



Combining ability for yield components in intra and inter specific hybrids of cotton (*Gossypium* spp.)

N.A. SARAVANAN AND A. GOPALAN

Centre for Plant Breeding and Genetics, Tamil Nadu Agrl. University, Coimbatore-641 003, Tamil Nadu.

Abstract: Combining ability analysis was carried out in a 7 x 7 diallel cross for yield and its contributing characters in cotton to study the nature of general and specific combining ability of parents and their hybrids respectively. All the six characters viz. days to first flower, plant height, number of bolls per plant, boll weight, number of seeds per boll and seed cotton yield per plant were found to be controlled by both additive and non-additive gene action with predominance of additive gene action. The parent Suvin was the best combiner for number of bolls per plant and MCU 12, Paiyur 1 and MCU 5 were the best combiners for seed cotton yield per plant.

Key words : Cotton, Combining ability.

Introduction

Information on the nature of combining ability and type of gene action of economic characters, is necessary for selection of suitable parents for development of hybrids. Inter specific cotton hybrids involving *G. hirsutum* (2n=26) and *G. barbadense* (2n=52) have received promising welcome in every regions. For any hybridization programme, the selection of parents is an important aspect in all crop improvement programmes. As such, studies to determine the combining ability not only provide necessary information regarding the choice of parents but they also simultaneously illustrate the nature of gene action involved. Accordingly, the present study was taken up during 1999-2000 at Faculty of Agriculture, Annamalai University to have an idea of the nature of combining ability for yield and other important traits in upland and Egyptian cotton with a view to identify good combiner for effective yield improvement.

Materials and Methods

A set of 7 x 7 diallel crosses between six *G. hirsutum* genotypes viz. MCU 12, Paiyur 1, SVPR 2, Anjali, Maruthi and MCU 5 and one *G. barbadense* genotype, Suvin were crossed in all possible combinations (including reciprocals) and 42 F₁ hybrids were produced. Seven parents and 42 F₁ hybrids were grown in a randomised block design with three replications. A single replication had one row each of parents and F₁ hybrids. Two to three seeds were hand dibbled

with a spacing of 140 x 45 cm. Ten plants were maintained for each population per replication. The recommended agronomic practices were provided to raise a good crop. Plant protection schedules also resorted to keep the crop free from pest and diseases. Five plants were randomly selected from each population per replication and observations were recorded on days to first flower, plant height, number of bolls per plants, boll weight, number of seeds per boll and seed cotton yield per plant. Combining ability analysis was carried out using method 2, model 1 as described by Griffing (1956).

Results and Discussion

ANOVA for combining ability

Combining ability analysis revealed that variances due to *gca* and *sca* were highly significant for all the six characters studied (Table 1). Indicating presence of both additive and non-additive gene action for controlling these traits. The magnitude of *gca* variance was, however higher than *sca* and *rca* variance which revealed preponderance of additive gene action for all the six characters. These observations are confirmation with the findings obtained by Marani (1967), Gridley (1975), Baker and Verhalen (1975) and Kalsy *et al.* (1981) for seed cotton yield per plant. Under such situation when both additive and non-additive gene actions controlled the important traits, recurrent selection approach would be desirable for improving yield.

Table 1. Analysis of variance of combining ability for six characters in hybrid and their parents

Source	Days to first flower	Plant height	Number of bolls per plant	Boll weight	Number of seeds per boll	Seed cotton yield per plant
<i>gca</i>	57.45**	1.291.85**	342.29**	2.36**	25.53**	602.54**
<i>sca</i>	2.24**	130.31**	49.05**	0.11**	2.12**	349.95**
<i>rca</i>	3.12**	136.16**	22.52**	0.07**	6.18**	311.45**
<i>gca/sca</i>	25.65	42.62	6.98	21.45	12.04	1.72

** Significant at 1 per cent level

Table 2. Estimates of general combining ability effects of seven parents for six quantitative characters in cotton

Source	Days to first flower	Plant height	Number of bolls per plant	Boll weight	Number of seeds per boll	Seed cotton yield per plant
MCU 12	-0.78**	-9.35**	-2.51**	0.31**	0.40**	4.70**
Paiyur 1	-1.59**	-4.72**	-1.80**	0.27**	0.74**	4.43**
SVPR 2	-2.65**	0.69**	-2.49**	0.37**	1.45**	2.65
Anjali	-0.17**	-5.66**	-3.78**	0.02	0.02	-9.89**
Suvin	3.42**	19.93**	10.68**	-0.76**	-2.85**	4.06*
Maruthi	1.66**	-3.07**	1.07**	-0.34**	0.19**	-9.20**
MCU 5	0.12**	2.18**	-1.16**	0.13**	0.04	3.24**

** Significant at 1 per cent level

* Significant at 5 per cent level

gca effects

The parents SVPR 2 and Paiyur 1 exhibited highly significant negative *gca* effects for days to first flower indicating their good general combining ability. MCU 12, Paiyur 1 and Anjali recorded highly significant negative *gca* effects for plant height. MCU 12, Paiyur 1 and SVPR 2 exhibited significantly positive *gca* effects for boll weight and number of seeds per boll, indicating good general combining ability for these traits. Suvin recorded highly significant positive *gca* effects for number of bolls per plant. Suvin, MCU 12 and Paiyur 1 recorded significant *gca* effects for seed cotton yield per plant. *gca* effects recorded by Suvin for number of bolls per plant seed cotton yield and by MCU 12 for boll weight and seed cotton yield suggesting that the parents Suvin

and MCU 12 could be used in breeding programme for improving seed cotton yield per plant.

sca effects

Estimates of specific and reciprocal combining ability effects were presented in Table 3. For days to first flower, the cross combinations Suvin x Maruthi, MCU 12 x Maruthi, Anjali x Maruthi and Anjali x MCU 5 and for plant height the cross combinations MCU 12 x Suvin, Anjali x Suvin, SVPR 2 x MCU 5 and Paiyur 1 x MCU 5 gave significant negative estimates of specific combining ability effects. The combinations Suvin x Maruthi, Suvin x MCU 5 and Paiyur 1 x Anjali were found to exhibit significant and positive specific combining ability effects for number of bolls per plant and seed cotton yield per plant. For boll weight, the

S.No. Hybrids	Days to first flower		Plant height		Number of bolls per plant		Boll weight		Number of seeds per boll		Seed cotton yield per plant	
	sca	rca	sca	rca	sca	rca	sca	rca	sca	rca	sca	rca
1. MCU 12 x Paiyur 1	-0.24*	-1.53**	0.52	0.87	1.94**	3.77**	0.05	-0.15**	-0.32**	2.29**	6.06	6.81
2. MCU 12 x SVPR 2	-0.42**	-1.17**	4.99**	-1.29*	1.74*	4.00**	-0.11**	0.02	0.98**	4.05**	3.09	-14.13**
3. MCU 12 x Anjali	-0.69**	-0.23	2.40	1.05	1.82**	0.17**	0.01	-0.09	0.72**	2.98**	-8.09**	-1.15
4. MCU 12 x Suvin	1.48**	3.40**	-9.84**	-13.21**	-4.52**	-4.01**	-0.24**	-0.07	-0.49**	-0.44*	-15.96**	-7.11
5. MCU 12 x Maruthi	-1.62**	-0.60**	-0.56	1.75**	2.24**	-2.60**	-0.09*	-0.09	-0.19	1.57**	7.59	-7.33
6. MCU 12 x MCU 5	1.34**	1.97**	-2.73**	-5.13**	-2.46**	-2.00**	-0.17**	-0.35**	-0.12	-1.31**	-4.97	-17.66**
7. Paiyur 1 x SVPR 2	-0.71**	0.07	-1.19*	-7.34**	0.39	4.17**	0.32**	0.07	1.00**	-1.09**	13.73**	14.08**
8. Paiyur 1 x Anjali	0.52**	0.70**	3.54**	-5.81**	5.17**	-5.07**	-0.15**	-0.10*	-0.16	-1.21**	10.32*	-18.46**
9. Paiyur 1 x Suvin	0.83**	-0.27*	2.13**	-3.83**	1.78*	3.67**	-0.18*	0.19**	0.64**	-1.85**	-0.53	16.89**
10. Paiyur 1 x Maruthi	0.09	0.77	-4.32**	-2.14**	-4.31**	-0.83	0.45**	0.43**	0.83**	-0.31	2.48	12.27**
11. Paiyur 1 x MCU 5	-0.25*	-2.57**	-4.49**	3.12**	-0.17	-0.40	-0.16**	-0.25**	1.02**	-3.32**	-5.88	-9.90*
12. SVPR 2 x Anjali	0.74**	-0.60**	3.86**	-8.52**	-3.56**	1.43	0.01	-0.11*	-0.07	-0.28	-11.29**	5.59
13. SVPR 2 x Suvin	0.05	-0.17	5.08**	-15.98**	-2.06**	-1.13	0.14**	0.23**	-0.92**	-1.29**	3.16	5.31
14. SVPR 2 x Maruthi	0.81**	-0.10	-2.39**	0.44	0.32	3.37**	-0.12**	0.19**	1.52**	2.84**	-10.53**	-4.13
15. SVPR 2 x MCU 5	-0.59**	0.57**	-5.17**	5.46**	-2.08**	1.13	-0.09**	-0.03	0.29	-0.07	-6.83	6.01
16. Anjali x Suvin	0.24*	0.17	-9.70**	10.02**	3.72**	3.37**	-0.28**	-0.06	-0.08	0.26	1.81	6.42
17. Anjali x Maruthi	-1.57**	-0.60**	-2.29**	-5.29**	-5.46**	0.37	-0.27**	-0.18	0.38**	-4.74	3.97	10.97**
18. Anjali x MCU 5	-1.49**	0.80**	1.74**	3.17**	0.67	1.60*	0.11**	0.19**	-1.11**	-0.84**	3.17	10.97**
19. Suvin x Maruthi	-2.39**	-1.90**	17.98*	17.29**	11.17**	5.87**	0.02	0.19**	-0.68**	0.19	23.29**	26.45**
20. Suvin x MCU 5	0.38**	-0.33*	18.05*	15.54**	7.07**	6.67**	0.12**	0.09	1.71**	-1.41**	23.08**	-19.12**
21. Maruthi x MCU 5	1.27**	0.00	-2.61**	8.29**	-2.15**	3.63**	-0.48**	0.10*	0.05	0.21	-18.31**	13.38**

** Significant at 1 per cent level

* Significant at 5 per cent level

cross combinations Paiyur 1 x Maruthi and Paiyur 1 x SVPR 2 and for number of seeds per boll Suvin x MCU 5, SVPR 2 x Maruthi, Paiyur 1 x MCU 5 and Paiyur 1 x SVPR 2 gave significant and positive specific combining ability effects. The direct cross combination Suvin x MCU 5 remained desirable by having high estimates of specific combining ability effects for seed cotton yield, number of seeds per boll, number of bolls per plant and boll weight. The hybrid Suvin x Maruthi remained the next best one followed by Paiyur 1 x SVPR 2 hybrid.

rca effects

For days to first flower the reciprocal cross MCU 5 x Paiyur 1, Maruthi x Suvin, Paiyur 1 x MCU 12 and SVPR 12 x MCU 12 and for plant height the reciprocal cross combinations Suvin x SVPR 2 and Suvin x MCU 12 recorded significant and negative reciprocal combining ability effects. The reciprocal cross combinations MCU 5 x Suvin, Maruthi x Suvin, SVPR 2 x Paiyur 1, and SVPR 2 x MCU 12, MCU

5 x Maruthi, Suvin x Paiyur 1 recorded significant and positive reciprocal combining ability effects for number of bolls per plant and seed cotton yield per plant. For boll weight, the reciprocal cross combinations Maruthi x Paiyur 1, Suvin x SVPR 2, Maruthi x Anjali, Maruthi x Suvin and MCU 5 x Anjali gave significant and positive *rca* effects. The reciprocal cross combinations SVPR 12 and MCU 12, Maruthi x SVPR 2, Anjali x MCU 12 and Paiyur 1 x MCU 12 gave significant and positive reciprocal combining ability effects for number of seeds per boll.

The estimates of specific and reciprocal combining ability effects revealed that no hybrid combination was considerably superior for all the characters. The best hybrid combinations involved atleast one good general combiner as their parents. The parents Suvin, SVPR 2, Paiyur 1 and MCU 12 can be used in hybrid breeding programmes. The direct cross combination Suvin x MCU 5 and its reciprocal were the best cross combinations as it had high *sca* effects for seed cotton yield per plant. Both the parents involved in these crosses had high *gca* effect which expected to give transgressive segregants in subsequent generations. Similar findings were reported by Singh *et al.* (1974), Deshwal (1978) and Waldia *et al.* (1980).

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