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Research Article

HETEROSIS IN CMS-R BASED INTRA HIRSUTUM COTTON HYBRIDS FOR SEED COTTON YIELD AND FIBER QUALITY TRAITS

GHEVARIYA C.B.[1], FALDU G.O.[2], SOLANKI B.G.[2] AND VIRADIYA Y.A.[1*]

[1]Department of Genetics and Plant breeding, N. M. College of Agriculture, Navsari Agricultural University, Navsari, Gujarat 396445
[2]Main Cotton Research Station, Surat, Navsari Agricultural University, Navsari, Gujarat 396445
*Corresponding Author: Email-yagneshnau@gmail.com

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Abstract- A line x tester crossing programme was taken up with seven lines and five testers with a view to obtain best heterotic crosses for seed cotton yield along with fiber quality traits. The Crosses *viz.* ,combinations GSHV-97/13 x AKH-7859, 4384 x AKH-076R, 4384 x AKH-7859, GJHV-156 x AKH-03-8h and GSHV-97/443 x DR-8 showed highly significant and positive standard heterosis for seed cotton yield per plant. Twenty six and twenty nine hybrids showed significant and positive standard heterosis for span length and fiber strength. Nine hybrids for ginning percent, three hybrids for strength: length ratio and one hybrid GSCMS-10 x DR-16 for LUR exhibited significant and positive standard heterosis.

Keywords- *G. hirsutum* L., Heterosis, Seed cotton yield, Fiber quality

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Introduction

India is the pioneer in the world for commercial exploitation of heterosis in cotton. Hybrids had played significant role to attain self sufficiency in cotton production in India. Cotton production in India got momentum with the release of world's first commercial cotton hybrid, Hybrid-4 followed by the release of various high yielding hybrids [1].

Generally, main aim of heterosis breeding is increasing the yield but apart from seed cotton yield, the fiber is the economic plant product of cotton, hence, quality of fiber and its suitability for spinning is very important one for textile industries. In this present investigation magnitude of heterosis was worked out for seed cotton yield and fiber quality traits in intra-hirsutum cotton hybrids developed using CMS-R based system.

Materials and Methods

In present investigation, seven *G. harknessii* based CMS genotypes GJHV-156, 4384, LRK-516, GSHV-97/443, GSHV-97/13, GSHV-4093, and GSCMS-10 were used as line and five restorer lines AKH-03-8h, AKH-7859, DR-16, DR-8, and AKH-076R were used as tester. These parents were crossed in L x T mating design and a set of 35 crosses along with parents were tested against standard check PKV Hy-4.

The trial was conducted at Main Cotton Research Station, Navsari Agricultural University-Surat during year 2015-16. The trial was laid out in randomized block design, replicated thrice with a spacing of 120 x 45 cm between row to row and plant to plant. Five plants were selected randomly from each plot to record the observations on seed cotton yield per plant(g).All the samples were ginned in laboratory for estimation of ginning percentage and analyzed for fiber traits *viz.*,2.5 % span length(mm), fiber Strength (gtex^{-1}), fiber maturity co-efficient, fiber fineness (mv), fiber strength/length ration and length uniformity ratio.

Results and Discussion

The ANOVA revealed that the mean squares due to genotypes were significant for all the characters except fiber maturity coefficient indicating the variability in experimental materials. Mean squares due to crosses were significant for all the characters except fiber maturity coefficient and mean squares due to parents *vs.* crosses were also significant for seed cotton yield per plant, 2.5 % span length and fiber strength suggesting presence of heterosis for these traits. The percent of heterosis is presented in [Table-1]. The results indicated that the magnitude of heterosis varied with characters. Eight hybrids manifested significant and positive standard heterosis for seed cotton yield per plant. The hybrid GSHV-97/13 x AKH-7859 (24.43 %) expressed significant and maximum positive standard heterosis closely followed by 4384 x AKH-076R (22.16 %), 4384 x AKH-7859(20.74 %) and GJHV-156 x AKH-03-8h (20.45 %) for yield. Several workers *viz*., Meshram *et al* [2] Patel *et al* [3] Manojkumar *et al* [4], Tuteja *et al*.[5], Tutej*aet al*. [6], Khosla *et al* [7]. reported significant heterosis in positive direction for seed cotton yield per plant. Apart from seed cotton yield quality of lint is important criteria for textile industries. Nine hybrids exhibited significant and positive standard heterosis for ginning percentage. It ranged from -4.12 (GSHV-4093 x AKH-076R) to 9.25 per cent (GSHV-97/13 x AKH-03-8h) [Table-2]. For fiber quality of lint, span length is also important. The range of standard heterosis over PKV Hy-4 was from -1.18 to 18.90. For this character, twenty six hybrids exhibited positive and significant standard heterosis. To judge the suitability of lint for high speed spinning, fiber strength is an important criterion. Twenty nine hybrids showed significant and standard heterosis for fiber strength. Maximum value was depicted by hybrid GJHV-156 x AKH-076R (26.15%) followed by 4384 x AKH-076R (24.6 %) and GSCMS-10 x AKH-076R (23.59 %). Formation of naps in the cotton while spinning is mainly due to the presence of immature fiber, which accounts for breakage of yarn. The range of heterosis varied from low to medium for fiber maturity coefficient. Similar trends for above traits were-

Table-1 *ANOVA for various characters in G. hirsutum L. cotton.*

Source of variation	d.f.	Seed cotton yieldper plant (g)	Ginning percentage	2.5% span length (mm)	Fiber strength (g tex^{-1})	Fiber maturity coefficient	Fiber fineness (mv)	Strength/length ratio	Length uniformity ratio (%)
Replications	2	97.96	5.73	0.49	0.46	0.0007	0.25	0.00	0.28
Genotypes	46	398.25**	6.25**	6.93**	14.87**	0.0009	1.01**	0.02**	10.55**
Parents (p)	11	385.52**	14.10**	12.25**	22.04**	0.0012	1.71**	0.02**	13.55**
Parents *vs.* Crosses	1	264.80*	0.57	25.26**	6.38**	0.0014	0.07	0.00	0.83
Crosses (c)	34	406.30**	3.87*	4.67**	12.80**	0.0008	0.81**	0.01**	9.87*
Error	92	102.15	2.01	0.52	0.30	0.0009	0.10	0.00	5.06

*, ** Significant at 5 % and 1 % levels, respectively

Table-2 *Estimation of standard heterosis of CMS-R based hybrids of G. hirsutum for Seed cotton yield and fiber quality characters.*

Sr. No.	Crosses	Ginning percentage	seed cotton yield per plant (g)	2.5 % span length (mm)	fiber strength (g tex^{-1})	fiber fineness (mv)	fiber maturity coefficient	strength/ length ratio	length uniformity ratio (%)
1.	GJHV-156 x AKH-03-8h	7.64 *	20.45 **	-0.79	-4.62 *	25.71 **	2.50	-4.33	2.04
2.	GJHV-156 x AKH-7859	7.44 *	3.41	6.30 **	14.36 **	5.71	2.50	7.36	6.12
3.	GJHV-156 x DR-16	5.73	10.23	5.51 *	18.46 **	-17.14 *	0.00	11.26	6.12
4.	GJHV-156 x DR-8	6.83	0.23	10.63 **	14.87 **	0.00	1.25	3.90	0.00
5.	GJHV-156 x AKH-076R	1.51	-6.53	7.48 **	26.15 **	-20.00 **	0.00	17.32 *	4.08
6.	4384 x AKH-03-8h	5.23	17.90 *	11.81 **	-3.59	20.00 **	2.50	-14.72 *	-6.12
7.	4384 x AKH-7859	3.52	20.74 **	12.60 **	9.23 **	5.71	2.50	-3.90	4.08
8.	4384 x DR-16	5.43	17.05 *	14.17 **	12.82 **	-5.71	1.25	-1.30	-2.04
9.	4384 x DR-8	1.81	10.80	9.06 **	11.28 **	-8.57	0.00	1.30	-6.12
10.	4384 x AKH-076R	0.50	22.16 **	11.02 **	24.62 **	5.71	3.75	11.26	2.04
11.	LRK-516 x AKH-03-8h	8.14 *	11.36	9.06 **	22.05 **	-17.14 *	1.25	11.26	0.00
12.	LRK-516 x AKH-7859	6.33	13.92	18.90 **	20.51 **	-20.00 **	-1.25	1.30	0.00
13.	LRK-516 x DR-16	4.72	-4.83	2.76	2.56	-25.71 **	-3.75	0.00	-4.08
14.	LRK-516 x DR-8	3.52	10.51	12.99 **	17.95 **	-5.71	1.25	3.90	2.04
15.	LRK-516 x AKH-076R	5.53	3.69	14.96 **	15.90 **	-11.43	0.00	0.00	-6.12
16.	GSCMS-10 x AKH-03-8h	3.62	-5.97	5.51 *	10.77 **	2.86	1.25	5.19	4.08
17.	GSCMS-10 x AKH-7859	4.52	-2.27	2.76	9.23 **	0.00	1.25	6.49	2.04
18.	GSCMS-10 x DR-16	6.53	-0.85	11.02 **	16.41 **	-8.57	1.25	3.90	8.16 *
19.	GSCMS-10 x DR-8	7.14 *	1.70	11.42 **	4.62 *	14.29	2.50	-6.49	0.00
20.	GSCMS-10 x AKH-076R	-1.01	5.97	2.76	23.59 **	8.57	3.75	19.48 **	4.08
21.	GSHV-97/443 x AKH-03-8h	4.42	5.97	15.35 **	17.95 **	0.00	2.50	1.30	-4.08
22.	GSHV-97/443 x AKH-7859	5.73	13.07	7.48 **	9.23 **	20.00 **	3.75	2.60	2.04
23.	GSHV-97/443 x DR-16	9.05 *	14.20 *	13.39 **	16.41 **	25.71 **	5.00	2.60	4.08
24.	GSHV-97/443 x DR-8	8.04 *	19.89 **	13.78 **	4.62 *	20.00 **	2.50	-7.79	0.00
25.	GSHV-97/443 x AKH-076R	2.21	12.22	8.66 **	17.44 **	0.00	2.50	7.79	-6.12
26.	GSHV-4093 x AKH-03-8h	4.82	-9.38	2.36	-18.46 **	2.86	-2.50	-20.78 **	0.00
27.	GSHV-4093 x AKH-7859	-3.22	3.69	2.76	1.03	17.14 *	2.50	-2.60	0.00
28.	GSHV-4093 x DR-16	7.04 *	7.67	7.48 **	5.64 *	8.57	1.25	-2.60	-2.04
29.	GSHV-4093 x DR-8	-2.11	-5.11	9.06 **	8.21**	31.43 **	5.00	-1.30	-2.04
30.	GSHV-4093 x AKH-076R	-4.12	4.83	1.18	-20.00 **	2.86	-2.50	-20.35 **	0.00
31.	GSHV-97/13 x AKH-03-8h	9.25 *	-11.93	3.94	6.15 **	14.29	2.50	1.30	2.04
32.	GSHV-97/13 x AKH-7859	6.73	24.43 **	6.30 **	10.77 **	25.71 **	5.00	3.90	4.08
33.	GSHV-97/13 x DR-16	1.71	11.36	4.72 *	8.21 **	2.86	1.25	2.60	0.00
34.	GSHV-97/13 x DR-8	5.53	2.84	-1.18	14.87 **	-11.43	0.00	15.58 *	2.04
35.	GSHV-97/13 x AKH-076R	8.74 *	-10.51	6.69 **	21.03 **	-8.57	1.25	12.99	4.08
	S.E (d) ±	1.16	8.25	0.59	0.45	0.25	0.02	0.05	1.84

-observed by Tuteja *et al* [8] and Tuteja *et al* [9].

For fiber fineness, lower values up to certain level are more important. The heterotic effects for this trait ranged from -3.75 to 5.00 for standard heterosis. Manojkumar *et al* [3] and Tuteja [10] reported similar result for fiber fineness.

For fiber strength: length ratio, data indicated three hybrids showed standard heterosis over PKV Hy-4. For length uniformity ratio, hybrid GSCMS-10 x DR-16, exhibited the significant and positive standard heterosis.

From critical examination, all heterotic hybrids for seed cotton yield showed significant heterosis for either fiber length or fiber strength or both except the hybrid GJHV-156 x AKH-03-8h, but it showed significant heterosis for ginning per cent. [Table-3].

Table-3 *Best heterotic crosses and their performance for seed cotton yield withother fiber quality traits in G. hirsutum L. cotton.*

Best crosses (P_1 x P_2)	Mean yield (g)	Standard heterosis (%)	Significant standard heterosis in other traits in desired direction
GSHV-97/13 x AKH-7859	146.00	24.43 **	2.5 per cent span length, fiber strength.
4384 x AKH-076R	143.33	22.16 **	2.5 per cent span length, fiber strength,
4384 x AKH-7859	141.67	20.74 **	2.5 per cent span length, fiber strength
GJHV-156 x AKH-03-8h	141.33	20.45 **	Ginning percentage
GSHV-97/443 x DR-8	140.67	19.89 **	Ginning percentage, 2.5 per cent span length, fiber strength.
4384 x AKH-03-8h	138.33	17.90*	2.5 per cent span length
4384 x DR-16	137.33	17.05*	2.5 per cent span length, fiber strength.
GSHV-97/443 x DR-16	134.00	14.20*	2.5 per cent span length, fiber strength.

Conclusion

From present investigation it concluded that heterotic hybrids for seed cotton yield also showed heterosis for fiber quality in desired direction.

Conflict of Interest: None declared

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