J. Cotton Res. Dev. **28** (2) 211-213 (July, 2014)

Heterosis and combining ability for yield and its components in *desi* cotton (*Gossypium arboreum* L.)

S. S. PATIL*, N. M. MAGAR AND V.Y.PAWAR
Mahatma Phule Krishi Vidyapeeth, Oilseeds Research Station, Jalgaon-425 001
**E-mail : sanjivspatil@gmail.com*

ABSTRACT : Investigation was carried out to study the heterosis and combining ability and yield related traits by using 8 x 8 half diallel mating design. The analysis of variance revealed significant differences among genotypes for all characters. The analysis of variance for combining ability revealed that the variance due to general combining ability (gca) was lower than specific combining ability (sca) indicating non additive type of gene action was predominant for all characters. The parents JLA 794 was good general combiner for seed cotton yield. The parent Hegha 46 found good general combiner for number of bolls, boll weight and lint yield (kg/ha). Cross Hegha 46 x MDL 2643 showed highest heterobeltosis, significant sca and involved one good general combiner parent for seed cotton yield.

Key words: Combining ability, *Gossypium arboreum,* heterosis, seed cotton yield

Cotton is an important commercial crop of India. Commercial exploitation of heterosis in cotton has achieved great success in India. As combining ability forms the basis for selection of parents for hybridization, therefore, the present study was undertaken to estimate heterosis as well as to have an idea about nature of combining ability for yield and other characters, with a view to identify good combiners. Diallel analysis is useful procedure for preliminary evaluation of genotypes for use in hybridization programme.

Eight parents of *Gossypium arboreum* L. *viz.* JLA 794, Turab, JLA 1799, AKA 0110, Hegha 46, ARBHA 35, Paig 8/1 and MDL 2643 were crossed in half diallel fashion to generate 28 hybrids. These hybrids were grown in randomized block design with two replications during *kharif,* 2009-2010 at Agriculture Research Station, Jalgaon. Each hybrid was sown in two rows of 6 m length with a spacing of 45 cm between rows and 30 cm between plants. Observations were recorded on randomly selected 5 plants from each replication on seed cotton yield (kg/ha), bolls/ plant, boll weight (g), lint yield (kg/ha), ginning percentage, seed index and lint index. The data was subjected to statistical analysis by using Model 1 Method 2. Heterosis was worked out.

The analysis of variance revealed that, mean squares due to genotypes were highly significant for all the characters studied which indicated considerable amount of variability among the genotypes for all the characters. The variance due to parents was significant for all the characters except seed cotton yield and lint yield. The variance due to hybrids was significant for all the characters. The analysis of variance for combining ability revealed that, the variance due to general combining ability (gca) was lower than specific combining ability (sca) indicating non additive type of gene action was predominant for all the characters. Nimbalkar *et al.,* (2004) and Patel *et al.,* (2009) also reported non additive type of gene action for these traits.

Number of bolls/plant is one of the most important yield components. The cross AKA 0110 x Paig 8/1 recorded maximum significant sca effects (5.447) and heterosis (76 %) over better parent for bolls/plant (Table 2). The cross combinations AKA 0110 x Hegha 46 and AKA 0110 x ARBHA 35 also recorded significant positive heterosis over better parent next to the cross combinations AKA 0110 x Paig 8/1 for bolls/ plant. The heterobeltosis ranged from -23.84 to 76 per cent (Table 1). This observation will be helpful to isolate superior genotypes for number of bolls per plant. Heterobeltosis for these traits was also reported by Tuteja and Singh (2001) and Patel *et al.,* (2009).

Average boll weight is generally associated with higher productivity. The cross Hegha 46 x MDL 2643 (23.08 %) recorded the highest heterosis for average boll weight over better parent. Maximum significant positive heterosis and sca effect for average boll weight was exhibited in cross Hegha 46 x MDL 2643 followed by ARBHA 35 x MDL 2643 and ARBHA 35 x Paig 8/1. G x A, A x A and A x P general combiner also produce positive significant heterosis and significant sca effects for average boll weight. The maximum positive significant heterobeltosis and sca effects for lint yield was observed in AKA 0110 x Paig 8/1 (76.20 %) followed by AKA 0110 x Hegha 46 (50.39 %). The range of heterobeltosis was -27.85 to 76.20 per cent. Tuteja and Singh (2001) and Patel *et al.,* (2009) also observed varied range of heterosis for average boll weight and lint yield.

For ginning outturn, highest significantly positive sca effects was expressed by two hybrids Turab x JLA 1799 (1.491) and ARBHA 35 x MDL 2643 (1.466). Good x poor and good x good general combiner leads to give heterobeltosis for the ginning outturn.

The range of heterobeltosis for seed index was -18.94 per cent (JLA 794 x AKA 0110) to 6.67 per cent (Paig 8/1 x MDL 2643) over better parent. The maximum positive significant sca effect was recorded by JLA 794 x Hegha 46 (0.359) followed by Hegha 46 x MDL 2643 (0.269) and Paig 8/1 x MDL 2643. The crosses having positive and significant sca effects for seed index involved poor x poor, poor x average and good x average general combiner, respectively. Kumar *et al.* (2003) reported same kind of results for this trait.

Table 1. Estimates of gca effects of different characters

Sr. No.	Parent	SC yield kg/ha	Bolls/ plant	Avg. boll weight (g)	Lint yield (kg/ha)	GP (%)	Seed index	Lint index
1	JLA 794	143.338*	0.545*	-0.044*	13.063	-0.241	-0.109*	-0.101*
2	Turab	-46.012	-1.820*	-0.094*	-61.738*	0.429*	0.036	0.079*
3	JLA 1799	-63.412*	0.280	0.066*	15.913	-0.221	0.016	-0.016
4	AKA 0110	-92.362*	0.990*	-0.004	43.113*	0.084	0.071*	0.064*
5	Hegha 46	-6.012	1.285*	0.086*	62.063*	-0.111	-0.144*	-0.101*
6	ARBHA 35	-8.662	-0.395*	0.026	-19.788	0.134	0.026	0.024
7	Paig 8/1	14.088	-0.870*	-0.044*	-39.73*	-0.171	0.071*	0.014
8	MDL 2643	59.038*	-0.015	0.006	-12.888	0.099	0.031	0.039
	SE + (gi)	28.26885	0.16124	0.01386	14.17203	0.19597	0.02193	0.02966

For, lint index the range of heterobeltosis was from -30.86 to 10.29 per cent and cross ARBHA 35 x MDL 2643 exhibited highest significant heterobeltosis (10.29 %) and sca effects (0.269) followed by JLA 794 x Paig 8/1. Kumar *et al.,* (2003), Singh *et al.,* (2003) and Wankhede *et al.,* (2009) reported similar findings for these traits.

Hybrids with positive and significant sca effects (Table 2) for all characters including seed cotton yield were produced by almost all type of parental combinations (good x good, good x average, good x poor, average x good, average x average, average x poor, poor x good, poor x average and poor x poor). The crosses with high sca effects were in general combinations of parents with good x good and good x poor or good x average gca effects. This was presented in the best three hybrids for seed cotton yield (kg/ha) *viz.*, Hegha 46 x MDL 2643 (Average x Good), JLA 794 x AKA 0110 (Good x Poor) and JLA 794 x Hegha 46 (Good x Average) had significant desired sca effects and significant desired heterotic response over better parent. Among top 10 hybrids, 7 hybrids *viz.*, Hegha 46 x MDL 2643, JLA 794 x AKA 0110, JLA 794 x Hegha 46, JLA 794 x Paig 8/1, ARBHA 35 x MDL 2643, JLA 794 x ARBHA 35 and Paig 8/1 x MDL 2643 exhibited at least one of their parent found to be good general combiner. The high seed cotton yield combination (high x low or high x average) might be attributed due to interaction between positive alleles in the good combiner. Magnitude of heterosis expressed by hybrids varied between crosses and both positive and negative heterosis were expressed by different hybrids for various characters. In present investigation the best performance of the hybrids *viz.*, Hegha 046 x MDL 2643 and JLA 794 x AKA 01110 showed significant positive heterobeltosis and sca effects for seed cotton yield as well as bolls/plant. The present results are in agreement with Kumar *et al.,* (2003) and Patel *et al.,* (2009). 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 trait, bolls/plant. Among the parents, JLA 794 and MDL 2643 was

Table 2. The best performing cross combinations, their gca effects, sca effects and heterobeltosis

Character	Best performing hybrids	Mean or *per se* performance	gca effects P1	gca effects P2	sca effects	Heterobeltosis (%)
SC (kg/ha)	Hegha-46 x MDL-2643	1731.0	A	G	491.406**	93.95**
	JLA-794 x AKA-0110	1587.5	G	P	349.956**	40.05**
	Turab x ARBHA-35	1379.0	A	A	247.106**	39.29**
Bolls/plant	AKA-0110 x Paig-8/1	19.8	G	P	5.447**	76.00**
	AKA-0110 x Hegha-46	20.25	G	G	3.742**	58.82**
	AKA-0110 x ARBHA-35	18.1	G	P	3.272**	58.77**
Boll weight (g)	Hegha-46 x MDL-2643	2.4	G	A	0.287**	23.08**
	ARBHA-35 x MDL-2643	2.25	A	A	0.197**	15.38**
	ARBHA-35 x Paig-8/1	2.2	A	P	0.197**	12.82**
Lint yield (kg/ha)	AKA-0110 x Paig-8/1	696.0	G	P	185.583**	76.20**
	AKA-0110 x Hegha-46	769.0	G	G	153.283**	50.39**
	AKA-0110 x ARBHA-35	681.0	G	A	150.633**	64.10**
Ginning percentage	Turab x JLA-1799	37.85	G	A	1.491**	4.85*
	ARBHA-35 x MDL-2643	37.85	A	A	1.466**	4.27*
	JLA-794 x Paig-8/1	36.8	A	A	1.061**	-2.77
Seed index	JLA-794 x Hegha-46	6.15	P	P	0.359**	4.24*
	Hegha-46 x MDL-2643	6.0	P	A	0.269**	0.03
	Paig-8/1 x MDL-2643	6.15	G	A	0.254**	0.07
Lint index	ARBHA-35 x MDL-2643	3.75	A	A	0.269**	10.29*
	JLA-794 x Paig-8/1	3.6	P	A	0.269**	0.03
	Turab x JLA-1799	3.7	G	A	0.219**	4.23

*, **Significant at 5 and 1 per cent probablity levels, respectively
G=Good combiner having significant GCA effect in desirable direction
A=Average combiner having either positive negatve but non sgnificant GCA effects
P=Poor combiner having significant GCA effects in undesirable direction
P1,P2=First and second parent respectively.

good general combiner for seed cotton yield and other economic traits. However the cross Hegha 46 x MDL 2643 showed higher significant heterobeltosis and sca effects and involved one of good general combiner parent for seed cotton yield. Hence, this cross needs to be tested at larger scale to ascertain its utility for commercial exploitation of heterosis.

REFERENCES

Kumar, M., Chhabra, B. S. and Kumar, O. R 2003. Heterosis for seed cotton yield and fibre characters in intra *Gossypium hirsutum* hybrids. *J. Cotton Res. Dev.* **17** : 27-29.

Nimbalkar, R. D., Jadhav, A. C. and Mehetre, S. S. 2004. Combining ability studies in cotton (*G. arboreum* and *G. herbaceum). J. Cotton Res. Dev.* **18** : 50-55.

Patel, K. G., Patel, R. B., Patel, M. I. and Kumar, V. 2009. Studies on heterosis and combining ability through introgression in diploid cotton *J. Cotton Res. Dev.* **23** : 23-26.

Singh, P. and Loknathan, T.R. and Agrawal, D. K. 2003. Heterosis for fibre properties in *intra hirsutum* crosses (*Gossypium hirsutum L.*). *Indian J. Genet.* **63** : 325-27.

Tuteja, O. P. and Singh, D. P. 2001. Heterosis for yield and its components in Asiatic cotton hybrids based on GMS system under varied environments. *Indian J. Genet.* **61**: 291-92.

Wankhede, S. N., Patil S. P., Burghate, S. K. and Chikhale,N. J. 2009. Heterosis for seed cotton yield and its quantitative characters of *Gossypium hirsutum. J. Cotton Res. Dev.* **23** : 27-31

Received for publication : November 3, 2012
Accepted for publication : February 28, 2013