

DEVELOPMENT OF COTTON (*GOSSYPIUM HIRSUTUM* L.) VARIETY  
JK 119 PRODUCING HIGHER YIELD THAN DCH 32 HYBRID

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(Received: June 27, 1988; accepted: February 9, 1989)

ABSTRACT

With a view to evolve a pure breeding *Gossypium hirsutum* L. cotton variety that produces higher yield than DCH 32 interspecific hybrid, composite crossing in  $F_1$  was done in 1975. Composite crossed populations, selections made, and intermated populations were grown with minimum plant protection for 3 years. Selection norms for yield, earliness, big-boll-small-bract, lint length, lint per cent, jassid and black arm resistance, were fixed. Promising 14 selections were yield tested at two locations and uniformity of progenies was ascertained. The final selection, JK 119-25-54, was tested in multilocation trials for 6 years in the South Zone of All-India Coordinated Cotton Improvement Project (AICCIP). The strain topped in yields with 33.3% increased lint yield over local checks, 50.7% over MCU-5, and 14.4% higher than the zonal check, LRA 5166. The strain JK 119-25-54 was also found to be highly tolerant to boll worms. At Raichur it gave higher yield over DCH 32 hybrid cotton. It was tested as JK 119 in farmers fields in Tungabhadra and Malaprabha Project areas and gave up to 23% higher yield than hybrid DCH 32 and recognised to be highly tolerant to boll worms also by farmers. The variety JK 119 was released for cultivation by small and marginal farmers through AICCIP in June 1988.

Key words: Composite crossing, variety development, cv. JK 119, *Gossypium hirsutum* L.

Commercial cultivation of cotton hybrids became very popular with the cotton growers in South and Central India after the release of Hybrid 4 in 1967 [1] and Varalaxmi. The interspecific *G. hirsutum* × *G. barbadense* hybrids started an era of producing high yields of superior long staple cotton in India [2]. Along with the cultivation of cotton hybrids on large scale covering 20% of the total cotton area, cotton production became increasingly costly to assume the status rich farmers crop [3]. Insect pest incidence, especially the boll worms, *Heliothis armigera*, *Earias vitella* and *Pectinophora gossypiella*, increased to the extent of requiring 20-25 sprays of insecticides for obtaining a successful crop of DCH 32 (an interspecific cotton hybrid released for cultivation in 1981).

Therefore, it was necessary to develop a pure breeding cotton variety producing equal or higher yields than hybrids that requires minimum plant protection. According to Fray [4], when yielding ability reaches a plateau in a crop and when hybrids take over, true breeding varieties matching the yields of hybrids need to be evolved. With this objective *G. hirsutum* L. cotton variety producing equal or even higher yield than hybrid DCH 32 was developed. After thoroughly testing in AICCIP and in farmers' fields, the variety JK 119 was released in June 1988. The evolutionary procedure and performance over seasons and locations are discussed.

## MATERIALS AND METHODS

The  $F_1$  hybrids were produced using parental strains, JK 97 (source of earliness and high yield), MCU 5 (jassid resistance and 30 mm fibre length), DBS 11-4 (black arm and jassid resistance), JK 125-2-42 (lint 45%), and JK 79-418 (big boll-small bract). These were previously identified consistently as high general combiners for the respective characters by post-graduate students, C. S. Police Patil, P. M. Salimath, Marangappanavar and N. K. S. Prasad, JK 97 was taken as base parent. The four  $F_1$  hybrids were composite crossed by the method suggested by Kadapa [5-7] by growing 100 plants per  $F_1$  in 1975. In the subsequent 2 years 10,000 composite crossed plants were grown in 0.20 ha each year and single plant selections were made by fixing norms as follows: seed cotton yield 70 g/plant, big boll (5.0 g) and small bract, fibre length 28.5 mm and 40% lint along with jassid and backarm tolerance, even with only one spray against jassids (*Empoasca bigutella bigutella*) and three sprays against bollworms at Dharwad. Inter se mating between progenies of selected plants was done as suggested by Joshi [8] for three cycles followed by selfing for 2 years. The 14 final selections were yield tested at 2 locations. The finally selected strain, JK 119-25-54, was tested for 6 years (1980-81-1985-86) in multilocation trials in the South Zone of Coordinated Cotton Project. It was further tested for 2 years in farmers' field trials under irrigation using the local varieties MCU 5, LRA 5166, and DCH 32 hybrid as checks.

## RESULTS AND DISCUSSION

Genotypic coefficient of variability was nearly the same as that of phenotypic in the 10,000 plant population of composite crossed  $S_0$  population for yield and yield component characters: as shown below:

Character	Phenotypic coefficient of variation (%)	Genotypic coefficient of variation (%)
Seed cotton yield	66.34	63.51
Boll number/plant	71.68	69.1
Average boll weight	51.34	50.98
Lint per cent	57.41	54.06

Table 1. Performance of top yielding five strains obtained by composite crossing at two locations in 1979

Strain	Seed cotton		Bolls/plant		Boll wt. (g)		Lint %		MFL, mm	
	Dharwad	Sirguppa	Dharwad	Sirguppa	Dharwad	Sirguppa	Dharwad	Sirguppa	Dharwad	Sirguppa
JK 102-13-16	27.8	28.6	32	38	6.1	5.9	39.4	42.1	26.8	27.1
JK 106-24-48	29.4	29.8	39	42	5.8	5.7	42.6	41.2	29.3	30.5
JK 131-1-72	31.7	26.4	46	40	5.4	5.0	37.8	39.3	26.6	28.0
JK 144-3-18	28.5	31.1	38	52	5.1	4.8	36.6	38.2	29.3	28.4
JK 119-25-54	36.5	39.5	49	55	5.9	5.7	39.6	42.4	32.1	31.8
Mysore Vijaya	14.1	18.6	21	23	4.1	3.9	32.5	33.1	30.0	28.2
Hampi	23.4	26.5	28	31	4.4	4.1	34.1	35.0	24.5	26.1
CD 5%	6.3	7.6	6.8	3.9	1.7	1.3	2.6	2.4	3.3	4.6



Table 3. Lint per cent of JK 119-25-54 and other cotton varieties

Variety	Lint %		Increase (%) in JK 119 over		
	mean	range	local varieties	MCU 5	LRA 5166
JK 119-25-54	39.1	39.0-42.0	18.0	15.0	9.0
Local cvs.	33.2	31.7-34.4	—	2.1	9.0
CU 5	33.9	31.6-35.4	-1.7	—	-6.3
RA 5166	36.1	33.7-37.0	9.0	6.0	—

The resulting strains were tested in replicated yield trial at two locations during 1979 (Table 1). Of the 14 strains tested, JK 119-25-54 was outstanding at both locations in seed cotton yield, boll number/plant, average boll weight, lint per cent and mean fibre length, combining all economic characters in one and the same genotype. Therefore, strain JK 119-25-54 was included for testing in AICCIP under irrigated conditions.

During the 6 years of trials at six locations in South Zone, the yield of JK 119-25-54 ranged between 4.7-55.1 q/ha with mean yield of 17.7 q/ha at Arabhavi, 36.1 q/ha at Sirguppa, 18.1 q/ha at Coimbatore, 17.6 q/ha at Srivilliputtur, 27.3 q/ha at Lam, and 37.0 q/ha at Raichur (Table 2). The overall average yield of JK 119-25-54 was 24.7 q/ha seed cotton and 9.9 q/ha lint. The local check varieties, Mysore Vijaya, Hampi and Amaravati, gave average yield of 21.8 q/ha seed cotton and 7.24 q/ha lint. The check variety MCU 5 with superior fibre quality produced 18.9 and 6.41 q/ha seed cotton and lint, respectively. It was noteworthy that in Table 4. Trial of interspecific (*G. hirsutum* × *G. barbadense*) cotton hybrids and *hirsutum* varieties at Raichur during 1985-86 and 1986-87.

Hybrid/ variety	Total seed cotton yield (q/ha)		Good seed cotton yield (q/ha)			Lint per cent	Lint yield q/ha	Increase in lint yield over DCH-32 %
	1985-86	1986-87	1985-86	1986-87	increase over DCH- 32, %			
<b>Hybrids:</b>								
NHB 116	23.99	16.28	20.33	11.33	18.2	31.9	5.04	17.7
NPHB 2	25.32	19.13	20.16	12.46	20.1	33.6	5.48	28.0
H 224	22.90	15.45	18.23	10.19	6.1	30.6	4.35	10.1
H 424	21.76	18.10	16.51	13.27	11.2	31.9	4.74	10.74
Varalaxmi	19.52	16.56	14.70	12.73	2.3	30.8	4.02	-9.39
DCH-32	20.10	14.23	16.18	10.61	—	32.0	4.28	—
<b>Varieties (<i>G. hirsutum</i>)</b>								
KAS 303	23.34	20.55	21.12	19.54	51.8	37.5	6.92	61.6
JK 119-25-54	24.10	22.69	22.85	21.43	65.3	40.9	9.05	111.4

Table 5. Results of farm trials of cotton crop conducted in Tungabhadra Project Area 1986-87

Name of farmer	Variety	Seed cotton yield, q/ha	Remarks
<b>By Extension Education Unit, Raichur:</b>			
Srishaia Panchal	JK 119	30.00	JK 119 least affected by bollworms
Jawalgera, Sindhanur Tq.	RAS 303	23.00	
Subba Reddy,	JK 119	29.00	RAS 303 highly susceptible to jassids and aphids
Jawalgera,	RAS 303	22.50	
Sindhanur Tq.	DCH-32	31.00	
Peeraiah	JK 119	27.00	DCH 32 highly susceptible to bollworms and whitefly
Sankarbandi	RAS 303	21.50	
	DCH 32	18.50	
Basawaraj Kokanur	JK 119	24.00	Average yield
Bellary Tq.	RAS 303	20.00	q/ha
	DCH 32	20.50	JK 119 27.50 DCH 32 25.12
<b>By Dy. Director of Agriculture, Raichur:</b>			
Shantamallaiah	JK 119	38.50	JK 119 highly resistant to bollworms, bolls formed from bottom to top in JK 119
Manvi Tq.	RAS 303	36.10	
	DCH 32	37.60	
Basavalingappa	JK 119	30.90	
Sindhanur Tq.	RAS 303	25.00	
	DCH 32	32.50	
Ramachandra Reddy	JK 119	34.50	Average yield
Jawalgera,	RAS 303	28.00	q/ha
Sindhanur Tq.	DCH 32	35.60	JK 119 35.00 DCH 32 34.80
Puttaswamy	JK 119	36.10	
Gorebal,	RAS 303	32.50	
Janvi Tq.	DCH 32	33.50	

none of the 28 trials the yield of JK 119-25-54 was lower than any other strain under comparison.

The increased lint yield of JK 119-25-54 was 33.3% over that of local checks and 50.70% over MCU 5. After cv. LRA 5166 was released, a comparison was made for 3 years (1983-84 to 1985-86) using this latest variety as zonal check. It gave an average yield of 27.20 q/ha as against 27.65 q/ha seed cotton by JK 119-25-54. Thus, JK 119-25-54 gave only marginal superiority in seed cotton yield over LRA 5166. But lint yield in JK 119-25-54 was 14.40% higher than in LRA 5166. The average lint per cent of JK 119-25-54 is 39.1, which is 9-10% higher than in the local check varieties. Mean lint per cent of locals was 33.1, MCU 5 33.9, and LRA 5166 36.1 (Table 3).

The crop seasons of 1985-86 and 1986-87 had very severe incidence of whitefly (*Bemecia tabacci*) on cotton in South India. The interspecific hybrids badly suffered in yield (Table 4). The highest yield of well opened fluffy seed cotton (good cotton) was obtained in hybrid NPHB 2 as compared to other interspecific hybrids in both years. In contrast, both *hirsutum* strains, JK 119-25-54 and RAS 303, gave much higher yield of good seed cotton (22.85 and 21.43 q/ha in JK 119-25-54, and 21.12 and 19.54 q/ha in RAS 303). Reduction in good seed cotton yield due to damage by whitefly was only marginal in the *hirsutum* varieties (6%) as compared to 30-60% in the interspecific hybrids. JK 119-25-54 produced 65.3% more seed cotton and

Table 6. Results of farmers trials of cotton varieties v/s DCH 32 hybrid 1987-88 (q/ha)

T.B.P. area, Dept. of Agriculture, Karnataka:	JK 119	RAS 303	DCH 32
Keribasappa, Kotihal Sirguppa Tq.	14.80	10.00	6.20
Bhadrinarayan, Sirguppa Tq.	14.20	10.40	5.60
Obisaheb, Shansvaspur, Bellary Tq.	13.00	9.80	5.00
Abdullasaheb, Shansvaspur, Bellary Tq.	13.6	10.2	5.60
Govindayya, Bangewadi, Bellary Tq.	12.0	10.6	4.00
Malaprabha Project, Dept. of Agriculture, Karnataka:	JK 119	DCH 32	
A.I. Kerishetti, Yekkeri, Soundatti Tq.	22.0	20.0	
K.R. Ingalsheyya, Tirilapur, Navalgund Tq.	36.0	13.5	
G.B. Pattar, Chikkanaragund, Naragund Tq.	31.0	13.0	
Average	29.7	15.5	
T.B.P. area, Extension Education Unit, Raichur:	JK 119	RAS 303	DCH 32
Shrikrishna Kasbe Camp.	36.86	37.66	19.66
Shankar Kasbe Camp.	27.33	30.33	17.00
Ayyappa Jawalgera	30.60	27.40	30.50
Rudrappa Jawalgera	29.40	27.40	26.20
Amarappa Sindhanur	31.20	29.20	20.80
Gundappa Sindhanur	31.20	27.80	31.20
Subba Reddy, Manvi	36.00	30.00	30.00
Ranga Reddy, Manvi	29.00	20.20	24.00
Average	30.67	30.49	24.92
% increase over DCH 32	23.08	22.35	—

111.4% more lint than hybrid DCH 32 and as a result of high lint per cent (40.9). The high degree of bollworm resistance in JK 119-25-54 was confirmed by the Principal Investigator, (Entomology) Central Institute for Cotton Research, Nagpur, during 1985-86 and 1986-87 [10].

The variety JK 119-25-54 was tested on farmers' fields in the canal irrigated areas of Tungabhadra and Malaprabha Projects (Karnataka) for two years (1986-87 and 1987-88) by the Department of Agriculture and Extension Education Unit U.A.S., Dharwad, under the name JK 119 (Tables 5 and 6). Variety JK 119 produced slightly lower yield than hybrid DCH 32 in three trials but higher in 5 trials with the average of 31.25 q/ha seed cotton against 29.96 q/ha in DCH 32. The very low yield of 4-6.2 q/ha of DCH 32 but high of JK 119 (12.0-14.8 q/ha) in Bellary district showed that hybrid DCH 32 was severely affected by the incidence of *Heliothis armigera* during 1987-88 which accounted for near devastation of the cotton crop in Andhra Pradesh. The neighbouring districts of Bellary and Raichur also witnessed heavy and uncontrolable *heliothis* damage on cotton crop. Based on the results, the variety JK 119 was released for irrigated cultivation by poor and marginal cultivators through AICCIP in June 1988. On the whole, it may be inferred that composite crossing among  $F_1$ s obtained by crossing additive genetic parental varieties for yield and yield components, followed by inter se mating between progenies of selections, would enable one to obtain quantum jump in yielding ability of true breeding variety of cotton.

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