RESEARCH PAPER
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Heterosis in GMS based diplod cotton hybrids for fibre quality traits

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Total of nine hybrids developed through genetic male sterility system were evaluated to estimate the manifestation of heterosis for fibre quality traits *viz.,* staple length, fibre strength, fibre fineness, elongation and uniformity. Out of nine F_1 hybrids evaluated, cross MSD 7 nor x RAhS-14 was found superior for fibre length. Cross MSD 7 nor x DDhc 11exhibited higher magnitude of heterosis for fibre strength and fibre elongation over mid parent and better parent. For fibre uniformity ratio, hybrid MSD 7 nkd x Jayadhar was found promising.

Key words : Genetic male sterility, Heterosis, Fibre quality

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INTRODUCTION

Cotton is an important cash crop of the world. It is popularly known as "white gold". Out of the four cultivated species *viz.*, *Gossypium hirsutum* L. and*G. barbadense* L. are tetraploids (2n = 4x = 52) and commonly called as the new world cottons, whereas *G. arboreum* L. and *G. herbaceum* L. are diploids (2n = 2x = 26) and are commonly called as old world or Asiatic cotton, popularly referred to as desi cottons in India. Cotton being an often cross pollinated crop, is amenable for heterosis breeding and among the breeding procedures, heterosis breeding is mainly responsible for increased production of cotton. The area under diploid cotton is decreasing despite their special features *viz.,* tolerant to drought and resistance to biotic stresses. This is mainly because of uneconomical hybrid seed production due to low boll setting through conventional method of hybrid seed production. Therefore, genetic male sterility was thought to be the best, economical and alternative method for hybrid seed production technique in cotton and especially in diploid cotton to realize higher yields as it avoids the laborious process of emasculation. Apart from easy hybrid seed production, the hybrid seed produced through male sterility is going to have high genetic purity. Genetic male sterility (GMS) in diploid cotton is under the control of single recessive allele ams_1 (Singh and Kumar, 1993). In this present investigation magnitude of heterosis was worked out for fibre quality traits in diploid cotton hybrids developed using genetic male sterility.

RESEARCH METHODOLOGY

Total of nine diploid cotton hybrids based on GMS system along with parents and standard *G. herbaceum* varietal check Jayadhar were tested at Main Agricultural Research Station, Dharwad during *Kharif* 2009-10. The experiment was conducted in Randomized Block Design, replicated thrice with a spacing 90 cm between rows and 60 cm between plants. The data were recorded on five randomly selected samples from each treatment and replication for fibre quality traits *viz.,* fibre length, fibre strength, micronaire value, uniformity ratio and fibre elongation. Data were analyzed using standard statistical software to work out the magnitude of heterosis expressed by the hybrids under evaluation over mid parent, better parent and standard check. Heterosis was expressed as per cent increase or decrease.

RESEARCH FINDINGS AND ANALYSIS

The analysis of variance revealed that the parents and hybrids had significant differences for all the characters under study. The per cent of heterosis realized is presented in Table 1. The results indicated that the magnitude of heterosis varied with the characters.

2.5 % span length:

The range of heterosis for span length over mid parent was from -13.97 (MSD 7 nkd x Jayadhar) to 18.94 per cent

Table 1: Percentage heterosis for fibre quality traits over mid parent (MPH), better parent (BPH) and check (Jayadhar)

Sr. No.	Crosses	2.5 % span length (mm)			Fibre strength (g/tex)			Micronaire (µg/inch)		
		MPH	BPH	Jayadhar	MPH	BPH	Jayadhar	MPH	BPH	Jayadhar
1.	MSD 7 nor × ARBH-35 (a x a)	2.64	0.40	2.85	19.83**	10.20**	11.92**	-11.23**	18.57**	18.57**
2.	MSD 7 nor × DDhc 11 (a x h)	5.25*	1.87	-0.20	37.20**	36.78**	16.58**	-16.96**	-13.08**	32.86**
3.	MSD 7 nor × Jayadhar (a x h)	3.08	2.03	2.03	0.70	-6.74*	-6.74*	10.16*	47.14**	47.14**
4.	MSD 7 nor × RAhS-14 (a x h)	18.94**	16.60**	14.23**	16.37**	12.11**	3.11	-9.43*	1.05	37.14**
5.	MSD 7 nkd × DLSa-102 (a x a)	-8.82**	-8.82**	-5.49*	-3.49	-4.01	-6.99**	-9.57**	-5.45	48.57**
6.	MSD 7 nkd × Jayadhar (a x h)	-13.97**	-15.49**	-12.40**	-21.84**	-23.06**	-23.06**	38.95**	88.57**	88.57**
7.	MSD 10 × RAhS-14 (a x h)	7.96**	2.32	7.52**	9.97**	2.95	8.55**	5.77	15.79**	57.14**
8.	MSD 11 × DLSa-102 (a x a)	-13.13**	-13.73**	-10.57**	-3.99	-5.68*	-9.59**	-3.74	-0.96	47.14**
9.	MSD 11 × ARBH-35 (a x a)	4.87*	4.76	7.32**	-3.07	-7.40**	-5.96*	22.99**	52.86**	52.86**
	S.E. ±	0.56	0.64	0.64	0.42	0.49	0.49	0.19	0.22	0.22
	C.D. (P=0.05)	1.12	1.30	1.30	0.86	0.99	0.99	0.38	0.44	0.44
	C.D. (P=0.01)	1.50	1.73	1.73	1.14	1.32	1.32	0.50	0.58	0.58

Table 1 Contd…..

Sr. No.	Crosses	Uniformity ratio (%)			Fibre elongation (%)		
		MPH	BPH	Jayadhar	MPH	BPH	Jayadhar
1.	MSD 7 nor × ARBH-35 (a x a)	-1.51	-5.77**	0.00	5.88**	4.46**	8.33**
2.	MSD 7 nor × DDhc 11 (a x h)	0.51	-2.94*	1.02	21.00**	10.00**	12.04**
3.	MSD 7 nor × Jayadhar (a x h)	5.21**	3.06*	3.06*	-4.15**	-5.45**	-3.70*
4.	MSD 7 nor × RAhS-14 (a x h)	1.04	-1.02	-1.02	3.23*	1.82	3.70*
5.	MSD 7 nkd × DLSa-102 (a x a)	3.00*	3.00*	5.10**	0.00	-1.79	1.85
6.	MSD 7 nkd × Jayadhar (a x h)	8.08**	4.90**	9.18**	-5.02**	-7.14**	-3.70*
7.	MSD 10 × RAhS-14 (a x h)	5.53**	2.94*	7.14**	-1.38	-2.73	-0.93
8.	MSD 11 × DLSa-102 (a x a)	8.25**	5.00**	7.14**	2.26	0.89	4.63**
9.	MSD 11 × ARBH-35 (a x a)	-2.51*	-6.73**	-1.02	1.79	1.79	5.56**
	S.E. ±	0.56	0.65	0.65	0.07	0.08	0.08
	C.D. (P=0.05)	1.13	1.31	1.31	0.14	0.16	0.16
	C.D. (P=0.01)	1.51	1.74	1.74	0.19	0.22	0.22

* and ** indicate significance of values at P=0.05 and P=0.01, respectively.

(MSD 7 nor x RAhS-14), four hybrids showed significant mid parent heterosis in desirable direction. The range of heterosis over better parent was from -15.49 to 16.60 per cent and only one cross, MSD 7 nor x RAhS-14 showed highly significant heterobeltiosis. The heterosis over commercial check Jayadhar ranged from -12.40 to 14.23 per cent and three hybrids (MSD 7 nor x RAhS-14, MSD 10 x RAhS-14 and MSD 11 x ARBH-35) had significant positive standard heterosis. These findings are in agreement with those of Patel *et al.* (2007).

Fibre strength:

The range of heterosis over mid parent was from -21.84 (MSD 7 nkd x Jayadhar) to 37.20 per cent (MSD 7 nor x DDhc-11), four hybrids (MSD 7 nor x ARBH-35, MSD 7 nor x DDhc-11, MSD 7 nor x RAhS-14 and MSD 10 x RAhS-14) showed significant positive mid parent heterosis. The range of heterosis over better parent was from -23.06 to 36.78 per cent and three hybrids (MSD 7 nor x ARBH-35, MSD 7 nor x DDhc-11 and MSD 7 nor x RAhS-14) had highly significant heterobeltiosis. The range of heterosis over Jayadhar was from -23.06 to 16.58 per cent. Three crosses (MSD 7 nor x ARBH-35, MSD 7 nor x DDhc-11 and MSD 10 x RAhS-14) exhibited significant useful heterosis. The results are in conformity with those of Karande *et al.* (2004) and Tuteja *et al.* (2005).

Micronaire value:

Four hybrids (MSD 7 nor x ARBH-35, MSD 7 nor x DDhc-11, MSD 7 nor x RAhS-14 and MSD 7 nkd x DLSa-102) displayed significant mid parent heterosis in desirable (negative) direction with range from -16.96 to 38.95 per cent. The range of heterosis over better parent was from -13.08 to 88.57 per cent and only one cross (MSD 7 nor x DDhc-11) exhibited significant heterosis in negative direction. None of the hybrids showed heterosis in desirable (negative) direction over the check Jayadhar. Similar results have been noticed by Tuteja *et al.* (2000 and 2005).

Uniformity ratio:

The range of heterosis over mid and better parent was from -2.51 (MSD 11 x ARBH-35) to 8.25 per cent (MSD 11 x DLSa-102) and from -6.73 (MSD 11 x ARBH-35) to 5.00 per cent (MSD 11 x DLSa-102), respectively. A total of five crosses showed significant positive heterosis over both the mid parent and better parent. Four crosses (MSD 7 nkd x DLSa-102, MSD 7 nkd x Jayadhar, MSD 10 x RAhS-14 and MSD 11 x DLSa-102) at 1 per cent level and one cross (MSD 7 nor x Jayadhar) at 5 per cent level of significance exhibited the standard heterosis over the check Jayadhar with a range from -1.02 (MSD 11 x ARBH-35 and MSD 7 nor x RAhS-14) to 9.18 per cent (MSD 7 nkd x Jayadhar). The findings are in accordance with the reports of Tuteja *et al.* (2005) and Patel *et al.* (2007).

Fibre elongation:

The mid parent heterosis ranged from -5.02 to 21.00 per cent and three crosses (MSD 7 nor x ARBH-35, MSD 7 nor x DDhc-11 and MSD 7 nor x RAhS-14) showed significant positive heterosis over mid parent. The range of heterosis over better parent ranged from -7.14 to 10.00 per cent and only two crosses (MSD 7 nor x ARBH-35, and MSD 7 nor x DDhc-11) had significant positive heterobeltiosis. The range of heterosis over Jayadhar was from -3.70 to 12.04 per cent. Four crosses (MSD 7 nor x ARBH-35, MSD 7 nor x DDhc, MSD 11 x DLSa-102 and MSD 11 x ARBH-35) at 1 per cent level and one cross MSD 7 nor x RAhS-14 at 5 per cent level of significance showed useful heterosis in positive direction. The results were akin to the reports of Thangaraj *et al.* (2002).

Conclusion:

From the present investigation the crosses MSD 7 nor x RAhS-14 for fibre length, MSD 7 nor x DDhc 11 for fibre strength and fibre elongation and MSD 7 nkd x Jayadhar for uniformity ratio were found promising.

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