

All India Coordinated Cotton Improvement Projects

PROJECT COORDINATOR'S REPORT: 2006-07

Cotton cultivation needs to be sustainable, offering livelihood security to millions of marginal and small farmers; such an enterprise has to be knowledge-based and market-driven and needs to evolve continuously through innovations in frontier sciences to break yield and quality barriers for satisfying present and future national needs and attaining global competitiveness with larger spin-off benefits to India. Cotton is the most important commercial crop contributing nearly 75% of total raw material needs of textile industry in our country. Cotton and Textile exports account for nearly one-third of total Foreign Exchange earnings of India, crossing Rs. 60,000 crores. India has achieved significant breakthrough in cotton yarn exports besides increasing its global market share in cotton textiles and apparels. About 60 million people of our country are involved directly or indirectly in cotton production, processing, textiles and related activities.

India is the only country where all four cultivated species of cotton are grown on commercial scale and covers 8.5-9.0 million hectares. Hybrid cotton cultivation in about 50% of total cotton area, is a significant milestone achievement in Indian Cotton Scenario. Qualitative and quantitative transformation has taken place in cotton production in India. *The production increased from a meagre 28 lakh bales (170 kg lint/bale) in 1947-48 to a high of 176 lakh bales in 1996-97 and an all time record of 245 lakh bales during 2005-06 (AICCIP, 2006). Still higher and phenomenal production of 270 lakh bales has been projected during 2006-07.* During the pre-independence period, India varying short and medium staple cottons. Today, India produces cotton fibres with varying staple lengths, from non-spinnable coarse to medium, long, extra long and superfine cotton for spinning 6 to 120^s counts. Due to rapid growth in Indian economy and increasing demand for cotton due to cessation of Quota Regime, the requirement of cotton has been projected at 350lakh bales by the year 2010.

With the abolition of ICCA in 1966, the ALL INDIA COORDINATED COTTON IMPROVEMENT PROJECT (AICCIP) was launched in 1967 with its Headquarters at Coimbatore (TamilNadu) with timely funding from ICAR. Concerted efforts by various AICCIP centres for cotton improvement and strides that the country made in cotton production for the last three decades or more are well-recorded in the history. The AICCIP knitted together 21 participating centres involving 15 State Agricultural Universities involved in cotton research

The Central Institute for Cotton Research, Nagpur and its Regional Stations at Coimbatore and Sirsa provide basis research support and also take part in certain research activities of the AICRP on Cotton. The Central Institute for Research on Cotton Technology (CIRCOT-ICAR), Mumbai and its Regional units located at Sirsa, Surat, Nagpur, Dharwad, Guntur and Coimbatore are closely associated with AICCIP in assessing the quality parameters of cotton besides ensuring value addition to cotton.

World and Indian Cotton Scenario

World cotton area during 2006-07 is estimated at 342 lakh ha., up by 2,10,000 ha from the previous season. Production of cotton is also estimated at 25.3 m tonnes, 3% higher than last season crop (ICAC). World cotton production registered a growth of 81.3% between 1980-81 and 2006-07. ICAC reports specify Chinese cotton production at 6.7 million tonnes, followed by India at 4.6 million tonnes and Indian cotton consumption to go up from 3.63 m. tonnes last year to 3.9 m. tonnes in 2006-07. It is also noted that Asian countries like China, India and Pakistan together have emerged to produce 13 million tones or almost half of global output. The average yield in China is estimated to have increased by 10%. As regards Indian situation, the average yield was stepped up by 7%, thanks to good weather, use of biotech Bt cotton hybrids thoughtfully developed by Private sector Cotton R&D firms, high yielding hybrids/varieties and adoption of improved packages of practices developed by ICAR and SAUs, all contributing cumulatively.

Supply and Use of Cotton (2006-07)

Country	Area 000 ha	Yield Kg/ha	000 Metric tonnes					
			Production	Opening Stocks	Imports	Consumption	Export	Ending Stocks
China	5404	1245	6729	3110	3384	10500	8	3033
India	9137	502	4590	1579	90	3917	890	1452
U.S.A	5152	918	4731	1317	5	1089	3418	1547
Pakistan	3060	686	2100	1102	420	2462	45	1115
Brazil	1034	1298	1343	759	95	850	330	1017
Uzbekistan	1429	770	1100	351	1	220	946	286

(Source: ICAC, Washington)

The Indian cotton scenario looks brighter as compared to many other countries in the world. The year 2006-07 was a recorded year of sorts for Indian cotton scenario, with the exports touching a high of 52 lakh bales.

Export of cotton by India: Export of cotton has registered a sharp increase in cotton season 2005-06 when the country exported a record quantity of 47 lakh bales as against 9.14 lakh bales during 2004-05. During the current year 2006-07, the cotton exports are expected to maintain the same pace. The Cotton Advisory Board has estimated cotton exports during 2006-07 at 48 lakh bales. The details of the cotton exports from India during the last five years are as follows:

Year	Cotton exports by India	
	Quantity in Lakh bales of 170 kgs	Value (Rs./Crores)
2002-03	0.84	66.31
2003-04	12.11	1089.15
2004-05	9.14	657.34
2005-06	47.00	3712.21
2006-07*	48.00*	3791.19*

* estimated

Growth of Cotton production : It is very satisfying to note that has registered a highest growth of 247 percent as regards cotton production is concerned with a share of 18% in the global production of cotton, nearly double its share of 9.6% in 1980-81.

Growth of Cotton production (000 tonnes)

Year	China	USA	India	World Total
1980-81	2707(19.6)	2422(17.5)	1322(9.6)	13831
1990-91	4508(23.8)	3376(17.8)	1989(10.5)	18978
2000-01	4417(22.7)	3742(19.2)	2380(12.2)	19457
2006-07 (Estimated)	6729(26.8)	4637(18.5)	4590(18.3)	25073

Growth in Average yield (kg lint per hectare)

Year	China	USA	India	World
1980-81	550	453	169	411
1990-91	807	711	267	574
2000-01	1093	1008	278	612
2006-07 (Estimated)	1245	894	502	733

Similarly, the productivity of cotton in India has also rallied to a higher level despite the major cotton growing areas remaining still under rainfed conditions. Eventhough it is very noteworthy to mention that Indian average lint yield has jumped from a meagre 169 kg/ha to touch 502 kg/ha (68% of world average), the need for overcoming the gap between potential yields and realized yields still exists and efforts have to be made by all concerned for recording overall growth.

Cotton Balance Sheet

Cotton prices, that have remained fairly stagnant during last few years, is reported to move above current levels in 2007-08. According to COTLOOK report, the world consumption would exceed production in 2007-08 and the surplus in the last two years would be offset by increase in demand. The Cotton Advisory Board has estimated cotton availability in the country at 332 lakh bales this year including 56lakh bales of opening stocks, 270 lakh bales of production and 6 lakh bales of imports. The mill consumption is projected at 205 lakh bales, non-mill at 15 lakh bales, 20 lakh bales among small-scale industries and exports at 48 lakh bales.

Cotton Balance Sheet (October-September) (in lakh bales of 170 kg per bale)

	2005-06	2006-07
SUPPLY		
Opening Stock	72.0	56.0
Cotton Crop Production	244	270.0
Imports	4.0	6.0
Total Supply	320.0	332.0
Demand		
Mill Consumption	182.0	205.0
Consumption by SSI units	20.0	20.0
Non-mill consumption	15.0	15.0
Exports	47.0	48.0
Total Demand	264.0	288.0
Closing Stock	56.0	44.0

(Source: East India Cotton Association)

State-wise Cotton Area, Production and Productivity:

The details of Cotton area, production and productivity are provided hereunder. A moderate overall rise in total area, quantum jump in production and notable improvement in productivity are evident and augurs well for future.

Cotton Area in Lakh Hectare

State	97-98	98-99	99-00	00-01	01-02	02-03	03-04	04-05	05-06	06-07*
Punjab	7.02	5.47	4.75	5.50	6.00	4.25	4.69	5.08	5.80	6.18
Haryana	6.55	5.87	5.10	5.80	6.10	5.35	5.26	6.21	5.97	5.33
Rajasthan	5.80	6.38	4.64	4.82	3.47	3.35	3.36	4.38	4.54	3.08
Gujarat	14.58	16.97	15.16	15.78	16.87	14.98	16.47	19.06	20.77	23.90
Maharashtra	31.00	31.99	32.53	27.93	29.80	26.17	27.66	29.80	28.89	31.24
Madhya Pradesh	5.48	5.32	5.41	5.57	6.23	5.50	5.81	5.76	6.35	6.66
Andhra Pradesh	8.50	10.03	9.09	8.87	10.02	9.00	7.82	11.74	9.75	9.48
Karnataka	6.00	6.09	5.29	5.35	5.11	3.62	3.34	5.12	3.81	3.56
Tamil Nadu	2.65	2.20	2.50	1.33	1.60	1.15	0.97	1.42	1.52	0.94
Others	0.50	0.80	0.81	0.53	0.73	0.53	0.76	0.62	0.80	0.95
Total	88.08	91.12	85.28	81.48	85.93	73.90	76.14	89.20	88.20	91.32

Cotton Production in Lakh Bales

State	97-98	98-99	99-00	00-01	01-02	02-03	03-04	04-05	05-06	06-07*
Punjab	7.5	5.5	9.5	11.5	9.3	8.0	10.5	16.5	21.0	27.0
Haryana	9.0	7.5	11.0	11.5	5.5	8.5	11.0	15.5	14.0	15.0
Rajasthan	11.5	12.0	12.5	11.5	7.0	5.0	7.5	11.0	11.0	8.0
Gujarat	42.0	45.0	35.0	27.0	32.5	31.0	46.0	73.0	80.0	90.0
Maharashtra	20.5	25.0	38.0	24.0	34.3	26.0	31.0	52.0	46.0	55.0
Madhya Pradesh	23.0	20.0	15.0	17.5	20.0	17.0	16.0	16.0	15.0	18.0
Andhra Pradesh	24.8	25.0	23.0	26.1	26.8	21.5	26.0	32.5	30.0	32.0
Karnataka	7.5	8.5	8.0	9.0	7.0	6.5	4.0	8.0	7.0	7.0
Tamil Nadu	5.5	5.5	5.5	5.5	5.0	4.0	3.5	5.5	5.5	5.0
Others	1.0	1.3	1.5	1.5	0.8	1.0	1.0	1.0	1.0	1.0
Loose Supply	5.8	6.3	8.0	8.0	10.0	11.50	11.0	12.0	12.0	12.0
Total	158.0	161.5	167.0	153.0	158.0	140.0	167.5	243.0	242.5	270.0

Cotton Productivity Lint kg/hectare

State	97-98	98-99	99-00	00-01	01-02	02-03	03-04	04-05	05-06	06-07*
Punjab	182	171	340	355	255	320	381	552	616	743
Haryana	234	217	367	337	181	270	356	424	399	478
Rajasthan	337	320	458	406	318	253	379	427	412	442
Gujarat	490	451	392	290	342	351	475	651	655	640
Maharashtra	112	133	199	145	194	169	191	297	271	299
Madhya Pradesh	714	639	471	534	409	525	468	472	402	459
Andhra Pradesh	495	424	430	498	458	406	565	471	525	574
Karnataka	213	237	257	286	266	305	204	266	312	334
Tamil Nadu	353	425	374	703	584	591	613	658	615	904
Total	305	266	333	319	309	322	404	463	467	503

Source: Cotton Advisory Board; * Estimate

General Crop condition, Climate, Pest and Disease Situation

The general weather and crop condition during the cotton growing period in all the three zones were by and large conducive for cotton crop growth and development. Despite some damages caused by excessive rains and floods in some areas in States like Gujarat and Maharashtra, the production prospects have been very bright and another record crop production could be achieved. Significant cotton production, especially driven by higher yields due to cultivation of Bt cotton hybrids on a larger scale, adoption of effective integrated nutrient and weed management practices, integrated pest load, especially bollworms, cumulatively led to record yields. However, there are certain issues that need to be attended to like minor pests like mirid bugs, mealy bugs in Gujarat and Karnataka, problem of pink bollworm in many areas, thrips and diseases like CLCuV in North Zone and grey mildew in Central and South Zone gaining ascendancy. Parawilt has been noticed in Bt cotton hybrids in this districts in the districts of Hisar, Sirsa and Fatehabad. Notable level of incidence of rust in farmers' fields has been noticed in Andhra Pradesh and need to be cautiously dealt with.

Monitoring of AICCIP Trials

Monitoring of AICCIP trials and also the Bt cotton hybrid evaluation trials under the aegis of ICAR being conducted by the AICCIP centres forms an important assignment for the AICCIP scientists. As in the earlier years, seven independent monitoring teams were constituted for monitoring of trials and suggestions made by them shall be discussed during the Annual Group Meeting for discussion and needful followup action. The details of the composition of the Monitoring team was as below:

Monitoring Team Constitution

North Zone		
AICCIP Trial & ICAR Bt Trials		
Dr. Chenga Reddy, Lam Guntur, Principal Scientist (Cotton) (Convener)	Lam Farm, GUNTUR	Breeding
Dr. S.S. Udikeri Entomologist (Cotton)	UAS, Dharwad	Entomology
Dr. Perane, Pathologist (Cotton)	MPKV, Rahuri	Pathology
Dr. K.Rajendran	TNAU, Coimbatore	Agronomy
Central Zone (Gujarat & M.P) AICCIP Trial		
Dr. B.R.Patil, Senior Research Scientist (Cotton)- Convener	PDKV, Akola	Breeding
Dr. Vichiter Singh, Assistant Entomologist	ARS, Sriganaganagar	Entomology
Dr. Sekhon, Plant Pathologist	PAU, Ludhiana	Pathology
Dr. Basavannappa Agronomist	UAS, Siruguppa	Agronomy
Central Zone (Gujarat & M.P) Bt Trial		
Dr. Siwach, Senior Cotton Breeder (Convener)	HAU, Hisar	Breeding
Dr. A.V.Kolhe, Assist. Cotton Entomologist	PDKV, Akola 444 104	Entomology
Dr. B.D.Ajmera, Plant Pathologist	RAU, Sriganaganager	Pathology
Dr. E.Narayana	Lam Farm, Guntur	Agronomy
Central Zone (Maharashtra & Orissa) AICCIP Trial		

Dr. P.L.Nehra, Agronomist & PI (AICCIP) (Convener)	RAU, Sriganaganer	Agronomy
Dr. Basha Mohideen, Senior Scientist (Cotton)	ANGRAU, Nandyal	Breeding
Dr. Vikas Jindal, Assist. Entomologist	PAU, Faridkot	Entomology
Dr.D.Monga, Head	ANGRAU, Nandyal	Pathology
Central Zone (Maharashtra & Orissa) Bt Trial		
Dr. A.Ramalingam, Cotton Breeder (Convener)	TNAU, Srivilliputhur	Breeding
Dr.S.Mohan, Professor	TNAU, Coimbatore	Entomology
Dr. Daljit Singh, Plant Pathogist,	PAU, Faridkot	Pathology
Dr. Sahadeva Reddy, Assistant Agronomist	ANGRAU, Nandyal	Agronomy
South Zone – AICCIP Trial		
Dr. R.K.Patnaik, Cotton Breeder, (Convener)	OUAT, Bhawanipatna	Breeding
Dr. P.Jayakumar	CICR, RS, Sirsa	Entomology
Dr. Jagdish Beniwal, Plant Pathologist	CCSHAU, Hisar	Pathology
Dr. S.K.Khamparia, Principal Scientist (Agronomy)	JNKVV, Khandwa	Agronomy
South Zone – Bt Trial		
Dr. Pramod Punthir, Senior Cotton Breeder and PI (AICCIP) (Convener)	RAU, Sriganaganer	Breeding
Dr. M.P.Vadodaria, Research Scientist (Entomology)	NAU, Surat	Entomology
Dr. O.M.Bambawale, Principal Scientist	NCIPM, New Delhi	Pathology
Dr.L.K.Bishnoi, Senior Agronomist	CCSHAU, Hisar	Agronomy

Bt Cotton Hybrid cultivation

The area under Bt cotton during the current season has shot upto 38% of the total area under the crop in the country. Both the accelerated transfer of technology due to the sustained and joint research and development efforts by private sector agencies and the State/ Central Institutions and the phenomenal spread of Bt cotton hybrids seem to be the main contributory factors for the break through achieved in cotton production. The area under Bt cotton during the current season has been phenomenally higher in Maharashtra and Andhra Pradesh, closely followed by Gujarat, Madhya Pradesh, Punjab, Karnataka and Tamil Nadu. At present, Bt cotton hybrids have been stated to be grown in around 34.61 lakh hectares.

Area under Bt cotton hybrids in 2006-07 (Lakh hectares)

State	Total State Area	Bt Cotton hybrid Area	% of Bt Cotton Area
Punjab	6.18	2.81	45.5
Haryana	5.33	0.42	7.9
Rajasthan	3.08	0.05	1.6
Gujarat	23.90	4.07	17.0
Maharashtra	31.24	16.55	53.0
Madhya Pradesh	6.66	3.02	45.3
Andhra Pradesh	9.48	6.57	69.3
Karnataka	3.56	0.80	22.5
Tamil Nadu	0.94	0.32	34.0
Total	91.37	34.61	37.9

(Source: DOCD, Mumbai)

Maintenance of Nucleus and Breeder Seeds

An amount of Rs.65 lakh was received under Mini Mission II of Technology Mission on Cotton towards maintenance of Nucleus and Breeder seeds and was taken up at 11 State Agricultural University and three ICAR Centres.

The Breeder seed production in respect of National indents was taken up at 9 State Agricultural University Centers and three ICAR centers. As against an indent of 3.28 q of parental lines of hybrids and 58.93 q of varieties, a total quantity of 58.93q of parental lines and 189.86 q of Breeder seeds of varieties was produced. There were no major mismatches between indent and production.

(Figures in Quintals)

S.No	Hybrid/Varieties	Centre	2006-07	
			Indent	Production
Hybrids				
1	RAJ DH 9	RAU,		
	Female	Sriganganagar	0.20	0.13
	Male		0.10	0.10
2	LHH 144	PAU, Ludhina		
	PIL 8(F)		0.03	5.20
	PIL 43(M)		0.03	2.60
3	AAH 1	CCSHAU, Hisar		
	GMS 1		0.07	0.80
	HD 226		0.04	0.50
4	HHH 223	CCSHAU, Hisar		
	H 1157		0.02	0.75
	H 1220		0.01	0.25
5	HHH 287	CCSHAU, Hisar		
	H GMS 1		0.02	0.90
	HHM 1		0.05	0.50
6	JKHy 3	JNKVV, Khandwa		
	JK 4 (Female)		0.02	0.73
	KH 11 (Male)		0.01	0.29
7	Hybrid 6	NAU, Gujarat		
	G Cot 100		0.25	0.70
	G Cot 10		0.25	2.50
8	Hybrid 8	NAU, Gujarat		
	G Cot 10		0.10	2.50
	Surat Dwarf		0.54	0.48
9	Hybrid 10	NAU, Gujarat		
	BC 68-2		0.15	0.75
	LRA 5166 (SB)		0.02	0.30
10	PKV Hy2	PDKV, Akola		

	AK 32		0.05	2.23
	DHY 286-1		0.02	3.12
11	NHH 44	MAU, Nanded		
	BN 1		0.12	0.36
	AC 738		0.10	0.24
12	PHH 316	MAU, Nanded		
	PH 93		0.02	0.25
	PH 325		0.01	0.10
13	Varalaxmi	UAS, Dharwad		
	Laxmi		0.04	0.06
	SB 289 E		0.04	0.04
14	DCH 32	UAS, Dharwad		
	BS 28		0.13	0.16
	SB 425 YF		0.16	0.16
15	DHH 11	UAS, Dharwad		
	CPD 423		0.34	0.36
	CPD 420		0.34	0.37
Varieties				
1	BN	RAU, Sriganganagar	1.40	2.00
2	RST 9	„	2.95	3.55
3	RS 810	„	1.50	2.16
4	RS 875	„	0.65	0.20
5	RS 2013	„	3.25	4.49
6	RG 8	„	4.90	18.50
7	RG 18	„	0.50	0.88
8	LH 900	PAU, Ludhina	1.20	4.20
9	LH 1556	„	2.15	13.40
10	LD 327	„	0.75	6.43
11	LD 694	„	0.25	5.85
12	F 505	„	2.35	3.65
13	F 846	„	4.87	7.40
14	F 1054	„	1.20	5.55
15	F 1378	„	2.10	9.20
16	F 1861	„	1.10	5.30
17	HS 6	CCSHAU, Hisar	2.85	3.00
18	H 777	„	1.24	1.50
19	H 1098	„	4.45	5.00
20	H 1117	„	4.15	25.00
21	H 1226	„	1.86	23.00
22	H 974	„	0.50	0.00
23	HD 123	„	6.19	20.00
24	DS 5	„	0.03	0.00
25	HD 324	„	1.20	2.50
26	Khandwa 2	JNKVV, Khandwa	0.25	0.50
27	Khandwa 3	„	0.20	0.20

28	Pusa 8-6	IARI, New Delhi	0.46	0.00
29	PKV Rajat (AKA 84635)	PDKV, Akola	0.35	5.60
30	Narasimha	ANGRAU, Guntur	0.05	0.05
31	LRA 5166	CICR, Coimbatore	0.68	2.75
32	LRK 516	„	0.75	1.00
33	Surabhi	„	1.05	3.50
34	Supriya	„	0.10	1.00
35	MCU 5 VT	„	0.02	2.50
		Hybrids	3.28	27.43
		Varieties	58.93	189.86
		Total	62.21	217.29

Notification of Cotton genotypes for cultivation

During the year, six hybrids were notified for commercial cultivation in North and Central zones. They are as follows:

Hybrid	Developed by	Nature of hybrid	Zone of adaptation	Notification No. and Date
Navinya (NACH 6)	Nirmal Seeds (P) Ltd, Jalgaon	GMS based intra arboreum hybrid	Central & South zone	SO 599 E Dt. 25 th April 06.
G.Cot. Hy 12	NAU, Surat	Intra hirsutum hybrid	Gujarat	SO 599 E Dt. 25 th April 06.
RAJ. DH.9	RAU, Sriganganagar	GMS based intra arboreum hybrid	Rajasthan	SO 599 E Dt. 25 th April 06.
Vasant (Navkar 5)	Navkar Hybrid Seed Company, Ahmedabad	Intra hirsutum hybrid	North Zone	SO 599 E Dt. 25 th April 06.
Ajeet 33 (AHH 90-2)	Ajeet Seeds (P) Ltd., Aurangabad	Intra hirsutum hybrid	Central Zone	SO 1572 E Dt. 20 th Sep' 06.
Ajeet 11 (AHH 90-1)	Ajeet Seeds (P) Ltd., Aurangabad	Intra hirsutum hybrid	Maharashtra	SO 1572 E Dt. 20 th Sep' 06.

The varietal identification committee, which met during the AICCIP group meeting at UAS, Dharwad during April 2006 recommended the following varieties and hybrids for submission to Central Sub-committee on Crop Standards and release of varieties of Agricultural crops for Release & Notification. They are as follows.

Hybrid	Developed by	Nature	Zone of adaptation
CISA 310	CICR, R.S., Sirsa	<i>G. arboreum</i> variety	North Zone
CSHH 238	CICR, R.S., Sirsa	Intra hirsutum hybrid	North Zone
ZCH 21405	Zuari Seeds Ltd, Bangalore	Intra hirsutum hybrid	Central Zone

During the 44th meeting of Central Sub-Committee on crop standards, Notification and release of varieties for agricultural crops held on 20th November 2006 recommended the above

varieties for Release and Notification subject to submission of morphological characters of the parents of CISA 310. Hybrids CSHH 238 and ZCH 21405 have since been notified.

Hybrid	Notification No. & Date
Hybrid Kalyan (CSHH 238)	SO. 122 (E) Dt. 6.2.07
Dhruv (ZCH 21405)	SO. 122 (E) Dt. 6.2.07

Denotification of Varieties

Based upon the proposals received from Tamil Nadu, the following varieties have been denotified.

KC 1, MCU 10, MCU 11, K 10, ADT 1, SVPR 1, Paiyur 1	SO 1574 E Dt. 20 th September 2006.
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Evaluation of Bt Cotton hybrids

During the current year, under the All India Coordinated Cotton Improvement Project, Bt cotton hybrids developed by Private sector R&D firms were evaluated in all the three zones. The details are furnished below.

Zone	No. of Entries		No. of locations	
	I Year	II Year	I Year	II Year
Intra hirsutum hybrids				
North Zone	19	2	6	5
Central Zone	26	12	14	5
South Zone	24	7	11	5
Inter specific (G. hirsutum x G. barbadense) Hybrids				
Central Zone	3	-	2	
South Zone	6	-	4	

The results are being compiled for submission to the Council.

DUS Testing in Cotton

As a signatory of Trade Related aspects of intellectual property rights (TRIPS), India has to make provision for giving effect to article 27.3 (b) of the agreement by an effective system of protection of plant varieties. Registration of New plant varieties in the registry of Protection of Plant Varieties and Farmers' Right Authority (PPV & FR Authority) will enable breeders to seek exclusive rights to produce and sell the seeds and will ensure benefits sharing in the future use of his/her variety by other breeders. However, for the registration of any variety under this act, the variety should confirm to the criteria of Novelty, Distinctiveness, Uniformity and Stability (DUS). To give effect to the above said, the Protection of Plant Varieties and Farmers' Right Act, 2001 (53 of 2001) was enacted by the Parliament on 30th October 2001. The Rules of this act have also been notified in September 2003. *The Indian Council of Agricultural Research is*

vested with the responsibility of conducting the DUS tests to establish the Distinctiveness, Uniformity and Stability of the varieties received for registration by the PPV & FR Authority.

Cultivated cottons belong to both Tetraploid (*G. hirsutum L. and G. barbadense L.*) and Diploid (*G. arboreum L. and G. herbaceum L.*) groups. DUS test guidelines for cotton have been developed taking UPOV guide lines as basis and includes 36 descriptors. India is unique in having both Tetraploid and Diploid cotton occupying a large area. Looking in to the total variability and range of characteristics, separate sets of DUS guide lines for the Tetraploid and Diploid cotton have been compiled and published by the Project Coordinator (Cotton) and Head, CICR, Regional Station, Coimbatore. Select AICCIP centres and CICR are geared up to actively involve in the characterization of cotton genotypes based on DUS Test guidelines for cotton

Extra Long Staple Cotton (ELS Cotton)

Development of Improved *G. barbadense* genotype

Improvement of *G. barbadense* cotton through the efforts of AICCIP and CICR, besides private sector R&D needs to be viewed in terms of seed cotton yield, ginning percentage and earliness. As compared to the Pima and Giza varieties, Suvin cotton suffers from low micronaire and inadequate fibre strength. Current breeding strategies are being oriented towards improving both. Research efforts currently undertaken indicate the possibility of increasing the yield and ginning out turn. However, more efforts are needed to increase the fibre quality. Attempts are to be made to use molecular markers to identify quantitative trait loci (QTL) governing fibre quality characters, map them and introduce them into a wide variety of populations through Marker Assisted Selection (MAS).

Suvin is the only *G. barbadense* Extra Long staple cotton variety (38-40 mm) that can spin upto 120s counts and is the finest cotton variety in the world. Maintenance breeding is rigorously followed at CICR, Regional Station, Coimbatore for ensuring the genetic purity and superior quality of the fibre. Around 50-70 Kgs of Breeder seeds of Suvin variety is produced annually and supplied to Seed producers. This ensures effective seed chain maintenance. Even though significant milestone has been achieved in respect of record cotton production during 2006-07 with 270 lakh bales of cotton, the country produced only 3-4 lakh bales of Extra Long Staple cotton as against requirement of 9-10 lakh bales. The shortage is being met through imports from USA, Egypt, Sudan and CIS countries. However, through research and development efforts through AICCIP (ICAR) and CICR Regional Station, Coimbatore of ICAR, and Private sector R&D efforts, several interspecific hybrids of cotton with extra long staple category with superior fibre quality attributes have been released and recommended for commercial cultivation. The details are as follows:

Extra Long Staple Cultivars developed and released through AICCIP with superior fiber quality attributes that are being popularized now due to renewed interest in textile sector

Variety/Hybrid	2.5% SL (mm)	Mic	BS 3.2mm	Count	Year of Release	Species
MCU 5	33.0	3.2	26.0	60s	1968	H
Varalaxmi	34.0	3.2	28.0	80s	1972	HB

Suvin	38.0	3.2	38.0	120s	1974	B
DCH 32	36.0	3.0	30.0	80s	1981	HB
MCU 5 VT	32.5	3.3	25.0	60s	1982	H
Savita	33.0	3.8	26.0	60s	1987	HH
TCHB 213	35.0	3.6	25.0	80s	1989	HB
TM 1312 (Surya)	32.5	3.4	26.0	50s	1994	HH
DHB 105	32.0	3.2	25.0	60s	1994	HB
VRS 7 (Surabhi)	32.5	3.2	24.0	60s	1996	H
CDHB 1 (Sruthi)	35.0	3.5	28.0	80s	1996	HB

Development of Interspecific hybrids

The available interspecific hybrids, viz., DCH 32 and TCHB 213, through high yielding often suffer from low micronaire. The fibre strength also do not meet the CIRCOT norms for 80s cotton. Hence, more efforts are necessary to increase micronaire and strength. Population improvement and synthesis of heterotic pools to develop superior parents and high yielding hybrids with improved fibre quality are receiving now greater attention. The currently tested hybrids in the national trials show marked improvement in yield with better micronaire and strength.

Evaluation of interspecific hybrids *

Hybrid	Seed cotton yield (kg/ha)	Ginning %	2.5% Span Length (mm)	Micronaire	Strength (g/tex)
JKCHB 214 (JK Seeds)	1496	33	34.5	3.6	26.0
USHB 25 (Seed Works Ltd)	1484	33	34.7	3.4	26.1
ARBHB 943 (UAS, Dharwad)	1388	33	34.5	3.7	23.9
RAHB 710 (UAS, Dharwad)	1431	33	34.1	3.9	24.8
DCH 32 (c)	989	35	36.5	3.4	24.8

* Ref: AICCIP Project Coordinator's Report, 2006

World ELS Cotton area and production declined to 6.45 lakh hectares and 33.11 lakh bales, respectively from 7.35 lakh hectares and 43.11 lakh bales. This leads to sharp increase in prices in the international market. The global output of ELS cotton is expected to increase by 24 percent to 7 lakh tonnes during 2006-07. However, with an annual production of only 2.0 lakh bales in India as against the demand of 9.0 lakh bales substantial imports are likely to bridge the gap. With the international prices remaining high and market resistance to increase the super fine yarn price, conversion of ELS cotton to high count yarn, is likely to become non-remunerative. Hence, urgent efforts are called for to increase the production and productivity of Indian ELS Cotton. Phy. 800 Pima and DP 340 Pima are the important Pima varieties in USA, while Giza 88, Giza 70 and Giza 86 constitute the bulk of the Egyptian varieties. Barakat 90, even though slightly inferior to Pima and Giza varieties, constitutes the major ELS variety in Sudan.

In India, Suvin is the only ELS variety with a fibre length of 35 mm and above. In India the interspecific hybrids constitute substantially to the ELS cotton production. DCH 32 and TCHB 213 are the popular hybrids. Several areas in the state of Karnataka, Tamil Nadu, Andhra Pradesh, Maharashtra. Madhya Pradesh have potential to grow ELS cotton.

Bt cotton ELS hybrids MRC 6918 and RCHB 708 Bt released by Mahyco and Rasi Seeds, respectively, will also contribute towards increased ELS production in the coming years. Better developmental efforts are called for to extend the ELS cotton area in the country, while urgent research efforts to increase yield and quality that is underway at CICR, Regional Station, Coimbatore and SAUs in AICCIP will go a long way in marking the ELS production more remunerative to the farmers. These measures shall also help in conserving valuable foreign exchange, besides bringing in additional revenue through value addition to ELS cotton based textiles.

Transfer of Technology

Front Line Demonstration

During the year 2006-07, **1350** Front Line Demonstrations (FLDs) on cotton production technology, **23** unit demonstrations on Integrated Pest Management (IPM) and **21** unit demonstrations on Farm Implements were conducted all over India. The number of demonstrations conducted centre wise and the budgetary outlay are as follows.

Table-1. Budget allocation for Front Line Demonstrations in Cotton (2006-07)

S.No.	Centres	FLDs on Production Technology		FLDs on IPM		FLDs on Farm Implements		Total (Rs.)
		No.	Budget (Rs.)	No.	Budget (Rs.)	No.	Budget (Rs.)	
North Zone								
1	PAU, Faridkot	50	100000	1	100000	2	200000	400000
2	HAU, Hisar	100	200000	1	100000	1	100000	400000
3	RAU, Sriganaganagar	30	60000	1	100000	1	100000	260000
4	MPUAT, Banswara	20	40000	1	100000	1	100000	240000
5	CICR, Sirsa	50	100000	1	100000	1	100000	300000
North Zone Total		250	500000	5	500000	6	600000	1600000
Central Zone								
6	NAU, Surat	70	140000	1	100000	1	100000	340000
7	JAU, Junagadh	50	100000	1	100000	1	100000	300000
8	JNKVV, Khandwa	40	80000	2	200000	1	100000	380000
9	PDKV, Akola	120	240000	2	200000	1	100000	540000
10	MAU, Nanded	120	240000	2	200000	1	100000	540000
11	MPKV, Rahuri	50	100000	1	100000	1	100000	300000
12	OUAT, Bhavanipatna	150	300000	1	100000	1	100000	500000
13	CICR, Nagpur	50	100000	1	100000	1	100000	100000
14	Raipur	50	100000	-	-	-	-	100000
15	West Bengal	50	100000	-	-	-	-	100000
Central Zone Total		750	1500000	11	1100000	8	800000	3400000
South Zone								

16	ANGRAU, Guntur	75	150000	2	200000	2	200000	550000
17	UAS, Dharwad	75	150000	2	200000	2	200000	550000
18	TNAU, Coimbatore	75	150000	1	100000	2	200000	450000
19	CICR, Coimbatore	25	50000	1	100000	1	100000	250000
20	CRIDA, Hyderabad	100	200000	1	100000	-	-	300000
21	PCs cell	-	100000	-	-	-	-	100000
South Zone Total		350	800000	7	700000	7	700000	2200000
Grand Total		1350	2800000	23	2300000	21	2100000	7200000

North zone

Punjab

Fifty demonstrations on improved hybrids/ varieties of both *G. hirsutum* and *G. arboreum* viz., LHH-144, MRC-6301Bt, MRC-6304 Bt, F-1861, F-1378, LH-1556 and Moti recorded 3.4 to 40.2 per cent increase in the mean seed cotton yield as compared to yield in their respective check plots. Demonstrations on improved agronomic practices had considerable to check. FLD's on Integrated Pest Management in 50 hectares recorded higher seed cotton yield in the range of 4.76- 25.0 per cent than farmers' practice. Demonstrations on farm implements viz., Hybrid cotton planter and Rotavator, Hybrid cotton planter and Disc harrow and Aeroblast sprayer helped in realization of better seed cotton yield.

Haryana

One hundred demonstrations were conducted on improved cotton hybrid viz., **AAH 1, HHH 223, HD 324, HD 123, H 1226 and H 1117** with advanced package of practices by Haryana Agricultural University, Hisar. The increase in seed cotton yield due to these advanced hybrids ranged from 7.21 to 26.95 per cent. Due to the demonstrations on IPM, on an average of 23.33% increase in seed cotton yield was obtained. Demonstrations on Farm implements viz., sub-soiler for deep ploughing and rotavator for hoeing in standing cotton crop resulted in 5.88 per cent increase in yield.

Rajasthan

Rajasthan Agricultural University, Sriganganagar conducted thirty demonstrations on improved cotton varieties RS-2013, RS-810, RST-9 and Raj DH-9 with improved package of practices as against Bikaneri nerma, RST-9 and F-846 with local packages of practices. The demonstrations increase the seed cotton yield from 13.7 to 30.8 per cent. Due to the demonstrations on IPM, the number of pesticides sprays had come down to four and the average seed cotton yield was 20.30 q/ha in IPM as compared 18.50 q/ha of non-IPM. Considering the total income and expenditure incurred, IPM farmers got more C:B ratio (1:2.63) than non-IPM farmers (1:2.15). Demonstrations on aero blast sprayer were also conducted to show the usefulness of the implement and also effective reduction in cost of spraying besides considerable savings in insecticides.

MPUAT, Banswara carried out twenty demonstrations on Integrated Crop Management practices of cotton on hybrids H-8 and PA-255, which increased the yield to utmost 19.56 per cent. On an average, the percent increase in yield due to demonstrations on IPM technology was 11.92 per cent. Demonstrations on rotavator, Self Propelled Power weeder, improved weeder, power sprayer, battery-operated sprayer reduced the cost of cultivation.

Central Zone

Gujarat

Navsari Agricultural University, Surat carried out 52 demonstrations on improved varieties viz, G.Cot.Hy-12, G.Cot.Hy.10, Approved Bt hybrids, G.Cot.23 and G.Cot.21 and 18 demonstrations on improved agronomic practices. The G.Cot.23 varietal demonstrations gave the maximum of one and half fold yield increase (1250 kg/ha) than the local desi variety (500 kg/ha). Similarly the demonstrations on improve agronomic practices on G.Cot 23 offered 164.30 per cent yield increase (1850 kg/ha) than Digvijay with traditional practices (700 kg/ha).

Junagadh Agricultural University, Junagadh conducted varietal demonstrations on improved cotton varieties / hybrids viz., Mallika Bt, RCH – 118, JK varun, Sai-118, Shakti-9. Tulasi, Mallika 207, Ankur, RCH 2 Bt, Vikram 5, Viswanath, Aji –BG II, Ajit– 155, Guj. Gold - 22 and Bunny, fertilizer management, intercropping with sesame and irrigation management. Results of varietal demonstrations indicated 6.56 per cent average yield increase over check with a range of 5.56 to 38.89 per cent.

Madhya Pradesh

J.K. Krishi Vishwa Vidyalaya, Khandwa conducted twenty demonstrations to exhibit the efficiency of Integrated Nutrient Management (INM) practices on the farmer's field over traditional practices. INM practices gave on an average of 16.22 q/ha seed cotton yield as compared to 14.17 q/ha in farmers practices indicating an increase in the range of 8.24 – 25.10 percent over the traditional practice of cultivation. Twenty demonstrations conducted with the local IPM module gave an increase of nine percent in the seed cotton yield as compared to the conventional method of pest control.

J.K. Krishi Vishwa Vidyalaya, Indore conducted demonstrations on improved cotton varieties and hybrids viz., H8 and DCH 32 that yielded 12-17 % more kapas than farmers' practices. Demonstrations on cotton intercropping with maize (2:1 row ratio) found more remunerative by giving on an average returns of Rs 20830 /ha to Rs 24380/ha as compared to Rs 14960/ha to 18920/ha in sole cotton. Demonstrations on Integrated Nutrients Management (INM) recorded on an average of 17-36% higher yield than farmers' practices.

Maharashtra

MPKV Rahuri, conducted fifty demonstrations on improved cotton varieties / hybrids viz., JLA – 794, Y-1 10.69, Phule 492 and NHH-44, intercropping with green gram and

pigeonpea, INM and Integrated Disease Management (IDM). The demonstrations on INM and IDM attributed 10.75 and 7.08 per cent yield increase respectively than the farmers' practices. Demonstrations on IPM resulted in 11.48 per cent more seed cotton yield.

Central Institute for Cotton Research, Nagpur carried out demonstrations on NHH 44 with the recent technologies for cotton improvement viz., INM, cotton + soybean intercropping system, foliar application of DAP and detopping opening of ridges and furrows for moisture conservation. It also conducted demonstrations on improved cotton hybrids NCS 145 Bt, Ankur 651 Bt, Ankur 09 Bt and MRCH 6301 Bt in comparison with the traditional hybrids NHH-44. In INM demonstrations the per cent increase in seed cotton yield ranged from 6.67-28.57 per cent with an average increase of 19.37 per cent. On an average, an additional monetary return of Rs 6305/ha has been obtained from demonstrations on cotton + soybean intercropping. Demonstrations on IPM offered 11.67 per cent increase in yield. Power sprayer, battery operated sprayer, cotton plant puller, animal drawn ridger, acid delinting machine and ginning machine were demonstrated to the farmers under demonstrations on farm implements.

South Zone

Andhra Pradesh

ANGRAU, Guntur organized demonstrations on performance of Bt cotton hybrids viz., Bunny Bt, RCH 2 Bt, Ankur Bt, JK Durga Bt, Mallika Bt and Signa Bt as against non-Bt hybrids. Demonstrations on Bt Cotton hybrids with recommended package of practices offered 31.45 per cent higher yield than the non-Bt hybrids. Due to IPM demonstrations farmers got an additional benefit of Rs. 6,031/- per hectare. Taiwan Sprayer and Rotavator were demonstrated under demonstrations on farm implements.

CRIDA, Hyderabad conducted one hundred demonstrations on improved varieties / hybrids viz., Bunny Bt, Bunny, Dassera, JK Durga Bt and RCH 20 Bt, improved agronomic practices and intercropping with cowpea, soybean and pulses. The demonstrations increased the seed cotton yield from 12.41 to 46.63 per cent as compared to the check plots. Demonstrations on IPM yielded an average additional income of Rs. 23,169 per acre.

Tamil Nadu

Central Institute for Cotton Research, Coimbatore conducted demonstrations on improved cotton varieties Surabhi and Sumangala, Extra Long Staple (ELS) Cotton hybrids Sruthi and DCH 32, Bt cotton hybrids and cotton + vegetables intercropping, Integrated Weed Management (IWM) and IDM. Demonstrations on improved varieties and Bt cotton hybrids increased the seed cotton yield to the maximum of 50.00 per cent. To reintroduce the ELS cotton, two demonstrations were conducted on cotton hybrids Sruthi and DCH 32. Demonstrations on IPM reduced the number of sprays from eight to three. Demonstrations on animal drawn junior hoe for intercultural operations in cotton fields reduced the cost of weeding to the extent of Rs. 4625 /- per hectare.

Integrated Cotton Cultivation (Contract Farming):

The Cotton Corporation of India took up the project of integrated Cotton Cultivation (Contract Farming) in the States of Punjab, Haryana, Maharashtra, Madhya Pradesh, Karnataka and Andhra Pradesh during cotton season 2005-06 covering the area of 20030 hectares under the contract farming by associated some of the leading textile mills like M/s. Nahar Group of Mills, Ludhiana, M/s. Pratibha Syntex, Indore, M/s. Forbes Gokak Mills, Mumbai and M/s. Super Spinning Mills, Coimbatore. The results have been quite encouraging with increase in yield, lower cost of production and increased income of the cotton farmers. The programme has led to the proposition that a symbiotic relationship between the producer and the consumer can be achieved for mutual benefit in contract farming programmes, especially in niche areas like promotion of Extra Long Staple cotton cultivation.
