Comparative Evaluation of Intraspecific Isohybrids in *Gossypium hirsutum* L.

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ABSTRACT

Isohybrids of Cotton Ankur 651 were tested at the research farm of the company under rainfed conditions during 1997-98 to study the effect of different plant characters on the economic parameters. New lines of the male parent Ca/H-128 that were isogenic for the character okra leaf shape, pigmented plant body and pigmented anther filament were developed by back-crossing. The combinations showed non-significant differences for days to flowering, number of monopodia, number of sympodia, plant height, ginning outturn, 2.5% span length, uniformity ratio, micronaire, fiber maturity and 1/8" gauge tenacity. Semi okra F_1 gave the highest seed cotton yield followed by entire leaf F_1, F_1 with pigmented plant body and F_1 with pigmented anther filament. Entire leaf F_1 exhibited the highest average growth rate followed by F_1 with pigmented anther filament, semi okra F_1 and F_1 with pigmented plant body. Semi okra F_1 proved efficient for economic characters.

Introduction

Cotton has a multifaceted role in Indian economy, providing livelihood to over sixty million people, contributing on nearly one third of the total export earnings to the national exchequer and being a valuable source of edible oil. The planning commission has indicated cotton production targets of 18 million bales by 2001-2002 and 23 million bales by 2006-2007. This daunting task looks is achievable with ease looking to the present scenario.

The area under cotton in India has stagnated to about 8.5 million ha. over the past few years. Of this, most of the area in the central and southern cotton growing zone is rainfed, irrigated cotton being confined to the northern cotton-growing zone. This north zone is predominantly occupied by varieties but 35-40 % of the central and south zone is occupied by hybrids that contribute 48 % to the total production. India is the only country in the world where hybrid cotton is cultivated over a large acreage on a commercial scale.

With no other crop that can boost up the economy like cotton, it will occupy a steady acreage. Hybrid cottons have given a new hope to the cotton farmers by assuring them of high yield even under adverse conditions unlike varieties. Hybrids like Ankur 651 areis gaining a wide base in the central and southern zone and also making a dent in some pockets in the north zone because of its ability to cope with adverse climatic conditions, earliness in flowering that helps it escaping some of the bollworm attack, tolerance against Jassids and synchronous boll bursting, ensuring good quality cotton in fewer pickings. It came up through the All India Co-ordinated Cotton Improvement Project. Based on its performance in the project trials, it was released and notified for cultivation under rainfed conditions by the Government of India.

Crop growth is affected by many factors, including among these, leaf area, and plant pigmentation. The effect of these agronomic characters can be well studied through isolines. The isolines offer immense scope in studying the effect of specific marker genes on the agronomic, economic and technological traits of a variety or a hybrid. They are developed through repeated back-crossing, share a common cytoplasm and genotype of the recurrent parent, differing in a single morphological character that is simply inherited.

Hybrid cotton Ankur 651, a promising hybrid of the area, was selected for this experimentation. From the isolines of the male parent, F_1s with entire leaf, semi-okra leaf, pigmented plant body and pigmented anther filament were developed. The objective of this experiment was to study the effect of these traits on the economic, physiological and technological properties of the hybrid and to identify a useful plant type for rainfed cultivation.

Material and Methods

The isolines of the male parent of this were developed by back-crossing up to the BC_8 generation. Plants resembling the recurrent parent were selected from the stabilized population of the isolines. The lines EC 211525, EC 155348 and CPP 7 were used as donor parents for super okra leaf shape, pigmented plant body and pigmented anther filament respectively. The back-crossing programme was initiated in 1991 on the research farm of Ankur Seeds. Crosses with the isogenic male parent were made during *Kharif* season of 1996 to produce material for this study.

The four hybrid combinations were sown in a randomized block design with three replications on 25th June 1997. A row to row spacing of 0.9 meter and plant to plant spacing of 0.6 meter was maintained in the population. In each replication, 75 plants were

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maintained. Each treatment occupied an area of 4.5m X 9m.

Observations were recorded on days to square initiation, days to 50% flowering, no. of bolls at 120 days, plant height at maturity (m), no. of monopodia, no. of sympodia, average boll weight (g), yield per hectare (kg), seed index (g) and lint index (g). Technological observations on ginning outturn (%), 2.5% span length (mm), uniformity ratio, micronaire, fiber maturity (%), and 1/8" gauge tenacity (gm/tex) were recorded in the oil and fiber testing laboratory of the company. Oil per cent was recorded on MARAN NMR of M/S Resonance Instruments UK. Dry matter accumulation was recorded on 5 randomly selected plants on 75th, 100th and 125th day of crop growth. Based on this, absolute growth rate or relative growth rate (RGR) was determined by the formula

$$\text{Relative growth rate} = \log_e W_2 - \log_e W_1 / t_2 - t_1$$

Where W_1 and W_2 are dry matter accumulation at time intervals t_1 and t_2

Results and Discussion

Mean performance of various isohybrids are given in Table 1, technological properties in Table 2 and mean relative growth rate in able 3.

The ANOVA revealed non-significant differences for days to 50% flowering, no. of monopodia, no. of sympodia, plant height, ginning outturn, 2.5% span length, uniformity ratio, micronaire, fiber maturity and tenacity at 1/8" gauge. The previous observations by Andries *et al.* (1983) on increased micronaire in okra leaf genotypes in comparison did not apply, mainly because semi - okra genotypes are intermediates of the entire and okra leaf genotypes.

Significant differences were observed for average boll weight, 120 days boll count, yield per hectare, seed index, lint index and oil per cent. Earlier, Meredith and Wells (1987) and Meredith *et al.* (1996) had observed a yield advantage of sub okra cotton over normal leaf near isogenic populations. The other characters like average boll weight, 120 days boll count, seed index and lint index directly influence yield. Increased yield and boll bearing in sub okra isohybrids may be due to higher canopy photosynthesis than the normal leaf biotype as observed by Wells *et al.* (1986) in his near isoline studies in cotton. Pigmented plant body isohybrids had recorded lower seed cotton yield, which is in line with the observations made by Karami and Weaver (1972) in red leaf biotype Stoneville 7A. Significantly lower yields of the pigmented plant body isohybrid can be attributed to lower boll weight of this hybrid combination. Significant differences existed for seed indices of the pigmented anther filament isohybrid and other hybrid combinations. For lint index, a marked difference could be observed between the pigmented plant body isohybrid and the pigmented anther filament isohybrid when compared with the entire leaf combination. The pigmented plant bodied combination had significantly lower lint index while the pigmented anther filament combination had higher lint index.

Mean values for RGR are presented in Table 3. ANOVA for RGR revealed significant differences among the treatments. At peak flowering highest RGR was recorded in the entire leaf isohybrid followed by the pigmented anther filament and the semiokra isohybrids at peak flowering. The isohybrid with pigmented plant body had lowest RGR at this stage. At post flowering, highest RGR was recorded in the semiokra isohybrid followed by the entire leaf isohybrid, the pigmented plant body and the pigmented anther filament isohybrids. Critical analysis of Table 3, shows consistently high RGR at peak flowering and post flowering stages in entire leaf and semiokra leaf isohybrids of Ankur 651, which is also evident from their yield data. This indicates positive association of RGR with yield. High RGR in hybrids has also been observed previously by Dhopte and Kamdar (1991). Prasad *et al.* (1978) also observed a positive significant association of RGR with seed yield in gram. We find comparatively lower RGR in the semiokra isohybrid in comparison to the entire leaf isohybrid, also been observed previously by Karami and Weaver (1972).

Overall, the semi-okra isohybrid appeared to be an efficient plant type under the rainfed conditions of central India because it had a combination of good characters from both the parents. Presence of pigmented anther filament seems to have no additional advantage over the non pigmented ones, but for its use as a phenotypic marker.

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Table 1. Mean yield components of ANKUR 651 Isohybrids.

Sr.No.	Isohybrid Combination with	Days to 50% Flower	Plant height (m)	Monopodia / plant	Sympodia / plant	Av. Boll wt. (g)	120 days boll count	Yield / ha (kg)	Seed index (g)	Lint index (g)	Oil %
1	Entire leaf	57.8	1.45	1	33.4	3.5	68.3	2310	9.0	5.1	18.6
2	Semiokra leaf	57.5	1.45	1	32.0	3.5	63.7	2448	9.0	5.0	18.2
3	Pigmented Plant body	59.6	1.43	1	32.8	3.0	54.7	2254	8.8	4.9	19.4
4	Pigmented anther filament	58.3	1.43	1	32.6	3.9	52.0	2296	10.1	5.8	20.2
	S.E.M	NS	NS	NS	NS	0.1.2	1.223	15.939	0.157	0.130	0.390
	C.D. (5%)	-	-	-	-	0.314	0.768	49.110	0.484	0.400	1.202
	C.V. (%)	-	-	-	-	5.07	3.705	1.21	2.95	4.32	3.54

Table 2. Mean technological parameters of ANKUR 651 Isohybrids.

SN	Isohybrid with	GOT %	2.5% SL	UR	Mic	FM %	1/8" Tenacity
1	Entire leaf	36.3	30.6	48.1	3.4	87	20.5
2	Semi okra leaf	36.1	30.5	49.0	3.5	86	21.3
3	Pigmented plant body	36.0	30.0	45.3	3.4	84	20.5
4	Pigmented anther filament	36.6	30.7	48.0	3.3	87	20.8
	S.E.m.	NS	NS	NS	NS	NS	NS
	C.D.(5%)	-	-	-	-	-	-
	C.V.(%)	-	-	-	-	-	-

Table 3. Mean relative growth rate of ANKUR 651 Isohybrids.

SN	Isohybrid with	Relative growth rate g/g/d	
		Pre-flowering	Post-flowering
1	Entire leaf	0.0452	0.0236
2	Semi okra leaf	0.0328	0.0255
3	Pigmented plant body	0.0280	0.0072
4	Pigmented anther filament	0.0366	0.0071
	S. E.m.	1.889×10^{-4}	1.571×10^{-4}
	C.D.(5%)	5.819×10^{-4}	4.839×10^{-4}
	C.V.(%)	0.92	1.71