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Studies on combining ability for yield, yield contributing and fibre quality traits in desi cotton (*Gossypium arboreum* L.)

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Abstract
Line x tester analysis was carried out involving 6 line and 4 testers for seed cotton yield and fibre quality traits. Significant difference among genotypes was observed for all traits under study meaning thereby considerable amount of genetic variability. The magnitude of GCA variances was higher than SCA variance suggesting per-ponderance of additive gene effects for almost all the traits. The genotypes PA 785, PA 774, JLA 794 and JLA 611 were found good general combiner for seed cotton yield and yield contributing characters. The cross combinations PA 785 x DAS 1201, PA 785 x JLA 794 had significant SCA effects for seed cotton yield. Therefore, the breeder should compromise at acceptable values of seed cotton yield and fiber quality parameters. It is advocated that the genotypes having such values for these traits could be used in further breeding programme.

Keywords: *Gossypium arboreum*, fibre quality, *GCA, SCA,* Seed cotton yield

Introduction
Knowledge on combining ability is useful for selection of desirable parents for exploitation of hybridity and transgressive expressions. Combining ability studies also elucidate the nature and magnitude of gene action involved in the inheritance of seed cotton yield and its related characters which will be useful to follow segregating material. Line x tester analysis would reveal general combining ability (GCA) effects of parents and specific combining ability. Combining ability of the genotypes form the basis for selection of the parents for hybridization. The present study was therefore undertaken to have an idea of the nature of combining ability for yield and fibre quality characters in *arboreum* cotton with a view to identify good combing parents. Line x tester analysis is a useful procedure for preliminary evaluation of genotypes for use in hybridization programme.

Materials and Methods
Four lines namely, PA 785, PA 08, PA 774 and PA 778 crossed as females (lines) to six male parents of cotton *viz,* JLA 794, AKA 7, JLA 611, DAS 1201, RG 690 and LD 919 as testers in line x tester manner. Twenty four F_1's along with 10 parents and three checks were grown in randomized block design with three replications at Cotton Research Station, Mahboob Baugh Farm, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani during *kharif* 2014-2015. Two rows of each treatment having 6.0 m length and spacing of 60cm between rows and 30cm between plants was sown. All the recommended package of practices were followed to raise a good crop. Observations were recorded on 5 randomly selected plants in each plot on seed cotton yield /plant, plant height, number of boll/plant and number of sympodia/plant. After recording the observations for each character, the analysis of variance was carried out. The mean square from line x tester design and the general combining ability (GCA) and specific combining ability (SCA) variance and effects were calculated. The data was subjected to statistical analysis as per suggested by Kempthrone (1957).

Results and Discussion
The analysis of variance revealed that differences among the genotypes were statistically significant for seed cotton yield and yield contributing characters indicating the presence of considerable amount of genetic variability (Table 1). Significant differences were observed for general (GCA) and specific combining ability (SCA) for all the characters under study. Both additive and non-additive gene effects were important for inheritance of these traits. The magnitude of variance due to GCA was higher for all the traits suggesting preponderance of additive gene effects. Bolek *et al.* 2010 [2], Dhamayanti, 2011 [4], Jatoi *et al.*, 2011 [5], Karademir *et al.*, 2010 [6], Kumar *et al.* 2014 [7], and Nadagundi *et al.*, 2011 [8] also reported

similar results. The general combining ability effects of parents is presented in Table 2. The estimates of GCA showed that among the females PA 785 have exhibited positive significant GCA effects for No. of sympodia/plant, No. of boll/plant and seed cotton yield/plant. PA 774 have exhibited positive significant GCA effects for No. of seed per boll and plant height. PA 08 have exhibited positive significant GCA effects for lint index and negative significant GCA effects for days to 50 % flowering. PA 778 have exhibited positive significant GCA effects for seed index. The parental lines PA 785, PA 08, PA 774 were found as best general combiner for seed cotton yield/plant and other yield contributing characters. Similarly, among the testers (males), JLA 794 have exhibited positive significant GCA effects for No of sympodia/plant, No of boll/plant, No of seed/boll, boll weight, plant height, seed cotton yield/plant, lint index and harvest index. AKA 7 have exhibited negative significant GCA effects for days to 50% flowering, days to 50% boll bursting and days to. DAS 1201 have exhibited positive and significant GCA effects for boll weight, plant height, lint index and harvest index. RG 690 have exhibited negative significant GCA effects for days to 50% flowering. JLA 611 have exhibited positive significant GCA effects for plant height, seed cotton yield/plant, seed index and harvest index. In male parents JLA 794, AKA 7, JLA 611 and DAS 1201 were found as best general combiner for seed cotton yield/plant and yield contributing characters. The best crosses with significant SCA effects for various traits are listed in Table 3.

Most of the crosses selected on the basis of significant SCA effects also had high per se performance. Among of 24 crosses, many of the crosses were ranked as top crosses for one or more characters. The crosses which exhibited significant desirable SCA effects were PA 08 x JLA 794 for days to 50% flowering, days to 50% boll bursting, No. of seed/boll, PA 778 x JLA 794 for No. of sympodia/plant, PA 785 x JLA 794 for No of boll/plant and harvest index, PA 774 x JLA 611 for plant height and lint index, PA 785 x DAS 1201 for seed cotton yield/plant, and harvest index, PA 08 x LD 919 for seed index, PA 778x AKA 7 for seed index. The genotypes which are found good general combiner could be used in crossing programme for improvement of the concerned traits. The cross combining having significant SCA effects should be tested across the years and locations prior to recommendation for commercial exploitation.

Table 1: Analysis of variance for combining Ability for different characters

		Mean sum of squares											
Source	**d.f.**	**Days to 50% flowering**	**Days to 50% boll bursting**	**No. of sympodia/plant**	**No. of boll/ plant**	**No. of seed/boll**	**Boll Weight (g)**	**Plant height (cm)**	**Days to maturity**	**Seed cotton yield/ plant (g)**	**Lint index**	**Seed index**	**Harvest index**
Replications	2	5.16	4.05	15.92	13.76	1.89	0.006	22.64	4.76	32.72	0.09	0.007	1.22
Crosses	23	6.47**	5.03	7.48	13.53**	1.80**	0.017**	249.14**	3.67	60.31**	0.10**	0.217**	3.65**
Females	3	5.90	2.03	32.20**	42.10**	7.52**	0.027**	531.41**	1.22	161.53**	0.20	0.249	1.43
Males	5	20.69**	16.18**	13.09**	21.00*	1.55	0.057**	769.17**	12.52**	112.92**	0.15	0.276	13.59**
M x F	15	1.84**	1.91	0.67	5.33*	0.74	0.002	19.35	1.21	22.53**	0.07**	0.191**	0.78
Error	66	0.53	3.08	3.96	2.68	0.68	0.006	24.90	3.32	8.33	0.02	0.040	0.78

*and ** indicated significance at 5 and 1 per cent respectively

Table 2: Estimates of General Combining Ability (GCA) for Lines

Parents	**Days to 50% flowering**	**Days to 50% boll bursting**	**No. of sympodia/plant**	**No. of bolls/plant**	**No. of seeds/boll**	**Boll Weight (g)**	**Plant height (cm)**	**Days to maturity**	**Seed cotton yield/plant (g)**	**Lint index**	**Seed index**	**Harvest index**
PA 08	-0.84**	-0.33	0.13	-0.07	-0.45*	-0.055**	-4.76**	-0.33	1.07	0.149**	0.07	-0.05
PA 785	0.15	0.05	1.38**	2.07**	-0.29	0.022	-051	0.11	3.67**	-0.053	-0.11*	-0.34
PA 778	0.37*	0.44	0.30	-1.58**	-0.21	0.035	-2.43*	0.27	-3.07**	-0.002	0.12*	0.05
PA 774	0.31	-0.16	-1.82**	-0.41	0.95**	-0.002	7.72**	-0.05	-1.67*	-0.09*	-0.08	0.34
S.E.(gi)	0.17	0.41	0.46	0.38	0.19	0.018	1.17	0.42	0.68	0.038	0.04	0.20
S.E.(gi-gj)	0.24	0.58	0.66	0.54	0.27	0.026	1.66	0.60	0.96	0.055	0.06	0.29
CD at 5%	0.34	0.83	0.94	0.77	0.39	0.037	2.36	0.86	1.36	0.078	0.09	0.41
CD at 1%	0.46	1.11	1.26	1.03	0.52	0.049	3.16	1.15	1.82	0.104	0.12	0.56

*and ** indicated significance at 5 and 1 per cent respectively.

Table 3: Estimates of General Combining Ability (GCA) of Testers

Parents	**Days to 50% flowering**	**Days to 50% boll bursting**	**No. of sympodia/plant**	**No. of bolls/plant**	**No. of seeds/boll**	**Boll Weight (g)**	**Plant height (cm)**	**Days to maturity**	**Seed cotton yield/ plant (g)**	**Lint index**	**Seed index**	**Harvest index**
JLA 794	0.208	0.306	1.344*	2.183**	0.533*	0.062**	6.567**	0.111	4.823**	0.107*	-0.073	1.082**
AKA 7	-2.375**	-2.111**	-0.522	-1.250*	-0263	-0.070**	-13.167**	-1.889**	-2.827**	0.000	-0.257**	-0.518*
JLA 611	1.042**	0.889	0.961	0.633	0.125	0.039	4.192**	0.611	2.094*	0.011	0.154*	0.649*
RG 690	-0.542*	-0.444	-1.489*	-1.317**	-0.383	-0.080**	-4.200**	-0.306	-3.302**	-0.120*	0.046	-1.135**
LD 919	0.542*	0.306	-0.456	-0.483	-0.262	-0.032	-1.542	0.528	-0.710	-0.137**	-0.005*	-1.160**
DAS 1201	1.125**	1.056*	0.161	0.233	0.250	0.080**	8.150**	0.944	-0.077	0.139**	0.135	1.082**
S.E.(gi-)	0.211	0.506	0.574	0.472	0.239	0.022	1.440	0.526	0.833	0.047	0.0580	0.255
S.E.(gi-gj)	0.299	0.716	0.812	0.668	0.338	0.032	2.037	0.744	1.178	0.067	0.082	0.361
CD at 5%	0.426	1.020	1.156	0.952	0.481	0.045	2.899	1.058	1.677	0.096	0.116	0.514
CD at 1%	0.569	1.361	1.544	1.270	0.642	0.060	3.870	1.413	2.239	0.128	0.156	0.686

*and ** indicated significance at 5 and 1 per cent respectively.

Table 4: Estimates of specific combining ability (SCA) of crosses for different characters

Hybrids	Days to 50% flowering	Days to 50% boll bursting	No. of sympodia/plant	No. of bolls/plant	No. of seeds/boll	Boll Weight (g)	Plant height (cm)	Days to maturity	Seed cotton yield/plant (g)	Lint index	Seed index	Harvest index
PA 08 x JLA 794	-1.65**	-1.08	0.14	-1.20	0.87	0.016	1.63	-0.66	-062	0.06	-0.32**	-0.693
PA 08 x AKA 7	-0.40	-0.33	0.61	0.51	0.24	-0.012	-2.96	-0.33	0.53	0.18	-0.05	0.574
PA 08 x JLA 611	0.84	0.66	0.32	0.01	-0.93	-0.040	-1.32	0.16	-0.70	-0.10	-0.09	0.474
PA 08 x RG 690	-0.23	-0.33	0.11	1.29	-0.23	0.018	1.13	-0.25	1.93	0.03	0.12	0.390
PA 08 x LD 919	0.68	0.58	-0.78	0.99	-0.07	0.007	2.67	0.58	3.08	0.02	0.31**	-0.385
PA 08 x DAS 1201	0.76	0.50	-0.40	-1.65	0.12	0.011	-1.15	0.50	-4.22*	-0.21*	0.03	-0.360
PA 785 x JLA 794	0.01	-0.80	-0.50	2.43*	-0.65	0.020	-0.01	-0.44	0.77	0.07	-0.01	0.590
PA 785 x AKA 7	-0.73	-0.72	-0.03	-1.39	0.14	0.012	2.45	-0.77	-2.81	-0.01	-0.04	-0.610
PA 785 x JLA 611	-0.15	-0.05	-0.45	0.25	0.55	0.010	-2.20	-0.27	2.00	0.02	-0.03	-0.376
PA 785 x RG 690	0.43	0.61	0.20	-1.12	0.16	0.008	1.48	0.30	-2.80	-0.08	-0.13	-0.660
PA 785 x LD 919	0.34	0.86	0.50	-2.02*	0.17	-0.059	-3.17	0.80	-3.46*	-0.15	0.38**	0.465
PA 785 x DAS 1201	0.09	0.11	0.28	1.85	-0.40	0.008	1.46	0.38	6.30**	0.14	-0.15	0.590
PA 778 x JLA 794	0.45	0.47	0.71	-0.62	0.17	-0.027	2.23	0.72	-0.37	0.03	0.10	-0.004
PA 778 x AKA 7	0.70	0.55	-0.15	0.40	-0.54	-0.008	0.23	0.72	067	-0.07	0.26*	0.329
PA 778 x JLA 611	-0.04	0.22	-0.23	-0.07	0.26	0.037	0.61	-0.11	-0.91	-0.19	0.003	0.029
PA 778 x RG 690	-0.12	-0.11	-0.32	-0.59	-0.04	-0.018	-3.26	0.13	0.28	0.10	-0.19	0.212
PA 778 x LD 919	-0.54	-0.86	-0.02	-0.50	-0.29	0.008	-1.15	-0.69	0.88	0.003	-0.33**	-0.429
PA 778 x DAS 1201	-0.45	-0.27	0.02	0.38	0.45	0.008	1.32	-0.77	-0.55	0.13	0.15	-0.138
PA 774 x JLA 794	1.18**	1.41	-0.35	-0.60	-0.40	-0.010	-3.85	0.38	0.22	-0.17	0.23	0.107
PA 774 x AKA 7	-0.43	0.50	-0.42	0.42	0.16	0.008	0.27	0.38	1.61	-0.09	-0.15	-0.293
PA 774 x JLA 611	-0.65	-0.83	0.36	-0.18	0.10	-0.007	2.91	0.22	-0.37	0.27**	0.13	-0.126
PA 774 x RG 690	-0.06	-0.16	0.01	0.42	0.11	-0.008	0.64	-0.19	0.58	-0.05	0.20	0.057
PA 774 x LD 919	-0.48	-0.58	0.31	0.52	0.19	0.044	1.65	-0.69	-0.50	0.11	-0.37**	0.349
PA 774 x DAS 1201	-0.40	-0.33	0.09	-0.58	-0.18	0.028	-1.63	-0.11	-1.54	-0.06	-0.03	-0.093
S.E. ±	0.42	1.01	1.14	0.94	0.47	0.045	2.88	1.05	1.66	0.09	0.11	0.510

*and ** indicated significance at 5 and 1 per cent respectively

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