

Original Research Article

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Combining Ability Studies in CMS based and Conventional Hybrids of Cotton (*G. hirsutum*)

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ABSTRACT

Cotton is one of the most important fiber and cash crop of India and plays a dominant role in the industrial and agricultural economy of the country. Sixty crosses with thirteen parents and three checks viz., PKV-Hy-4, NHH-206 and NHH-44 were grown in Randomized Block Design with two replications. The results showed that the tester AKH-07R possessed the highest GCA effect for the seed cotton yield per hectare and also exhibited high GCA (in desirable direction) for the traits, number of sympodia, number of bolls per, harvest index and cotton seed yield per plant. The line CAK 23 B reported the high GCA effect to the traits, earliness index, number of bolls per plant, boll weight, seed cotton yield per plant, seed cotton yield per hectare, ginning percentage and fiber strength. The CMS cross, CAK 53A x AKH-07 R possessed the highest SCA for the traits number of sympodia per plant, number of bolls per plant, boll weight, seed cotton yield per plant also it showed highest per se performance for the seed cotton yield per plant. From the conventional system the highest SCA effect for the trait seed cotton yield per plant observed for crosses CAK 23B x DHY-286-1R with high mean performance. For the fiber traits in CMS, highest SCA for strength showed by SRT-1A x R-2000-23 also high SCA for the traits upper half mean length. In the conventional hybrids, CAK 53B x R-2000-23 exhibited the highest SCA effect for the fiber strength also the high per se performance to the seed cotton yield.

Keywords

Combining ability,
GCA, SCA, Yield,
Fibre strength

Article Info

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Introduction

Cotton is being cultivated in 70 countries of the world with a total coverage of 33.14 m ha. China, India, USA and Pakistan are the major cotton producing countries in the world accounting for 70 per cent of the world's cotton area and production. India is the largest cotton growing country in the world with

35.29 per cent of world cotton area followed by China (15.23%). China and India are the major cotton consuming countries in the world (around 55%). USA and India constitute 27 and 19.5 per cent of the world's cotton exports respectively. There are four cultivated species of cotton viz. *Gossypium arboreum*, *G. herbaceum*, *G. hirsutum* and *G. barbadense*. The first two species are diploid ($2n=26$) and

are native to old world. They are also known as Asiatic cottons because they are grown in Asia. The last two species are tetraploid ($2n=52$) and are also referred to as New World Cottons. *G.hirsutum* also known as American cotton or upland cotton and *G.barbadense* Egyptian cotton or Sea Island cotton or Peruvian Cotton or Tanguish Cotton or quality cotton. *G.hirsutum* the predominant species which alone contributes about 90 % to the global production. Perhaps, India is the only country in the world where all the four cultivated species are grown on commercial scale.

Materials and Methods

The present study comprised of three male sterile CMS lines, three maintainer lines and ten male fertile males (testers/ restorers) with three standard checks in two sets i.e. CMS and conventional thus making 60 F_1 s (30 CMS and 30 conventional) using Line x Tester mating design. These lines, testers and hybrids along with three checks were sown during *kharif*, 2016 at three locations *viz.*, Cotton Research Station, Nanded (L-1), Experimental farm of Department of Agricultural Botany, VNMKV, Parbhani (L-2) and Experimental farm, Agricultural Research Station, Badnapur (L-3). The observations recorded on days to 50 % flowering, plant height (cm), number of sympodia per plant, days to 50 % boll burst, earliness index, number of sympodia per plant, number of boll per plant, boll weight (g), seed cotton yield per plant (g), seed index (g), lint index (g), harvest index (%), seed cotton yield per hectare (kg), ginning percentage, upper half mean length (mm), uniformity index (%), micronaire value (ug/inch) and fibre strength (g/tex).

Results and Discussion

The pooled analysis of variance for line x tester was found significant for all the

characters. The significance of location x crosses interaction for plant height, days to 50 % boll burst, number of sympodia per plant, number of bolls per plant, boll weight, seed cotton yield per plant, harvest index, seed cotton yield per hectare and ginning percentage showed the diversity between the environments.

The location x line effects were found significant for plant height, days to 50 % boll burst, number of bolls per plant, uniformity index and micronaire value. The significance of location x line x tester interaction effect for plant height, number of monopodia per plant, days to 50 % boll burst, number of sympodia per plant, number of boll per plant, boll weight, seed cotton yield per plant, lint index, harvest index, seed cotton yield per hectare, ginning percentage indicated higher interaction of non-additive genetic effects with environment. This could be the reason for difference in heterosis over the environment for yield (Table 1).

GCA effect of parents

The lines CAK 53A, CAK 53B and tester DHY-286-1R had the highest GCA effect for the traits days to 50 % flowering and days to 50% boll burst. The tester AKH-07R possessed the highest GCA effect for the seed cotton yield per hectare and also exhibited high GCA (in desirable direction) for the traits, number of sympodia, number of bolls per, harvest index and cotton seed yield per hectare. The line CAK 23 B reported the high GCA effect to the traits, earliness index, number of bolls per plant, boll weight, seed cotton yield per plant, seed cotton yield per hectare, ginning percentage and fiber strength. The tester, R-2000-23 showed highest GCA effect for characters fiber strength, uniformity index and ginning percentage also possessed the significant (in desirable direction) high GCA effect to the traits i.e. upper half mean

length, seed cotton yield per plant and number of bolls per plant. Hence these genotypes can be used in future for improvement of fiber properties.

The line CAK 53 B exhibited the highest GCA effect for the character upper half mean length, uniformity index and number of bolls per plant also showed the second position among line for the traits fiber strength, days to 50 % flowering and days to 50 % boll burst. For micronaire value the high GCA effect is showed by line CAK 53 A and tester R-1044-13.

SCA effect of crosses

In the CMS set of crosses, according to the pooled data the highest SCA effects were observed for the cross combination CAK 23A x R-42-8 (42.89) which also exhibited good performance in seed yield. It also exhibited the highest SCA effect for the traits, days to 50 % flowering, days to 50 % boll burst, earliness index, seed index, cotton seed yield per hectare. The CMS cross, CAK 53 A x AKH-07 R possessed the highest SCA for the traits like number of sympodia per plant (3.32), number of bolls per plant (0.74), boll weight(0.74), seed cotton yield per plant (33.72) and it showed highest per se performance for the seed cotton yield per plant, ginning percentage, lint index and harvest index. In the conventional set of crosses, the highest SCA effect for seed cotton yield per plant observed for crosses CAK 23B x DHY-286-1R (47.99) with high mean performance. It had also recorded high SCA effect in the earliness index and number of bolls per plant. The cross combination CAK 23B X R-2000-23 exhibited the highest SCA effect for number of bolls per plant, number of sympodia per plant and plant height.

For the fiber traits in CMS, highest SCA effects were recorded by SRT-1A x R-2000-

23 for fiber strength (3.59) upper half mean length (1.05). In the conventional hybrids, CAK 53 B x R-2000-23 (3.39) exhibited the highest SCA effect for the fiber strength and high per se performance to the seed cotton yield.

Nature of gene action

The ratio of GCA and SCA i.e. predictability ratio of micronaire value indicating the predominantly additive gene action in expression of the characters. This ratio for number of sympodia per plant and boll weight was greater than 0.50 but less than 0.80 indicated that the equal importance of the additive as well as non-additive gene action, while rest of the traits possessed the lower predictability ratio than 0.50 indicating the non-additive gene action as the prime cause in the expression of these traits. So while applying the selection in the further generations, gene action controlling the characters should be taken into consideration viz. where fixable component i.e. additive gene action is evident, the selection in the further generations would be rewarding after judging the positive correlation of the characters under investigation with the yield. In the characters where non fixable component is predominant heterosis breeding and recombination breeding with postponement of selection at later generation would be feasible (Laxman and Pradeep, 2003.)

Selection of promising parent and crosses

The lines CAK 23B and SRT-1B appeared to be the best general combiner for seed cotton yield and some fibre properties which may do well in cross combination with other parents. The tester AKH-07 R found to be best general combiner for the seed cotton yield. The tester R-2000-23 was found best general combiner for most of the fibre properties with high seed cotton yield.

Table.1 Pooled estimates of GCA effects of parents and SCA effects of crosses studied over three environments

Sr. No.	Genotype	Days to 50 % flowering	Plant height (cm)	No. of monopodia per plant	Days to 50 % boll burst	Earliness index	No. of sympodia per plant	No. of bolls per plant	Boll weight (g)	Seed cotton yield per plant (g)
GCA Lines										
1	CAK 53A	-3.78**	-1.12	0.04	-1.8**	-0.009*	0.82**	-1.39*	-0.21**	-7.99**
2	CAK 53B	-3.05**	-2.19*	0.12*	-0.98**	-0.008*	0.21	2.95**	-0.05	-0.24
3	CAK 23A	0.71**	-2.77**	-0.084	0.41*	-0.001	0.11	-2.92**	0.01	-8.68**
4	CAK 23B	0.96**	2.49**	0.06	-0.18	0.016**	1.01**	2.90**	0.32**	12.49**
5	SRT-1A	3.56**	-0.938	-0.04	1.43**	0.004	-1.37**	-2.39**	-0.08	-4.59**
6	SRT-1B	1.58**	4.54**	-0.10	1.11**	-0.002	-0.79**	0.85	0.02	9.02**
GCA Testers										
1	R-42-8	0.21	-2.70*	0.05	0.06	-0.006	-1.49**	-1.09	-0.19*	-2.00
2	R-2000-23	0.48*	0.46	0.01	-0.40	-0.004	0.70	2.35**	0.28**	14.56**
3	R- 2000-17-2	-0.73**	0.27	-0.07	0.40	0.010	-0.69	0.57	0.18*	-9.29**
4	R-2000-26	-0.28	3.21**	-0.07	0.81**	-0.032**	-0.06	1.90*	0.10	4.00**
5	R-1044-13	1.26**	-3.67**	0.09	-0.07	0.018**	0.02	0.72	-0.01	1.77
6	R-2000-21	-0.20	-1.07	0.004	-1.01**	-0.006	0.30	-3.38**	0.05	-10.81**
7	R-23	1.23**	4.25**	-0.05	0.78**	0.029**	-0.27	-3.93**	-0.14	-14.53**
8	R-53	-0.03	-0.95	-0.06	0.09	-0.021**	-0.30	-0.93	-0.11	0.93
9	AKH-07R	1.04**	1.07	-0.06	0.40	0.019**	1.59**	5.19**	0.12	29.56**
10	DHY-286-1R	-2.98**	-0.86	0.16*	-1.07**	-0.007	0.20	-1.40	-0.29**	-14.18**
SCA Crosses										
1	CAK 53A X R-42-8	7.08**	3.56	-0.18	3.46**	0.015	1.82	0.84	-0.17	-16.25**
2	CAK 53A X R-2000-23	1.64**	-5.43	-0.13	-1.06	0.022	-2.21*	-3.44	-0.14	-28.49**
3	CAK 53A X R- 2000-17-2	-3.96**	1.86	-0.42*	-1.86**	-0.002	-0.81	-0.28	-0.02	-6.80*
4	CAK 53A X R-2000-26	-6.41**	-2.84	-0.28	-2.78**	0.022	-0.02	-2.79	-0.08	22.36**
5	CAK 53A X R-1044-13	1.53**	2.45	-0.21	0.60	-0.032*	-0.09	-1.67	-0.37	14.04**
6	CAK 53A X R-2000-21	2.67 **	-0.08	0.11	1.38*	0.021	-0.38	1.49	0.082	-4.67
7	CAK 53A X R-23	1.89**	3.46	0.60**	-0.25	-0.027*	-0.79	-2.41	-0.133	4.92
8	CAK 53A X R-53	-2.99**	2.81	0.14	0.43	-0.003	-1.09	-2.05	-0.06	-7.11*
9	CAK 53A X AKH-07R	1.75**	-2.71	0.04	-1.53**	0.020	3.32**	15.45**	0.74**	33.72**
10	CAK 53A X DHY-286-1R	-3.21**	-3.07	0.33	1.60**	-0.035**	0.28	-5.13*	0.17	-11.72**

Table 1 Continue...

Sr. No.	Genotype	Days to 50 % flowering	Plant height (cm)	No. of monopodia per plant	Days to 50 % boll burst	Earliness index	No. of sympodia per plant	No. of bolls per plant	Boll weight (g)	Seed cotton yield per plant (g)
11	CAK 53B X R-42-8	0.18	6.39*	0.12	0.48	-0.033*	0.77	5.09*	0.10	-11.61**
12	CAK 53B X R-2000-23	0.57	1.43	0.11	1.62**	0.048**	0.59	-3.70	0.06	12.03**
13	CAK 53B X R- 2000-17-2	-2.70**	2.34	-0.13	-3.35**	0.032*	-0.13	4.59*	0.14	0.55
14	CAK 53B X R-2000-26	-1.64**	1.06	0.24	-1.10	0.020	1.41	6.12**	0.03	6.10
15	CAK 53B X R-1044-13	6.80**	1.30	0.12	4.62**	-0.033*	-0.14	-5.26*	-0.28	-29.64**
16	CAK 53B X R-2000-21	2.77**	-2.61	0.19	-0.10	0.039**	0.84	0.30	-0.37	-10.01**
17	CAK 53B X R-23	-1.50**	-5.98*	-0.42*	-2.23**	-0.034**	-0.04	0.50	0.09	23.62**
18	CAK 53B X R-53	-1.72**	0.23	0.008	-1.37*	-0.010	-1.39	-0.59	0.61**	11.00**
19	CAK 53B X AKH-07R	0.02	2.04	-0.35	1.15*	0.008	-1.35	-0.13	-0.45*	-5.24
20	CAK 53B X DHY-286-1R	-2.78**	-6.22*	0.10	0.28	-0.037**	-0.54	-6.91**	0.05	3.19
21	CAK 23A X R-42-8	-6.74**	-6.62*	-0.09	-4.75**	0.091**	1.23	2.78	0.02	45.89**
22	CAK 23A X R-2000-23	-4.18**	-1.45	-0.06	-1.77 **	-0.026*	0.92	3.63	-0.24	27.92**
23	CAK 23A X R- 2000-17-2	2.86**	0.24	0.26	2.25**	-0.049**	0.63	1.71	0.06	17.40**
24	CAK 23A X R-2000-26	6.08**	-6.03*	-0.28	1.33*	0.004	-0.11	-3.79	0.14	-41.49**
25	CAK 23A X R-1044-13	-3.96**	-1.81	0.35	-1.77**	-0.016	1.13	0.65	0.35	15.92**
26	CAK 23A X R-2000-21	-0.16	-4.56	-0.44*	2.00**	-0.026	0.55	1.19	0.25	8.55**
27	CAK 23A X R-23	1.39*	2.92	-0.15	1.02	0.005	-0.72	-1.17	0.25	-15.80**
28	CAK 23A X R-53	3.00**	3.68	0.04	0.05	0.014	0.28	-2.19	-0.12	-2.84
29	CAK 23A X AKH-07R	-0.24	7.10*	0.79**	0.25	-0.066**	-2.56**	-5.47**	-0.58**	-36.51**
30	CAK 23A X DHY-286-1R	1.95**	6.54*	-0.42*	1.38*	0.070**	-1.34	2.66	-0.15	-19.04**
31	CAK 23B X R-42-8	-2.16**	-7.57**	0.29	-1.31*	-0.036**	-2.83**	-5.44**	0.17	-43.23**
32	CAK 23B X R-2000-23	0.22	10.61**	-0.03	1.15*	-0.029*	2.15*	10.92**	0.04	15.88**
33	CAK 23B X R- 2000-17-2	0.78	4.49	0.22	1.51**	-0.067**	-0.26	-7.32**	-0.50*	-3.22
34	CAK 23B X R-2000-26	-1.82**	4.36	-0.15	-0.73	-0.019	-2.09*	-5.80**	-0.50*	-26.68**
35	CAK 23B X R-1044-13	0.95	9.76**	-0.14	-1.67**	0.004	-0.89	0.69	-0.03	18.86**
36	CAK 23B X R-2000-21	-2.07**	2.18	-0.16	-2.23**	0.010	0.41	-1.68	0.008	-11.89**
37	CAK 23B X R-23	1.14*	-10.97**	0.02	0.96	0.030*	-0.01	-1.83	0.18	-1.74
38	CAK 23B X R-53	1.25*	-9.06**	-0.16	1.32*	0.021	-0.45	-5.00*	0.06	-1.16
39	CAK 23B X AKH-07R	0.33	-5.42	-0.12	-1.15*	-0.001	1.92*	5.83**	0.52*	5.22
40	CAK 23B X DHY-286-1R	1.36*	1.62	0.24	2.15**	0.086**	2.06*	9.65**	0.04	47.99**

Table 1 Continue...

41	SRT-1A X R-42-8	4.23**	-12.52**	-0.01	3.40**	-0.019	-0.84	-4.87*	-0.20	18.69**
Sr. No.	Genotype	Days to 50 % flowering	Plant height (cm)	No. of monopodia per plant	Days to 50 % boll burst	Earliness index	No. of sympodia per plant	No. of bolls per plant	Boll weight (g)	Seed cotton yield per plant (g)
42	SRT-1A X R-2000-23	3.96**	-13.22**	-0.06	2.87**	0.012	-1.05	-11.61**	0.19	-27.36**
43	SRT-1A X R- 2000-17-2	3.68**	-6.51*	0.02	0.90	0.020	0.46	-0.25	0.06	-15.39**
44	SRT-1A X R-2000-26	0.90	-1.35	0.17	1.31*	-0.021	2.80**	9.14**	0.54**	42.89**
45	SRT-1A X R-1044-13	-5.65**	-4.57	-0.01	-3.79**	0.069**	0.31	-0.83	0.12	5.01
46	SRT-1A X R-2000-21	-4.17**	3.47	0.36	-3.51**	-0.002	0.35	2.48	0.02	14.99**
47	SRT-1A X R-23	-4.78**	10.30**	-0.08	-0.15	-0.005	0.67	2.44	-0.47*	-23.41**
48	SRT-1A X R-53	-1.01	8.84**	-0.29	0.70	-0.019	0.27	5.33*	-0.29	-18.69**
49	SRT-1A X AKH-07R	-0.42	9.70**	-0.21	0.90	0.026*	-1.68	-3.32	-0.07	10.64*
50	SRT-1A X DHY-286-1R	3.26**	5.86*	0.12	-2.62**	-0.061**	-1.31	1.50	0.08	-7.36*
51	SRT-1B X R-42-8	-2.61**	16.75**	-0.13	-1.28*	-0.018	-0.14	1.60	0.08	6.51*
52	SRT-1B X R-2000-23	-2.22**	8.05**	0.19	-2.81**	-0.027*	-0.40	4.20*	0.07	0.009
53	SRT-1B X R- 2000-17-2	-0.66	-2.41	0.04	0.55	0.066**	0.15	1.55	0.25	7.47*
54	SRT-1B X R-2000-26	2.88**	4.80	0.30	1.96**	-0.007	-1.98*	-2.87	-0.13	-3.17
55	SRT-1B X R-1044-13	0.33	-7.12*	-0.10	2.02**	0.008	-0.30	6.437**	0.20	-24.19**
56	SRT-1B X R-2000-21	0.97	1.60	-0.05	2.46**	-0.041**	-1.78	-3.79	0.00	3.04
57	SRT-1B X R-23	1.86**	0.26	0.02	0.66	0.032*	0.90	2.48	0.07	12.41**
58	SRT-1B X R-53	1.47**	-6.51*	0.25	-1.14*	-0.003	2.38*	4.51*	-0.19	18.81**
59	SRT-1B X AKH-07R	-1.44**	-10.70**	-0.13	0.38	0.012	0.36	-12.36**	-0.15	-7.83*
60	SRT-1B X DHY-286-1R	-0.58	-4.73	-0.38*	-2.81**	-0.022	0.85	-1.76	-0.20	-13.05**
	S.E. ±									
	Lines	0.17	0.88	0.06	0.18	0.004	0.31	0.65	0.06	1.00
	Tester	0.22	1.14	0.08	0.23	0.005	0.39	0.84	0.08	1.29
	Crosses	0.55	2.78	0.18	0.56	0.013	0.97	2.06	0.20	3.17

Table 1 Continue...

Sr. No.	Genotype	Seed index (g)	Lint index (g)	Harvest index (%)	Seed cotton yield per hectare (kg)	Ginning percentage	Upper half mean length (mm)	Uniformity index (%)	Micronaire value (ug/in)	Fibre strength (g/tex)
GCA Lines										
1	CAK 53A	-0.33**	-0.07	-1.55**	-148.06**	-0.07	0.40**	-0.06	-0.30**	-0.31**
2	CAK 53B	0.01	-0.09	-0.46*	-4.45	-0.12	0.89**	0.69**	-0.14**	0.63**
3	CAK 23A	0.12	-0.16*	-1.00**	-160.81**	-0.57**	-0.47**	-0.64**	0.18**	0.03
4	CAK 23B	0.008	0.16*	4.52**	231.32**	0.45**	0.52**	0.39**	-0.18**	1.12**
5	SRT-1A	0.04	0.03	-1.16**	-85.16**	-0.07	-1.08**	-0.15	0.15**	-1.26**
6	SRT-1B	0.14	0.12	-0.33	167.18**	0.38*	-0.27**	-0.22*	0.27**	-0.21*
GCA Testers										
1	R-42-8	-0.15	-0.04	-0.52	-37.20	0.62**	-0.47**	-0.96**	0.40**	-1.13**
2	R-2000-23	-0.02	0.02	1.75**	269.78**	0.81**	1.12**	1.16**	-0.16**	1.68**
3	R- 2000-17-2	0.04	-0.14	-0.81**	-172.19**	-0.75**	0.84**	0.67**	-0.26**	-0.09
4	R-2000-26	0.18	0.37**	1.87**	74.16**	0.81**	0.17*	0.23	-0.19**	-1.00**
5	R-1044-13	0.01	-0.22*	-0.75**	32.83	-1.03**	0.80**	0.08	-0.28**	0.75**
6	R-2000-21	-0.20*	-0.07	-0.69*	-200.314**	0.66**	-0.97**	-1.18**	-0.09*	-0.40**
7	R-23	-0.03	-0.16	-3.49**	-269.09**	-0.67**	-1.03**	0.37**	0.20**	-0.71**
8	R-53	-0.18	-0.13	0.08	17.34	-0.48*	-0.73**	0.30*	-0.05	0.43**
9	AKH-07R	0.11	0.21*	3.79**	547.42**	-0.55**	-0.86**	-0.60**	0.05	-0.52**
10	DHY-286-1R	0.24**	0.16	-1.21**	-262.74**	0.58**	1.13**	-0.08	0.40**	1.00**
SCA Crosses										
1	CAK 53A X R-42-8	-0.77**	-0.48*	1.57*	-300.93**	0.50	-2.07**	-1.82**	0.12	-1.09**
2	CAK 53A X R-2000-23	0.54*	-0.02	-6.58**	-527.64**	0.19	0.04	-0.63*	0.12	-0.45
3	CAK 53A X R- 2000-17-2	-0.62**	-0.30	2.12**	-126.00*	-1.89**	0.16	0.22	0.30**	-0.68*
4	CAK 53A X R-2000-26	0.47*	0.14	0.25	414.12**	-0.37	-0.69**	-1.16**	-0.43**	0.10
5	CAK 53A X R-1044-13	0.26	-0.003	-6.97**	260.05**	-0.80	-0.78**	0.82**	0.09	-0.92**
6	CAK 53A X R-2000-21	-0.05	-0.03	4.03**	-86.56	0.06	0.44*	1.16**	-0.18	0.56*
7	CAK 53A X R-23	0.50*	-0.18	-1.67*	91.22	0.39	3.02**	0.63*	0.47**	1.01**
8	CAK 53A X R-53	0.28	0.066	2.55**	-131.69*	-1.14*	0.77**	0.53	0.02	1.18**

Table 1 Continue...

Sr. No.	Genotype	Seed index (g)	Lint index (g)	Harvest index (%)	Seed cotton yield per hectare (kg)	Ginning percentage	Upper half mean length (mm)	Uniformity index (%)	Micronaire value (ug/in)	Fibre strength (g/tex)
9	CAK 53A X AKH-07R	0.005	0.96**	9.66**	624.54**	2.72**	1.00**	1.51**	0.02	0.05
10	CAK 53A X DHY-286-1R	-0.61**	-0.13	-4.97**	-217.09**	0.31	-1.91**	-1.27**	-0.54**	0.23
11	CAK 53B X R-42-8	-0.78**	-0.12	-1.32*	-214.99**	1.19*	0.92**	1.17**	0.19*	0.36
12	CAK 53B X R-2000-23	-0.99**	-0.45*	-0.28	222.87**	-1.66**	0.26	-0.07	-0.16	3.39**
13	CAK 53B X R- 2000-17-2	0.48*	0.23	3.47**	10.24	-0.22	-0.33	-1.13**	0.11	0.50
14	CAK 53B X R-2000-26	-0.11	0.03	-2.73**	113.00	0.05	-1.46**	-1.06**	-0.01	-2.36**
15	CAK 53B X R-1044-13	0.16	-0.15	-3.03**	-548.94**	-1.93**	-0.16	2.14**	-0.01	0.29
16	CAK 53B X R-2000-21	0.87**	0.46*	-4.02**	-185.52**	0.55	0.07	0.64*	0.10	-0.84**
17	CAK 53B X R-23	-0.69**	-0.20	0.35	437.53**	1.33**	0.54**	0.57	-0.14	-0.18
18	CAK 53B X R-53	0.56*	0.45*	6.90**	203.79**	1.08*	0.46**	-0.63*	-0.18*	-1.08**
19	CAK 53B X AKH-07R	0.23	-0.33	-0.80	-97.11	0.92	0.20	0.01	-0.04	-0.07
20	CAK 53B X DHY-286-1R	0.26	0.09	1.47*	59.12	-1.31**	-0.49**	-1.64**	0.16	-0.008
21	CAK 23A X R-42-8	0.58*	0.24	0.93	849.83**	-0.40	-1.64**	1.32**	-0.08	-2.96**
22	CAK 23A X R-2000-23	-0.24	-0.05	-3.51**	517.17**	0.83	-0.10	0.52	-0.27**	-2.00**
23	CAK 23A X R- 2000-17-2	-0.03	0.19	1.62*	322.22**	-1.12*	1.04**	1.72**	-0.26**	1.85**
24	CAK 23A X R-2000-26	0.06	0.22	1.41*	-768.46**	1.42**	-0.58**	-0.65*	0.28**	0.42
25	CAK 23A X R-1044-13	0.12	0.03	2.06**	294.87**	-0.49	-0.318	-0.52	0.59**	-2.88**
26	CAK 23A X R-2000-21	-0.39	-0.13	0.98	158.46**	0.11	2.41**	-0.03	-0.20*	2.26**
27	CAK 23A X R-23	-0.28	-0.03	1.15	-292.65**	-0.07	-1.37**	0.31	-0.34**	1.06**
28	CAK 23A X R-53	0.19	-0.41	-1.97**	-52.68	-1.22*	0.20	-0.77*	-0.11	2.10**
29	CAK 23A X AKH-07R	-0.01	-0.16	-6.12**	-676.15**	-0.41	-1.04**	-1.93**	0.28**	-0.69*
30	CAK 23A X DHY-286-1R	0.01	0.11	3.43**	-352.61**	1.35**	1.41**	0.03	0.12	0.83**
31	CAK 23B X R-42-8	0.49*	0.21	-1.83**	-800.69**	-0.29	-0.78**	-1.42**	-0.44**	0.97**
32	CAK 23B X R-2000-23	0.46*	0.36	2.39**	294.16**	0.46	-0.91**	-1.42**	0.04	-3.10**
33	CAK 23B X R- 2000-17-2	0.14	-0.37	-3.04**	-59.76	-1.25*	1.31**	0.88**	0.18*	-0.80**
34	CAK 23B X R-2000-26	-0.45*	-0.60**	-3.82**	-494.14**	-1.40**	1.41**	1.16**	0.31**	0.98**
35	CAK 23B X R-1044-13	0.49*	0.14	-1.53*	349.26**	0.76	0.94**	-0.61*	-0.55**	2.16**
36	CAK 23B X R-2000-21	-0.53*	-0.37	0.67	-220.34**	0.36	-1.34**	-0.61*	0.40**	-0.21
37	CAK 23B X R-23	0.02	0.05	1.45*	-32.37	0.96*	-0.92**	-0.56	-0.06	0.10
38	CAK 23B X R-53	-0.56*	-0.40	-1.73**	-21.62	1.23*	-0.30	0.05	-0.15	0.87**

Table 1 Continue...

39	CAK 23B X AKH-07R	-0.68**	0.47*	1.44*	96.82	-1.07*	0.98**	1.86**	-0.07	1.38**
40	CAK 23B X DHY-286-1R	0.60**	0.49*	5.99**	888.69**	0.22	-0.39*	0.67*	0.33**	-2.36**
41	SRT-1A X R-42-8	0.03	0.01	-0.05	346.17**	0.47	1.05**	-0.34	0.07	1.31**
42	SRT-1A X R-2000-23	-0.03	-0.04	2.39**	-506.72**	-0.32	2.45**	1.65*	-0.04	3.59**
43	SRT-1A X R- 2000-17-2	0.10	0.22	-1.84**	-285.11**	2.35**	-0.19	-0.50	0.07	-0.95**
Sr. No.	Genotype	Seed index (g)	Lint index (g)	Harvest index (g)	Seed cotton yield per hectare (kg)	Ginning percentage	Upper half mean length (mm)	Uniformity index (%)	Micronaire value (ug/in)	Fibre strength (g/tex)
44	SRT-1A X R-2000-26	0.02	0.38	7.88**	794.35**	1.02*	-0.54**	0.86**	-0.07	-0.66*
45	SRT-1A X R-1044-13	-0.71**	-0.17	5.37**	92.80	0.95	-0.59**	-1.87**	0.09	-1.03**
46	SRT-1A X R-2000-21	0.07	0.009	-0.33	277.58**	-1.39**	0.66**	0.27	-0.29**	-0.47
47	SRT-1A X R-23	0.17	0.14	-3.66**	-433.58**	-1.49**	-0.93**	0.21	0.06	-0.82**
48	SRT-1A X R-53	-0.03	0.19	-4.70**	-346.16**	-1.53**	-0.89**	0.78*	-0.03	-1.61**
49	SRT-1A X AKH-07R	0.33	-0.49*	-0.97	197.05**	-0.44	-1.65**	-2.17**	0.12	-0.38
50	SRT-1A X DHY-286-1R	0.03	-0.24	-4.07**	-136.37*	0.37	0.65**	1.11**	0.01	1.03**
51	SRT-1B X R-42-8	0.44	0.13	0.70	120.61*	-1.47**	2.52**	1.09**	0.13	1.40**
52	SRT-1B X R-2000-23	0.26	0.22	5.59**	0.16	0.49	-1.73**	-0.05	0.31**	-1.43**
53	SRT-1B X R- 2000-17-2	-0.08	0.01	-2.34**	138.41*	2.13**	-1.99**	-1.18**	-0.40**	0.08
54	SRT-1B X R-2000-26	0.01	-0.16	-2.99**	-58.87	-0.72	1.87**	0.85**	-0.07	1.50**
55	SRT-1B X R-1044-13	-0.34	0.15	4.10**	-448.04**	1.51**	0.92**	0.04	-0.21*	2.37**
56	SRT-1B X R-2000-21	0.04	0.08	-1.34*	56.38	0.29	-2.25**	-1.42**	0.16	-1.29**
57	SRT-1B X R-23	0.27	0.24	2.38**	229.84**	-1.12*	-0.32	-1.18**	0.01	-1.18**
58	SRT-1B X R-53	-0.44	0.10	-1.05	348.37**	1.58**	-0.24	0.03	0.46**	-1.46**
59	SRT-1B X AKH-07R	0.12	-0.45*	-3.20**	-145.14*	-1.71**	0.51**	0.72*	-0.32**	-0.27
60	SRT-1B X DHY-286-1R	-0.30	-0.31	-1.84**	-241.73**	-0.96*	0.72**	1.09**	-0.08	0.26
	S.E. ±									
	Lines	0.07	0.07	0.21	18.56	0.15	0.06	0.10	0.03	0.09
	Tester	0.09	0.09	0.27	23.96	0.20	0.07	0.13	0.04	0.11
	Crosses	0.23	0.22	0.66	58.68	0.49	0.18	0.31	0.09	0.28

Selection of the most encouraging cross combination needs high SCA along with high per se and GCA effect of respective parents. The cross combinations CAK 53A x AKH-07R, CAK 23B x AKH-07R, CAK 23B x DHY-286-1R, CAK 23B x R-2000-23, SRT-1A x R-2000-26, CAK 23A x R-42-8, CAK 53B x R-23 and SRT-1A x R-2000-26 shows high SCA effect for seed cotton yield. For fibre strength CAK 53 B x R-2000-23, SRT-1A x R-2000-23 possessed the high SCA effect. Ahuja and Dhayal (2007), Panhwaret *al.*(2008), Abroet *al.*(2009), Anandan (2010), Patilet *al.*(2011), Simon (2013), Patel and Kumar (2014), Pushpam *et al.*(2015) and Reddy *et al.*(2016).

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