International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
www.chemijournal.com
IJCS 2021; 9(1): 3083-3091

Received: 19-11-2020
Accepted: 21-12-2020

Chinchane VN
Department of Agricultural Botany, (Genetics and Plant Breeding) Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani, Maharashtra, India

Deosarkar DB
Department of Agricultural Botany, (Genetics and Plant Breeding) Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani, Maharashtra, India

Kalpande HV
Department of Agricultural Botany, (Genetics and Plant Breeding) Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani, Maharashtra, India

KS Baig
Department of Agricultural Botany, (Genetics and Plant Breeding) Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani, Maharashtra, India

Corresponding Author:
Chinchane VN
Department of Agricultural Botany, (Genetics and Plant Breeding) Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani, Maharashtra, India

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

Chinchane VN, Deosarkar DB, Kalpande HV and KS Baig

DOI: https://doi.org/10.22271/chemi.2021.v9.i1aq.11702

Abstract
Fifty six hybrid combinations developed by crossing 7 lines and 8 testers were tested along with their parents including 4 checks in Line X Tester design for seed cotton yield and yield contributing characters 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 magnitude of heterosis was estimated in relation to better parent and standard checks. The magnitude of heterosis, heterobeltiosis and standard heterosis for all the characters in the present study was highly appreciable. Out of fifty six crosses, the crosses showed highest and desirable significant standard heterosis for various traits viz., cross PA 801 x AKA 8 for days to 50 per cent flowering, days to 50 per cent boll bursting and days to maturity; PA 809 x CNA 449 for plant height ; PAIG 346 x DWDa 1402 for number of sympodia per plant ; PAIG 346 x DWDa 1402 for number of bolls per plant; PA 740 x DIgvijay for boll weight; PAIG 346 x JLA 797 for seed cotton yield per plant and seed index; PA 812 x HD 514 for lint index and PA 809 x AKA 8 for harvest index over standard check PKVDH 1,PKV Suvarna, NACH 12 and PA 255, respectively. The crosses PAIG 346 X JLA 794, PAIG 346 X DWDa 1402, PA 809 X AKA 8, PA 785 X CNA 449, PAIG 346 X CNA 449 and PAIG 346 X HD 514 hold promise for further evaluation and commercial exploitation of heterosis for seed cotton yield and yield contributing traits.

Keywords: Desi cotton, heterobeltiosis, seed cotton yield, standard heterosis

Introduction

India is the pioneer country in the world for commercial exploitation of heterosis in cotton. After successful release of first commercial hybrid in the world, Hybrid-4 (Patel, 1971), several inter and intra specific new world cotton hybrids have been released in the country. These hybrids, though had high yield potentiality, big boll size, early maturity coupled with desirable fibre qualities were susceptible to biotic and abiotic stresses which put limitations on their large scale adaptation. Even after introduction of Bt gene in these hybrids sucking pests and abiotic stresses are major problems. Asiatic cottons are known for their inherent ability of resistance against major pests and diseases in addition to high ginning outturn, low cost of management and wide adaptability under rainfed cultivation due to deep root system.

In order to remain competitive in the world market, several cotton breeding efforts needed to be placed on priority in research. The economic importance of cotton in agriculture and industry lies in its yield and fibre quality. Global competition in the production and use of cotton fibre with advanced plant improvement technologies in yield and yarn manufacturing had accelerated the efforts to increase yield and improve fibre quality.

Since the time India attained independence, research efforts in cotton were intensified with the three major objectives of increasing the total production, raising productivity per hectare and to produce adequate long and extra-long staple cottons to meet the demands of the large Indian textile industry and ever growing population. Heterosis breeding was adopted as a major genetic approach for achieving these objectives through the development of high yield potential and high quality hybrid cottons. In India heterosis has been exploited extensively to improve the yield. Several factors like geographical and genetic diversity, agronomic performance, adaptability and genetic base of parental lines are reported to play an important role in the manifestation of heterosis in cotton.

Materials and Methods

The present study comprised of seven females (lines) and eight males (testers) with four standard checks thus making 56 F_1s using Line x Tester mating design. These lines, testers and hybrids along with four checks were sown during *kharif*, 2016 at three locations *viz.*, Cotton Research Station, MB Farm, Parbhani (L_1), Cotton Research Station, Nanded (L_2), and Agricultural Research Station, Badnapur (L_3). The observations recorded on days to 50% flowering, days to 50% boll bursting, plant height (cm), 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 (%).Analysis was carried out as per the method suggested by Fonesca and Patterson (1968) [2].

Results and Discussion

Out of fifty six crosses, twenty six, fourteen and twenty crosses expressed significant standard heterosis over check PKVDH 1, PKV Suvarna and PA 255 respectively. While nine crosses recorded significant standard heterosis over standard check NACH 12. These nine crosses also exhibited highest heterobeltiosis. The cross PAIG 346 X JLA 794 possessed highest standard heterosis over PKVDH 1 (47.74%), PKV Suvarna (32.92%), NACH 12 (27.52%) and PA 255 (40.13%) for seed cotton yield per plant. Whereas, it ranked second for heterobeltiosis (43.38%).It also exhibited high heterobeltiosis, standard heterosis over PKVDH 1,PKV Suvarna, NACH 12 and PA 255 for plant height (BPH=8.38%, SH-1= 17.55%, SH-2=16.44%, SH-3=12.92%, SV-1=15.03%), number of sympodia per plant (BPH=100.25%, SH-1=67.74%, SH-2=54.18%, SH-3=45.86%, SV-1=50.19%), number of bolls per plant (BPH=46.75%, SH-1=45.31%, SH-2=40.60%, SH-3=33.21%, SV-1=51.24%), boll weight (BPH=6.09%,SH-1=22.16%, SH-2=14.30%, SH-3=7.66%, SV-1=10.11%), seed index (BPH=13.27%, SH-1=28.96%, SH-2=22.28%, SH-3=21.44%, SV-1=19.52%), harvest index (BPH=20.76%, SH-1=21.58%, SH-2=18.39%, SH-3=16.88%, SV-1=21.03%) and days to maturity (BPH=-1.16%, SH-1=-0.95%, SH-2=-1.68%, SH-3=-1.68%, SV-1=-1.11%) (Table 1).

This cross also recorded significant heterosis over better parent and all the checks for days to 50% flowering (BPH=-2.52%, SH-1=-2.07%, SH-2= -2.52%, SH-3=-5.13%, SV-1=-2.75%), days to 50% boll bursting (BPH= -2.94%, SH-1=-1.70%, SH-2=-1.98%, SH-3=-2.94%, SV-1= -2.80%) and days to maturity (BPH=-1.90%, SH-1=-1.69%, SH-2=-2.41%, SH-3=-2.41%, SV-1=-2.72%). This cross was found to be promising in all aspects like earliness parameters, high yield and fibre parameters across the locations encompassing the Marathwada region.

Another cross PAIG 346 X DWDa 1402 ranked second and third with respect to heterobeltiosis and standard heterosis for seed cotton yield per plant (BPH = 43.04=%, SH-1=47.39%, SH-2=32.92%, SH-3=27.52%, SV-1=40.13%). Besides yield, it also recorded highly significant heterobeltiosis and standard heterosis over all the checks for plant height (BPH=9.11%, SH-1=15.74%, SH-2=14.65%, SH-3=11.18%, SV-1=13.25%), number of sympodia per plant (BPH=74.01%, SH-1=73.11%, SH-2=59.13%, SH-3=50.54%, SV-1=55.00%), number of bolls per plant (BPH=51.41%, SH-1=49.93%, SH-2=45.06%, SH-3=37.44%, SV-1=56.04%), seed index (BPH=8.37%, SH-1=22.19%, SH-2=15.86%, SH-3=15.07%, SV-1=13.24%) and harvest index (BPH=19.61%, SH-1=21.42%, SH-2=18.23%, SH-3=16.71%, SV-1=20.56%). This cross also recorded significant heterosis in desirable direction either over better parent or any of the check for boll weight (SH-1=18.37%, SH-2=10.76%, SH-3=4.33%, SV-1=6.70%) and lint index (SH-1=6.01%, SH-2=8.88%, SV-1=7.71%).

Cross PA 809 X AKA 8 ranked first for heterobeltiosis and third for standard heterosis for seed cotton yield per plant (BPH=44.94%, SH-1=46.87%, SH-2=32.45%, SH3=27.07%, SV-1=39.63%). It showed highly significant heterobeltiosis and standard heterosis for days to 50% flowering, days to 50% boll bursting, number of sympodia per plant, number of bolls per plant, harvest index and micronaire whereas it has showed either desirable heterobeltiosis or standard heterosis over either of the check for plant height, boll weight, seed index, lint index and days to maturity.

The cross PA 785 X CNA 449 stood at fourth place for standard heterosis for seed cotton yield per plant (SH-1=38.06%, SH-2=24.50% SH3=19.45%, SV-1=31.26%). whereas it ranked eighth for heterobeltiosis (BPH=30.93%). It has shown significant heterobeltiosis and standard heterosis for plant height, number of sympodia per plant, number of bolls per plant, boll weight, lint index and harvest index. It has also showed either significant heterobeltiosis or significant standard heterosis for remaining character like seed index (SH1, SH2, SH3, SV1).

The cross PAIG 346 X CNA 449 ranked fifth for standard heterosis for seed cotton yield per plant (SH1=36.44%, SH2=23.04%, SH3=18.05%, SV1=29.72%) although it ranked sixth for heterobeltiosis (BPH=32.41%). It has also showed significantly desirable heterobeltiosis and standard heterosis for plant height, number of sympodia per plant, number of bolls per plant, boll weight, seed index and harvest index. It has also showed significantly desirable heterobeltiosis or standard heterosis for remaining character like lint index (SH2, SV1). The cross PAIG 346 X HD 514 ranked ninth for heterobeltiosis (30.17%) and sixth for standard heterosis (SH1=34.13%, SH2=20.95%, SH3=16.04%, SV1=27.51%) for seed cotton yield per plant. It has showed significant heterobeltiosis and standard heterosis for days to 50% boll bursting, number of sympodia per plant, number of bolls per plant, lint index, harvest index and days to maturity. It has shown either significant heterobeltiosis or standard heterosis on any of the check for remaining character like days to 50% flowering (SH3).

The high heterosis for yield contributing characters was also observed by Naik and Patel (2004) [7], Giri *et al.* (2006) [3], Patel *et al* (2009) [11], Jyotiba *et al.* (2010) [5]; Patel *et al.* (2010),Sarvanan and Koodalingam (2011) [15] for interspecific crosses; Kumar *et al.*(2003) [6], Patel *et al.* (2008) [10], Neelam *et al.* (2008) [8], Patil *et al.* (2009) [12], Sekhar *et al.* (2012) [16], Singh *et al.* (2013) [17] and Sonawane *et al.* (2013) [18] for intra *arboreum* crosses.The heterosis for high yield with earliness traits was also reported by Potdukhe *et al.* (2002) [13], Giri *et al.* (2006) [3], Patel *et al.* (2010) [9], Balu *et al.* (2012) [1], Jaiwar *et al.* (2012) [4] and Pushpam *et al.* (2015) [14].

Thus the present study on heterosis has clearly indicated that heterotic response for yield and its components results only in selected cross combinations indicating the predominant role of non-fixable inter-allelic interactions. The crosses PAIG 346 X JLA 794, PAIG 346 X DWDa 1402, PA 809 X AKA 8, PA 785 X CNA 449, PAIG 346 X CNA 449 and PAIG 346 X HD 514 hold promise for further evaluation and commercial exploitation of heterosis for high yield.

There is a biological balance between the major yield components i.e. number of bolls per plant on one hand and boll size, seed index and number of sympodia per plant on main stem on the other hand, for high heterotic expression of yield. It is evident from the result that it is not necessary that high heterosis for all the yield components only will result in high heterosis for yield but increase in any one or two yield components may also result into high degree of heterosis for yield.

Table 1 : ANOVA for various characters studied in three environments

Location	Source of variation	d.f.	Mean sum of squares					
			Days to 50% flowering	Days to 50% boll burst	Plant height (cm)	Number of sympodia / plant	Number of bolls / plant	Boll weight (g)
Parbhani (L_1)	Replication	1	1.12	1.70	56.30	3.61	2.88	0.0006
	Treatment	74	14.95**	25.73**	225.47**	37.99**	46.32**	0.045**
	Error	74	1.70	2.30	20.02	7.34	11.26	0.005
Nanded (L_2)	Replication	1	1.50	2.94	26.12	0.10	0.54	0.011
	Treatment	74	14.97**	24.35**	213.84**	30.64**	43.51**	0.033**
	Error	74	1.31	2.07	19.72	4.65	6.32	0.006
Badnapur (L_3)	Replication	1	2.16	0.10	6.74	0.07	4.36	0.006
	Treatment	74	13.32**	26.55**	179.41**	24.64**	39.74**	0.036**
	Error	74	1.20	2.66	15.98	4.22	5.68	0.006

Location	Source of variation	d.f.	Mean sum of squares				
			Seed cotton yield / plant (g)	Seed index (g)	Lint index (g)	Harvest index (g)	Days to maturity
Parbhani (L_1)	Replication	1	21.35	0.11	0.007	4.89	2.66
	Treatment	74	266.84**	0.41**	0.035**	15.27**	17.71**
	Error	74	40.71	0.072	0.021	3.22	2.69
Nanded (L_2)	Replication	1	2.74	0.013	0.012	0.91	2.66
	Treatment	74	270.00**	0.36**	0.033**	11.60**	19.97**
	Error	74	24.21	0.034	0.011	2.41	2.90
Badnapur (L_3)	Replication	1	0.30	0.064	0.019	2.44	0.42
	Treatment	74	248.75**	0.44*	0.042**	10.93**	19.29**
	Error	74	24.13	0.029	0.010	2.46	2.85

*,** - Significant at 5 per cent and 1 per cent level, respectively

Table 2: Per cent heterosis pooled over environments over better parent (BPH), standard hybrid PKVDH 1 (SH 1), PKV Suvarna (SH 2), NACH 12 (SH 3) and standard variety PA 255 (SV 1)

S. No.	Crosses	Days to 50% flowering					Days to 50% boll bursting				
		BPH	SH 1	SH2	SH3	SV1	BPH	SH 1	SH2	SH3	SV1
1	PA 801 x AKA 8	-7.96**	-9.45**	-9.86**	-12.28**	-10.07**	-4.48**	-6.37**	-6.64**	-7.55**	-7.42**
2	PA 801 x Phule Dhanwantary	-1.86	-3.00**	-3.44**	-6.03**	-3.66**	-0.14	-1.42*	-1.69*	-2.66**	-2.52**
3	PA 801 x CNA 449	-0.45	1.38	0.92	-1.79	0.69	0.85	1.13	0.85	-0.14	0.00
4	PA 801 x HD 514	-1.17	-2.76**	-3.21**	-5.8**	-3.43**	-0.72	-2.27**	-2.54**	-3.50**	-3.36**
5	PA 801 x DWDa 1402	-2.80**	-4.15**	-4.59**	-7.14**	-4.81**	-2.71**	-3.26**	-3.53**	-4.48**	-4.34**
6	PA 801 x JLA 794	-0.46	0.00	-0.46	-3.13**	-0.69	-0.14	-0.14	-0.42	-1.40*	-1.26
7	PA 801 x Digvijay	-2.86**	9.45**	8.94**	6.03**	8.70**	-5.77**	6.37**	6.07**	5.03**	5.18**
8	PA 801 x G.Cot 23	-2.29**	8.06**	7.57**	4.69**	7.32**	-5.20**	5.81**	5.51**	4.48**	4.62**
9	PA 740 x AKA 8	-3.40**	-1.84	-2.29*	-4.91**	-2.52**	-1.97**	-1.13	-1.41*	-2.38**	-2.24**
10	PA 740 x Phule Dhanwantary	-0.68	0.92	0.46	-2.23*	0.23	0.84	1.70*	1.41*	0.42	0.56
11	PA 740 x CNA 449	-0.45	1.38	0.92	-1.79	0.69	-0.14	0.71	0.42	-0.56	-0.42
12	PA 740 x HD 514	-4.76**	-3.23**	-3.67**	-6.25**	-3.89**	-3.37**	-2.55**	-2.82**	-3.78**	-3.64**
13	PA 740 x DWDa 1402	-2.72**	-1.15	-1.61	-4.24**	-1.83	-2.11**	-1.27	-1.55*	-2.52**	-2.38**
14	PA 740 x JLA 794	-2.04*	-0.46	-0.92	-3.57**	-1.14	-1.54*	-0.71	-0.99	-1.96**	-1.82**
15	PA 740 x Digvijay	-9.82**	1.61	1.15	-1.56	0.92	-11.04**	0.42	0.14	-0.84	-0.70
16	PA 740 x G.Cot 23	-7.50**	2.30*	1.83	-0.89	1.60	-10.53**	-0.14	-0.42	-1.40*	-1.26
17	PA 812 x AKA 8	-5.16**	-6.91**	-7.34**	-9.82**	-7.55**	-3.87**	-4.96**	-5.23**	-6.15**	-6.02**
18	PA 812 x Phule Dhanwantary	-3.03**	-4.15**	-4.59**	-7.14**	-4.81**	-1.72*	-2.83**	-3.11**	-4.06**	-3.92**
19	PA 812 x CNA 449	-4.30**	-2.53**	-2.98**	-5.58**	-3.20**	-2.12**	-1.84**	-2.12**	-3.08**	-2.94**
20	PA 812 x HD 514	-4.93**	-6.68**	-7.11**	-9.60**	-7.32**	-3.72**	-4.82**	-5.08**	-6.01**	-5.88**
21	PA 812 x DWDa 1402	0.00	-1.38	-1.83	-4.46**	-2.06*	-0.43	-0.99	-1.27	-2.24**	-2.10**
22	PA 812 x JLA 794	-1.83	-1.38	-1.83	-4.46**	-2.06*	-0.85	-0.85	-1.13	-2.10**	-1.96**
23	PA 812 x Digvijay	-11.86**	-0.69	-1.15	-3.79**	-1.37	-11.79**	-0.42	-0.71	-1.68*	-1.54*
24	PA 812 x G.Cot 23	-8.96**	0.69	0.23	-2.46**	0.00	-9.77**	0.71	0.42	-0.56	-0.42
25	PA 809 x AKA 8	-2.77**	-3.00**	-3.44**	-6.03**	-3.66**	-3.28**	-3.82**	-4.10**	-5.03**	-4.90**
26	PA 809 x Phule Dhanwantary	-0.23	-0.46	-0.92	-3.57**	-1.14	-0.14	-0.71	-0.99	-1.96**	-1.82**
27	PA 809 x CNA 449	-0.45	1.38	0.92	-1.79	0.69	0.85	1.13	0.85	-0.14	0.00
28	PA 809 x HD 514	-2.08*	-2.30*	-2.75**	-5.36**	-2.97**	-1.57*	-2.12**	-2.40**	-3.36**	-3.22**
29	PA 809 x DWDa 1402	-1.62	-1.84	-2.29*	-4.91**	-2.52**	-1.28	-1.84**	-2.12**	-3.08**	-2.94**
30	PA 809 x JLA 794	-0.23	0.23	-0.23	-2.90**	-0.46	0.14	0.14	-0.14	-1.12	-0.98
31	PA 809 x Digvijay	-9.21**	2.53**	2.06*	-0.67	1.83	-10.16**	1.42*	1.13	0.14	0.28
32	PA 809 x G.Cot 23	-7.71**	2.07*	1.61	-1.12	1.37	-8.12**	2.55**	2.26**	1.26	1.40*
33	PA 785 x AKA 8	-5.02**	-4.15**	-4.59**	-7.14**	-4.81**	-3.80**	-3.12**	-3.39**	-4.34**	-4.20**

34	PA 785 x Phule Dhanwantary	-0.68	0.23	-0.23	-2.90**	-0.46	-0.84	-0.14	-0.42	-1.40*	-1.26
35	PA 785 x CNA 449	-0.45	1.38	0.92	-1.79	0.69	0.14	0.85	0.56	-0.42	-0.28
36	PA 785 x HD 514	-5.71**	-4.84**	-5.28**	-7.81**	-5.49**	-5.20**	-4.53**	-4.8**	-5.73**	-5.60**
37	PA 785 x DWDa 1402	-0.23	0.69	0.23	-2.46**	0.00	-0.28	0.42	0.14	-0.84	-0.7
38	PA 785 x JLA 794	0.91	1.84	1.38	-1.34	1.14	0.70	1.42*	1.13	0.14	0.28
39	PA 785 x Digvijay	-10.43**	0.92	0.46	-2.23*	0.23	-10.92**	0.57	0.28	-0.70	-0.56
40	PA 785 x G.Cot 23	-8.33**	1.38	0.92	-1.79	0.69	-9.01**	1.56*	1.27	0.28	0.42
41	PA 832 x AKA 8	-4.43**	-5.53**	-5.96**	-8.48**	-6.18**	-3.55**	-3.68**	-3.95**	-4.90**	-4.76**
42	PA 832 x Phule Dhanwantary	0.47	-0.69	-1.15	-3.79**	-1.37	-0.71	-0.85	-1.13	-2.10**	-1.96**
43	PA 832 x CNA 449	-2.26*	-0.46	-0.92	-3.57**	-1.14	-0.85	-0.57	-0.85	-1.82**	-1.68*
44	PA 832 x HD 514	-6.53**	-7.60**	-8.03**	-10.49**	-8.24**	-4.54**	-4.67**	-4.94**	-5.87**	-5.74**
45	PA 832 x DWDa 1402	-0.93	-2.07*	-2.52**	-5.13**	-2.75**	-1.70*	-1.84**	-2.12**	-3.08**	-2.94**
46	PA 832 x JLA 794	-0.46	0.00	-0.46	-3.13**	-0.69	-0.14	-0.14	-0.42	-1.40*	-1.26
47	PA 832 x Digvijay	-10.22**	1.15	0.69	-2.01*	0.46	-9.91**	1.70*	1.41*	0.42	0.56
48	PA 832 x G.Cot 23	-6.46**	3.46**	2.98**	0.22	2.75**	-9.77**	0.71	0.42	-0.56	-0.42
49	PAIG 346 x AKA 8	-2.75**	-2.30*	-2.75**	-5.36**	-2.97**	-3.22**	-1.98**	-2.26**	-3.22**	-3.08**
50	PAIG 346 x Phule Dhanwantary	5.05**	5.53**	5.05**	2.23*	4.81**	-1.26	0.00	-0.28	-1.26	-1.12
51	PAIG 346 x CNA 449	-0.23	1.61	1.15	-1.56	0.92	-0.56	0.71	0.42	-0.56	-0.42
52	PAIG 346 x HD 514	-1.61	-1.15	-1.61	-4.24**	-1.83	-3.22**	-1.98**	-2.26**	-3.22**	-3.08**
53	PAIG 346 x DWDa 1402	-2.52**	-2.07*	-2.52**	-5.13**	-2.75**	-2.94**	-1.70*	-1.98**	-2.94**	-2.80**
54	PAIG 346 x JLA 794	0.46	0.92	0.46	-2.23*	0.23	-1.26	0.00	-0.28	-1.26	-1.12
55	PAIG 346 x Digvijay	-10.63**	0.69	0.23	-2.46**	0.00	-11.42**	0.00	-0.28	-1.26	-1.12
56	PAIG 346 x G.Cot 23	-7.71**	2.07*	1.61	-1.12	1.37	-9.64**	0.85	0.56	-0.42	-0.28
	S.E.±	0.69	0.69	0.69	0.69	0.69	0.81	0.81	0.81	0.81	0.81
	C.D. @ 5%	1.36	1.36	1.36	1.36	1.36	1.61	1.61	1.61	1.61	1.61

Table 2. (Contd…)

S. No.	Crosses	Plant height (cm)					Number of sympodia/plant				
		BPH	SH 1	SH2	SH3	SV1	BPH	SH 1	SH2	SH3	SV1
1	PA 801 x AKA 8	0.60	2.00	1.04	-2.02	-0.19	35.46**	35.88**	24.90**	18.17*	21.67**
2	PA 801 x Phule Dhanwantary	-11.70**	-10.46**	-11.31**	-13.99**	-12.38**	9.44	0.72	-7.41	-12.41	-9.81
3	PA 801 x CNA 449	8.72**	10.24**	9.20**	5.89**	7.87**	41.96**	31.54**	20.91*	14.39	17.78*
4	PA 801 x HD 514	10.98**	12.53**	11.46**	8.09**	10.11**	57.30**	44.78**	33.08**	25.90**	29.63**
5	PA 801 x DWDa 1402	8.72**	15.33**	14.24**	10.78**	12.85**	34.72**	34.02**	23.19**	16.55*	20.00*
6	PA 801 x JLA 794	7.83**	16.95**	15.84**	12.34**	14.44**	45.84**	34.23**	23.38**	16.73*	20.19*
7	PA 801 x Digvijay	4.58	6.04	5.04	1.86	3.76	-2.04	-0.93	-8.94	-13.85	-11.30
8	PA 801 x G.Cot 23	4.30	5.76	4.76	1.59	3.48	9.07	4.45	-3.99	-9.17	-6.48
9	PA 740 x AKA 8	7.40**	7.54**	6.52**	3.30	5.23*	9.28	9.62	0.76	-4.68	-1.85
10	PA 740 x Phule Dhanwantary	-9.84**	-9.73**	-10.58**	-13.29**	-11.67**	26.42*	5.89	-2.66	-7.91	-5.19
11	PA 740 x CNA 449	11.48**	12.97**	11.91**	8.52**	10.55**	41.07**	30.71**	20.15*	13.67	17.04*
12	PA 740 x HD 514	-4.14	-4.02	-4.93*	-7.80**	-6.08*	53.86**	31.75**	21.10*	14.57	17.96*
13	PA 740 x DWDa 1402	7.22**	13.74**	12.66**	9.25**	11.29****	29.52**	28.85**	18.44*	12.05	15.37
14	PA 740 x JLA 794	6.63**	15.64**	14.55**	11.09**	13.16**	23.95*	3.83	-4.56	-9.71	-7.04
15	PA 740 x Digvijay	8.86**	9.00**	7.97**	4.70*	6.66**	36.81**	38.37**	27.19**	20.32**	23.89**
16	PA 740 x G.Cot 23	7.46**	7.60**	6.58**	3.36	5.29*	38.23**	32.37**	21.67**	15.11	18.52*
17	PA 812 x AKA 8	6.33*	0.95	0.00	-3.02	-1.21	32.37**	32.78**	22.05**	15.47*	18.89*
18	PA 812 x Phule Dhanwantary	-9.58**	-14.15**	-14.96**	-17.53**	-15.99**	2.15	-1.76	-9.70	-14.57	-12.04
19	PA 812 x CNA 449	5.74*	7.15**	6.14*	2.93	4.85*	36.34**	31.13**	20.53*	14.03	17.41*
20	PA 812 x HD 514	-3.38	-8.27**	-9.13**	-11.88**	-10.24**	55.91**	49.95**	37.83**	30.40**	34.26**
21	PA 812 x DWDa 1402	1.71	7.89**	6.87**	3.63	5.57*	14.14	13.55	4.37	-1.26	1.67
22	PA 812 x JLA 794	2.11	10.75**	9.70**	6.38**	8.37**	29.68**	24.72**	14.64	8.45	11.67
23	PA 812 x Digvijay	12.19**	8.55**	7.53**	4.28	6.22**	10.02	11.27	2.28	-3.24	-0.37
24	PA 812 x G.Cot 23	12.19**	6.52**	5.51*	2.32	4.23	31.18**	26.16**	15.97	9.71	12.96
25	PA 809 x AKA 8	4.87*	4.74*	3.75	0.61	2.49	68.04**	68.56**	54.94**	46.58**	50.93**
26	PA 809 x Phule Dhanwantary	-8.25**	-8.36**	-9.23**	-11.97**	-10.33**	7.40	5.07	-3.42	-8.63	-5.93
27	PA 809 x CNA 449	17.16**	18.73**	17.61**	14.05**	16.18**	53.70**	50.36**	38.21**	30.76**	34.63**
28	PA 809 x HD 514	-6.46**	-6.58**	-7.46**	-10.26**	-8.59**	39.11**	36.09**	25.10**	18.35*	21.85**
29	PA 809 x DWDa 1402	10.49**	17.20**	16.09**	12.58**	14.69**	28.07**	27.40**	17.11*	10.79	14.07
30	PA 809 x JLA 794	7.04**	16.09**	14.99**	11.51**	13.60**	32.77**	29.89**	19.39*	12.95	16.30*
31	PA 809 x Digvijay	7.16**	7.03**	6.02*	2.81	4.73*	9.82	11.07	2.09	-3.42	-0.56
32	PA 809 x G.Cot 23	9.96**	9.83**	8.79**	5.50*	7.47**	27.27**	24.51**	14.45	8.27	11.48
33	PA 785 x AKA 8	8.59**	5.76*	4.76*	1.59	3.48	34.08**	36.71**	25.67**	18.88*	22.41**
34	PA 785 x Phule Dhanwantary	-7.67**	-10.08**	-10.93**	-13.62**	-12.01**	9.94	12.10	3.04	-2.52	0.37
35	PA 785 x CNA 449	6.50**	7.92**	6.90**	3.67	5.60*	53.55**	56.57**	43.92**	36.15**	40.19**
36	PA 785 x HD 514	-6.07*	-8.52**	-9.39**	-12.13**	-10.49**	29.41**	31.95**	21.29**	14.75	18.15*
37	PA 785 x DWDa 1402	5.13*	11.51**	10.46**	7.12**	9.12**	26.57**	29.06**	18.63*	12.23	15.56
38	PA 785 x JLA 794	1.91	10.52**	9.48**	6.17**	8.15**	26.17**	28.65**	18.25*	11.87	15.19
39	PA 785 x Digvijay	9.21**	6.36**	5.35*	2.17	4.08	18.05*	20.37*	10.65	4.68	7.78

40	PA 785 x G.Cot 23	5.71*	2.96	1.98	-1.10	0.75	10.14	12.31	3.23	-2.34	0.56
41	PA 832 x AKA 8	5.26*	7.47**	6.46**	3.24	5.16*	10.52	10.86	1.90	-3.60	-0.74
42	PA 832 x Phule Dhanwantary	-11.55**	-9.70**	-10.55**	-13.26**	-11.64**	5.46	3.83	-4.56	-9.71	-7.04
43	PA 832 x CNA 449	10.62**	12.94**	11.87**	8.49**	10.52**	54.41**	52.02**	39.73**	32.19**	36.11**
44	PA 832 x HD 514	-6.20**	-4.23	-5.13*	-8.00**	-6.29**	1.68	0.10	-7.98	-12.95	-10.37
45	PA 832 x DWDa 1402	6.35**	12.81**	11.75**	8.37**	10.39**	13.51	12.93	3.80	-1.80	1.11
46	PA 832 x JLA 794	4.69*	13.55**	12.47**	9.07**	11.11**	15.55	13.75	4.56	-1.08	1.85
47	PA 832 x Digvijay	7.16**	9.41**	8.38**	5.10*	7.06**	1.64	2.79	-5.51	-10.61	-7.96
48	PA 832 x G.Cot 23	3.89	6.07*	5.07*	1.89	3.80	6.51	4.86	-3.61	-8.81	-6.11
49	PAIG 346 x AKA 8	7.29**	5.82*	4.82*	1.65	3.55	56.29**	56.77**	44.11**	36.33**	40.37**
50	PAIG 346 x Phule Dhanwantary	-5.87*	-7.15**	-8.03**	-10.81**	-9.15**	33.09**	11.48	2.47	-3.06	-0.19
51	PAIG 346 x CNA 449	12.24**	13.74**	12.66**	9.25**	11.29**	71.21**	58.63**	45.82**	37.95**	42.04**
52	PAIG 346 x HD 514	-3.48	-4.80*	-5.70*	-8.55**	-6.85**	85.99**	59.26**	46.39**	38.49**	42.59**
53	PAIG 346 x DWDa 1402	9.11**	15.74**	14.65**	11.18**	13.25**	74.01**	73.11**	59.13**	50.54**	55.00**
54	PAIG 346 x JLA 794	8.38**	17.55**	16.44**	12.92**	15.03**	100.25**	67.74**	54.18**	45.86**	50.19**
55	PAIG 346 x Digvijay	15.89**	14.31**	13.23**	9.80**	11.85**	7.16	8.38	-0.38	-5.76	-2.96
56	PAIG 346 x G.Cot 23	12.73**	11.19**	10.14**	6.81**	8.81**	22.68*	17.48	7.98	2.16	5.19
	S.E.±	2.50	2.50	2.50	2.50	2.50	1.43	1.43	1.43	1.43	1.43
	C.D. @ 5%	4.93	4.93	4.93	4.93	4.93	2.82	2.82	2.82	2.82	2.82

Table 2: (Contd…)

S. No.	Crosses	Number of bolls/plant					Seed cotton yield/plant (g)				
		BPH	SH 1	SH2	SH3	SV1	BPH	SH 1	SH2	SH3	SV1
1	PA 801 x AKA 8	22.47**	25.03**	20.97**	14.62*	30.13**	25.57**	23.46**	11.34*	6.82	17.38**
2	PA 801 x Phule Dhanwantary	-2.41	-3.78	-6.90	-11.79	0.15	1.71	-3.71	-13.17*	-16.69**	-8.45
3	PA 801 x CNA 449	21.28**	19.58**	15.70*	9.62	24.45**	31.21**	24.22**	12.02*	7.47	18.09**
4	PA 801 x HD 514	29.21**	40.42**	35.86**	28.72**	46.14**	33.93**	29.78**	17.03**	12.28*	23.38**
5	PA 801 x DWDa 1402	23.26**	21.54**	17.59**	11.41	26.49**	22.89**	16.34**	4.91	0.65	10.60
6	PA 801 x JLA 794	28.51**	26.71**	22.60**	16.15*	31.88**	27.48**	20.68**	8.83	4.41	14.73**
7	PA 801 x Digvijay	-11.21	-12.45	-15.29*	-19.74**	-8.88	-12.97*	-17.61**	-25.71**	-28.72**	-21.67**
8	PA 801 x G.Cot 23	-9.36	-10.63	-13.53*	-18.08**	-6.99	-9.79	-14.60*	-22.99**	-26.12**	-18.81**
9	PA 740 x AKA 8	11.10	13.43	9.74	3.97	18.05*	6.66	4.87	-5.43	-9.27	-0.30
10	PA 740 x Phule Dhanwantary	-18.61**	-18.04*	-20.70**	-24.87**	-14.70*	-11.54	-19.81**	-27.69**	-30.63**	-23.77**
11	PA 740 x CNA 449	6.81	7.55	4.06	-1.41	11.94	24.45**	12.80*	1.72	-2.41	7.24
12	PA 740 x HD 514	17.50**	27.69**	23.55**	17.05**	32.90**	23.02**	19.21**	7.50	3.13	13.33*
13	PA 740 x DWDa 1402	13.61*	14.41*	10.69	4.87	19.07**	24.26**	12.63*	1.57	-2.56	7.08
14	PA 740 x JLA 794	-8.75	-8.11	-11.10	-15.77*	-4.37	2.97	-6.66	-15.83**	-19.25**	-11.26*
15	PA 740 x Digvijay	14.72*	15.52*	11.77	5.90	20.23**	26.05**	14.25*	3.03	-1.15	8.62
16	PA 740 x G.Cot 23	10.28	11.05	7.44	1.79	15.57*	16.65**	5.74	-4.65	-8.52	0.52
17	PA 812 x AKA 8	7.37	20.14**	16.24*	10.13	25.04**	15.69**	22.42**	10.40*	5.91	16.39**
18	PA 812 x Phule Dhanwantary	-11.00	-0.42	-3.65	-8.72	3.64	-15.25**	-10.31	-19.12**	-22.41**	-14.73**
19	PA 812 x CNA 449	8.88	21.82**	17.86**	11.67	26.78**	13.11*	19.70**	7.94	3.56	13.80*
20	PA 812 x HD 514	13.62*	27.13**	23.00**	16.54*	32.31**	14.48**	21.15**	9.25	4.81	15.17**
21	PA 812 x DWDa 1402	-5.12	6.15	2.71	-2.69	10.48	3.78	9.82	-0.97	-4.99	4.41
22	PA 812 x JLA 794	-3.25	8.25	4.74	-0.77	12.66	4.85	10.95	0.05	-4.01	5.48
23	PA 812 x Digvijay	-9.25	1.54	-1.76	-6.92	5.68	-9.55	-4.29	-13.69**	-17.19**	-9.01
24	PA 812 x G.Cot 23	-5.75	5.45	2.03	-3.33	9.75	-0.52	5.27	-5.07	-8.92	0.08
25	PA 809 x AKA 8	42.97**	53.57**	48.58**	40.77**	59.83**	44.94**	46.87**	32.45**	27.07**	39.63**
26	PA 809 x Phule Dhanwantary	-6.25	0.70	-2.57	-7.69	4.80	-4.43	-3.16	-12.67*	-16.22**	-7.93
27	PA 809 x CNA 449	30.60**	40.28**	35.72**	28.59**	46.00**	26.87**	28.56**	15.94**	11.23*	22.23**
28	PA 809 x HD 514	16.73**	26.85**	22.73**	16.28*	32.02**	11.89*	13.38*	2.25	-1.90	7.79
29	PA 809 x DWDa 1402	8.85	16.92*	13.13	7.18	21.69**	17.55**	19.12**	7.42	3.06	13.25*
30	PA 809 x JLA 794	14.45*	22.94**	18.94**	12.69*	27.95**	20.93**	22.54**	10.50*	6.02	16.50**

Table 2. (Contd…)

S. No.	Crosses	Plant height (cm)					Number of Sympodia/plant				
		BPH	SH 1	SH2	SH3	SV1	BPH	SH 1	SH2	SH3	SV1
31	PA 809 x Digvijay	-14.32*	-7.97	-10.96	-15.64*	-4.22	-7.95	-6.72	-15.88**	-19.30**	-11.32*
32	PA 809 x G.Cot 23	10.42	18.60**	14.75*	8.72	23.44**	4.43	5.82	-4.57	-8.45	0.61
33	PA 785 x AKA 8	21.23**	23.78**	19.76**	13.46*	28.82**	12.97*	19.12**	7.42	3.06	13.25*
34	PA 785 x Phule Dhanwantary	17.61*	19.58**	15.70*	9.62	24.45**	3.19	8.81	-1.88	-5.86	3.44
35	PA 785 x CNA 449	42.64**	45.03**	40.32**	32.95**	50.95**	30.93**	38.06**	24.50**	19.45**	31.26**
36	PA 785 x HD 514	-7.85	0.14	-3.11	-8.21	4.22	-5.69	-0.55	-10.32*	-13.96**	-5.45
37	PA 785 x DWDa 1402	9.08	10.91	7.31	1.67	15.43*	3.21	8.84	-1.85	-5.84	3.47
38	PA 785 x JLA 794	18.71**	20.7**	16.78*	10.64	25.62**	8.57	14.48*	3.24	-0.95	8.84
39	PA 785 x Digvijay	-3.30	-1.68	-4.87	-9.87	2.33	-7.53	-2.49	-12.07*	-15.64**	-7.30
40	PA 785 x G.Cot 23	-1.99	-0.35	-3.59	-8.65	3.71	-9.40	-4.46	-13.85**	-17.34**	-9.17
41	PA 832 x AKA 8	1.23	3.36	0,00	-5.26	7.57	-6.72	-8.29	-17.29**	-20.65**	-12.81*

42	PA 832 x Phule Dhanwantary	-8.99	-16.50*	-19.22**	-23.46**	-13.10	-13.94*	-21.84**	-29.52**	-32.38**	-25.70**
43	PA 832 x CNA 449	32.60**	22.03**	18.06**	11.86	27.00**	35.06**	22.65**	10.61*	6.12	16.61**
44	PA 832 x HD 514	-17.12**	-9.93	-12.86	-17.44**	-6.26	-7.20	-10.08	-18.91**	-22.21**	-14.51**
45	PA 832 x DWDa 1402	14.39	7.83	4.33	-1.15	12.23	9.09	-0.93	-10.66*	-14.29**	-5.81
46	PA 832 x JLA 794	25.76**	15.38*	11.64	5.77	20.09**	19.43**	8.46	-2.19	-6.17	3.11
47	PA 832 x Digvijay	-20.12**	-26.71**	-29.09**	-32.82**	-23.73**	-16.62**	-24.28**	-31.71**	-34.49**	-28.01**
48	PA 832 x G.Cot 23	2.29	-6.15	-9.20	-13.97*	-2.33	-5.33	-14.02*	-22.47**	-25.61**	-18.26**
49	PAIG 346 x AKA 8	31.51**	34.27**	29.91**	23.08**	39.74**	26.34**	30.19**	17.40**	12.63*	23.77**
50	PAIG 346 x Phule Dhanwantary	-1.55	-2.52	-5.68	-10.64	1.46	-13.13*	-10.49	-19.28**	-22.56**	-14.90**
51	PAIG 346 x CNA 449	35.17**	33.85**	29.50**	22.69**	39.30**	32.41**	36.44**	23.04**	18.05**	29.72**
52	PAIG 346 x HD 514	21.75**	32.31**	28.01**	21.28**	37.70**	30.17**	34.13**	20.95**	16.04**	27.51**
53	PAIG 346 x DWDa 1402	51.41**	49.93**	45.06**	37.44**	56.04**	43.04**	47.39**	32.92**	27.52**	40.13**
54	PAIG 346 x JLA 794	46.75**	45.31**	40.60**	33.21**	51.24**	43.38**	47.74**	33.23**	27.82**	40.46**
55	PAIG 346 x Digvijay	-17.09*	-17.90*	-20.57**	-24.74**	-14.56*	-23.87**	-21.55**	-29.26**	-32.13**	-25.42**
56	PAIG 346 x G.Cot 23	-2.54	-3.5	-6.63	-11.54	0.44	-9.25	-6.49	-15.67**	-19.10**	-11.10*
	S.E.±	1.65	1.65	1.65	1.65	1.65	3.25	3.25	3.25	3.25	3.25
	C.D. @ 5%	3.26	3.26	3.26	3.26	3.26	6.42	6.42	6.42	6.42	6.42

Table 2: (Contd…)

S. No.	Crosses	Boll weight (g)					Seed index (g)				
		BPH	SH 1	SH2	SH3	SV1	BPH	SH 1	SH2	SH3	SV1
1	PA 801 x AKA 8	3.61*	14.59**	7.22**	0.99	3.29	2.51	5.61**	0.14	-0.55	-2.13
2	PA 801 x Phule Dhanwantary	4.38*	15.43**	8.01**	1.73	4.05*	-0.42	2.58	-2.73	-3.39	-4.93*
3	PA 801 x CNA 449	9.45**	21.04**	13.25**	6.67**	9.10**	5.98**	19.43**	13.25**	12.47**	10.69**
4	PA 801 x HD 514	4.63**	15.71**	8.27**	1.98	4.30*	0.90	3.95	-1.43	-2.11	-3.66
5	PA 801 x DWDa 1402	5.87**	18.93**	11.29**	4.82**	7.21**	5.56**	9.21**	3.55	2.84	1.21
6	PA 801 x JLA 794	5.40**	17.81**	10.24**	3.83*	6.19**	5.87**	20.53**	14.29**	13.51**	11.71**
7	PA 801 x Digvijay	0.57	11.22**	4.07*	-1.98	0.25	0.47	12.05**	6.25**	5.53**	3.85*
8	PA 801 x G.Cot 23	-7.80**	12.76**	5.51**	-0.62	1.64	-1.60	16.03**	10.02**	9.27**	7.54**
9	PA 740 x AKA 8	-1.17	12.20**	4.99**	-1.11	1.14	0.45	4.62*	-0.80	-1.48	-3.04
10	PA 740 x Phule Dhanwantary	-0.68	12.76**	5.51**	-0.62	1.64	-0.70	3.43	-1.93	-2.60	-4.15*
11	PA 740 x CNA 449	4.63**	18.79**	11.15**	4.70**	7.08**	7.94**	21.64**	15.34**	14.55**	12.73**
12	PA 740 x HD 514	1.05	14.73**	7.35**	1.11	3.41	2.65	6.91**	1.38	0.68	-0.92
13	PA 740 x DWDa 1402	6.05**	20.41**	12.66**	6.12**	8.53**	11.88**	16.53**	10.49**	9.74**	7.99**
14	PA 740 x JLA 794	7.35**	21.88**	14.04**	7.42**	9.86**	8.85**	23.93**	17.52**	16.71**	14.86**
15	PA 740 x Digvijay	10.44**	25.39**	17.32**	10.51**	13.02**	9.87**	22.54**	16.19**	15.40**	13.57**
16	PA 740 x G.Cot 23	-0.69	21.46**	13.65**	7.05**	9.48**	0.64	18.68**	12.53**	11.76**	9.99**
17	PA 812 x AKA 8	5.58**	14.03**	6.69**	0.49	2.78	4.29*	10.95**	5.21**	4.49*	2.83
18	PA 812 x Phule Dhanwantary	2.60	10.80**	3.67*	-2.35	-0.13	-0.63	5.72**	0.25	-0.44	-2.02
19	PA 812 x CNA 449	6.13**	16.55**	9.06**	2.72	5.06**	6.44**	19.95**	13.74**	12.96**	11.17**
20	PA 812 x HD 514	4.42*	12.76**	5.51**	-0.62	1.64	9.25**	16.24**	10.22**	9.46**	7.73**
21	PA 812 x DWDa 1402	4.87**	17.81**	10.24**	3.83*	6.19**	6.74**	13.56**	7.68**	6.95**	5.25**
22	PA 812 x JLA 794	5.52**	17.95**	10.37**	3.96*	6.32**	6.48**	21.23**	14.95**	14.17**	12.36**
23	PA 812 x Digvijay	5.88**	16.13**	8.66**	2.35	4.68**	5.89**	18.09**	11.98**	11.21**	9.45**
24	PA 812 x G.Cot 23	-8.14**	12.34**	5.12**	-0.99	1.26	-2.46	15.02**	9.06**	8.32**	6.59**
25	PA 809 x AKA 8	2.07	14.24**	6.89**	0.68	2.97	1.56	13.27**	7.41**	6.67**	4.98*
26	PA 809 x Phule Dhanwantary	0.13	12.06**	4.86**	-1.24	1.01	-2.50	8.74**	3.11	2.41	0.78
27	PA 809 x CNA 449	5.64**	18.23**	10.63**	4.20*	6.57**	11.24**	25.36**	18.87**	18.05**	16.18**
28	PA 809 x HD 514	3.01	15.29**	7.87**	1.61	3.92*	0.96	12.61**	6.77**	6.04**	4.36*
29	PA 809 x DWDa 1402	6.74**	19.92**	12.20**	5.69**	8.09**	5.81**	18.01**	11.90**	11.13**	9.37**
30	PA 809 x JLA 794	9.40**	22.44**	14.57**	7.91**	10.37**	9.74**	24.95**	18.48**	17.67**	15.80**

Table 2. (Contd…)

S. No.	Crosses	Boll weight (g)					Seed index (g)				
		BPH	SH 1	SH2	SH3	SV1	BPH	SH 1	SH2	SH3	SV1
31	PA 809 x Digvijay	1	13.04**	5.77**	-0.37	1.90	-0.42	11.07**	5.32**	4.60*	2.93
32	PA 809 x G.Cot 23	-2.98	18.65**	11.02**	4.57**	6.95**	-11.95**	3.83	-1.54	-2.22	-3.77
33	PA 785 x AKA 8	1.15	11.08**	3.94*	-2.10	0.13	11.36**	10.78**	5.04*	4.32*	2.66
34	PA 785 x Phule Dhanwantary	2.04	12.06**	4.86**	-1.24	1.01	7.53**	6.22**	0.72	0.03	-1.56
35	PA 785 x CNA 449	7.15**	17.67**	10.10**	3.71*	6.07**	1.55	14.44**	8.51**	7.77**	6.06**
36	PA 785 x HD 514	4.21*	14.45**	7.09**	0.87	3.16	5.33*	3.89	-1.49	-2.16	-3.71
37	PA 785 x DWDa 1402	1.75	14.31**	6.96**	0.74	3.03	-1.12	2.29	-3.00	-3.67	-5.20**
38	PA 785 x JLA 794	5.65**	18.09**	10.50**	4.08*	6.45**	1.02	15.02**	9.06**	8.32**	6.59**
39	PA 785 x Digvijay	-1.92	7.71**	0.79	-5.07**	-2.91	1.59	13.30**	7.44**	6.70**	5.01*
40	PA 785 x G.Cot 23	-4.82**	16.41**	8.92**	2.60	4.93**	-6.70**	10.02**	4.32*	3.61	1.97
41	PA 832 x AKA 8	-0.12	12.20**	4.99**	-1.11	1.14	6.28**	11.15**	5.40**	4.68*	3.01
42	PA 832 x Phule Dhanwantary	-4.68**	7.08**	0.20	-5.62**	-3.48*	-1.69	2.82	-2.51	-3.17	-4.71*
43	PA 832 x CNA 449	5.24**	18.23**	10.63**	4.20*	6.57**	4.54*	17.80**	11.70**	10.94**	9.18**

44	PA 832 x HD 514	-2.25	9.82**	2.76	-3.21	-1.01	2.55	7.26**	1.71	1.01	-0.59
45	PA 832 x DWDa 1402	6.24**	19.35**	11.68**	5.19**	7.59**	8.75**	13.74**	7.85**	7.11**	5.41**
46	PA 832 x JLA 794	5.37**	18.37**	10.76**	4.33*	6.70**	11.45**	26.90**	20.32**	19.5**	17.60**
47	PA 832 x Digvijay	-2.37	9.68**	2.62	-3.34	-1.14	-2.14	9.15**	3.50	2.79	1.16
48	PA 832 x G.Cot 23	-4.24**	17.11**	9.58**	3.21	5.56**	-0.47	17.37**	11.29**	10.53**	8.78**
49	PAIG 346 x AKA 8	-0.73	14.31**	6.96**	0.74	3.03	1.49	14.44**	8.51**	7.77**	6.06**
50	PAIG 346 x Phule Dhanwantary	-3.29	11.36**	4.20*	-1.85	0.38	-8.35**	3.34	-2.01	-2.68	-4.23*
51	PAIG 346 x CNA 449	8.04**	24.4**	16.40**	9.64**	12.14**	11.28**	25.47**	18.98**	18.16**	16.29**
52	PAIG 346 x HD 514	1.83	17.25**	9.71**	3.34	5.69**	-1.65	10.89**	5.15**	4.43*	2.77
53	PAIG 346 x DWDa 1402	2.80	18.37**	10.76**	4.33*	6.70**	8.37**	22.19**	15.86**	15.07**	13.24**
54	PAIG 346 x JLA 794	6.09**	22.16**	14.30**	7.66**	10.11**	13.27**	28.96**	22.28**	21.44**	19.52**
55	PAIG 346 x Digvijay	4.26*	20.06**	12.34**	5.81**	8.22**	-2.27	10.19**	4.49*	3.77	2.13
56	PAIG 346 x G.Cot 23	-1.49	20.48**	12.73**	6.18**	8.60**	3.92*	22.54**	16.19**	15.40**	13.57**
	S.E.±	0.046	0.046	0.046	0.046	0.046	0.12	0.12	0.12	0.12	0.12
	C.D. @ 5%	0.091	0.091	0.091	0.091	0.091	0.24	0.24	0.24	0.24	0.24

Table 2: (Contd…)

S. No.	Crosses	Lint index (g)					Harvest index (%)				
		BPH	**SH 1**	**SH2**	**SH3**	**SV1**	**BPH**	**SH 1**	**SH2**	**SH3**	**SV1**
1	PA 801 x AKA 8	5.69**	8.23**	11.16**	4.28*	9.96**	6.22*	5.23	2.46	1.15	4.75
2	PA 801 x Phule Dhanwantary	3.16	1.30	4.04*	-2.41	2.91	1.82	0.87	-1.78	-3.04	0.41
3	PA 801 x CNA 449	2.32	2.13	4.89*	-1.60	3.76	11.12**	10.08**	7.19**	5.82*	9.58**
4	PA 801 x HD 514	4.15*	8.00**	10.93**	4.06*	9.73**	16.48**	15.87**	12.83**	11.38**	15.34**
5	PA 801 x DWDa 1402	1.77	1.16	3.90	-2.54	2.77	4.35	5.93*	3.15	1.83	5.45*
6	PA 801 x JLA 794	2.38	1.34	4.09*	-2.36	2.96	8.13**	8.87**	6.01*	4.65	8.37**
7	PA 801 x Digvijay	0.00	2.41	5.18*	-1.34	4.04*	1.05	0.10	-2.53	-3.77	-0.35
8	PA 801 x G.Cot 23	0.77	8.51**	11.45**	4.55*	10.24**	1.68	0.73	-1.92	-3.17	0.27
9	PA 740 x AKA 8	-0.95	1.43	4.18*	-2.27	3.05	6.31*	4.85	2.10	0.79	4.38
10	PA 740 x Phule Dhanwantary	2.50	2.41	5.18*	-1.34	4.04*	4.56	2.08	-0.60	-1.88	1.61
11	PA 740 x CNA 449	2.69	2.59	5.37**	-1.16	4.23*	8.69**	7.51**	4.68	3.34	7.02*
12	PA 740 x HD 514	3.12	6.94**	9.83**	3.03	8.65**	12.82**	12.23**	9.28**	7.88**	11.72**
13	PA 740 x DWDa 1402	-0.28	-0.37	2.33	-4.01*	1.22	6.48*	8.09**	5.25*	3.91	7.60**
14	PA 740 x JLA 794	3.52	3.42	6.22**	-0.36	5.08*	3.96	4.67	1.92	0.61	4.19
15	PA 740 x Digvijay	3.79	6.29**	9.17**	2.41	7.99**	16.07**	13.32**	10.34**	8.93**	12.81**
16	PA 740 x G.Cot 23	-0.52	7.12**	10.02**	3.21	8.83**	13.49**	10.80**	7.89**	6.51*	10.30**
17	PA 812 x AKA 8	-2.44	-0.09	2.61	-3.74	1.50	6.92**	10.15**	7.25**	5.88*	9.65**
18	PA 812 x Phule Dhanwantary	8.63**	3.61	6.41**	-0.18	5.26**	1.59	4.66	1.91	0.61	4.18
19	PA 812 x CNA 449	1.11	0.93	3.66	-2.76	2.54	4.95	8.11**	5.27*	3.93	7.62**
20	PA 812 x HD 514	9.99**	14.06**	17.15**	9.89**	15.88**	6.79*	10.01**	7.12**	5.75*	9.51**
21	PA 812 x DWDa 1402	2.00	1.39	4.13*	-2.32	3.01	3.18	6.29*	3.50	2.18	5.81*
22	PA 812 x JLA 794	7.66**	6.57**	9.45**	2.67	8.27**	2.83	5.93*	3.15	1.83	5.45*
23	PA 812 x Digvijay	-1.36	1.02	3.75	-2.67	2.63	-0.85	2.14	-0.55	-1.82	1.67
24	PA 812 x G.Cot 23	-1.12	6.48**	9.36**	2.58	8.18**	-3.82	-0.92	-3.53	-4.76	-1.38
25	PA 809 x AKA 8	3.39	5.87**	8.74**	2.01	7.57	20.52**	22.48**	19.26**	17.74**	21.92**
26	PA 809 x Phule Dhanwantary	4.79*	3.15	5.94**	-0.62	4.79*	0.14	1.76	-0.91	-2.18	1.30
27	PA 809 x CNA 449	-0.28	-0.46	2.23	-4.10*	1.13	16.12**	18.01**	14.91**	13.44**	17.47**
28	PA 809 x HD 514	4.19*	8.05**	10.97**	4.10*	9.77**	3.02	4.69	1.94	0.64	4.21
29	PA 809 x DWDa 1402	0.79	0.19	2.90	-3.48	1.79	6.07*	7.79**	4.96	3.62	7.30**
30	PA 809 x JLA 794	2.29	1.25	3.99	-2.45	2.87	9.64**	11.42**	8.49**	7.10**	10.91**

Table 2. (Contd…)

S. No.	Crosses	Lint index (g)					Harvest index (%)				
		BPH	**SH 1**	**SH2**	**SH3**	**SV1**	**BPH**	**SH 1**	**SH2**	**SH3**	**SV1**
31	PA 809 x Digvijay	0.27	2.68	5.46**	-1.07	4.32*	0.66	2.30	-0.39	-1.66	1.83
32	PA 809 x G.Cot 23	-3.74*	3.65	6.46**	-0.13	5.31**	4.92	6.63*	3.83	2.50	6.14*
33	PA 785 x AKA 8	4.20*	6.71**	9.60**	2.81*	8.41**	9.01**	8.96**	6.10*	4.74	8.47**
34	PA 785 x Phule Dhanwantary	4.49*	2.36	5.13*	-1.38	3.99*	3.81	3.76	1.04	-0.26	3.29
35	PA 785 x CNA 449	8.20**	8.00**	10.93**	4.06*	9.73**	19.48**	19.43**	16.29**	14.80**	18.88**
36	PA 785 x HD 514	3.17	6.98**	9.88**	3.07	8.69**	4.13	4.08	1.35	0.05	3.61
37	PA 785 x DWDa 1402	0.09	-0.51	2.19	-4.14	1.08	5.28	6.87*	4.06	2.73	6.38*
38	PA 785 x JLA 794	4.72*	3.65	6.46**	-0.13	5.31**	6.30*	7.02*	4.21	2.88	6.53*
39	PA 785 x Digvijay	0.00	2.41	5.18*	-1.34	4.04*	0.64	0.60	-2.05	-3.30	0.14
40	PA 785 x G.Cot 23	-1.89	5.64**	8.50**	1.78	7.33**	2.58	2.53	-0.16	-1.44	2.06
41	PA 832 x AKA 8	0.45	2.87	5.65**	-0.89	4.51*	3.89	2.46	-0.23	-1.50	2.00
42	PA 832 x Phule Dhanwantary	2.42	-2.22	0.43	-5.79**	-0.66	3.18	-0.37	-2.99	-4.23	-0.83
43	PA 832 x CNA 449	1.53	1.34	4.09*	-2.36	2.96	17.81**	16.52**	13.46**	12.01**	15.99**
44	PA 832 x HD 514	-0.40	3.28	6.08**	-0.49	4.93*	4.56	4.01	1.28	-0.01	3.54
45	PA 832 x DWDa 1402	1.02	0.42	3.14	-3.25	2.02	2.98	4.54	1.79	0.49	4.06

46	PA 832 x JLA 794	1.21	0.19	2.90	-3.48	1.79	4.81	5.53*	2.75	1.44	5.05
47	PA 832 x Digvijay	-0.90	1.48	4.23*	-2.23	3.10	2.95	-0.59	-3.20	-4.44	-1.05
48	PA 832 x G.Cot 23	-4.73*	2.59	5.37**	-1.16	4.23*	0.42	-3.04	-5.59*	-6.80*	-3.48
49	PAIG 346 x AKA 8	2.53	5.00*	7.84**	1.16	6.67**	16.63**	16.45**	13.39**	11.94**	15.92**
50	PAIG 346 x Phule Dhanwantary	0.63	2.96	5.75**	-0.80	4.61*	3.26	3.10	0.39	-0.89	2.63
51	PAIG 346 x CNA 449	0.36	2.68	5.46**	-1.07	4.32*	18.05**	17.86**	14.76**	13.29**	17.32**
52	PAIG 346 x HD 514	7.85**	11.84**	14.87**	7.75**	13.63**	18.34**	18.15**	15.04**	13.57**	17.61**
53	PAIG 346 x DWDa 1402	3.62	6.01**	8.88**	2.14	7.71**	19.61**	21.42**	18.23**	16.71**	20.86**
54	PAIG 346 x JLA 794	2.40	4.76*	7.60**	0.94	6.44**	20.76**	21.58**	18.39**	16.88**	21.03**
55	PAIG 346 x Digvijay	2.80	5.27**	8.12**	1.43	6.95**	4.62	4.45	1.71	0.41	3.98
56	PAIG 346 x G.Cot 23	-2.75	4.72*	7.55**	0.89	6.39**	3.74	3.57	0.85	-0.44	3.10
	S.E.±	0.07	0.07	0.07	0.07	0.07	0.97	0.97	0.97	0.97	0.97
	C.D. @ 5%	0.14	0.14	0.14	0.14	0.14	1.92	1.92	1.92	1.92	1.92

Table 2: (Contd…)

S. No.	Crosses	Days to maturity				
		BPH	**SH 1**	**SH2**	**SH3**	**SV1**
1	PA 801 x AKA 8	-3.32**	-4.44**	-5.14**	-5.14**	-5.44**
2	PA 801 x Phule Dhanwantary	-1.28*	-2.01**	-2.73**	-2.73**	-3.03**
3	PA 801 x CNA 449	-0.11	0.21	-0.52	-0.52	-0.84
4	PA 801 x HD 514	-1.28*	-2.33**	-3.04**	-3.04**	-3.35**
5	PA 801 x DWDa 1402	-1.60**	-2.54**	-3.25**	-3.25**	-3.56**
6	PA 801 x JLA 794	0.64	0.42	-0.31	-0.31	-0.63
7	PA 801 x Digvijay	-3.06**	3.91**	3.15**	3.15**	2.82**
8	PA 801 x G.Cot 23	-1.79**	4.23**	3.46**	3.46**	3.14**
9	PA 740 x AKA 8	-1.79**	-1.48*	-2.20**	-2.20**	-2.51**
10	PA 740 x Phule Dhanwantary	-0.74	-0.42	-1.15*	-1.15*	-1.46*
11	PA 740 x CNA 449	-0.53	-0.21	-0.94	-0.94	-1.26*
12	PA 740 x HD 514	-2.85**	-2.54**	-3.25**	-3.25**	-3.56**
13	PA 740 x DWDa 1402	-1.69**	-1.37*	-2.10**	-2.10**	-2.41**
14	PA 740 x JLA 794	-1.26*	-0.95	-1.68**	-1.68**	-1.99**
15	PA 740 x Digvijay	-5.72**	1.06	0.31	0.31	0.00
16	PA 740 x G.Cot 23	-5.38**	0.42	-0.31	-0.31	-0.63
17	PA 812 x AKA 8	-1.92**	-2.75**	-3.46**	-3.46**	-3.77**
18	PA 812 x Phule Dhanwantary	-1.38*	-2.11**	-2.83**	-2.83**	-3.14**
19	PA 812 x CNA 449	-1.69**	-1.37*	-2.10**	-2.10**	-2.41**
20	PA 812 x HD 514	-2.77**	-3.59**	-4.30**	-4.30**	-4.60**
21	PA 812 x DWDa 1402	-0.64	-1.48*	-2.20**	-2.20**	-2.51**
22	PA 812 x JLA 794	-0.64	-0.85	-1.57**	-1.57**	-1.88**
23	PA 812 x Digvijay	-7.99**	-1.37*	-2.10**	-2.10**	-2.41**
24	PA 812 x G.Cot 23	-5.18**	0.63	-0.10	-0.10	-0.42
25	PA 809 x AKA 8	-0.95	-1.16*	-1.89**	-1.89**	-2.20**
26	PA 809 x Phule Dhanwantary	-1.38*	-1.59**	-2.31**	-2.31**	-2.62**
27	PA 809 x CNA 449	0.95	1.27*	0.52	0.52	0.21
28	PA 809 x HD 514	-2.12**	-2.33**	-3.04**	-3.04**	-3.35**
29	PA 809 x DWDa 1402	-1.91**	-2.11**	-2.83**	-2.83**	-3.14**
30	PA 809 x JLA 794	-0.42	-0.63	-1.36*	-1.36*	-1.67**
31	PA 809 x Digvijay	-5.92**	0.85	0.10	0.10	-0.21
32	PA 809 x G.Cot 23	-5.18**	0.63	-0.10	-0.10	-0.42
33	PA 785 x AKA 8	-3.26**	-2.85**	-3.57**	-3.57**	-3.87**
34	PA 785 x Phule Dhanwantary	-1.16*	-0.74	-1.47*	-1.47*	-1.78**
35	PA 785 x CNA 449	-0.63	-0.21	-0.94	-0.94	-1.26*
36	PA 785 x HD 514	-2.63**	-2.22**	-2.94**	-2.94**	-3.24**
37	PA 785 x DWDa 1402	-0.84	-0.42	-1.15*	-1.15*	-1.46*
38	PA 785 x JLA 794	0.95	1.37*	0.63	0.63	0.31
39	PA 785 x Digvijay	-7.2**	-0.53	-1.26*	-1.26*	-1.57**
40	PA 785 x G.Cot 23	-6.47**	-0.74	-1.47*	-1.47*	-1.78**
41	PA 832 x AKA 8	-2.76**	-3.07**	-3.78**	-3.78**	-4.08**
42	PA 832 x Phule Dhanwantary	-1.38*	-1.69**	-2.41**	-2.41**	-2.72**
43	PA 832 x CNA 449	-1.37*	-1.06	-1.78**	-1.78**	-2.09**
44	PA 832 x HD 514	-3.39**	-3.70**	-4.41**	-4.41**	-4.71**
45	PA 832 x DWDa 1402	-1.38*	-1.69**	-2.41**	-2.41**	-2.72**
46	PA 832 x JLA 794	-0.85	-1.06	-1.78**	-1.78**	-2.09**
47	PA 832 x Digvijay	-7.10**	-0.42	-1.15*	-1.15*	-1.46*
48	PA 832 x G.Cot 23	-4.48**	1.37*	0.63	0.63	0.31
49	PAIG 346 x AKA 8	-1.69**	-1.48*	-2.20**	-2.20**	-2.51**
50	PAIG 346 x Phule Dhanwantary	-1.16*	-0.95	-1.68**	-1.68**	-1.99**
51	PAIG 346 x CNA 449	1.05	1.37*	0.63	0.63	0.31

52	PAIG 346 x HD 514	-1.48*	-1.27*	-1.99**	-1.99**	-2.30**
53	PAIG 346 x DWDa 1402	-1.90**	-1.69**	-2.41**	-2.41**	-2.72**
54	PAIG 346 x JLA 794	-1.16*	-0.95	-1.68**	-1.68**	-1.99**
55	PAIG 346 x Digvijay	-6.31**	0.42	-0.31	-0.31	-0.63
56	PAIG 346 x G.Cot 23	-5.08**	0.74	0.00	0.00	-0.31
	S.E.±	0.91	0.91	0.91	0.91	0.91
	C.D. @ 5%	1.79	1.79	1.79	1.79	1.79

*,** - Significant at 5 per cent and 1 per cent level, respectively

References

1. Balu A, Kavithamani PD, Ravikesavan R, Rajarathinam S. Heterosis for seed cotton yield and its quantitative characters of *Gossypium barbadense* L. J. cotton Res. Dev 2012;26(1):37-40.
2. Fonseca S, Patterson FC. Hybrid vigour in seven parent diallel crosses in common winter wheat (*T. aestivum*). Crop Sci 1968;8:85-86.
3. Giri RK, Nirania KS, Dutt Y, Sangwan RS, Jain PP. Heterosis for seed cotton yield and its contributing traits in upland cotton (*Gossypium hirsutum* L.). J. Cotton Res. Dev 2006;20(1):39-47.
4. Jaiwar SS, Avinashe HA, Patel BN. Heterosis for seed cotton yield and its contributing traits in upland cotton (*G. hirsutum* L.). J. Soils Crops 2012;22(2):314-320.
5. Jyotiba SS, Patil BR, Deshpande SK, Patil RS. Heterosis studies in GMS based diploid cotton. Electronic Journal of Plant Breeding 2010;1(4):685- 688.
6. Kumar M, Chhabra BS, Kumar R. Heterosis for seed cotton yield and fibre quality characters in intra *G. arboreum* L. hybrids. J. Cott. Res. & Dev 2003;17(1):27-29.
7. Naik SS, Patel JC. Genetic evaluation of conventional and genetic male sterility based interspecific and intraspecific hybrids in diploid cotton. M.Sc. Thesis submitted to N.A.U., Navsari 2004.
8. Neelam G, Potdukhe NR, Swati Bharad. Heterosis and combining ability for yield, economic and morphological traits in desi cotton (*Gossypium arboreum* L.) Int. J. Pl. Sci 2008;4(1):153-156.
9. Patel JP, Fougat RS, Jadeja GC, Patel CG, Suthar KP. Heterosis study for yield and yield attributing characters in iner-specific Asiatic cotton hybrids. Int. J. Agric. Sci 2010;6(1):78-83.
10. Patel KG, Patel RB, Patil MI, Kumar V. Study on heterosis and combining ability through integration in diploid cotton. J. Cotton Res. Dev 2008;23(1):23-26
11. Patel KG, Patel RB, Patil MI, Kumar V. Studies on heterosis and combining ability through introgression in diploid cotton. J. Cotton Res. Dev. 2009;23(1):23-26
12. Patil SS, Gavit AF, Magar NM, Pawar VY. Heterosis in hybrids of *Gossypium arboreum* cotton. J. Cotton Res. Dev 2009;23(2):209-212.
13. Potdukhe NR. Level of heterosis for quantitative traits in upland cotton. J. Indian Soc. Cotton Improv., 2002;27(3):200-204.
14. Pushpam R, Thangraj K, Ravindran TS. Heterosis and combining ability studies in upland cotton for yield characters. Ele. J. Plant. Breed 2015;6(2):459:463.
15. Saravanan S, Koodalingam K. Exploitation of hybrid vigour among interspecfic crosses of *Gossypium arboreum* L. and *Gossypium herbaceum* L.Electronic Journal of Plant Breeding 2011;2(1):143-146.
16. Sekhar L, Khadi BM, Patil RS, Katageri IS, Vamadevaiah HM, Chetti MB *et al*. 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 2012;25(3):313-321.
17. Singh A, Avtar R, Sheoran RK, Jain A, Dharwal G. Heterosis in male sterility based desi cotton hybrids for seed cotton yield and component traits. Annals of Biology 2013;29(1):32-34.
18. Sonawane HS, Patil SS, Patil SC, Magar NM. Heterotic studies for yield and its component traits in deshi cotton (*Gossypium arboreum* L.) Abstract presented in National Convention on Indian Cotton 2013, 34.