

Original Research Article

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Heterosis Studies in CMS Based and Conventional Hybrids for Yield and Yield Contributing Traits in Cotton (*G. hirsutum* L.) Over the Environments

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ABSTRACT

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The present study comprised of three male sterile CMS lines, three maintainer lines and ten male fertile males (testers/ restorers) with three standard checks in two sets i.e. CMS and conventional thus making 60 F₁s (30 CMS and 30 conventional) using Line x Tester mating design. The crosses, CAK 53A x AKH- 07R, CAK 23B x AKH-07R, CAK 23B x DHy-286-1R, CAK 23B x R-2000-23 and SRT-1A x R-2000-26 were found better for seed cotton yield per plant and hold promise for further evaluation and commercial exploitation of heterosis both in CMS and conventional system for high yield.

Introduction

Cotton is one of the most important fiber and cash crop of India and plays a dominant role in the industrial and agricultural economy of the country. It provides the basic raw material (cotton fibre) to cotton textile industry. In India, most of the cotton hybrids are produced manually by using conventional method of hand emasculation and pollination thus making hybrid seed production expensive. In the recent years, the phenomenon of male sterility being used for heterosis breeding which has helped to reduce cost of hybrid

seed production about 70 per cent (Meshram *et al.*, 1995). In cotton, different sources of male sterility are available. Out of which genetic male sterility (GMS) and cytoplasmic genetic male sterility (CGMS) are mainly used in both diploid and tetraploid species of cotton for hybrid development. Male sterility based cotton hybrids are blessed with cheaper and higher seed production. But both the male sterility system (GMS and CGMS) have low productivity than their fertile counterpart. Low productivity of lines developed from sterile cytoplasm in case of CGMS system may be explained with

Plasmon sensitivity hypothesis, according to which the maternal cytoplasm provides an unstable substrate from paternal genes.

Exploitation of hybrid vigour in cotton has gained much significance in view of its tremendous yield increase and is considered as outstanding accomplishment of plant breeding. There is a continuous need to evolve new hybrids which should exceed the existing hybrids in yield and fibre quality. Breeding of commercial hybrids has been proved to be the most important tool in increasing the yields of crop plants substantially within a short period.

Materials and Methods

The present study comprised of three male sterile CMS lines, three maintainer lines and ten male fertile males (testers/ restorers) with three standard checks in two sets i.e. CMS and conventional thus making 60 F₁s (30 CMS and 30 conventional) using Line x Tester mating design. These lines, testers and hybrids along with three checks were sown during *kharij*, 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). Observations were recorded on randomly selected five competitive plants from each replication for each genotype on days to 50 % flowering, plant height (cm), number of sympodia per plant, days to 50 % boll burst, earliness index, 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) and harvest index.

Results and Discussion

The experimental results revealed that the heterotic effect was high in the conventional than CMS for the traits like, seed cotton yield

per plant, days to 50% flowering, plant height, boll weight and seed index. But among both the sets of crosses (thirty CMS and thirty conventional) the CMS cross CAK 53A x AKH 07 R possessed the highest heterosis over better parent and standard heterosis for the traits earliness index and lint index. For seed cotton yield per plant the conventional hybrids 21, 3, 18 and 18 and in CMS 13, 2, 10 and 12 exhibited the positive significant heterosis over the better parent, PKV-Hy-4, NHH-206 and NHH-44 respectively. Maximum positive significant crosses were found in conventional system than in CMS system. Similar results of significant desirable heterosis for seed cotton yield and related traits were also reported by Deosarkar *et al.*, (2009), Tuteja and Agrawal (2014) and Sharma *et al.*, (2016).

In the CMS crosses, magnitude of heterosis was high over the better parent and standard check for the characters *viz.*, seed cotton yield per plant, days to 50 % flowering, plant height, number of monopodia per plant, number of bolls per plant, number of sympodia per plant, boll weight, harvest index and moderate for the trait earliness. Heterosis for seed cotton yield in CMS based hybrids have been reported by Tuteja *et al.*, (2011), Shinde *et al.*, (2012), Tuteja and Agrawal (2014).

Among the conventional crosses, higher heterotic effects were found for the traits *viz.*, seed cotton yield per plant, number of monopodia per plant, seed index, number of sympodia per plant, number of bolls per plant and seed cotton yield per plant. Moderately observed for lint index and earliness index. Low heterotic effects were found for days to 50% boll burst. Heterosis for different traits in conventional hybrids were also reported by workers Deosarkar *et al.*, (2009), Patel *et al.*, (2014), Pushpam *et al.*, (2015) and Sharma *et al.*, (2016).

Table.1 Per cent heterosis pooled over environments over better parent (BPH), check hybrids PKV-Hy-4 (SH1), NHH-206 (SH 2) and NHH-44 (SH 3)

Sr. No.	Crosses	Days to 50 % flowering				Plant height (cm)			
		BPH	SH 1	SH2	SH3	BPH	SH 1	SH2	SH3
1	CAK 53A X R-42-8	-1.00	2.84 *	3.65 **	6.99 **	6.08	-7.76 *	-1.79	0.54
2	CAK 53A X R-2000-23	-8.71 **	-5.17 **	-4.43 **	-1.34	-7.60 *	-12.79 **	-7.14 *	-4.94
3	CAK 53A X R- 2000-17-2	-18.91 **	-15.76 **	-15.10 **	-12.37 **	5.25	-6.67	-0.63	1.73
4	CAK 53A X R-2000-26	-21.89 **	-18.86 **	-18.23 **	-15.59 **	-2.14	-8.19 *	-2.25	0.07
5	CAK 53A X R-1044-13	-7.71 **	-4.13 **	-3.39 **	-0.27	4.02	-9.55 **	-3.70	-1.42
6	CAK 53A X R-2000-21	-8.21 **	-4.65 **	-3.91 **	-0.81	4.07	-9.50 **	-3.65	-1.36
7	CAK 53A X R-23	-7.21 **	-3.62 **	-2.86 *	0.27	0.95	-1.85	4.51	6.98
8	CAK 53A X R-53	-16.42 **	-13.18 **	-12.50 **	-9.68 **	2.34	-6.90 *	-0.87	1.48
9	CAK 53A X AKH-07R	-7.71 **	-4.13 **	-3.39 **	-0.27	3.59	-9.92 **	-4.09	-1.82
10	CAK 53A X DHY-286-1R	-21.34 **	-18.09 **	-17.45 **	-14.78 **	1.32	-11.90 **	-6.19	-3.97
11	CAK 53B X R-42-8	-10.20 **	-6.72 **	-5.99 **	-2.96 *	7.83 *	-6.24	-0.17	2.20
12	CAK 53B X R-2000-23	-9.20 **	-5.68 **	-4.95 **	-1.88	-2.30	-7.79 *	-1.82	0.51
13	CAK 53B X R- 2000-17-2	-15.92 **	-12.66 **	-11.98 **	-9.14 **	4.68	-7.17 *	-1.16	1.18
14	CAK 53B X R-2000-26	-13.68 **	-10.34 **	-9.64 **	-6.72 **	0.47	-5.73	0.37	2.75
15	CAK 53B X R-1044-13	1.24	5.17 **	5.99 **	9.41 **	1.82	-11.47 **	-5.74	-3.50
16	CAK 53B X R-2000-21	-6.97 **	-3.36 **	-2.60 *	0.54	0.51	-12.60 **	-6.94	-4.74
17	CAK 53B X R-23	-11.19 **	-7.75 **	-7.03 **	-4.03 **	-8.38 *	-10.92 **	-5.15	-2.91
18	CAK 53B X R-53	-13.43 **	-10.08 **	-9.38 **	-6.45 **	-1.12	-10.04 **	-4.22	-1.95
19	CAK 53B X AKH-07R	-9.20 **	-5.68 **	-4.95 **	-1.88	7.25	-6.74 *	-0.70	1.65
20	CAK 53B X DHY-286-1R	-19.60 **	-16.28 **	-15.63 **	-12.90 **	-2.86	-15.53 **	-10.06 **	-7.93 *
21	CAK 23A X R-42-8	-13.64 **	-11.63 **	-10.94 **	-8.06 **	-1.40	-17.96 **	-12.65 **	-10.58 **
22	CAK 23A X R-2000-23	-10.70 **	-7.24 **	-6.51 **	-3.49 **	-5.47	-10.78 **	-50	-2.75
23	CAK 23A X R- 2000-17-2	1.03	1.81	2.60 *	5.91 **	2.07	-9.48 **	-3.62	-1.34
24	CAK 23A X R-2000-26	14.29 **	7.49 **	8.33 **	11.83 **	-6.58	-12.36 **	-6.68	-4.47
25	CAK 23A X R-1044-13	-7.12 **	-5.68 **	-4.95 **	-1.88	2.57	-14.66 **	-9.13 *	-6.98
26	CAK 23A X R-2000-21	2.43	-2.07	-1.3	1.88	2.42	-14.78 **	-9.27 *	-7.12
27	CAK 23A X R-23	8.47 **	2.58 *	3.39 **	6.72 **	-0.99	-3.74	2.50	4.93
28	CAK 23A X R-53	7.55 **	3.10 *	3.91 **	7.26 **	1.60	-7.57 *	-1.59	0.74
29	CAK 23A X AKH-07R	-1.03	-0.26	0.52	3.76 **	16.73 **	-2.87	3.41	5.86
30	CAK 23A X DHY-286-1R	-6.95 **	-3.10 *	-2.34	0.81	14.14 **	-5.03	1.12	3.52

Table.1 Continue...

Sr. No.	Crosses	Days to 50 % flowering				Plant height (cm)			
		BPH	SH 1	SH2	SH3	BPH	SH 1	SH2	SH3
31	CAK 23B X R-42-8	-6.31 **	-4.13 **	-3.39 **	-0.27	3.07	-14.24 **	-8.69 *	-6.52
32	CAK 23B X R-2000-23	-3.73 **	0.00	0.78	4.03 **	10.37 **	4.17	10.91 **	13.54 **
33	CAK 23B X R- 2000-17-2	-1.79	-1.03	-0.26	2.96 *	11.33 **	-1.28	5.11	7.60 *
34	CAK 23B X R-2000-26	1.65	-4.39 **	-3.65 **	-0.54	7.81 *	1.15	7.70 *	10.25 **
35	CAK 23B X R-1044-13	0.76	2.33	3.13 *	6.45 **	20.03 **	-0.13	6.33	8.86 *
36	CAK 23B X R-2000-21	-0.27	-4.65 **	-3.91 **	-0.81	14.87 **	-4.43	1.76	4.17
37	CAK 23B X R-23	8.47 **	2.58 *	3.39 **	6.72 **	-8.64 *	-11.18 **	-5.43	-3.19
38	CAK 23B X R-53	5.12 **	0.78	1.56	4.84 **	-5.50	-14.02 **	-8.46 *	-6.29
39	CAK 23B X AKH-07R	0.26	1.03	1.82	5.11 **	9.20 *	-9.14 **	-3.26	-0.96
40	CAK 23B X DHY-286-1R	-7.44 **	-3.62 **	-2.86 *	0.27	14.51 **	-4.73	1.44	3.84
41	SRT-1A X R-42-8	7.32 **	9.82 **	10.68 **	14.25 **	-10.72 **	-21.47 **	-16.38 **	-14.40 **
42	SRT-1A X R-2000-23	5.72 **	9.82 **	10.68 **	14.25 **	-14.54 **	-19.34 **	-14.12 **	-12.08 **
43	SRT-1A X R- 2000-17-2	6.67 **	7.49 **	8.33 **	11.83 **	-2.71	-13.72 **	-8.14 *	-5.96
44	SRT-1A X R-2000-26	4.15 **	3.88 **	4.69 **	8.06 **	-0.60	-6.74 *	-0.70	1.65
45	SRT-1A X R-1044-13	-5.34 **	-3.88 **	-3.13 *	0.00	-3.87	-15.45 **	-9.97 **	-7.84 *
46	SRT-1A X R-2000-21	-3.63 **	-3.88 **	-3.13 *	0.00	6.56	-6.26	-0.20	2.17
47	SRT-1A X R-23	-2.33	-2.58 *	-1.82	1.34	7.18 *	4.21	10.95 **	13.59 **
48	SRT-1A X R-53	1.55	1.29	2.08	5.38 **	8.23 *	-1.54	4.84	7.32 *
49	SRT-1A X AKH-07R	3.08 *	3.88 **	4.69 **	8.06 **	14.76 **	0.95	7.48 *	10.03 **
50	SRT-1A X DHY-286-1R	-0.74	3.36 **	4.17 **	7.53 **	9.11 *	-4.02	2.19	4.61
51	SRT-1B X R-42-8	-6.06 **	-3.88 **	-3.13 *	0.00	23.35 **	8.51 *	15.53 **	18.27 **
52	SRT-1B X R-2000-23	-6.47 **	-2.84 *	-2.08	1.08	9.91 **	3.74	10.45 **	13.07 **
53	SRT-1B X R- 2000-17-2	-3.08 *	-2.33	-1.56	1.61	6.61	-5.46	0.66	3.05
54	SRT-1B X R-2000-26	4.15 **	3.88 **	4.69 **	8.06 **	10.11 **	3.30	9.99 **	12.60 **
55	SRT-1B X R-1044-13	0.76	2.33	3.13 *	6.45 **	-1.00	-12.92 **	-7.28 *	-5.08
56	SRT-1B X R-2000-21	1.30	1.03	1.82	5.11 **	10.11 **	-3.15	3.12	5.57
57	SRT-1B X R-23	4.92 **	4.65 **	5.47 **	8.87 **	3.15	0.29	6.78	9.31 *
58	SRT-1B X R-53	2.33	2.07	2.86 *	6.18 **	-1.12	-10.04 **	-4.22	-1.95
59	SRT-1B X AKH-07R	-1.54	-0.78	0.00	3.23 *	0.14	-11.91 **	-6.21	-3.99
60	SRT-1B X DHY-286-1R	-9.43 **	-5.68 **	-4.95 **	-1.88	4.10	-8.43 *	-2.51	-0.20
	S.E.±	0.77	0.77	0.77	0.77	3.94	3.94	3.94	3.94
	C.D. @ 5%	1.52	1.52	1.52	1.52	7.77	7.77	7.77	7.77

Table.1 Continue...

Sr. No.	Crosses	No. of monopodia per plant				Days to 50 % boll burst			
		BPH	SH 1	SH2	SH3	BPH	SH 1	SH2	SH3
1	CAK 53A X R-42-8	-9.51	-19.93	-24.65 *	-35.91 **	0.86	2.63 **	0.14	-0.28
2	CAK 53A X R-2000-23	-20.27	-20.15	-24.86 *	-36.09 **	-4.67 **	-1.75 *	-4.13 **	-4.54 **
3	CAK 53A X R- 2000-17-2	-30.11 *	-36.46 **	-40.21 **	-49.14 **	-3.44 **	-1.75 *	-4.13 **	-4.54 **
4	CAK 53A X R-2000-26	-32.24 **	-30.04 *	-34.17 **	-44.00 **	-3.87 **	-2.19 **	-4.56 **	-4.96 **
5	CAK 53A X R-1044-13	-9.17	-19.63	-24.38 *	-35.68 **	-3.52 **	0.00	-2.42 **	-2.84 **
6	CAK 53A X R-2000-21	-1.13	-9.37	-14.72	-27.47 **	-1.87 **	-0.15	-2.56 **	-2.98 **
7	CAK 53A X R-23	14.8	9.89	3.40	-12.05	-1.72 *	0.00	-2.42 **	-2.84 **
8	CAK 53A X R-53	0.92	-10.7	-15.97	-28.53 **	-1.72 *	0.00	-2.42 **	-2.84 **
9	CAK 53A X AKH-07R	-4.5	-15.5	-20.49	-32.37 **	-4.39 **	-1.46 *	-3.85 **	-4.26 **
10	CAK 53A X DHY-286-1R	1.89	7.45	1.11	-14.00	-5.52 **	0.00	-2.42 **	-2.84 **
11	CAK 53B X R-42-8	10.09	-2.58	-8.33	-22.03 *	-1	0.73	-1.71 *	-2.13 **
12	CAK 53B X R-2000-23	-5.38	-5.24	-10.83	-24.16 **	-1.70 *	1.31	-1.14	-1.56 *
13	CAK 53B X R- 2000-17-2	-12.18	-20.15	-24.86 *	-36.09 **	-4.02 **	-2.34 **	-4.70 **	-5.11 **
14	CAK 53B X R-2000-26	-6.00	-2.95	-8.68	-22.33 *	-1.72 *	0.00	-2.42 **	-2.84 **
15	CAK 53B X R-1044-13	11.59	-1.25	-7.08	-20.97 *	0.56	4.23 **	1.71 *	1.28
16	CAK 53B X R-2000-21	7.09	-1.85	-7.64	-21.44 *	-2.44 **	-0.73	-3.13 **	-3.55 **
17	CAK 53B X R-23	-29.07 *	-32.10 **	-36.11 **	-45.66 **	-2.73 **	-1.02	-3.42 **	-3.83 **
18	CAK 53B X R-53	-1.75	-13.06	-18.19	-30.42 **	-2.58 **	-0.88	-3.28 **	-3.69 **
19	CAK 53B X AKH-07R	-20.35	-29.52 *	-33.68 **	-43.59 **	-1.42 *	1.61 *	-0.85	-1.28
20	CAK 53B X DHY-286-1R	-4.27	0.96	-5.00	-19.20 *	-5.93 **	-0.44	-2.85 **	-3.26 **
21	CAK 23A X R-42-8	-15.81	-21.77	-26.39 *	-37.39 **	-3.75 **	-2.63 **	-4.99 **	-5.39 **
22	CAK 23A X R-2000-23	-22.62	-22.51	-27.08 *	-37.98 **	-3.40 **	-0.44	-2.85 **	-3.26 **
23	CAK 23A X R- 2000-17-2	-4.92	-11.66	-16.88	-29.30 **	2.60 **	3.80 **	1.28	0.85
24	CAK 23A X R-2000-26	-37.81 **	-35.79 **	-39.58 **	-48.61 **	2.61 **	3.36 **	0.85	0.43
25	CAK 23A X R-1044-13	7.31	-0.30	-6.18	-20.20 *	-3.66 **	-0.15	-2.56 **	-2.98 **
26	CAK 23A X R-2000-21	-35.19 **	-39.78 **	-43.33 **	-51.80 **	1.59 *	2.34 **	-0.14	-0.57
27	CAK 23A X R-23	-26.29 *	-29.45 *	-33.61 **	-43.53 **	1.73 *	3.07 **	0.57	0.14
28	CAK 23A X R-53	-14.61	-20.66	-25.35 *	-36.50 **	0.58	1.61 *	-0.85	-1.28
29	CAK 23A X AKH-07R	20.89	12.32	5.69	-10.1	-0.99	2.04 **	-0.43	-0.85
30	CAK 23A X DHY-286-1R	-34.99 **	-31.44 **	-35.49 **	-45.13 **	-3.86 **	1.75 *	-0.71	-1.13
31	CAK 23B X R-42-8	9.69	1.92	-4.1	-18.43 *	-1.3	-0.15	-2.56 **	-2.98 **

Table.1 Continue...

Sr. No.	Crosses	No. of monopodia per plant				Days to 50 % boll burst			
		BPH	SH 1	SH2	SH3	BPH	SH 1	SH2	SH3
32	CAK 23B X R-2000-23	-14.81	-14.69	-19.72	-31.72 **	-1.42 *	1.61 *	-0.85	-1.28
33	CAK 23B X R- 2000-17-2	0.08	-7.01	-12.5	-25.58 **	1.44 *	2.63 **	0.14	-0.28
34	CAK 23B X R-2000-26	-25.88 *	-23.47 *	-27.99 *	-38.75 **	0.29	1.02	-1.42 *	-1.84 **
35	CAK 23B X R-1044-13	-9.29	-15.72	-20.69	-32.55 **	-4.08 **	-0.58	-2.99 **	-3.40 **
36	CAK 23B X R-2000-21	-14.38	-20.44	-25.14 *	-36.33 **	-2.61 **	-1.90 **	-4.27 **	-4.68 **
37	CAK 23B X R-23	-11.26	-15.06	-20.07	-32.01 **	1.15	2.48 **	0.00	-0.43
38	CAK 23B X R-53	-17.39	-23.25 *	-27.78 *	-38.57 **	1.16	2.19 **	-0.28	-0.71
39	CAK 23B X AKH-07R	-15.81	-21.77	-26.39 *	-37.39 **	-2.69 **	0.29	-2.14 **	-2.55 **
40	CAK 23B X DHY-286-1R	-0.63	4.80	-1.39	-16.13	-3.72 **	1.90 **	-0.57	-0.99
41	SRT-1A X R-42-8	-5.75	-16.53	-21.46	-33.20 **	4.18 **	5.40 **	2.85 **	2.41 **
42	SRT-1A X R-2000-23	-21.15	-21.03	-25.69 *	-36.80 **	1.42 *	4.53 **	1.99 **	1.56 *
43	SRT-1A X R- 2000-17-2	-12.66	-20.59	-25.28 *	-36.44 **	2.31 **	3.50 **	1.00	0.57
44	SRT-1A X R-2000-26	-16.44	-13.73	-18.82	-30.95 **	3.48 **	4.23 **	1.71 *	1.28
45	SRT-1A X R-1044-13	-3.75	-14.76	-19.79	-31.78 **	-4.51 **	-1.02	-3.42 **	-3.83 **
46	SRT-1A X R-2000-21	6.52	-2.36	-8.13	-21.85 *	-2.32 **	-1.61 *	-3.99 **	-4.40 **
47	SRT-1A X R-23	-21.59	-24.94 *	-29.38 **	-39.93 **	1.59 *	2.92 **	0.43	0
48	SRT-1A X R-53	-25.58	-34.10 **	-37.99 **	-47.25 **	2.02 **	3.07 **	0.57	0.14
49	SRT-1A X AKH-07R	-22	-30.92 **	-35.00 **	-44.71 **	0.42	3.50 **	1.00	0.57
50	SRT-1A X DHY-286-1R	-10.57	-5.68	-11.25	-24.51 **	-6.34 **	-0.88	-3.28 **	-3.69 **
51	SRT-1B X R-42-8	-14.75	-24.50 *	-28.96 **	-39.57 **	-0.14	1.02	-1.42 *	-1.84 **
52	SRT-1B X R-2000-23	-12.23	-12.1	-17.29	-29.65 **	-3.68 **	-0.73	-3.13 **	-3.55 **
53	SRT-1B X R- 2000-17-2	-14.77	-22.51	-27.08 *	-37.98 **	1.73 *	2.92 **	0.43	0
54	SRT-1B X R-2000-26	-13.72	-10.92	-16.18	-28.71 **	3.77 **	4.53 **	1.99 **	1.56 *
55	SRT-1B X R-1044-13	-11.42	-21.55	-26.18 *	-37.21 **	0.14	3.80 **	1.28	0.85
56	SRT-1B X R-2000-21	-16.59	-23.54 *	-28.06 *	-38.81 **	2.61 **	3.36 **	0.85	0.43
57	SRT-1B X R-23	-18.97	-22.44	-27.01 *	-37.92 **	2.02 **	3.36 **	0.85	0.43
58	SRT-1B X R-53	-1.17	-12.47	-17.64	-29.95 **	0.14	1.17	-1.28	-1.70 *
59	SRT-1B X AKH-07R	-20.92	-29.96 *	-34.10 **	-43.95 **	-0.28	2.77 **	0.28	-0.14
60	SRT-1B X DHY-286-1R	-34.50 **	-30.92 **	-35.00 **	-44.71 **	-6.76 **	-1.31	-3.70 **	-4.11 **
	S.E.±	0.26	0.26	0.26	0.26	0.79	0.79	0.79	0.79
	C.D. @ 5%	0.52	0.52	0.52	0.52	1.56	1.56	1.56	1.56

Table.1 Continue...

Sr. No.	Crosses	Earliness index				No. of sympodia per plant			
		BPH	SH 1	SH 2	SH 3	BPH	SH 1	SH 2	SH 3
1	CAK 53A X R-42-8	7.24 *	-3.15	1.78	-1.72	14.43	2.15	-2.18	-2.3
2	CAK 53A X R-2000-23	1.00	-1.94	3.05	-0.49	1.42	-9.47	-13.31	-13.41
3	CAK 53A X R- 2000-17-2	-0.5	-3.39	1.53	-1.97	-3.26	-9.47	-13.31	-13.41
4	CAK 53A X R-2000-26	6.89 *	-6.05 *	-1.27	-4.67	11.49	-0.48	-4.7	-4.81
5	CAK 53A X R-1044-13	2.39	-6.54 *	-1.78	-5.16	11.56	-0.42	-4.64	-4.75
6	CAK 53A X R-2000-21	5.22	-2.42	2.54	-0.98	11.56	-0.42	-4.64	-4.75
7	CAK 53A X R-23	-2.47	-4.36	0.51	-2.95	-2.04	-6.68	-10.64	-10.74
8	CAK 53A X R-53	-9.52 **	-7.99 **	-3.31	-6.63 *	-1.53	-8.79	-12.65	-12.76
9	CAK 53A X AKH-07R	-1.18	1.21	6.36 *	2.7	46.85 **	31.08 **	25.53 **	25.38 **
10	CAK 53A X DHY-286-1R	-4.65	-10.65 **	-6.11 *	-9.34 **	15.57	3.16	-1.21	-1.33
11	CAK 53B X R-42-8	-0.54	-10.17 **	-5.60 *	-8.85 **	2.71	-8.32	-12.2	-12.3
12	CAK 53B X R-2000-23	4.99	1.94	7.12 *	3.44	16.99	4.43	0.01	-0.11
13	CAK 53B X R- 2000-17-2	4.74	1.69	6.87 *	3.19	-2.81	-9.05	-12.9	-13.01
14	CAK 53B X R-2000-26	6.61 *	-6.30 *	-1.53	-4.91	17.33	4.74	0.30	0.18
15	CAK 53B X R-1044-13	2.12	-6.78 *	-2.04	-5.41 *	6.96	-4.53	-8.57	-8.68
16	CAK 53B X R-2000-21	8.09 **	0.24	5.34	1.72	15.92	3.47	-0.91	-1.03
17	CAK 53B X R-23	-3.46	-5.33 *	-0.51	-3.93	-1.1	-5.79	-9.78	-9.89
18	CAK 53B X R-53	-10.48 **	-8.96 **	-4.33	-7.62 **	-7.73	-14.53	-18.15 *	-18.24 *
19	CAK 53B X AKH-07R	-2.84	-0.48	4.58	0.98	9.43	-2.32	-6.45	-6.56
20	CAK 53B X DHY-286-1R	-4.91	-10.90 **	-6.36 *	-9.58 **	5.42	-5.89	-9.88	-9.99
21	CAK 23A X R-42-8	19.05 **	8.96 **	14.50 **	10.57 **	2.06	-6.11	-10.08	-10.19
22	CAK 23A X R-2000-23	-4.99	-7.75 **	-3.05	-6.39 *	14.99	5.79	1.31	1.19
23	CAK 23A X R- 2000-17-2	-6.23 *	-8.96 **	-4.33	-7.62 **	1.66	-4.86	-8.89	1.74
24	CAK 23A X R-2000-26	1.06	-7.51 **	-2.8	-6.14 *	2.63	-5.58	-9.58	-9.69
25	CAK 23A X R-1044-13	5.82 *	-3.15	1.78	-1.72	11.76	2.82	-1.53	-1.65
26	CAK 23A X R-2000-21	-0.78	-7.99 **	-3.31	-6.63 *	9.73	0.95	-3.33	-3.44
27	CAK 23A X R-23	3.46	1.45	6.62 *	2.95	-6.36	-10.8	-14.58	-14.68
28	CAK 23A X R-53	-5.95 *	-4.36	0.51	-2.95	3	-4.59	-8.63	-8.74
29	CAK 23A X AKH-07R	-12.29 **	-10.17 **	-5.60 *	-8.85 **	-2.86	-10.63	-14.42	-14.52
30	CAK 23A X DHY-286-1R	12.92 **	5.81 *	11.20 **	7.37 **	-3.99	-11.67	-15.41	-15.52
31	CAK 23B X R-42-8	1.59	-7.02 **	-2.29	-5.65 *	-19.68 *	-26.11 **	-29.23 **	-29.32 **

Table.1 Continue...

Sr. No.	Crosses	Earliness index				No. of sympodia per plant			
		BPH	SH 1	SH 2	SH 3	BPH	SH 1	SH 2	SH 3
32	CAK 23B X R-2000-23	-2.99	-5.81 *	-1.02	-4.42	29.66 **	19.28 *	14.23	14.1
33	CAK 23B X R- 2000-17-2	-6.48 *	-9.20 **	-4.58	-7.86 **	1.72	-4.81	-8.84	-8.95
34	CAK 23B X R-2000-26	0.00	-8.47 **	-3.82	-7.13 **	-4.79	-12.41	-16.12	-16.22
35	CAK 23B X R-1044-13	11.64 **	2.18	7.38 **	3.69	4.03	-4.29	-8.35	-8.46
36	CAK 23B X R-2000-21	7.31 *	-0.48	4.58	0.98	14.99	5.79	1.31	1.19
37	CAK 23B X R-23	9.63 **	7.51 **	12.98 **	9.09 **	4.33	-0.61	-4.82	-4.93
38	CAK 23B X R-53	-2.62	-0.97	4.07	0.49	4.15	-3.53	-7.61	-7.72
39	CAK 23B X AKH-07R	-0.71	1.69	6.87 *	3.19	34.20 **	23.46 **	18.24 *	18.09 *
40	CAK 23B X DHY-286-1R	17.83 **	10.41 **	16.03 **	12.04 **	25.64 **	15.59	10.7	10.56
41	SRT-1A X R-42-8	-1.53	-6.30 *	-1.53	-4.91	-13.9	-28.54 **	-31.56 **	-31.65 **
42	SRT-1A X R-2000-23	1.5	-1.45	3.56	0.00	-2.92	-16.00	-19.56 *	-19.65 *
43	SRT-1A X R- 2000-17-2	4.74	1.69	6.87 *	3.19	-9.45	-15.26	-18.85 *	-18.95 *
44	SRT-1A X R-2000-26	-5.85 *	-10.41 **	-5.85 *	-9.09 **	22.00 *	3.51	-0.88	-1.00
45	SRT-1A X R-1044-13	15.52 **	9.93 **	15.52 **	11.55 **	13.68	-11.72	-15.45	-15.56
46	SRT-1A X R-2000-21	1.02	-3.87	1.02	-2.46	7.22	-9.68	-13.51	-13.61
47	SRT-1A X R-23	2.72	0.73	5.85 *	2.21	-6.85	-11.26	-15.02	-15.12
48	SRT-1A X R-53	-9.95 **	-8.43 **	-3.77	-7.08 *	-7.16	-14.00	-17.64 *	-17.74 *
49	SRT-1A X AKH-07R	1.42	3.87	9.16 **	5.41 *	12.2	-14.44	-18.06 *	-18.16 *
50	SRT-1A X DHY-286-1R	-8.14 **	-12.59 **	-8.14 **	-11.30 **	-4.63	-20.79 *	-24.14 **	-24.23 **
51	SRT-1B X R-42-8	-2.29	-7.02 **	-2.29	-5.65 *	-4.25	-20.53 *	-23.89 **	-23.98 **
52	SRT-1B X R-2000-23	-5.24	-7.99 **	-3.31	-6.63 *	5.96	-8.32	-12.2	-12.3
53	SRT-1B X R- 2000-17-2	10.72 **	7.51 **	12.98 **	9.09 **	-7.96	-13.87	-17.52 *	-17.62 *
54	SRT-1B X R-2000-26	-4.58	-9.20 **	-4.58	-7.86 **	-9.43	-23.16 **	-26.41 **	-26.50 **
55	SRT-1B X R-1044-13	5.34	0.24	5.34	1.72	13.31	-12.00	-15.73	-15.83
56	SRT-1B X R-2000-21	-5.85 *	-10.41 **	-5.85 *	-9.09 **	-4.52	-19.58 *	-22.98 **	-23.08 **
57	SRT-1B X R-23	7.41 **	5.33 *	10.69 **	6.88 *	-1.55	-6.21	-10.18	-10.29
58	SRT-1B X R-53	-8.57 **	-7.02 **	-2.29	-5.65 *	11.14	2.95	-1.41	-1.53
59	SRT-1B X AKH-07R	-1.42	0.97	6.11 *	2.46	33.95 **	2.14	-2.19	-2.31
60	SRT-1B X DHY-286-1R	-3.05	-7.75 **	-3.05	-6.39 *	16.22	-3.47	-7.56	-7.67
	S.E.±	0.02	0.02	0.02	0.02	1.37	1.37	1.37	1.37
	C.D. @ 5%	0.04	0.04	0.04	0.04	2.70	2.70	2.70	2.70

Table.1 Continue...

Sr. No.	Crosses	No. of bolls per plant				Boll weight (g)			
		BPH	SH 1	SH 2	SH 3	BPH	SH 1	SH 2	SH 3
1	CAK 53A X R-42-8	12.22	-12.3	-9.14	-0.37	-10.84	-11.41	-23.03 *	-26.65 **
2	CAK 53A X R-2000-23	1.52	-15.05	-11.98	-3.49	-1.68	8.22	-5.98	-10.4
3	CAK 53A X R- 2000-17-2	-3.56	-10.52	-7.29	1.66	3.01	9.11	-5.2	-9.66
4	CAK 53A X R-2000-26	-1.26	-14.39	-11.31	-2.75	8.87	3.25	-10.3	-14.51
5	CAK 53A X R-1044-13	25.02	-14.61	-11.53	-2.99	-9.8	-11.98	-23.53 *	-27.12 **
6	CAK 53A X R-2000-21	20.55	-17.66	-14.69	-6.46	7.00	8.16	-6.04	-10.45
7	CAK 53A X R-23	-11.05	-32.26 **	-29.81 **	-23.04 *	-19.67 *	-7.84	-19.93 *	-23.69 **
8	CAK 53A X R-53	15.31	-21.24 *	-18.4	-10.53	-2.97	-4.14	-16.72	-20.63 *
9	CAK 53A X AKH-07R	113.58 **	56.00 **	61.63 **	77.23 **	43.55 **	36.14 **	18.27	12.72
10	CAK 53A X DHY-286-1R	-1.69	-32.85 **	-30.43 **	-23.72 *	-10.16	-1.91	-14.78	-18.79 *
11	CAK 53B X R-42-8	48.14 **	15.78	19.95 *	31.53 **	6.03	5.35	-8.47	-12.77
12	CAK 53B X R-2000-23	17.47	-1.7	1.84	11.67	11.00	22.18 *	6.15	1.16
13	CAK 53B X R- 2000-17-2	28.91 **	19.61 *	23.92 *	35.88 **	14.62	21.41	5.48	0.53
14	CAK 53B X R-2000-26	48.71 **	28.92 **	33.57 **	46.46 **	20.23	14.02	-0.94	-5.59
15	CAK 53B X R-1044-13	28.61 *	-12.16	-8.99	-0.21	-0.07	-2.49	-15.28	-19.26 *
16	CAK 53B X R-2000-21	35.62 *	-7.37	-4.03	5.23	-4.29	-3.25	-15.95	-19.89 *
17	CAK 53B X R-23	20.13	-8.51	-5.21	3.93	-6.94	6.76	-7.25	-11.61
18	CAK 53B X R-53	43.04 **	-2.3	1.22	10.99	29.48 **	27.92 *	11.13	5.91
19	CAK 53B X AKH-07R	63.27 **	19.26 *	23.56 *	35.49 **	1.28	-3.95	-16.56	-20.47 *
20	CAK 53B X DHY-286-1R	10.59	-24.47 *	-21.74 *	-14.19	-8.70	-0.32	-13.4	-17.47
21	CAK 23A X R-42-8	13.93	-10.96	-7.75	1.15	5.39	4.72	-9.03	-13.3
22	CAK 23A X R-2000-23	23.19 *	3.09	6.8	17.11	2.32	12.62	-2.16	-6.75
23	CAK 23A X R- 2000-17-2	-1.94	-9.01	-5.73	3.37	13.9	20.65	4.82	-0.11
24	CAK 23A X R-2000-26	-10.8	-22.67 *	-19.88 *	-12.15	24.31 *	20.59	4.76	-0.16
25	CAK 23A X R-1044-13	23.86	-12	-8.82	-0.02	27.37 *	24.28 *	7.97	2.9
26	CAK 23A X R-2000-21	7.46	-23.65 *	-20.90 *	-13.26	21.69 *	23.01 *	6.87	1.85
27	CAK 23A X R-23	-12.31	-33.21 **	-30.81 **	-24.13 *	0.39	15.17	0.06	-4.64
28	CAK 23A X R-53	3.14	-26.72 **	-24.07 *	-16.75	3.03	1.78	-11.57	-15.73
29	CAK 23A X AKH-07R	13.1	-17.39	-14.41	-6.15	-3.55	-6.44	-18.72 *	-22.53 *
30	CAK 23A X DHY-286-1R	23.32	-12.38	-9.22	-0.46	-13.89	-5.99	-18.33	-22.16 *
31	CAK 23B X R-42-8	3.9	-18.80 *	-15.88	-7.76	23.41 *	22.63 *	6.53	1.53

Table.1 Continue...

Sr. No.	Crosses	No. of bolls per plant				Boll weight (g)			
		BPH	SH 1	SH 2	SH 3	BPH	SH 1	SH 2	SH 3
32	CAK 23B X R-2000-23	74.42 **	45.96 **	51.22 **	65.81 **	23.68 *	36.14 **	18.27	12.72
33	CAK 23B X R- 2000-17-2	-13.23	-19.49 *	-16.59	-8.54	5.05	11.28	-3.32	-7.86
34	CAK 23B X R-2000-26	3.58	-10.2	-6.96	2.02	11.37	8.03	-6.15	-10.55
35	CAK 23B X R-1044-13	50.83 **	7.17	11.03	21.75 *	24.56 *	21.54 *	5.59	0.63
36	CAK 23B X R-2000-21	21.02	-14.01	-10.91	-2.31	24.59 *	25.94 *	9.41	4.27
37	CAK 23B X R-23	9.9	-16.3	-13.28	-4.91	8.89	24.92 *	8.53	3.43
38	CAK 23B X R-53	17.04	-16.84	-13.85	-5.53	22.97 *	21.48	5.54	0.58
39	CAK 23B X AKH-07R	89.73 **	38.59 **	43.58 **	57.44 **	52.76 **	48.18 **	28.74 **	22.69 *
40	CAK 23B X DHY-286-1R	82.29 **	29.52 **	34.19 **	47.14 **	4.09	13.64	-1.27	-5.91
41	SRT-1A X R-42-8	-15.89	-34.27 **	-31.90 **	-25.33 *	-16.96	-7.33	-19.49 *	-23.27 *
42	SRT-1A X R-2000-23	-34.26 **	-44.99 **	-43.00 **	-37.50 **	13.08	26.20 *	9.63	4.49
43	SRT-1A X R- 2000-17-2	-6.98	-13.7	-10.58	-1.95	5.31	17.53	2.1	-2.69
44	SRT-1A X R-2000-26	39.96 **	21.34 *	25.71 **	37.84 **	18.85	32.63 **	15.23	9.82
45	SRT-1A X R-1044-13	18.1	-15.14	-12.09	-3.6	0.69	12.36	-2.38	-6.97
46	SRT-1A X R-2000-21	14.56	-17.69	-14.72	-6.49	-0.34	11.22	-3.38	-7.92
47	SRT-1A X R-23	5.5	-19.65 *	-16.76	-8.72	-26.50 **	-15.68	-26.74 **	-30.18 **
48	SRT-1A X R-53	38.64 **	-0.39	3.2	13.17	-17.13	-7.52	-19.66 *	-23.43 *
49	SRT-1A X AKH-07R	25.07	-8.64	-5.35	3.79	-1.48	9.94	-4.49	-8.97
50	SRT-1A X DHY-286-1R	19.09	-14.43	-11.35	-2.79	-10.62	-0.25	-13.34	-17.41
51	SRT-1B X R-42-8	24.76 *	-2.5	1.02	10.76	-3.48	7.71	-6.42	-10.82
52	SRT-1B X R-2000-23	40.17 **	17.29	21.52 *	33.25 **	12.74	25.81 *	9.3	4.17
53	SRT-1B X R- 2000-17-2	10.82	2.82	6.53	16.81	15.31	28.68 **	11.79	6.54
54	SRT-1B X R-2000-26	6.87	-7.35	-4.01	5.26	-1.03	10.45	-4.04	-8.55
55	SRT-1B X R-1044-13	65.93 **	19.22 *	23.52 *	35.44 **	6.74	19.12	3.49	-1.37
56	SRT-1B X R-2000-21	0.76	-27.60 **	-24.99 *	-17.76	2.28	14.15	-0.83	-5.49
57	SRT-1B X R-23	19.59	-8.93	-5.64	3.46	-4.78	9.24	-5.09	-9.55
58	SRT-1B X R-53	49.64 **	7.52	11.39	22.14 *	-10.28	0.13	-13.01	-17.1
59	SRT-1B X AKH-07R	-0.84	-27.57 **	-24.96 *	-17.72	-0.57	10.96	-3.6	-8.13
60	SRT-1B X DHY-286-1R	18.97	-14.52	-11.44	-2.89	-16.9	-7.27	-19.44 *	-23.22 *
	S.E.±	2.91	2.91	2.91	2.91	0.28	0.28	0.28	0.28
	C.D. @ 5%	5.75	5.75	5.75	5.75	0.56	0.56	0.56	0.56

Table.1 Continue...

Sr. No.	Crosses	Seed cotton yield per plant (gm)				Seed index			
		BPH	SH 1	SH 2	SH 3	BPH	SH 1	SH 2	SH 3
1	CAK 53A X R-42-8	-24.76 **	-47.56 **	-19.51 **	-14.79 *	-15.73 **	-11.08 **	18.58 **	31.24 **
2	CAK 53A X R-2000-23	-3.83	-43.93 **	-13.94 *	-8.89	10.75 *	7.42	43.26 **	58.56 **
3	CAK 53A X R- 2000-17-2	-33.55 **	-45.75 **	-16.74 **	-11.86	-10.95 **	-6.62	24.54 **	37.83 **
4	CAK 53A X R-2000-26	53.69 **	-10.20 **	37.82 **	45.91 **	3.22	9.13 *	45.53 **	61.07 **
5	CAK 53A X R-1044-13	64.73 **	-19.03 **	24.27 **	31.56 **	2.94	4.45	39.29 **	54.16 **
6	CAK 53A X R-2000-21	32.58 **	-45.24 **	-15.95 **	-11.02	-4.18	-2.57	29.93 **	43.80 **
7	CAK 53A X R-23	-11.30 *	-40.31 **	-8.39	-3.02	1.21	6.79	42.41 **	57.61 **
8	CAK 53A X R-53	-7.77	-37.44 **	-3.98	1.65	4.80	2.11	36.17 **	50.71 **
9	CAK 53A X AKH-07R	195.47 **	20.70 **	85.26 **	96.12 **	9.87 *	2.32	36.45 **	51.02 **
10	CAK 53A X DHY-286-1R	12.70	-53.96 **	-29.34 **	-25.20 **	-0.20	-3.85	28.23 **	41.92 **
11	CAK 53B X R-42-8	-9.87	-37.18 **	-3.58	2.07	-11.49 **	-6.62	24.54 **	37.83 **
12	CAK 53B X R-2000-23	65.49 **	-3.51	48.09 **	56.78 **	-4.82	-7.68	23.12 **	36.26 **
13	CAK 53B X R- 2000-17-2	-18.06 **	-33.10 **	2.68	8.7	6.90	12.10 **	49.50 **	65.46 **
14	CAK 53B X R-2000-26	41.50 **	-17.32 **	26.90 **	34.34 **	0.40	6.15	41.56 **	56.67 **
15	CAK 53B X R-1044-13	3.54	-49.11 **	-21.89 **	-17.31 **	6.08	7.64	43.55 **	58.87 **
16	CAK 53B X R-2000-21	37.47 **	-43.22 **	-12.86 *	-7.74	11.92 **	13.81 **	51.77 **	67.97 **
17	CAK 53B X R-23	21.61 **	-18.17 **	25.60 **	32.97 **	-9.07 *	-4.06	27.94 **	41.60 **
18	CAK 53B X R-53	24.16 **	-15.79 **	29.25 **	36.84 **	13.10 **	10.19 *	46.95 **	62.64 **
19	CAK 53B X AKH-07R	131.51 **	-5.43	45.15 **	53.67 **	17.86 **	9.76 *	46.38 **	62.01 **
20	CAK 53B X DHY-286-1R	59.15 **	-34.99 **	-0.21	5.64	16.14 **	11.89 **	49.22 **	65.15 **
21	CAK 23A X R-42-8	49.05 **	3.88	59.44 **	68.80 **	4.36	12.10 **	49.50 **	65.46 **
22	CAK 23A X R-2000-23	75.77 **	2.72	57.66 **	66.91 **	-3.96	3.17	37.59 **	52.28 **
23	CAK 23A X R- 2000-17-2	-9.44 *	-26.07 **	13.47 *	20.13 **	-0.59	6.79	42.41 **	57.61 **
24	CAK 23A X R-2000-26	-38.80 **	-64.23 **	-45.10 **	-41.88 **	2.18	9.76 *	46.38 **	62.01 **
25	CAK 23A X R-1044-13	40.25 **	-18.04 **	25.80 **	33.18 **	0.99	8.49 *	44.68 **	60.13 **
26	CAK 23A X R-2000-21	11.66	-34.74 **	0.16	6.04	-7.92 *	-1.08	31.91 **	46.00 **
27	CAK 23A X R-23	-37.94 **	-58.24 **	-35.91 **	-32.15 **	-4.55	2.53	36.74 **	51.33 **
28	CAK 23A X R-53	-3.36	-34.45 **	0.61	6.51	-0.59	6.79	42.41 **	57.61 **
29	CAK 23A X AKH-07R	4.94	-38.67 **	-5.87	-0.34	0.40	7.85	43.83 **	59.18 **
30	CAK 23A X DHY-286-1R	-32.69 **	-60.66 **	-39.63 **	-36.09 **	2.38	9.98 *	46.67 **	62.32 **
31	CAK 23B X R-42-8	-32.56 **	-53.00 **	-27.86 **	-23.63 **	1.98	9.55 *	46.10 **	61.70 **

Table.1 Continue...

Sr. No.	Crosses	Seed cotton yield per plant (g)				Seed index (g)			
		BPH	SH 1	SH 2	SH 3	BPH	SH 1	SH 2	SH 3
32	CAK 23B X R-2000-23	88.85 **	10.37 **	69.39 **	79.33 **	3.17	10.83 **	47.80 **	63.58 **
33	CAK 23B X R- 2000-17-2	-8.88	-25.61 **	14.18 *	20.87 **	0.20	7.64	43.55 **	58.87 **
34	CAK 23B X R-2000-26	12.75 *	-34.11 **	1.13	7.07	-5.35	1.68	35.60 **	50.08 **
35	CAK 23B X R-1044-13	74.78 **	2.15	56.78 **	65.98 **	3.96	11.68 **	48.94 **	64.84 **
36	CAK 23B X R-2000-21	12.69 *	-34.14 **	1.09	7.02	-10.89 **	-4.28	27.66 **	41.29 **
37	CAK 23B X R-23	5.89	-28.75 **	9.35	15.77 *	-2.18	5.08	40.14 **	55.10 **
38	CAK 23B X R-53	24.85 **	-15.32 **	29.97 **	37.60 **	-10.89 **	-4.28	27.66 **	41.29 **
39	CAK 23B X AKH-07R	95.06 **	14.00 **	74.97 **	85.23 **	-8.91 *	-2.15	30.50 **	44.43 **
40	CAK 23B X DHY-286-1R	93.64 **	13.17 **	73.70 **	83.89 **	8.12 *	16.15 **	54.89 **	71.43 **
41	SRT-1A X R-42-8	21.29 **	-15.46 **	29.75 **	37.36 **	-1.21	4.23	39.01 **	53.85 **
42	SRT-1A X R-2000-23	2.67	-40.14 **	-8.13	-2.74	8.11	4.87	39.86 **	54.79 **
43	SRT-1A X R- 2000-17-2	-38.88 **	-50.10 **	-23.41 **	-18.92 **	2.64	7.64	43.55 **	58.87 **
44	SRT-1A X R-2000-26	87.97 **	9.83 **	68.57 **	78.46 **	2.41	8.27 *	44.40 **	59.81 **
45	SRT-1A X R-1044-13	55.13 **	-23.75 **	17.03 **	23.89 **	-4.61	-3.21	29.08 **	42.86 **
46	SRT-1A X R-2000-21	79.32 **	-25.94 **	13.67 *	20.34 **	2.30	4.02	38.72 **	53.53 **
47	SRT-1A X R-23	-42.33 **	-61.19 **	-40.44 **	-36.94 **	1.81	7.42	43.26 **	58.56 **
48	SRT-1A X R-53	-17.87 **	-44.29 **	-14.50 *	-9.48	5.68	2.96	37.30 **	51.96 **
49	SRT-1A X AKH-07R	171.06 **	4.22	59.96 **	69.35 **	19.69 **	11.47 **	48.65 **	64.52 **
50	SRT-1A X DHY-286-1R	36.62 **	-47.47 **	-19.38 **	-14.65 *	13.49 **	9.34 *	45.82 **	61.38 **
51	SRT-1B X R-42-8	23.03 **	-14.25 **	31.61 **	39.33 **	4.84	10.61 *	47.52 **	63.27 **
52	SRT-1B X R-2000-23	61.53 **	-5.82	44.55 **	53.03 **	13.38 **	9.98 *	46.67 **	62.32 **
53	SRT-1B X R- 2000-17-2	-1.46	-19.55 **	23.48 **	30.72 **	1.42	6.36	41.84 **	56.99 **
54	SRT-1B X R-2000-26	41.48 **	-17.33 **	26.88 **	34.32 **	3.42	9.34 *	45.82 **	61.38 **
55	SRT-1B X R-1044-13	28.60 **	-36.79 **	-2.99	2.71	1.26	2.74	37.02 **	51.65 **
56	SRT-1B X R-2000-21	82.73 **	-24.53 **	15.83 **	22.63 **	3.14	4.87	39.86 **	54.79 **
57	SRT-1B X R-23	19.19 **	-19.80 **	23.10 **	30.32 **	4.23	9.98 *	46.67 **	62.32 **
58	SRT-1B X R-53	45.23 **	-1.49	51.19 **	60.06 **	1.53	-1.08	31.91 **	46.00 **
59	SRT-1B X AKH-07R	160.50 **	0.16	53.73 **	62.75 **	18.09 **	9.98 *	46.67 **	62.32 **
60	SRT-1B X DHY-286-1R	53.90 **	-40.83 **	-9.18	-3.85	10.18 *	6.15	41.56 **	56.67 **
	S.E.±	4.48	4.48	4.48	4.48	0.32	0.32	0.32	0.32
	C.D. @ 5%	8.84	8.84	8.84	8.84	0.63	0.63	0.63	0.63

Table.1 Continue...

Sr. No.	Crosses	Lint index (g)				Harvest index (%)			
		BPH	SH 1	SH 2	SH 3	BPH	SH 1	SH 2	SH 3
1	CAK 53A X R-42-8	-8.67	4.54	16.94 *	16.63 *	-16.31 **	-17.76 **	-16.10 **	-11.47 **
2	CAK 53A X R-2000-23	11.8	17.10 *	30.99 **	30.64 **	-26.71 **	-33.50 **	-32.16 **	-28.42 **
3	CAK 53A X R- 2000-17-2	-8.65	6.46	19.08 *	18.76 *	-4.27	-17.04 **	-15.37 **	-10.71 **
4	CAK 53A X R-2000-26	10.7	29.45 **	44.81 **	44.42 **	3.03	-14.86 **	-13.14 **	-8.35 **
5	CAK 53A X R-1044-13	2.04	11.76	25.01 **	24.68 **	-24.81 **	-41.22 **	-40.04 **	-36.73 **
6	CAK 53A X R-2000-21	-0.80	14.39	27.95 **	27.61 **	4.31	-11.61 **	-9.82 **	-4.85
7	CAK 53A X R-23	-14.01 *	8.61	21.49 **	21.16 *	-32.05 **	-34.37 **	-33.05 **	-29.36 **
8	CAK 53A X R-53	1.12	15.46 *	29.16 **	28.81 **	4.96	-13.49 **	-11.74 **	-6.88 *
9	CAK 53A X AKH-07R	18.23 **	45.28 **	62.51 **	62.07 **	34.04 **	15.45 **	17.77 **	24.26 **
10	CAK 53A X DHY-286-1R	18.24 *	17.82 *	31.79 **	31.44 **	-8.74 *	-37.10 **	-35.83 **	-32.30 **
11	CAK 53B X R-42-8	-1.57	12.67	26.04 **	25.70 **	-21.26 **	-22.62 **	-21.06 **	-16.71 **
12	CAK 53B X R-2000-23	1.48	6.30	18.90 *	18.59 *	-4.94	-13.74 **	-12.00 **	-7.15 **
13	CAK 53B X R- 2000-17-2	2.05	18.93 *	33.04 **	32.68 **	3.24	-10.54 **	-8.73 **	-3.7
14	CAK 53B X R-2000-26	8.01	26.31 **	41.28 **	40.91 **	-3.16	-19.97 **	-18.36 **	-13.86 **
15	CAK 53B X R-1044-13	-1.78	7.57	20.33 *	20.01 *	-7.62 *	-27.78 **	-26.33 **	-22.27 **
16	CAK 53B X R-2000-21	9.16	25.87 **	40.79 **	40.42 **	-17.73 **	-30.28 **	-28.88 **	-24.96 **
17	CAK 53B X R-23	-14.80 *	7.61	20.37 *	20.05 *	-23.46 **	-26.07 **	-24.58 **	-20.42 **
18	CAK 53B X R-53	8.83	24.27 **	39.01 **	38.64 **	22.59 **	1.04	3.08	8.76 **
19	CAK 53B X AKH-07R	-7.40	13.79	27.28 **	26.95 **	4.89	-9.66 **	-7.84 **	-2.76
20	CAK 53B X DHY-286-1R	23.28 **	22.84 **	37.41 **	37.04 **	20.49 **	-16.96 **	-15.28 **	-10.62 **
21	CAK 23A X R-42-8	-1.93	19.77 **	33.97 **	33.61 **	-16.55 **	-17.99 **	-16.34 **	-11.72 **
22	CAK 23A X R-2000-23	-6.49	14.19	27.73 **	27.39 **	-16.02 **	-23.80 **	-22.26 **	-17.97 **
23	CAK 23A X R- 2000-17-2	-4.83	16.22 *	30.00 **	29.66 **	-4.10	-16.90 **	-15.22 **	-10.55 **
24	CAK 23A X R-2000-26	5.84	29.25 **	44.58 **	44.20 **	8.56 **	-10.29 **	-8.48 **	-3.43
25	CAK 23A X R-1044-13	-9.46	10.56	23.67 **	23.34 **	7.99 *	-15.58 **	-13.88 **	-9.13 **
26	CAK 23A X R-2000-21	-10.02	9.88	22.92 **	22.59 **	-3.59	-18.31 **	-16.66 **	-12.06 **
27	CAK 23A X R-23	-12.87 *	10.04	23.09 **	22.77 **	-22.71 **	-25.35 **	-23.84 **	-19.65 **
28	CAK 23A X R-53	-16.51 **	1.95	14.04	13.74	-7.95 **	-24.13 **	-22.60 **	-18.34 **
29	CAK 23A X AKH-07R	-5.48	16.14 *	29.92 **	29.57 **	-13.31 **	-25.34 **	-23.83 **	-19.64 **
30	CAK 23A X DHY-286-1R	-0.46	21.56 **	35.98 **	35.62 **	26.04 **	-13.14 **	-11.38 **	-6.50 *
31	CAK 23B X R-42-8	3.98	26.98 **	42.04 **	41.66 **	-9.05 **	-10.62 **	-8.81 **	-3.79

Table.1 Continue...

Sr. No.	Crosses	Lint index (g)				Harvest index (%)			
		BPH	SH 1	SH 2	SH 3	BPH	SH 1	SH 2	SH 3
32	CAK 23B X R-2000-23	8.19	32.12 **	47.79 **	47.40 **	17.70 **	6.80 **	8.95 **	14.96 **
33	CAK 23B X R- 2000-17-2	-9.43	10.6	23.72 **	23.39 **	-1.47	-14.62 **	-12.90 **	-8.10 **
34	CAK 23B X R-2000-26	-3.92	17.34 *	31.25 **	30.90 **	9.48 **	-9.52 **	-7.70 **	-2.61
35	CAK 23B X R-1044-13	-0.82	21.12 **	35.49 **	35.13 **	14.56 **	-10.44 **	-8.64 **	-3.60
36	CAK 23B X R-2000-21	-8.13	12.2	25.50 **	25.17 **	12.86 **	-4.36	-2.43	2.94
37	CAK 23B X R-23	-4.92	20.09 **	34.33 **	33.97 **	-6.58 *	-9.77 **	-7.95 **	-2.88
38	CAK 23B X R-53	-9.92	10.00	23.05 **	22.72 **	10.75 **	-8.71 **	-6.87 **	-1.74
39	CAK 23B X AKH-07R	13.40 *	39.34 **	55.86 **	55.45 **	27.38 **	9.71 **	11.92 **	18.09 **
40	CAK 23B X DHY-286-1R	13.58 *	38.70 **	55.15 **	54.74 **	57.42 **	8.49 **	10.68 **	16.78 **
41	SRT-1A X R-42-8	3.97	19.01 *	33.13 **	32.77 **	-19.71 **	-21.09 **	-19.50 **	-15.07 **
42	SRT-1A X R-2000-23	6.74	19.29 **	33.44 **	33.08 **	0.90	-8.44 **	-6.60 *	-1.45
43	SRT-1A X R- 2000-17-2	4.41	21.68 **	36.11 **	35.75 **	-18.50 **	-26.63 **	-25.15 **	-21.02 **
44	SRT-1A X R-2000-26	17.83 **	37.78 **	54.12 **	53.71 **	18.41 **	6.60 **	8.75 **	14.74 **
45	SRT-1A X R-1044-13	-1.39	10.2	23.27 **	22.94 **	3.13	-7.16 **	-5.29 *	-0.07
46	SRT-1A X R-2000-21	2.49	18.17 *	32.19 **	31.84 **	-13.66 **	-22.28 **	-20.71 **	-16.34 **
47	SRT-1A X R-23	-5.68	19.13 *	33.26 **	32.90 **	-36.53 **	-38.70 **	-37.46 **	-34.02 **
48	SRT-1A X R-53	6.07	21.12 **	35.49 **	35.13 **	-24.35 **	-31.90 **	-30.53 **	-26.70 **
49	SRT-1A X AKH-07R	-8.08	12.95	26.35 **	26.01 **	-2.22	-11.98 **	-10.21 **	-5.26
50	SRT-1A X DHY-286-1R	5.35	17.74 *	31.70 **	31.35 **	-26.33 **	-33.68 **	-32.35 **	-28.62 **
51	SRT-1B X R-42-8	8.15	23.79 **	38.48 **	38.11 **	-15.35 **	-16.81 **	-15.13 **	-10.46 **
52	SRT-1B X R-2000-23	14.16 *	27.58 **	42.71 **	42.33 **	12.82 **	2.37	4.43	10.19 **
53	SRT-1B X R- 2000-17-2	1.81	18.65 *	32.72 **	32.37 **	-17.50 **	-25.73 **	-24.23 **	-20.06 **
54	SRT-1B X R-2000-26	8.28	26.62 **	41.64 **	41.26 **	-11.46 **	-20.29 **	-18.69 **	-14.21 **
55	SRT-1B X R-1044-13	7.49	20.13 **	34.37 **	34.02 **	1.83	-8.33 **	-6.48 *	-1.33
56	SRT-1B X R-2000-21	5.70	21.88 **	36.34 **	35.97 **	-14.19 **	-22.75 **	-21.19 **	-16.85 **
57	SRT-1B X R-23	-2.27	23.44 **	38.07 **	37.71 **	-17.43 **	-20.25 **	-18.65 **	-14.16 **
58	SRT-1B X R-53	5.93	20.96 **	35.31 **	34.95 **	-11.01 **	-19.89 **	-18.27 **	-13.77 **
59	SRT-1B X AKH-07R	-5.71	15.86 *	29.60 **	29.26 **	-6.40 *	-15.74 **	-14.04 **	-9.30 **
60	SRT-1B X DHY-286-1R	5.67	18.09 *	32.10 **	31.75 **	-17.21 **	-25.47 **	-23.97 **	-19.78 **
	S.E.±	0.31	0.31	0.31	0.31	0.93	0.93	0.93	0.93
	C.D. @ 5%	0.61	0.61	0.61	0.61	1.83	1.83	1.83	1.83

By comparing both the sets by using different parameters based on CMS system and conventional method revealed that three crosses i.e. CAK 53 x R-2000-26, CAK 53 x R-2000-17-2 and CAK 53 x R-53 were common for 50 % flowering both in CMS and conventional system.

From overall results the mean performance and heterotic expression of conventional hybrids were better than hybrid based on the CMS. The presence of the strong sterile cytoplasm have a tendency to reduce heterosis, since in such cases restorers can only restore fertility but cannot neutralize completely the adverse effect of strong sterile cytoplasm on heterosis as observed by Bhale and Bhatt (1990). However, certain cross combinations particularly CMS based showed significant high heterotic effect and better performance over the conventional hybrids. For example the cross CAK 53A X AKH -07 R showed heterotic effect for seed cotton yield per plant, number of sympodia per plant, number of bolls per plant and boll weight and CAK 53A X R-2000-26 for 50% flowering depicted high mean performance and high heterotic effect compared to their counterpart based on the conventional method. This indicated that cytoplasmic male sterility could be successfully utilized for commercial exploitation of heterosis.

The crosses, CAK 53A x AKH- 07R, CAK 23B x AKH-07R, CAK 23B x DHy-286-1R, CAK 23B x R-2000-23 and SRT-1A x R-2000-26 were found better for seed cotton yield per plant and hold promise for further evaluation and commercial exploitation of heterosis both in CMS and conventional system for high yield.

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