester mating design in upland cotton. *Proc. Pakistan Acad. Sci.* **45** : 69-74.

Patel, A. D., Patel, U. G. and Kumar, V. 2009. Diallel analysis for combining ability for seed cotton yield and its component traits in upland cotton. *J. Cotton Res. Deve.* **23** : 222-25.

Rao, G. N. and Reddy, M. S. S. 2002. Combining ability studies of yield and yield contributing traits using diversified plant types in cotton. *J. Cotton Res. Deve.* **16** : 19-23.

Sundaravadivelu, K., Reddy, V.R.K and Rathinavel, K. 2005. Heterosis and inbreeding depression in intervarietal crosses of cotton (*Gossypium hirsutum* L.) selfed progenies. *Crop Res.,* Hisar. **29** : 474-79.

Wandhare, M.R., Patil, B.R, Ambhore, K.T. and Bhongle, S.A. 2010. Diallel analysis for estimating combining ability of quantative traits in upland cotton. *Ann. Plant Physiol.* **24** : 62-64.

Received for publication : December 22, 2012
Accepted for publication : March 12, 2013