

Original Research Article

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Stability Analysis for Seed Cotton Yield and its Component Traits in Hybrids of Desi Cotton (*Gossypium arboreum* L.)

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ABSTRACT

Cotton is a long duration crop and grown over a wide range of environments. It is, therefore necessary to evaluate cotton genotypes in different environments to know its stability in varying environmental conditions. The knowledge of kind and magnitude of G x E interaction has become essential to the plant breeder in taking the decisions concerning breeding methods, selection programmes and their testing procedures in crop plants. Stability in yield is a major consideration in breeding of rainfed cotton which is highly influenced by erratic and uncertain rainfall conditions. Development of stable genotypes with high yield potential under rainfed condition is need of the day to meet the growing domestic demands of medium and superior medium staple cotton. Fifty six crosses with fifteen parents and four checks *viz.*, PKVDH1, PKV Suvarna, NACH 12 and PA 255 were grown in Randomized Block Design with two replications. The experiment was conducted under rainfed condition at three locations *viz.*, Cotton Research Station, MB Farm, Parbhani (L₁), Cotton Research Station, Nanded (L₂), and Agricultural Research Station, Badnapur (L₃) during *khariif*, 2016. The observations are recorded days to 50 % flowering, days to 50 % boll bursting, plant height, no. of sympodia per plant, no. of bolls per plant, boll weight, seed cotton yield per plant, seed index, lint index, harvest index and days to maturity. This experiment has resulted in identification of four parents *i.e.* PA 809, PA 785, HD 514, and PA 832 which were found to be stable and responsive to the low yielding environment which can be used as parents for improving yield stability of the cotton genotypes. The results showed that the stable crosses for the seed cotton yield per plant were PAIG 346 x JLA 794, PAIG 346 x DWDa 1402, PA 785 x CNA 449, PAIG 346 x CNA 449, PAIG 346 x HD 514 and PA 801 x HD 514 which have also responded well to favourable environments.

Keywords

Cotton, Stability, Yield, Fibre strength

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Introduction

Genotype x environment interactions is of major importance to the plant breeder in developing improved genotypes. When genotypes are compared over a series of environments, the relative rankings usually

differ. This causes difficulty in demonstrating the significant superiority of any genotype. This interaction is usually present whether the varieties are pure lines, single cross, double cross hybrids, top crosses, S₁ lines or any other material with which the breeder may be working.

Cotton plant has indeterminate growth habit which is greatly influenced by environmental conditions. Under high fertility conditions, cotton plant can attain more plant height, more nodes, more sympodia, delayed flowering whereas under stress conditions the plants may remain stunted with less monopods, sympodia and nodes or may initiate flowering very early.

Similarly the final yields of cotton, which is governed by polygenes and which are highly influenced by environment is a very complex character and have several components. To improve yield, in actual practice a breeder has to select individuals on the basis of phenotypic expression. Many characters of economic worth are quantitatively inherited and manifest high genotype environment effects.

Hence the present study was carried out to determine the stability of parents and crosses to identify most stable genotypes for future breeding programme.

Materials and Methods

The present study comprised of seven females (lines) and eight males (testers) with four standard checks thus making 56 F₁s 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 (L₁), Cotton Research Station, Nanded (L₂), and Agricultural Research Station, Badnapur (L₃).

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 Eberhart and Russell (1968).

Results and Discussion

From the ANOVA it was evident that mean squares for genotypes x environment were significant for number of sympodia per plant, number of bolls per plant, boll weight and seed cotton yield per plant which indicated inconsistency of performance of cotton genotypes across the environments for these characters. The significance of environment linear component for all the characters indicated considerable differences among the environments and their predominant effects on the traits. The significance of genotypes x environment linear component for plant height, number of sympodia per plant, number of bolls per plant, boll weight, seed cotton yield per plant, seed index and days to maturity indicated preponderance of linear component in these traits and hence prediction appeared possible. The pooled deviation for most of characters except number of sympodia per plant and number of bolls per plant was non-significant indicated the performance of the genotypes for these traits could be predictable.

Among all the character, yield is a very complex character which is controlled by polygene thereby showing the continuous variation in interaction with environment. It is also one of the most important characters breeder aims at. Therefore it would be wise to identify stable crosses on the basis of yield followed by other characters as it is the highly prone to environmental differences. Out of fifteen parents, five parents showed highly stable performance across the environments. They exhibited high mean than parental mean and non-significant deviation from regression. Among parents line PA 785 was found to be highly stable for yield per plant followed by PA 809 and HD 514. Out of fifty six crosses, twenty two crosses were widely stable with high mean than hybrid mean and non-significant deviation from regression (Table 1).

Table.1 Estimates of stability parameters of genotypes over three environments

Sr. No.	Genotype	Days to 50 % flowering			Days to 50 % boll bursting			Plant height (cm)			Number of sympodia /plant		
		Mean	Bi	S ² di	Mean	Bi	S ² di	Mean	Bi	S ² di	Mean	Bi	S ² di
	Lines												
1	PA 801	71.16	1.64	0.83	115.33	-0.69*	-1.16	106.30	1.08	6.64	14.83	1.00	-2.12
2	PA 740	73.50	1.10	-0.49	118.66	0.48	-0.58	104.96	1.14	-8.58	13.50	0.20*	-2.64
3	PA 812	71.00	1.10	-0.49	116.33	0.24	-1.02	99.53	1.00	-8.31	15.50	0.16*	-2.65
4	PA 809	72.16	1.12	-0.33	117.00	1.34	-0.28	104.70	1.23	-8.12	15.77	0.09	-0.15
5	PA 785	73.00	1.39	-0.65	118.50	1.34	-0.28	102.10	0.70*	-9.37	16.43	0.46	-2.22
6	PA 832	71.50	1.39	-0.65	117.50	0.93	-0.96	107.03	1.13	-8.59	15.87	0.47	-2.66
7	PAIG 346	72.66	-0.56	-0.61	119.16	-0.45	-1.07	103.40	1.21	-8.89	13.50	0.43	-2.45
	Testers												
1	AKA 8	70.00	1.10	-0.49	115.00	-0.21	-0.68	98.20	0.94	-9.30	16.17	0.43	-2.52
2	PhuleDhanwantary	71.50	1.39	-0.65	116.16	1.83	-1.14	71.00	0.49*	-9.36	12.23	0.17*	-2.67
3	CNA 449	73.66	1.93	-0.41	118.00	2.07	-1.12	106.23	0.92	-5.36	14.93	-0.05	-0.77
4	HD 514	71.00	1.10	-0.49	115.83	0.24	-1.02	87.70	0.56	-9.14	13.80	0.34*	-2.67
5	DWDa 1402	71.33	3.05*	-0.70	117.00	2.07	-1.12	111.20	0.61*	-9.37	16.03	0.34*	-2.68
6	JLA 794	72.66	1.12	-0.33	117.66	1.83	-1.14	113.70	0.27	13.49	11.83	0.25	-1.93
7	Digvijay	81.50	0.29	-0.22	132.83	1.59	-0.86	101.43	1.08	-9.13	16.30	0.33	-2.55
8	G.Cot 23	80.00	1.39	-0.65	131.33	1.79	0.41	99.23	0.35	-9.02	15.43	0.41	-0.97
	Crosses												
1	PA 801 x AKA 8	65.50	2.77	-0.50	110.16	1.83	-1.14	106.93	0.77	-4.09	21.90	1.12	-2.45
2	PA 801 x PhuleDhanwantary	70.16	-1.94	-0.42	116.00	1.87	-0.35	93.86	0.51	-8.35	16.23	1.38	-1.18
3	PA 801 x CNA 449	73.33	1.09	1.69	119.00	2.59	3.05	115.56	1.17	-7.09	21.20	1.44	-2.47
4	PA 801 x HD 514	70.33	1.66	-0.68	115.00	2.07	-1.12	117.96	1.24	-8.70	23.33	1.19	-2.38
5	PA 801 x DWDa 1402	69.33	2.23	0.80	113.83	1.79	0.41	120.90	1.57	-6.65	21.60	1.17	-2.43
6	PA 801 x JLA 794	72.33	1.37	0.02	117.50	1.87	-0.35	122.60	1.53	-6.83	21.63	0.60	11.09*
7	PA 801 x Digvijay	79.16	-1.66	-0.68	125.16	2.76	-1.09	111.16	1.61	-7.91	15.97	1.93	-2.00
8	PA 801 x G.Cot 23	78.16	0.01	0.46	124.50	0.73	0.15	110.86	1.53	-9.40	16.83	0.82	24.77**
9	PA 740 x AKA 8	71.00	1.67	0.14	116.33	0.45	-1.07	112.73	1.49	-6.00	17.67	1.59	-1.76
10	PA 740 x PhuleDhanwantary	73.00	0.81	0.64	119.66	2.24	1.29	94.63	0.57	-7.59	17.07	1.37	-2.52

Table.1 (Contd...)

Sr. No.	Genotype	Days to 50 % flowering			Days to 50 % boll bursting			Plant height (cm)			Number of sympodia /plant		
		Mean	Bi	S ² di	Mean	Bi	S ² di	Mean	Bi	S ² di	Mean	Bi	S ² di
11	PA 740 x CNA 449	73.33	1.37	0.02	118.50	0.73	0.15	118.43	0.14	3.35	21.07	1.46	-1.59
12	PA 740 x HD 514	70.00	1.67	0.14	114.66	-0.97	1.18	100.61	1.32	-5.84	21.23	0.47	10.58*
13	PA 740 x DWDa 1402	71.50	1.67	0.14	116.16	1.10	0.59	119.23	1.55	-8.85	20.77	0.60	9.41*
14	PA 740 x JLA 794	72.00	1.39	-0.65	116.83	1.38	-1.15	121.23	1.47	-9.15	16.73	0.56	13.08*
15	PA 740 x Digvijay	73.50	0.29	-0.22	118.16	1.83	-1.14	114.26	1.60	-8.40	22.30	1.94	-2.43
16	PA 740 x G.Cot 23	74.00	-0.53	2.73*	117.50	-3.00	-0.73	112.80	0.11	-6.95	21.33	2.12	-2.56
17	PA 812 x AKA 8	67.33	-0.01	0.46	111.83	-2.04	-0.41	105.83	1.17	-8.50	21.40	1.50*	-2.68
18	PA 812 x PhuleDhanwantary	69.33	0.84	0.30	114.33	0.65	-0.15	90.00	-0.32	-6.32	15.83	1.19	-2.38
19	PA 812 x CNA 449	70.50	1.67	0.14	115.50	1.34	-0.28	112.33	0.87	-4.00	21.13	0.79	15.52**
20	PA 812 x HD 514	67.50	0.00*	-0.70	112.00	2.80	0.67	96.16	0.07	-9.26	24.17	1.14	-2.20
21	PA 812 x DWDa 1402	71.33	0.56	-0.61	116.50	1.14	-1.11	113.10	0.81	-8.39	18.30	1.40	-2.01
22	PA 812 x JLA 794	71.33	2.23	0.80	116.66	2.24	1.29	116.10	1.57	-6.26	20.10	0.87	23.77**
23	PA 812 x Digvijay	71.83	0.27	-0.55	117.16	1.83	-1.14	113.80	-2.81	-7.48	17.93	1.66	-0.25
24	PA 812 x G.Cot 23	72.83	-1.12	-0.33	118.50	-1.14	-1.11	111.66	1.51	-3.40	20.33	0.68	9.13*
25	PA 809 x AKA 8	70.16	2.22	-0.68	113.16	4.83	-0.93	109.80	0.71	-1.37	27.17	0.43	-0.57
26	PA 809 x PhuleDhanwantary	72.00	2.77	-0.50	116.83	2.73	-0.52	96.06	1.02	-8.34	16.93	1.75	-1.20
27	PA 809 x CNA 449	73.33	1.94	-0.42	119.00	2.28	-0.93	124.46	1.31	-2.49	24.23	1.42	-1.93
28	PA 809 x HD 514	70.66	-0.27	-0.55	115.16	-2.31	-0.82	97.93	0.89	-5.00	21.93	1.47	-2.61
29	PA 809 x DWDa 1402	71.00	1.39	-0.65	115.50	1.55	1.52	122.86	1.35	0.10	20.53	1.68	-2.47
30	PA 809 x JLA 794	72.50	2.20	0.17	117.83	2.11	0.49	121.70	1.49	-9.28	20.93	1.72	-0.91
31	PA 809 x Digvijay	74.16	3.03	0.32	119.33	3.25	-0.08	112.20	1.32	-8.64	17.90	1.11	17.13**
32	PA 809 x G.Cot 23	73.83	-0.54	-0.11	120.66	4.83	-0.93	115.13	1.14	-8.33	20.07	2.37	-0.90
33	PA 785 x AKA 8	69.33	3.05*	-0.70	114.00	-0.21	-0.68	110.86	1.43	-2.13	22.03	1.50	-2.09
34	PA 785 x PhuleDhanwantary	72.50	1.10	-0.49	117.50	0.93	-0.96	94.26	0.64	-3.88	18.07	0.67	10.44*
35	PA 785 x CNA 449	73.33	2.47	1.04	118.66	2.56	-0.22	113.13	1.28	-7.48	25.23	1.34	-2.33
36	PA 785 x HD 514	68.83	4.43	-0.62	112.33	-0.69*	-1.16	95.90	1.05	-0.45	21.27	1.63	-1.19
37	PA 785 x DWDa 1402	72.83	1.66	-0.68	118.16	1.62	-0.90	116.90	2.11	-3.81	20.80	1.74	-1.82
38	PA 785 x JLA 794	73.66	-1.66	-0.68	119.33	-2.56	-0.22	115.87	1.42	-0.54	20.73	1.19	18.76**
39	PA 785 x Digvijay	73.00	1.39	-0.65	118.33	1.59	-0.86	111.50	1.11	-5.00	19.40	0.98	19.79**
40	PA 785 x G.Cot 23	73.33	1.66	-0.68	119.50	0.93	-0.96	107.93	1.34	-9.31	18.10	1.65	-1.07

Table.1 (Contd...)

Sr. No.	Genotype	Days to 50 % flowering			Days to 50 % boll bursting			Plant height (cm)			Number of sympodia /plant		
		Mean	Bi	S ² di	Mean	Bi	S ² di	Mean	Bi	S ² di	Mean	Bi	S ² di
41	PA 832 x AKA 8	68.33	-1.40	1.00	113.33	-2.04	-0.41	112.66	1.11	-1.51	17.87	0.66	8.90*
42	PA 832 x PhuleDhanwantary	71.83	-1.40	1.00	116.66	-0.45	-1.07	94.66	0.32	-9.26	16.73	0.73	7.76*
43	PA 832 x CNA 449	72.00	2.49	-0.65	117.00	1.87	-0.35	118.40	1.20	-8.98	24.50	1.44	-1.52
44	PA 832 x HD 514	66.83	0.27	-0.55	112.16	3.90*	-1.17	100.40	1.12	-8.92	16.13	1.21	-2.22
45	PA 832 x DWDa 1402	70.83	0.84	0.30	115.50	0.41	0.77	118.26	0.93	-8.08	18.20	1.31	-1.33
46	PA 832 x JLA 794	72.33	1.37	0.02	117.50	0.73	0.15	119.03	1.80	-7.05	18.33	1.36	-2.45
47	PA 832 x Digvijay	73.16	-2.76	-0.31	119.66	-3.77	7.18**	114.70	1.12	-8.33	16.57	1.51	0.13
48	PA 832 x G.Cot 23	74.83	0.27	-0.55	118.50	0.31	5.30*	111.20	1.32	-2.08	16.90	0.90	18.86*
49	PAIG 346 x AKA 8	70.66	1.12	-0.33	115.33	2.73	-0.52	110.93	1.35	-3.55	25.27	1.25	-2.62
50	PAIG 346 x PhuleDhanwantary	76.33	1.66	-0.68	117.66	2.76	-1.09	97.33	0.46	-6.32	17.97	1.61	-1.49
51	PAIG 346 x CNA 449	73.50	1.10	-0.49	118.50	0.93	-0.96	119.23	1.95	0.31	25.57	1.85	-2.58
52	PAIG 346 x HD 514	71.50	-1.39	-0.65	115.33	-0.90	-0.77	99.80	1.03	9.42	25.67	0.96	-1.67
53	PAIG 346 x DWDa 1402	70.83	1.94	-0.42	115.66	0.69	-1.16	121.33	1.43	-5.88	27.90	0.23	-1.84
54	PAIG 346 x JLA 794	73.00	1.10	-0.49	117.66	1.83	-1.14	123.23	0.85	-6.29	27.03	0.21	-2.55
55	PAIG 346 x Digvijay	72.83	0.84	0.30	117.66	1.10	0.59	119.83	1.49	-2.36	17.47	1.43	-2.06
56	PAIG 346 x G.Cot 23	73.83	1.37	0.02	118.66	-0.65	-0.15	116.56	0.84	-9.16	18.93	0.87	17.66*
	Check												
1	PKVDH 1	72.33	0.84	0.30	117.66	0.90	-0.77	104.83	1.01	-5.83	16.18	0.15	-2.58
2	PKV Suvarna	72.66	2.22	-0.68	118.00	0.21	-0.68	105.83	0.41	14.26	17.53	0.20	-2.61
3	NACH 12	74.66	0.54	-0.11	119.16	0.69	-1.16	109.13	0.76	4.57	18.53	0.29*	-2.68
4	PA 255	72.83	0.27	-0.55	119.00	-0.21	-0.68	107.13	1.20	3.86	18.00	0.18	-2.58
	Population Mean	72.20			117.40			108.80			19.13		
	S.E. (m)±	0.52			0.70			1.4			1.46		

Table.1 (Contd...)

Sr. No.	Genotype	Number of bolls /plant			Boll weight (g)			Seed cotton yield/plant (g)			Seed index (g)		
		Mean	Bi	S ² di	Mean	Bi	S ² di	Mean	Bi	S ² di	Mean	Bi	S ² di
	Lines												
1	PA 801	23.50	0.95	-3.75	2.62	2.63	-0.0018	54.47	0.83*	-14.70	5.91	0.57	-0.0208
2	PA 740	24.00	-0.20*	-3.83	2.69	1.89	-0.0024	52.15	0.49	-8.59	5.97	-0.51	-0.0124
3	PA 812	26.67	0.13	-3.76	2.56	1.80	-0.0026	60.88	0.18*	-14.60	6.10	1.12	-0.0077
4	PA 809	25.60	1.01	-3.80	2.66	1.97	-0.0012	58.30	0.67	-14.66	6.40	-1.75	-0.0215
5	PA 785	24.23	0.78	-3.83	2.61	-2.46	-0.0026	60.67	0.70	-14.53	5.66	1.88	-0.0210
6	PA 832	21.87	0.76	-3.8	2.67	-0.49	-0.0006	52.25	0.71	-14.67	6.00	2.15	-0.0212
7	PAIG 346	23.60	0.73*	-3.84	2.73	-0.17	-0.0018	59.28	0.61*	-14.69	6.47	-0.53	-0.0087
	Testers												
1	AKA 8	24.33	0.63	-3.51	2.37	0.17	-0.0006	56.57	0.54*	-14.67	5.70	1.20	-0.0198
2	PhuleDhanwantary	19.33	0.30	-3.80	2.27	-0.81	0.0114*	39.30	0.42	-14.46	5.66	-0.13	-0.0113
3	CNA 449	21.93	0.48	-3.65	2.61	-1.96	0.0002	47.20	0.35	-14.24	6.46	-0.10	-0.0143
4	HD 514	25.90	0.26	-3.77	2.49	0.00	-0.0012	55.75	0.49	-14.06	5.44	0.47	-0.0159
5	DWDa 1402	22.47	0.51	-3.78	2.67	2.46	-0.0006	49.28	0.55*	-14.65	5.93	2.66	-0.0226
6	JLA 794	19.47	0.30	-3.79	2.37	0.17	-0.0026	47.43	0.44	-14.39	5.70	1.20	-0.0210
7	Digvijay	19.30	0.20	-2.84	2.27	-0.81	0.0042	34.38	0.34	-14.54	5.66	-0.13	-0.0183
8	G.Cot 23	18.10	0.59	-0.28	2.61	-1.96	0.0054	34.52	0.44	3.73	6.46	-0.10	-0.0204
	Crosses												
1	PA 801 x AKA 8	29.80	1.00	-1.34	2.72	2.62	-0.0028	71.03	1.49	-8.65	6.06	0.19	-0.0157
2	PA 801 x PhuleDhanwantary	22.93	1.30	-1.81	2.74	-0.33	-0.0022	55.40	1.64	-9.41	5.88	0.30	-0.0146
3	PA 801 x CNA 449	28.50	1.08	-2.27	2.87	4.75	0.0030	71.47	1.40	-12.28	6.85	-0.31	-0.0117
4	PA 801 x HD 514	33.47	0.95	-3.58	2.75	1.97	-0.0022	74.67	1.06	-13.68	5.96	2.15	-0.0209
5	PA 801 x DWDa 1402	28.97	1.57	-3.45	2.82	0.33	-0.0012	66.93	1.11	-13.11	6.26	-0.39	-0.0132
6	PA 801 x JLA 794	30.20	0.68	17.03*	2.80	1.47	0.0010	69.43	0.69	38.05	6.91	-0.27	-0.0211
7	PA 801 x Digvijay	20.87	1.85	0.83	2.64	-1.31	-0.0028	47.40	2.00	-13.67	6.43	9.27*	-0.0232
8	PA 801 x G.Cot 23	21.30	0.99	27.89**	2.68	1.48	-0.0026	49.13	0.83	59.68*	6.65	1.97	-0.0212
9	PA 740 x AKA 8	27.03	1.49	-2.77	2.66	2.30	-0.0028	60.33	1.65	-10.26	6.00	-3.12	-0.0111
10	PA 740 x PhuleDhanwantary	19.53	1.33	-2.11	2.68	-1.47	-0.0018	46.13	1.54	-13.10	5.93	2.25	-0.0186

Table.1 (Contd...)

Sr. No.	Genotype	Number of bolls /plant			Boll weight (g)			Seed cotton yield/plant (g)			Seed index (g)		
		Mean	Bi	S ² di	Mean	Bi	S ² di	Mean	Bi	S ² di	Mean	Bi	S ² di
11	PA 740 x CNA 449	25.63	1.46	-3.25	2.82	2.63	-0.0022	64.90	1.22	-13.28	6.98	5.11	0.0013
12	PA 740 x HD 514	30.43	0.54	10.87	2.72	1.80	-0.0026	68.58	0.46	56.09*	6.13	1.17	-0.0226
13	PA 740 x DWDa 1402	27.27	1.29	-2.37	2.86	-0.66	0.0010	64.80	1.15	-13.41	6.68	-0.10	-0.0143
14	PA 740 x JLA 794	21.90	0.84	11.04	2.89	2.29	-0.0012	53.70	0.77	63.50*	7.11	0.21	-0.0166
15	PA 740 x Digvijay	27.53	1.57	-2.67	2.98	0.49	-0.0018	65.73	1.21	-10.82	7.03	0.07	0.0025
16	PA 740 x G.Cot 23	26.47	1.62	-1.88	2.88	-0.16	0.0010	60.83	1.51	-5.12	6.81	0.17	-0.0178
17	PA 812 x AKA 8	28.63	1.49	-2.77	2.71	-1.97	-0.0022	70.43	1.29	-13.34	6.36	2.14	-0.0217
18	PA 812 x PhuleDhanwantary	23.73	1.49	-2.77	2.63	-4.76	-0.0026	51.60	1.46	-8.98	6.06	-1.29	0.0455
19	PA 812 x CNA 449	29.03	0.90	18.93*	2.77	2.46	-0.0006	68.87	0.67	22.87	6.88	2.57	0.0153
20	PA 812 x HD 514	30.30	-0.25	10.22	2.68	1.97	-0.0022	69.70	0.35	11.63	6.67	3.66	-0.0229
21	PA 812 x DWDa 1402	25.30	1.43	-2.06	2.80	-2.95	-0.0012	63.18	1.18	-14.43	6.51	2.40	-0.0222
22	PA 812 x JLA 794	25.80	1.08	12.88*	2.80	2.13	0.0030	63.83	1.02	81.68*	6.95	7.24	-0.0188
23	PA 812 x Digvijay	24.20	1.62	-2.10	2.76	14.26*	-0.0030	55.07	1.57	-2.05	6.77	-7.31	-0.0187
24	PA 812 x G.Cot 23	25.13	0.99	24.67**	2.67	-2.46	-0.0018	60.57	0.87	73.93*	6.60	2.17	-0.0215
25	PA 809 x AKA 8	36.60	0.22	3.65	2.71	4.18	-0.0020	84.50	0.44	-14.44	6.50	1.32	-0.0212
26	PA 809 x PhuleDhanwantary	24.00	1.66	-2.90	2.66	-1.80	-0.0026	55.72	1.62	-3.40	6.24	-0.47	-0.0146
27	PA 809 x CNA 449	33.43	1.22	-3.78	2.81	1.97	-0.0022	73.97	0.48*	-14.64	7.19	1.99	-0.0205
28	PA 809 x HD 514	30.23	1.25	-3.04	2.74	1.97	-0.0028	65.23	1.12	-14.42	6.46	11.65*	-0.0224
29	PA 809 x DWDa 1402	27.87	1.35	-1.97	2.85	2.95	-0.0022	68.53	1.57	-12.70	6.77	-2.04	0.160**
30	PA 809 x JLA 794	29.30	1.50	-2.28	2.91	2.95	-0.0022	70.50	1.42	-2.63	7.17	-1.90	-0.0115
31	PA 809 x Digvijay	21.93	1.24	15.95*	2.687	1.80	-0.0030	53.67	2.32	-9.24	6.37	2.28	-0.0199
32	PA 809 x G.Cot 23	28.27	1.64	-3.55	2.82	-0.01	0.0042	60.88	1.59	-2.20	5.95	2.60	-0.0200
33	PA 785 x AKA 8	29.50	1.31	-3.05	2.64	0.49	0.0010	68.53	1.13	-7.72	6.35	1.07	-0.0181
34	PA 785 x PhuleDhanwantary	28.50	1.42	-2.40	2.66	4.58	0.0020	62.60	1.14	-12.48	6.09	2.37	-0.0200
35	PA 785 x CNA 449	34.57	1.17	-3.69	2.80	2.30	-0.0012	79.43	1.16	-14.07	6.56	0.17	-0.0128
36	PA 785 x HD 514	23.87	1.64	-1.06	2.72	-2.46	-0.0018	57.22	1.45	-7.98	5.96	-2.94	0.0531
37	PA 785 x DWDa 1402	26.43	1.64	-0.79	2.717	2.29	-0.0022	62.62	1.68	-4.32	5.87	0.26	-0.0101
38	PA 785 x JLA 794	28.77	1.01	20.30*	2.81	5.24	0.0002	65.87	1.17	138.11**	6.60	-0.20	-0.0131
39	PA 785 x Digvijay	23.43	0.88	11.48*	2.56	0.49	-0.0018	56.10	1.04	84.50*	6.50	-5.11	-0.0165
40	PA 785 x G.Cot 23	23.75	1.48	0.11	2.77	-2.63	-0.0012	54.97	1.92	4.35	6.31	-6.58	0.0586

Table.1 (Contd...)

Sr. No.	Genotype	Number of bolls /plant			Boll weight (g)			Seed cotton yield/plant (g)			Seed index (g)		
		Mean	Bi	S ² di	Mean	Bi	S ² di	Mean	Bi	S ² di	Mean	Bi	S ² di
41	PA 832 x AKA 8	24.63	0.69	11.37*	2.66	2.79	-0.0018	52.77	0.73	26.86	6.37	-0.99	-0.0218
42	PA 832 x PhuleDhanwantary	19.90	0.71	16.57*	2.54	-0.75	0.0075	44.97	0.42	26.01	5.90	3.77	0.0106
43	PA 832 x CNA 449	29.08	0.98	-3.85	2.81	-0.50	0.0082	70.57	0.55	-12.34	6.76	-0.17	-0.0156
44	PA 832 x HD 514	21.47	1.30	-1.32	2.61	-0.01	0.0020	51.73	1.22	-8.57	6.15	2.76	-0.0212
45	PA 832 x DWDa 1402	25.70	1.30	-1.57	2.83	0.82	-0.0006	57.00	1.30	-13.09	6.52	2.30	-0.0210
46	PA 832 x JLA 794	27.50	1.24	-2.02	2.81	1.15	-0.0018	62.40	1.32	-10.09	7.28	2.97	-0.0220
47	PA 832 x Digvijay	17.47	1.13	-1.62	2.60	-0.16	-0.0018	43.57	1.38	-3.98	6.26	0.44	-0.0103
48	PA 832 x G.Cot 23	22.37	1.04	21.38*	2.78	-2.30	-0.0022	49.47	1.06	59.73*	6.73	2.69	-0.0174
49	PAIG 346 x AKA 8	32.00	0.86	-3.78	2.71	1.80	-0.0026	74.90	0.85	-14.45	6.56	-0.19	0.0048
50	PAIG 346 x PhuleDhanwantary	23.23	1.61	-3.71	2.64	2.79	-0.0018	51.50	0.83	-14.33	5.93	2.94	-0.0195
51	PAIG 346 x CNA 449	31.90	1.41	-3.64	2.95	1.31	-0.0028	78.50	0.98	-14.56	7.20	0.00	0.0046
52	PAIG 346 x HD 514	31.53	1.39	-3.78	2.78	0.32	0.0042	77.17	1.41	-12.62	6.36	0.04	-0.0178
53	PAIG 346 x DWDa 1402	35.73	1.07	0.96	2.81	-1.80	-0.0030	84.80	1.20	-9.49	7.01	2.49	-0.0193
54	PAIG 346 x JLA 794	34.63	0.76	-2.87	2.90	3.11	-0.0030	85.00	1.01	-14.12	7.40	-0.90	-0.0217
55	PAIG 346 x Digvijay	19.57	1.35	-1.97	2.85	8.03	-0.0026	45.13	1.79	-5.89	6.32	7.79*	-0.0228
56	PAIG 346 x G.Cot 23	23.00	0.67	34.99**	2.86	0.16	0.0054	53.80	0.41	163.28**	7.03	2.06	-0.0229
	Check												
1	PKVDH 1	23.83	0.28	-3.41	2.37	1.31	-0.0028	57.53	0.34*	-14.68	5.73	0.93	-0.0207
2	PKV Suvarna	24.63	0.14	-3.60	2.54	-1.97	-0.0022	63.80	0.14	-14.32	6.05	-0.30	-0.0175
3	NACH 12	26.00	0.11	-2.72	2.69	2.79	-0.0018	66.50	0.41	-14.57	6.09	3.29	-0.0229
4	PA 255	22.90	0.60	-3.26	2.63	1.80	-0.0026	60.52	0.51	-14.43	6.19	-1.92	-0.0220
	Population Mean	25.89			2.72			60.37			6.41		
	S.E. (m)±	1.63			0.03			2.97			0.07		

Table.1 (Contd...)

Sr. No.	Genotype	Lint index (g)			Harvest index (%)			Ginning percentage (%)			Days to maturity		
		Mean	Bi	S ² di	Mean	Bi	S ² di	Mean	Bi	S ² di	Mean	Bi	S ² di
	Lines												
1	PA 801	3.53	1.85	-0.004	35.37	0.81	-1.34	36.65	2.21	-0.64	155.83	1.52	-0.82
2	PA 740	3.60	1.46	-0.006	34.86	0.37	-1.18	36.73	1.45	-0.40	158.16	0.81	-1.40
3	PA 812	3.43	2.56	-0.007	36.78	0.73	-1.28	34.74	-2.68	-0.50	156.33	0.35	-1.27
4	PA 809	3.54	2.56	-0.007	36.28	0.72	-1.31	36.44	0.78	-0.66	157.33	1.73	-0.99
5	PA 785	3.53	0.26	-0.007	35.69	0.64	-1.35	35.94	3.20	-0.65	158.33	1.62	-1.40
6	PA 832	3.44	1.46	-0.006	34.47	0.46*	-1.35	34.79	1.80	-0.62	157.16	0.81	-1.40
7	PAIG 346	3.68	1.59	-0.006	35.65	0.19	-1.28	35.98	2.61	-0.54	158.00	1.16	-1.25
	Testers												
1	AKA 8	3.69	0.46	-0.005	35.21	0.64	-1.29	37.34	0.82	-0.13	155.50	1.16	-1.25
2	PhuleDhanwantary	3.43	1.53	-0.006	33.70	0.53*	-1.35	35.71	0.96	-0.62	156.50	1.27	-1.31
3	CNA 449	3.59	0.79	-0.005	35.31	0.58	-1.32	35.88	-0.92	-0.65	158.16	3.24	-1.39
4	HD 514	3.73	0.79	-0.005	35.52	0.64	-1.28	37.54	-1.15	0.34	156.00	1.16	-1.25
5	DWDa 1402	3.58	1.19	-0.007	36.24	0.41	-1.33	35.33	-1.96	-0.46	156.16	2.08	-1.33
6	JLA 794	3.56	1.79	-0.007	35.95	0.51	-1.16	36.26	-1.48	-0.65	157.33	-0.70	-0.86
7	Digvijay	3.69	-2.44	-0.007	33.18	0.43	-1.33	36.66	3.21	-0.66	169.00	2.54	-1.03
8	G.Cot 23	3.88	0.00*	-0.007	31.76	0.20	-1.27	36.75	0.79	-0.60	167.33	1.62	-1.40
	Crosses												
1	PA 801 x AKA 8	3.90	-3.44*	-0.007	37.57	0.07	-0.86	38.63	0.46	-0.55	150.66	2.08	-1.33
2	PA 801 x PhuleDhanwantary	3.65	1.68	-0.004	36.01	0.84	-0.75	37.56	5.00	-0.50	154.50	2.43	-1.40
3	PA 801 x CNA 449	3.68	1.74	-0.007	39.30	1.74	-0.71	37.37	-3.79	0.12	158.00	2.22	0.85
4	PA 801 x HD 514	3.89	1.12	-0.003	41.37	2.34	-0.01	38.35	-1.50	-0.54	154.00	1.16	-1.25
5	PA 801 x DWDa 1402	3.64	-0.52	-0.005	37.82	0.95	-1.25	36.93	2.45	-0.63	153.66	2.29	1.44
6	PA 801 x JLA 794	3.65	2.57	-0.006	38.87	0.95	-1.32	35.57	-2.90	-0.66	158.33	1.52	-0.82
7	PA 801 x Digvijay	3.69	2.96	-0.007	35.74	1.30	-0.69	36.68	-1.94	-0.49	163.83	1.62	-1.40
8	PA 801 x G.Cot 23	3.91	-0.22	-0.007	35.96	1.47	-1.10	37.69	-2.74	-0.45	164.33	2.78	-1.19
9	PA 740 x AKA 8	3.65	0.47	-0.006	37.44	1.67	-0.66	39.98	3.53	-0.35	155.33	0.46	-1.29
10	PA 740 x PhuleDhanwantary	3.69	-0.45	-0.005	36.44	1.09	-1.11	38.01	-2.57	-0.67	157.00	1.16	-1.25

Table.1 (Contd...)

Sr. No.	Genotype	Lint index (g)			Harvest index (%)			Ginning percentage (%)			Days to maturity		
		Mean	Bi	S ² di	Mean	Bi	S ² di	Mean	Bi	S ² di	Mean	Bi	S ² di
11	PA 740 x CNA 449	3.69	-0.15	-0.007	38.38	0.59	-1.11	37.60	-1.52	-0.57	157.33	1.52	-0.82
12	PA 740 x HD 514	3.85	-0.84	-0.006	40.07	1.21	-0.19	40.23	-1.00	-0.67	153.66	2.19	-0.44
13	PA 740 x DWDa 1402	3.59	0.97	-0.007	38.59	1.15	-1.32	36.81	-2.59	-0.51	155.50	1.37	-0.38
14	PA 740 x JLA 794	3.72	0.36	-0.005	37.37	1.42*	-1.35	36.50	-2.51	-0.64	156.16	2.08	-1.33
15	PA 740 x Digvijay	3.83	-0.25	-0.007	40.46	0.82	-1.34	38.13	1.25	-0.19	159.33	2.89	-1.34
16	PA 740 x G.Cot 23	3.86	1.23	-0.007	39.56	2.18	-1.12	37.46	0.88	-0.31	158.33	0.25	-0.25
17	PA 812 x AKA 8	3.60	0.72	-0.006	39.33	1.81	-1.33	38.59	2.69	-0.10	153.33	0.25	-0.25
18	PA 812 x PhuleDhanwantary	3.73	3.83	-0.006	37.37	0.79	-1.33	37.75	4.34	-0.19	154.33	0.56	-0.32
19	PA 812 x CNA 449	3.63	0.79	-0.005	38.60	0.60	-1.35	36.37	0.61	-0.66	155.50	1.37	-0.38
20	PA 812 x HD 514	4.11	-3.92	-0.007	39.28	0.48*	-1.35	37.69	1.62	-0.43	152.00	2.43	-1.40
21	PA 812 x DWDa 1402	3.65	-2.04	-0.007	37.95	0.96	-1.20	35.60	0.70	-0.61	155.33	0.46	-1.29
22	PA 812 x JLA 794	3.84	0.49	-0.007	37.82	-0.22	-1.17	37.63	-0.09	-0.57	156.33	1.83	0.42
23	PA 812 x Digvijay	3.64	1.46	-0.006	36.47	0.58	-0.71	37.14	2.73	-0.67	155.50	2.54	-1.03
24	PA 812 x G.Cot 23	3.83	1.36	-0.004	35.37	1.10	-1.10	37.24	2.38	-0.58	158.66	-0.56	-0.32
25	PA 809 x AKA 8	3.81	2.92	-0.005	43.73	1.32	-1.31	38.79	4.16	-0.55	155.83	0.46	-1.29
26	PA 809 x PhuleDhanwantary	3.71	-0.63	-0.007	36.33	1.13	-1.30	37.79	3.11	0.01	155.16	2.40	4.31*
27	PA 809 x CNA 449	3.58	-2.11	-0.007	42.13	0.91	1.09	37.31	-0.07	0.51	159.66	0.60	0.67
28	PA 809 x HD 514	3.89	2.86	-0.007	37.38	0.93	-1.33	39.27	1.30	-0.47	154.00	-3.59	-1.16
29	PA 809 x DWDa 1402	3.61	0.97	-0.007	38.49	1.51	-0.96	37.83	-5.09	-0.58	154.33	-4.51*	-1.37
30	PA 809 x JLA 794	3.64	-0.54	-0.006	39.78	0.87	0.10	39.44	-1.12	-0.41	156.66	1.97	-1.22
31	PA 809 x Digvijay	3.70	1.20	-0.005	36.52	1.58	0.84	36.92	-2.64	-0.46	159.00	4.76	-0.61
32	PA 809 x G.Cot 23	3.73	1.53	-0.004	38.07	2.10	-1.25	38.33	1.88	-0.63	158.66	3.35	-1.07
33	PA 785 x AKA 8	3.84	-2.94	-0.007	38.90	1.23	-1.34	39.87	1.36	-0.41	153.16	0.70	-0.86
34	PA 785 x PhuleDhanwantary	3.68	1.17	-0.007	37.05	0.64	-1.33	37.36	2.11	-0.65	156.50	1.16	-1.25
35	PA 785 x CNA 449	3.89	15.80**	0.075	42.64	1.06	1.68	38.83	9.59	-0.29	157.33	2.68	-0.05
36	PA 785 x HD 514	3.85	-0.47	-0.006	37.16	1.57	-1.26	39.03	0.68	0.80	154.16	0.92	-0.95
37	PA 785 x DWDa 1402	3.58	2.81	-0.006	38.16	0.72	-1.34	34.27	2.61	-0.66	157.00	1.27	-1.31
38	PA 785 x JLA 794	3.73	1.70	-0.006	38.21	1.74	-1.07	36.58	-1.42	-0.54	159.83	-0.81*	-1.40
39	PA 785 x Digvijay	3.69	-1.93	-0.005	35.92	1.22	-0.80	36.31	6.79	-0.64	156.83	-0.70	-0.86
40	PA 785 x G.Cot 23	3.80	0.36	-0.005	36.61	0.93	-0.80	38.28	0.23	-0.48	156.50	3.49	0.03

Table.1 (Contd...)

Sr. No.	Genotype	Lint index (g)			Harvest index (%)			Ginning percentage (%)			Days to maturity		
		Mean	Bi	S ² di	Mean	Bi	S ² di	Mean	Bi	S ² di	Mean	Bi	S ² di
41	PA 832 x AKA 8	3.70	2.98	-0.002	36.58	0.99	-0.89	37.41	2.89	-0.56	152.83	0.35	-1.27
42	PA 832 x PhuleDhanwantary	3.52	2.60	-0.006	35.57	0.83	-1.34	36.77	1.40	-0.53	155.00	0.00*	-1.40
43	PA 832 x CNA 449	3.65	1.60	-0.004	41.60	3.09	-0.32	35.46	3.47	-0.65	156.00	2.43	-1.40
44	PA 832 x HD 514	3.72	2.77	-0.006	37.14	0.99	-1.17	38.97	3.12	-0.57	151.83	5.22	-1.10
45	PA 832 x DWDa 1402	3.61	2.96	-0.005	37.32	1.15	-1.34	36.16	4.41	-0.64	155.00	0.21	0.58
46	PA 832 x JLA 794	3.61	1.03	-0.004	37.68	0.97	-0.72	35.92	3.77	-0.19	156.00	2.43	-1.40
47	PA 832 x Digvijay	3.65	-0.86	-0.005	35.49	0.84	-1.35	37.42	2.57	-0.59	157.00	-3.59	-1.16
48	PA 832 x G.Cot 23	3.69	1.05	-0.006	34.62	-0.21	-1.29	38.35	3.11	0.87	159.83	-3.35	-1.07
49	PAIG 346 x AKA 8	3.78	0.95	-0.004	41.58	1.82	-0.67	37.35	0.82	-0.65	155.33	-0.70	-0.86
50	PAIG 346 x PhuleDhanwantary	3.71	3.16	-0.005	36.81	0.81	-1.34	38.52	1.92	-0.62	156.16	0.81	-1.40
51	PAIG 346 x CNA 449	3.70	0.26	-0.007	42.08	1.68	-1.12	37.02	-0.04	-0.58	159.83	0.25	-0.25
52	PAIG 346 x HD 514	4.03	1.74	-0.007	42.18	1.64	0.46	41.75	-2.75	-0.28	155.66	-0.46	-1.29
53	PAIG 346 x DWDa 1402	3.82	1.94	-0.005	43.35	1.68	-1.23	38.58	4.60	-0.63	155.00	1.27	-1.31
54	PAIG 346 x JLA 794	3.77	0.47	-0.006	43.41	1.51	-1.18	39.12	2.64	0.17	156.16	-0.35	-1.27
55	PAIG 346 x Digvijay	3.79	0.41	-0.007	37.29	1.77	-1.28	35.31	1.16	-0.41	158.33	-0.81*	-1.40
56	PAIG 346 x G.Cot 23	3.77	-1.81	-0.007	36.98	1.07	-1.02	36.94	2.83	-0.23	158.83	-4.51*	-1.37
	Check												
1	PKVDH 1	3.60	3.60	-0.007	35.70	-0.06	-1.17	37.64	-1.68	-0.55	157.66	-0.35	-1.27
2	PKV Suvarna	3.50	0.68	-0.006	36.67	0.58	-1.34	35.87	1.46	-0.61	158.83	1.73	-0.99
3	NACH 12	3.74	2.42	-0.004	37.14	0.27*	-1.35	37.66	0.17	-0.64	158.83	1.52	-0.82
4	PA 255	3.54	-1.12	-0.006	35.87	0.41	-1.24	36.00	-0.69	-0.56	159.33	1.52	-0.82
	Population Mean	3.70			37.62			37.31			156.90		
	S.E. (m)±	0.034			0.42			0.34			0.50		

Among them PAIG 346 x JLA 794 was widely stable followed by PAIG 346 x DWDa 1402, PA 785 x CNA 449, PAIG 346 x CNA 449, PAIG 346 x HD 514 and PA 801 x HD 514. These crosses possessed by value greater than unity indicated their high response towards elevated environmental quality for crop growth. Among all the characters, days to maturity was the highly stable character as twelve parents and twenty four crosses found to be highly stable across the environments. It was followed by harvest index and days to 50 % flowering where ten and nine parents each showed stability across the environments.

The lowest stability was observed for lint index followed by seed cotton yield per plant. In general fibre parameters remain least affected by environment than yield contributing and earliness traits. For remaining characters eight parents showed stability for ginning percentage. Seven parents each observed stable for days to 50 % boll bursting, plant height, number of sympodia per plant and boll weight. Six parents each found stable for number of bolls per plant and seed index. Similar findings were also reported by Chahal *et al.*, (2001), Shashibhushan and Patel (2003), Nirani *et al.*, (2004), Pund and Dev (2006), Khan *et al.*, (2008), Gumber *et al.*, (2009), Deshmukh and Deosarkar (2015) and Balkrishna *et al.*, (2016).

Among the crosses, thirty seven crosses found stable for plant height, twenty seven for boll weight, twenty five crosses for seed index, twenty four each for number of bolls per plant and days to maturity, twenty three each for days to 50% flowering and number of sympodia per plant, twenty two for seed cotton yield per plant, twenty one for harvest index, nineteen for lint index and eighteen for days to 50% boll bursting. Among the crosses, PAIG 346 x JLA 794, PAIG 346 x DWDa 1402, PA 785 x CNA 449, PAIG 346 x CNA

449, PAIG 346 x HD 514 and PA 801 x HD 514 were identified as best combinations for stability which have also responded well to favourable environments. Their stable performance was partly attributed to the highly stable nature of their parents in the said environments, stability of the yield contributing traits for which they were observed and their individual buffering capabilities.

The data of the present study revealed that the hybrids had higher mean value for seed cotton yield than the parents. Similarly, regression coefficients for hybrids were superior to parents. Thus, in the present study hybrids exhibited superiority over parents for stability. These results are in agreement with the earlier findings Shashibhushan and Patel (2003), Patel and Patel (2006), Pund and Dev (2006), Khan *et al.*, (2008), Singh *et al.*, (2014), Balkrishna *et al.*, (2016) and Patil *et al.*, (2017).

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