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Heterosis for seed cotton yield and fibre quality characters in cotton (*Gossypium hirsutum* L.)

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ABSTRACT : Forty five intra *hirsutum* hybrids from a 10 × 10 diallel crossing excluding reciprocals along with their parents and check were evaluated at Regional Agricultural Research Station, Lam Farm, Guntur during *kharif*, 2013-2014. The objective of this study was to determine the useful heterosis in *Gossypium hirsutum* for seed cotton yield and fibre quality traits. The standard heterosis was calculated over check hybrid NCS 145. The hybrids NDLH 1938 × L 604 (39.47**), NDLH 1938 × RAH 1004 (36.57**) and NDLH 1938 × L 770 (34.48**) showed significant positive heterosis over check for seed cotton yield/plant. The cross combination NDLH 1938 × L 604 also showed highest performance for bolls/plant, boll weight, lint yield/plant, 2.5 per cent span length and bundle strength. Where ever cross combinations involving NDLH 1938 as a female parent recorded significant positive heterosis for most of the yield contributing characters. Thus the female parent NDLH 1938 can be used for exploitation of heterosis.

Key words : Cotton, fibre quality, heterisis, seed cotton yield

Cotton (*Gossypium* spp.*)* popularly called "White Gold" is the most important renewable natural fibre crop of global importance enjoying a premier position among all the commercial crops. For developing potential hybrids in cotton, it is necessary to exploit the hybrid vigour available in cotton. Hybridization is the most potent technique for breaking yield barriers and evolving genotypes with higher yield potential. Selection of appropriate parents for hybridization is the single most important factor determining both the extent and magnitude of success of any plant breeding programme. The present experiment was carried out with the objective of finding out the extent of heterosis over mid parent and check for seed cotton yield and fibre quality attributes in three environments.

The present investigation was carried out by selecting the ten parents *viz.,* NDLH 1938, L 788, L 770, NA 1325, L604, SURABHI, RAH 1004, HYPS 152, MCU 5 and G COT 16 and forty five intra specific cross combinations were generated in diallel fashion without reciprocals. The evaluation of hybrids along with parents and standard check (NCS 145) was done at Regional Agricultural Research Station, Lam Farm, Guntur during *kharif*, 2013-2014. Each entry was represented by following 120 x 60 cm spacing with 3 rows for each entry with a row length of 6m. Recommended doses of fertilizers 120 N, 60 P_2O_5 and 40 K_2O kg/ha were applied in split doses. Observations were recorded on five randomly selected plants from each genotype/ replication for seed cotton yield/plant. The data

was recorded on seed cotton yield/plant, bolls/plant, boll weight, seed index, lint index, ginning outturn, 2.5 per cent span length, micronaire value, bundle strength, uniformity ratio, elongation and lint yield/plant for statistical analysis for estimation of heterosis. The heterotic effects were measured as deviation of F_1 mean from mid parent (relative heterosis) and the standard check (standard heterosis) mean. The test of significance of heterosis over mid parent and standard check was done by 't' test.

The heterosis observed over the check for seed cotton yield and fibre quality traits by the forty five crosses has been presented in the Table 1. The results indicated that the phenomenon of heterosis was observed for all the characters, however, its magnitude varied with the characters.

Heterosis for seed cotton yield/plant over mid parent and standard check ranged from -19.22 (L 788 × MCU 5) to 60.16 (NDLH 1938 × L 604) and -1.52 (L 788 × MCU 5) to 84.4 (NDLH 1938 × L 604), respectively. Fourteen crosses over mid parent and twenty two crosses over standard check exhibited significant positive heterosis. The best heterotic combinations identified were NDLH 1938 × L 604 (33.83** and 39.47**), NDLH 1938 × RAH 1004 (27.43** and 36.57**) and NDLH 1938 × L 770 (24.49** and 34.48**) over mid and standard check respectively. These results are in conformity with the results of Punitha *et al.,* (2012) for heterosis over mid parent; Manish Kumar *et al.,* (2013), Nirania *et al.,* (2014) and Tuteja (2014) over standard check.

Eleven crosses over mid parent and twenty one crosses over standard check exhibited significant positive heterosis for bolls/plant. The best hybrids for the character identified were NDLH 1938 × RAH 1004 (17.57** and 17.76**) and NDLH 1938 × L 770 (10.94** and 8.51) over mid parent and standard check, respectively. For boll weight the crosses L 770 × G COT 16 (25.19** and 32.91**), NDLH 1938 × L 604 (20.96** and 31.04**) and NA 1325 × MCU 5 (21.04** and 30.61**) exhibited highest significant positive over mid parent and standard check, respectively. Similar results for significant positive heterosis on number of bolls/plant and boll weight were reported by Punitha *et al.,* (2012), Tuteja *et al.,* (2013) and Patil *et al.,* (2014).

For the character seed index the best crosses identified were NDLH 1938 × G COT 16 (14.58** and 22.05**), L 770 × G COT 16 (15.27** and 21.55**) and L 788 × NA 1325 (13.19**, and 21.27**) over mid and standard check, respectively. Eleven crosses over mid and all the forty five crosses over standard check exhibited significant positive heterosis for lint index. The top three crosses identified for lint index were L 770 × G COT 16 (19.47** and 45.82**), L 788 × RAH 1004 (15.83** and 44.29**) and NA 1325 × HYPS 152 (17.86** and 40.51**) over mid parent and standard check, respectively. Based on the *per se* performance and standard heterosis the top three hybrids noticed for ginning outturn were SURABHI × RAH 1004, SURABHI × HYPS 152 and L 770 × NA 1325. These results are in conformity with the results of heterosis reported by Manish Kumar *et al.,* (2013), Tuteja *et al.,* (2013), Nirania *et al.,* (2014) and Tuteja (2014).

With regards to fibre quality traits like 2.5 per cent span length five crosses over mid

Table 1. Per cent heterosis over check hybrid (NCS 145) for different characters in cotton

Hybrid	Bolls/ plant	Boll weight	Seed index	Lint index	Ginning outturn	2.5 per cent span length	Micro-naire value	Bundle strength	Uniformity ratio	Elongation	Seed cotton yield/ plant	Lint yield/ plant
NDLH 1938 × L 788	24.49**	15.88**	55.54**	58.46**	0.57	1.9	48.28**	0.92	2.92	4.19	44.24**	47.00**
NDLH 1938 × L 770	8.16*	33.93**	55.12**	43.44**	-5.53*	7.63**	12.90**	6.14*	8.88**	5.98*	43.94**	37.29**
NDLH 1938 × NA 1325	14.12**	9.65	27.19**	55.89**	13.18**	**-12.58****	40.82**	**-12.85****	8.07**	3.92	25.02*	43.37**
NDLH 1938 × L 604	26.02**	**47.08****	53.28**	56.84**	0.86	8.02**	14.91**	8.22**	-0.96	4.26	**84.40****	89.90**
NDLH 1938 × SURABHI	5.44	45.29**	31.92**	43.44**	5.12*	-2.64	32.81**	-0.07	5.21**	9.07**	52.02**	62.52**
NDLH 1938 × RAH 1004	11.82**	25.91**	32.66**	65.11**	**14.14****	-7.01*	18.80**	-4.11	9.67**	10.79**	40.02**	62.76**
NDLH 1938 × HYPS 152	-1.02	24.36**	21.13**	30.80**	4.71	2.78	20.47**	6.38*	4.97**	6.74*	22.82	29.99**
NDLH 1938 × MCU 5	-2.21	9.88	51.58**	77.57**	9.89**	2.61	17.91**	10.12**	5.78**	8.04**	7.11	18.42
NDLH 1938 × G COT 16	-3.06	23.42**	85.21**	73.38**	-5.07*	7.01*	13.13**	4.21	**-4.45***	2.06	18.94	13.33
L 788 × L 770	6.29	14.47*	37.99**	28.61**	-4.99	1.91	10.46**	-3.96	5.07**	2.68	21.3	15.96
L 788 × NA 1325	10.03*	21.63**	90.08**	73.95**	-6.53*	-3.73	12.57**	-6.22*	-1.25	0.34	33.34**	25.53**
L 788 × L 604	14.29**	21.01**	95.77**	56.37**	**-14.81****	9.75**	7.01	2.79	0.04	3.02	37.72**	17.86
L 788 × SURABHI	7.82	17.28**	**96.33****	78.80**	-6.82**	7.33**	28.03**	4.96	-2.2	7.01**	26.08*	18
L 788 × RAH 1004	5.61	**-5.45**	60.91**	78.52**	6.18*	-5.18	37.71**	0.36	6.57**	**13.13****	0.06	6.65
L 788 × HYPS 152	-2.55	12.84*	17.27**	35.36**	9.26**	-12.06**	19.02**	-6.34*	**10.85****	6.25*	9.52	20.42*
L 788 × MCU 5	2.21	-3.5	60.77**	42.40**	-8.36**	0.74	15.46**	6.71*	3.2	5.91*	**-1.52**	**-10.1**
L 788 × G COT 16	12.67**	32.68**	47.50**	32.32**	-7.47**	7.01*	-4.34	4.01	4.20*	2.89	48.72**	39.09**
L 770 × NA 1325	1.19	7.94	64.54**	88.69**	8.34**	-4.82	48.16**	-8.55**	-0.07	5.43*	8.81	18.73
L 770 × L 604	4.25	21.17**	41.85**	60.36**	7.55**	2.61	13.13**	-1.68	2.77	4.88	25.70*	36.77**
L 770 × SURABHI	13.61**	12.53*	40.84**	40.97**	-0.5	2.06	14.35**	-2.69	2.86	3.99	27.40*	27.95**
L 770 × RAH 1004	**26.70****	30.74**	37.76**	69.49**	13.38**	2.94	5.45	0.09	0.52	2.06	64.99**	**91.08****
L 770 × HYPS 152	8.84*	9.34	49.15**	59.13**	3.63	3.4	8.68*	-1.08	-0.66	4.19	18.64	23.91*
L 770 × MCU 5	5.87	12.22*	49.79**	43.82**	-3.21	2.98	1.89	0.3	-3.12	-0.34	18.55	15.18
L 770 × G COT 16	-2.89	44.36**	73.31**	**92.11****	6.01*	5.18	25.92**	2.58	5.10**	6.12*	38.95**	49.23**
NA 1325 × L 604	**-16.16****	27.78**	58.57**	72.43**	4.84	-2.1	32.93**	-6.54*	5.90**	2.82	6.5	12.14
NA 1325 × SURABHI	9.35*	4.82	44.74**	41.35**	-2.07	-0.83	16.91**	3.13	3.03	5.43*	14.44	12.73
NA 1325 × RAH 1004	20.24**	7.78	44.97**	71.01**	10.42**	-11.07**	21.80**	-12.46**	7.44**	4.26	28.98*	44.40**

contd...

Table 1 contd...

NA 1325 × HYPS 152	11.73**	14.01*	47.36**	57.60**	3.8	-0.06	22.36**	-4.41	2.37	2.96	27.14*	33.58**
NA 1325 × MCU 5	10.54**	20.70**	42.72**	50.10**	2.77	0.86	28.48**	-0.33	2.94	3.51	32.68**	37.89**
NA 1325 × G COT 16	17.18**	20.86**	49.56**	59.98**	3.76	1.44	35.37**	-3.18	6.82**	6.39*	41.35**	48.86**
L 604 × SURABHI	7.31	14.16*	36.52**	47.53**	4.58	4.48	0.11	4.54	5.42**	2.89	22.17	29.01**
L 604 × RAH 1004	8.50*	5.21	22.78**	50.95**	13.46**	-11.36**	17.24**	-9.61**	8.65**	3.23	14	30.80**
L 604 × HYPS 152	2.89	45.53**	13.78**	**14.83****	0.37	6.05*	7.12	6.97**	3.18	8.66**	48.89**	51.75**
L 604 × MCU 5	-3.83	25.21**	44.97**	59.70**	5.80*	8.99**	25.47**	0.37	0.21	1.51	19.75	27.87**
L 604 × G COT 16	11.56**	7.32	58.89**	66.92**	2.54	9.23**	20.69**	3.69	1.15	5.36*	19.61	23.39**
SURABHI × RAH 1004	9.69*	-1.87	11.02**	31.37**	10.98**	-6.62*	23.69**	-7.86**	8.85**	5.09	8.1	20.93**
SURABHI × HYPS 152	13.78**	35.49**	**5.93**	16.06**	5.89*	5.51	-12.90**	6.19*	0.46	3.37	53.39**	65.13**
SURABHI × MCU 5	4.59	21.25**	33.21**	33.94**	-0.18	2.73	14.91**	-4.26	-0.65	4.05	26.30*	27.36**
SURABHI × G COT 16	1.19	12.14*	40.10**	35.84**	-2.5	**11.91****	**-20.47****	**11.93****	-1.9	**-0.41**	13.14	10.72
RAH 1004 × HYPS 152	7.91	2.96	12.77**	30.99**	9.72**	-9.11**	40.04**	-4.09	8.92**	12.10**	10.96	22.76*
RAH 1004 × MCU 5	16.16**	3.42	30.96**	30.23**	-0.77	-5.96*	**48.94****	-0.16	9.52**	12.30**	20.08	19.97*
RAH 1004 × G COT 16	4.57	17.04**	30.87**	28.42**	-1.73	-7.15*	35.04**	-2.72	10.71**	6.60*	22	20.86*
HYPS 152 × MCU 5	4.59	8.95	45.93**	40.59**	-2.96	5.84*	12.12**	-3.26	-2.16	1.86	13.69	10.68
HYPS 152 × G COT 16	-1.19	1.63	36.70**	28.04**	-4.72	2.37	8.34*	5.55*	0.97	2.61	0.38	-4.55
MCU 5 × G COT 16	3.23	20.86**	56.96**	64.16**	2.28	11.85**	4.34	10.09**	0.03	3.37	24.05*	27.89**

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

parent and twelve crosses over standard check exhibited significant positive heterosis. The best three hybrids identified for this trait were HYPS 152 × MCU 5, NDLH 1938 × L 604 and L 770 × L 604. Among forty five hybrids, the best crosses over standard check identified for micronaire value were NDLH 1938 × RAH 1004 (29.98**), NDLH 1938 × SURABHI (26.11**) and NDLH 1938 × L 788 (25.22**). For bundle strength based on *per se* performance and standard heterosis the top three hybrids were SURABHI × HYPS 152, L 770 × G COT 16 and NDLH 1938 × L 604. The crosses NDLH 1938 × RAH 1004, RAH 1004 × G COT 16 and RAH 1004 × HYPS 152 showed positive and significant heterosis for uniformity ratio. Based on the overall performance the top three heterotic combinations identified for elongation were RAH 1004 × HYPS 152, NDLH 1938 × SURABHI and NDLH 1938 × RAH 1004. The present results are in agreement with the heterosis for quality traits reported by Sandip Patil *et al.,* (2012) and Deshmukh *et al.,* (2014).

The heterotic combinations NDLH 1938 × RAH 1004 (29.25** and 58.24**), NDLH 1938 × L 604 (25.15** and 50.69**) and NDLH 1938 × L 770 (11.2 and 44.47**) showed significant positive heterosis for lint yield/plant over mid parent and standard check.

It could be concluded that, cross combinations exhibited heterosis for seed cotton yield also showed high heterotic values for both or either of its component traits, bolls/plant and boll weight. The cross combinations NDLH 1938 × L 604, NDLH 1938 × RAH 1004 and NDLH 1938 × L 770 showed the significant standard heterosis values for seed cotton yield and fibre quality component traits. The cross combination involving NDLH 1938 parent recorded significant positive heterosis for most of the characters. Thus, these crosses and the parent NDLH 1938 can be used for development of hybrids. The study also reveals good scope for commercial exploitation of heterosis.

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