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Heterosis studies for seed cotton yield and yield contributing traits in *desi* cotton (*Gossypium arboreum L.*)

R.DIVYA BANDHAVI*, H. V. KALPANDE, V. N. CHINCHANE AND ANIL KUMAR
Department of Agricultural Botany, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani - 431 402
**E-mail : divyabandhavir@gmail.com*

ABSTRACT : The present investigation was undertaken to study "Heterosis studies for yield traits in *desi* cotton (*Gossypium arboreum* L.)" programme involving twenty four hybrid combinations derived by crossing six *arboreum* lines (PA 713, PA 743, PA 734, PA 760, PA 720, PAIG 326) with four *arboreum* testers (PA 255, PA 402, PA 08, PA 528) were tested along with their parents including 2 checks (PKVDH 1, SWADESHI 651) at Cotton Research Station, Mahboob Baugh Farm, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani during *kharif* season of 2013-2014. The observations on 13 yield attributing characters were recorded *viz.,* days to 50 per cent flowering, Days to 50 per cent boll bursting, days to maturity, Plant height (cm), sympodia /plant, bolls/plant, seeds/boll, Boll weight (g), seed index (g), seed cotton yield/plant (g), lint index, harvesting index, ginning outturn. The economic heterosis was calculated over standard check PKVDH 1,SWADESHI 651. The magnitude of heterosis and heterobeltosis for all the characters in the present study was highly appreciable. Among all the characters, the magnitude of mid parent, better parent and standard heterosis was highest for sympodia/plant . PA 760 x PA 08 for seed cotton yield/plant, cross PA 720 x PA 528 for seed/boll in case of mid parent and standards checks, cross PA 720 x PA 08 and PA 760 x PA 528 for boll weight, cross PA 720 x PA 255 for ginning outturn were found most su/ior cross for respective characters. There is no positive significant in case of plant height.The cross PA 760 x PA 08 was found most heterotic over standard hybrids and commercial hybrid for seed cotton yield/plant.

Key words : *Desi* cotton, ginning outturn, harvesting index, heterosis, seed index, sympodia

India is /haps the first country to make use of cotton. Cotton the 'White Gold' enjoys a pre eminent status among all cash crops in the country. It is grown commercially in the tem/ ate and tropical regions of more than 70 countries. In the last few years there has been a significant reduction in area of *G. arboreum* cotton across the country and particularly in Maharashtra because of lower productivity and inferior fibre pro/ties as compared to tetraploid cotton in rainfed eco system and non availability of *Bt* variety/hybrid. Genetic improvement in *desi* cotton could be gain either through combination or exploitation of hybrid vigour. Therefore, more emphasis should be given to increase the seed cotton yield/unit area, by developing varieties with short structure, big boll size and medium to longer staple length with sustained yield in multiple environments. To achieve such desirable characteristics in a new variety, pro/ breeding strategies should be followed. The progress in breeding programme depends on magnitude of genetic variability present in breeding material. The existence of variability is essential for resistance to biotic and abiotic factor as well as for varietal adaptability. Selection is also effective when there is high degree of genetic variability among the individuals in a population. The information on the nature and magnitude of gene action is important in understanding the genetic potential of population and decide the breeding procedure to be adopted in given population. Line x tester analysis is a precise method for obtaining such information when a large parents to be tested.

The present investigation was undertaken to study "Heterosis studies for seed cotton yield and yield contributing traits in *desi* cotton (*Gossypium arboreum* L.)", line x tester programme involving twenty four hybrid combinations derived by crossing six *arboreum* lines(PA 713, PA 743, PA 734, PA760,PA 720, PAIG 326,PA 713) with four *arboreum* testers(PA 255, PA 402, PA 08, PA 528) were tested along with their parents including 2 checks(PKVDH 1, SWADESHI 651) at Cotton Research Station, Mahboob Baugh farm, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani during *kharif* season of 2013-2014. All the parental material was planted during summer 2013. Two sets of parental lines were sown at an interval of 8 days to ensure synchrony in flowering and to complete hybridization between selected parents. The line x tester (6 x 4) crossing was effected and total 24 crosses along with ten parents and 2 checks were grown in randomized block *desi*gn with three replications with spacing of 60x 30cm. Observations were recorded on the following yield and yield components days to 50 per cent flowering, days to 50 per cent boll bursting, Days to maturity, Plant height (cm), sympodia /plant, bolls/plant, seeds/boll, Boll weight (g), Seed index (g), Seed cotton yield/plant (g), Lint index, Harvesting index, Ginning outturn were recorded.

Heterosis (%) over mid parent (MP), better parent (BP) and standard check (SC) were calculated for all thirteen characters. The results obtained were presented in Table 2, The genotypes with early flowering, boll bursting and maturity have a special significance in multiple cropping systems. The crosses PA 713 x PA 255 and PA 740 x PA 08 showed significant and negative heterosis over mid and better parent for days to 50 per cent flowering, whereas, cross PA 713 x PA 08 showed significant negative heterosis over better parent. Significant negative heterosis for earliness was also reported by Jaiwar *et al.,* (2012).For days to 50 per cent boll bursting, the cross PA 713 x PA 08 over mid parent, better parent and standard check PKVDH 1 shown highest significant negative heterosis in desirable direction. Similarly the cross PA 713 x PA 255 over mid and better parents, PA 720 x PA 402 over better parent, exhibited significant negative heterosis for days to maturity. However none of the crosses showed negative significant heterosis for day to maturity over both standard checks PKVDH 1 and Swadeshi 651. The cross PA 720 x PA 528 over mid, better parent and over both standard checks PKVDH 1 and Swadeshi 651 exhibited highest significant positive heterosis for sympodia/ plant. Out of 24 crosses, eleven over mid, six over better parent, fifteen over PKVDH 1 and five crosses over Swadeshi 651 showed desirable

Table 1. ANOVA for line x tester analysis

Source	d.f.	Days to 50 per cent flowering	Days to to 50 per cent boll bursting	Sym-podia/ plant	Boll/ plant	Seed/ boll	Boll weight (g)	Plant height (cm)	Days to maturity	Seed cotton yield/ plant	Lint index	Seed index	Harvest index	Ginning outturn (%)
Replications	2	1.451	1.892	4.759	2.006	4.023	0.029	22.66	1.922	10.990	0.030	0.034	2.947	2.241
Crosses	23	4.464**	9.695**	34.377**	5.206**	8.772**	0.093**	821.98**	23.301**	75.896**	0.523**	1.195**	17.266*	6.794**
Lines	5	3.000	8.114	44.684	2.847	4.646*	0.073	1274.42	13.322	55.135	0.383	1.809	24.628	14.669*
Testers	3	1.000	16.051	20.663	7.311	2.382	0.164	58.539	12.759	289.61**	1.523	1.741	3.448*	10.395
LXT	15	5.644**	8.951**	33.684**	5.571	11.426**	0.085**	823.854**	28.737**	40.07**	0.369**	0.881**	17.576	3.449**
Error	66	2.0267	1.954	5.836	3.752	3.092	0.019	207.43	6.265	7.269	0.060	0.103	9.361	1.363

* Significant 5 per cent level

* * Significant 1 per cent level

positive heterosis. Heterosis for this trait was reported by the earlier workers, Tuteja *et al.,* (2011) and Balu *et al.,* (2012).As far as plant height is concerned, out of 24 intra *arboreum* crosses, fourteen recorded highest significant positive heterosis over both checks PKVDH 1 and Swadeshi 651 whereas, none of the crosses recorded significant higher plant height over mid and better parents.. These findings are in accordance with the results obtained by Kumar (2013). Seed cotton yield is a complex trait, dependent on many other component traits such as boll number and boll weight. Results of heterosis on bolls/plant and boll weight are discussed as component characters of seed cotton yield. The cross PA 712 x PA 402, PA 712 x PA 08, PA 734 x PA 255, PA 760 x PA 08 and PA 760 x PA 255 had shown significantly high positive heterosis over mid parent, better parent and both standard checks. Out of twenty four crosses, six exhibited significant positive heterosis over mid parent, five over better parent, seven over standard check PKVDH 1 and nine over Swadeshi 651 for seed cotton yield/plant. These findings are in accordance with the results. Out of 24 crosses, eleven crosses over mid parent, six over better parent, fourteen over standard check PKVDH 1 and none over Swadeshi 651 showed desirable significant positive heterosis for boll/plant. The cross PAIG 326 x PA 402 exhibited maximum positive heterosis over mid parent, better parent and over standard check PKVDH 1. Heterosis for this trait was observed to the extent of 44.22 per cent cent in PAIG 326 x PA 528 over standard check PKVDH 1. Heterosis for this trait was reported by the earlier workers . Positive heterosis is desirable for seed/boll. The cross PA 720 x PA 528 exhibited maximum positive heterosis over mid parent and over both standard checks. Out of twenty four crosses, two over mid parent, two over better parent, one over standard check PKVDH 1 and one over Swadeshi 651 showed desirable significant positive heterosis for number seed/boll. Heterosis for this trait was reported by Tuteja *et al.* (2005) Kumar (2014). The crosses PA 743 x PA 402 and PA 760 x PA 528 exhibited maximum positive heterosis over mid parent, better parent and standard checks PKVDH 1 and Swadeshi 651. Out of 24 crosses, six crosses over mid parent, two over better parent, eighteen over standard check PKVDH 1 and nine over Swadeshi 651 for boll weight showed desirable positive heterosis. Heterosis for this trait was reported by the earlier workers Sekhar *et al.,* (2012) and Singh *et al.,* (2013). For the ginning outturn, positive heterosis is desirable. Heterosis for this trait was observed to the extent of 5.96/cent in PA 720 x PA 255 over mid parent. Out of 24 crosses, four showed desirable positive heterosis over mid parent and none showed for better parent and both the checks. Heterosis for this trait was reported by the earlier worker Tuteja *et al.,* (2011) and Balu *et al.,* (2012). For the seed index, positive heterosis is desirable. Out of 24 crosses, nine crosses over mid parent, three over better parent, nineteen over standard check PKVDH 1 and twenty one over Swadeshi 651 showed desirable positive heterosis for seed index. The cross PA 743 x PA 255, PA 743 x PA 08 and PA 720 x PA 255 exhibited positive heterosis over mid parent, better parent and both standard checks. Heterosis for seed index was observed to the extent of 46.38/cent in PA 743 x PA 08 over standard check Swadeshi. For the lint index positive heterosis is desirable. The

Table 2. Estimates of heterosis in percentage over mid parent (M.P.), better parent (B.P.) and standard check (S.C.) for Seed cotton yield and Harvesting Index

Sr. No.	Hybrids	Seed cotton yield per plant					Harvest index				
		Mean	M.P. heterosis (%)	B.P. heterosis (%)	Standard heterosis over (%)		**Mean**	M.P. heterosis (%)	B.P. heterosis (%)	Standard heterosis over (%)	
					PKVDH 1	Swadeshi-615				PKVDH 1	Swadeshi 615
1	PA 713 x PA 255	**35.46**	8.74	7.37	15.90*	22.72**	**41.47**	8.27	-1.12	5.07	-2.68
2	PA 713 x PA 402	**37.20**	19.42**	15.53*	21.57**	28.72**	**38.61**	-8.55	-9.15	-2.17	-9.38
3	PA 713 x PA 08	**38.65**	22.41**	20.03**	26.31**	33.74**	**39.00**	-8.12	-9.20	-1.19	-8.47
4	PA 713 x PA 528	**26.35**	-17.72**	-18.17*	-13.89	-8.82	**40.10**	-1.03	-4.37	1.61	-5.88
5	PA 743 x PA 255	**34.80**	4.37	3.42	13.73	20.42*	**44.21**	18.52**	10.69	12.02	3.76
6	PA 743 x PA 402	**31.30**	-1.80	-6.98	2.29	8.30	**36.55**	-11.32*	-13.99*	-7.38	-14.21*
7	PA 743 x PA 08	**36.15**	11.92*	7.43	18.14*	25.09**	**41.39**	-0.14	-3.63	4.86	-2.86
8	PA 743 x PA 528	**23.25**	-29.01**	-30.91**	-24.02**	-19.55*	**36.55**	-7.52	-8.49	-7.39	-14.22*
9	PA 734 x PA 255	**27.75**	-13.66*	-15.99*	-9.13	-3.98	**35.72**	2.14	1.25	-9.49	-16.16**
10	PA 734 x PA 402	**30.55**	-0.41	-2.24	-0.16	5.17	**42.10**	8.25	-0.94	6.67	-1.19
11	PA 734 x PA 255	**38.90**	25.08**	24.48**	27.12**	34.60**	**38.88**	-0.61	-9.48	-1.49	-8.75
12	PA 734 x PA 402	**30.43**	-3.54	-4.45	-0.54	5.31	**42.27**	13.65*	8.09	7.09	-0.80
13	PA 760 x PA 08	**41.10**	30.72**	24.42**	34.31**	42.21**	**41.37**	7.37	-2.44	4.83	-2.89
14	PA 760 x PA 528	**32.85**	9.59	9.14	7.35	13.67	**43.89**	3.38	3.27	11.21	3.01
15	PA 760 x PA 255	**39.05**	28.45**	26.17**	27.61**	35.12**	**43.35**	1.58	0.94	9.84	1.74
16	PA 760 x PA 402	**24.95**	-19.12**	-21.66**	-18.46*	-13.67	**41.10**	0.85	-3.08	4.14	-3.54
17	PA 720 x PA 08	**33.25**	8.51	0.66	8.66	15.05	**42.83**	18.39**	13.63*	8.52	0.52
18	PA 720 x PA 528	**31.35**	7.46	4.15	2.45	8.48	**41.83**	4.32	-1.58	5.99	-1.82
19	PA 720 x PA 255	**27.15**	-8.28	-12.28	-11.27	-6.06	**42.62**	5.70	-0.76	7.99	0.03
20	PA 720 x PA 402	**25.70**	-14.48*	-19.31**	-16.01*	-11.07	**42.29**	10.13	8.15	7.15	-0.74
21	PAIG 326 x PA 255	**33.45**	10.61	1.26	9.31	15.74*	**39.40**	-0.43	-11.42*	-0.17	-7.53
22	PAIG 326x PA 402	**31.80**	10.51	5.65	3.92	10.03	**41.19**	-5.30	-7.40	4.36	-3.33
23	PAIG 326x PA 08	**29.15**	-0.17	-5.82	-4.74	0.87	**39.75**	-9.06	-10.63	0.73	-6.70
24	PAIG 326x PA 528	**26.00**	-12.31	-18.37*	-15.03*	-10.03	**37.21**	-10.96*	-16.34**	-5.71	-12.66*
	SE	**1.5623**	1.9064	2.2013	2.2013	2.2013	**1.7496**	2.1635	2.4982	2.4982	2.4982

cross PA 720 x PA 255 and PA 713 x PA 402 showed significantly higher lint index over mid parent, better parent and standard checks PKVDH 1 and Swadeshi 651. Out of twenty four crosses, nine crosses for mid parent, six for better parent, ten for both the check PKVDH 1 and two for Swadeshi 651 showed desirable positive heterosis. Most of the crosses showed negative significant heterosis over mid parent, better parent and both standard checks, which is not desirable for this trait. Similar results were obtained by Gurerein (2011). The cross PA 740 x AKA 7 showed maximum positive heterosis over mid parent, better parent and standard check PKVDH 1. However, over standard check Swadeshi 651 all crosses showed negative heterosis for harvest index.

REFERENCES

Balu A., Kavithamani, P. D., Ravikesavan, R. and Rajarathinam, S. 2012. Heterosis for seed cotton yield and its quantitative characters of *Gossypium barbadense* L., *J. Cotton Res. Dev.,* **26** : 37-40.

Guvercin, R. S. 2011. Heterosis, heterobeltiosis and economic heterosis on some characters affecting fiber yields of F1cotton hybrids (*Gossypium* ssp.). [Turkish]. *Tarim Bilimleri Dergisi.,* **17** : 113-21.

Karademir, E. and Gencer, O. 2010. Combining ability and heterosis for yield and fiber quality pro/ties in cotton (*G. hirsutum* L.) obtained by half diallel mating design. *Notulae Botanicae, Horti Agrobotanici*, Cluj-Napoca., **38** : 222-27.

Khan, N. U. 2011. Economic heterosis for morpho-yield traits in F1 and F2 diallel crosses of upland cotton. *SABRAO J. Breed. and Genet.,* **43** : 144-64.

Kumar, A. 2014. Heterosis and combining ability for yield and fibre quality in *desi* cotton (*Gossypium arboreum* L.). *M.Sc. Thesis* submitted to V.N.M.K.V. Parbhani.

Lalage S. B., Deshmukh, N. D., Halakude, I. S. and Rajput, J. C. 2011. Heterosis for yield and yield attributing traits in *arboreum* cotton (*Gossypium arboreum* L.). *World Cotton Research Conference-5*, Mumbai, India, 69-71.

Reddy, C.V.C.M. and Reddy Y. R. 2011. Genetic parameters for yield and fibre quality traits in *desi* cotton (*Gossypium arboreum* L.). *J. Cotton Res. Dev.*, **25 :** 168-70.

Sandip, A., Patil M.R., Naik G.R., Chougule V.D., Pathak and Atul B.Patil 2012. Combining analysis for yield and fibre quality traits in upland cotton (*Gossypium hirsutum* L.).

Sekhar, L., Khadi, B. M., Patil, R. S., Katageri, I. S., Vamadevaiah, H. M., Chetti, M. B. and Nadaf, H. L. 2012. Study of heterosis in thermo sensitive genetic male sterility (TGMS) based diploid cotton hybrids for yield, yield component and fibre quality characters. *Karnataka J. Agri. Sci..,* **25** : 313-21.

Singh, A., Avtar, Ram, Sheoran, R. K., Jain, Ashish and Dharwal, Gaurav 2013. Heterosis in genetic male sterility based *desi* cotton hybrids for seed cotton yield and component traits. *Annals of Bio.,* **29** : 32-34.

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