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ICAR

CIRCOT

ANNUAL REPORT
1993-94

Central Institute for Research on
Cotton Technology
Bombay

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1993-94

Central Institute for Research on Cotton Technology

Indian Council of Agricultural Research

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Introduction

This seventieth Annual Report of Central Institute for Research on Cotton Technology (CIRCOT), covers the period April 1, 1993 to March 31, 1994.

CIRCOT was established by the Indian Central Cotton Committee (ICCC) in the year 1924 under the name of Technological Laboratory of ICCC. The objectives then were to undertake spinning tests on various cotton strains received from agricultural departments in the country and to test their spinning values. To carry out these activities, the Institute had established co-ordination with the Departments of Agriculture and Agricultural Universities located in major cotton producing tracts in the country. After the abolition of commodity committees including the ICCC, its name was changed to Cotton Technological Research Laboratory (CTRL). Since then the research activities were given a re-orientation and geared-up towards meeting the challenges of increasing the production of quality cottons. Research on the better utilisation of cotton agro-wastes was also accorded importance in order to give cultivators incentives in the form of self employment opportunities and additional income.

Realising the phenomenal increase in the research component, the Quinquennial Review Team (QRT) recommended changing the name of CTRL to Central Institute for Research on Cotton Technology (CIRCOT) and CTRL was rechristened as CIRCOT with effect from April 1, 1991.

The important functions of CIRCOT are as follows:

1. To participate effectively in the programmes for improvement in the production of quality cotton in India by evaluating the quality of new strains evolved by agricultural scientists and giving them necessary technical guidance.

2 To carry out research on physical, structural and chemical properties of cotton in relation to quality and processing performance.

3. To carry out research investigations on the ginning problems of cotton.

4. To investigate the greater and better utilisation of cotton, cotton wastes, linters, cotton seeds, etc.

5 To help the trade and industry by providing reliable and accurate

data on the quality of representative trade varieties of Indian cottons.

6 To issue authoritative reports on the samples received for tests from Government departments, the trade and other bodies.

7. To collect and disseminate technical information on cotton.

Organisation : As could be seen from the organisational chart in Annexure I, Director heads the Institute assisted by a team of senior scientists and Technical officers. An administrative officer provides him assistance in the general administration, while the Finance and Accounts Officer looks after matters concerned with accounts and audit of this Institution.

Library : To keep pace with the advancements in the field of cotton research, latest available books on cotton, cotton technology, waste utilisation and general books of research interest were periodically being added during this year also. During 1993-94 102 books were added to the library and the total number of books by the end of March 1994 was 4,781. With the addition of 125 bound volumes of journals the total number of bound volumes stands at 5,968. Ninety journals were obtained through subscription (52 foreign and 38 Indian). Many journals are also received by way of complimentary or on exchange basis. Besides the staff of this Institute, the library facilities were availed of by the students and researchers from various colleges affiliated to Bombay University, sister institutions and personnel from the textile industry.

Inter-library loan facilities were also maintained with other libraries in Bombay.

New Equipment : A list of equipments added to the various Divisions/Sections are given in Annexure II.

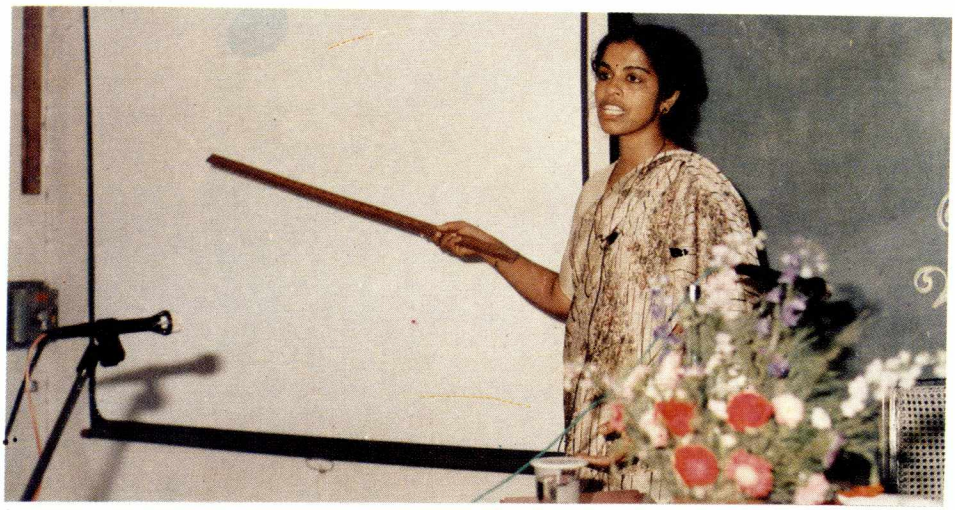
Distinguished visitors : Apart from official visits of personnel from ICAR headquarters and other organisations, many dignitaries from home and abroad visited the Institute on various occassions. A list of such visitors is given in Annexure III.

Management Committee : The Thirty-sixth meeting of the Management Committee was held on December 19, 1993. Apart from the regular items such as confirmation of the minutes of the previous meeting, action taken on the recommendations of the committee, progress of expenditure, progress of works, action taken on the recommendations of the Institute Joint Council and Grievance Committee, etc., on-going research projects and research highlights were considered and appropriate recommendations made.

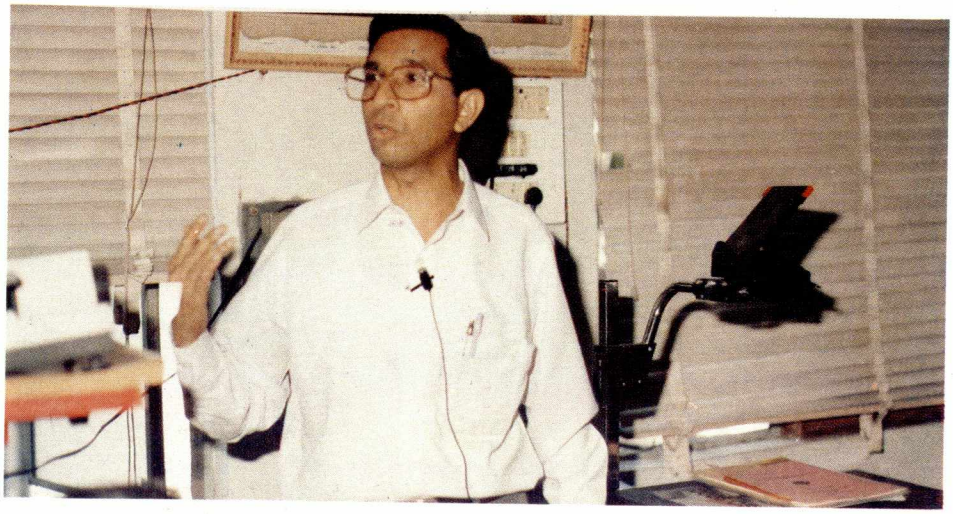
National Science Day Celebration : National Science Day on February 28, 1994 was celebrated this year also with lectures by Dr. Susan Eapen, Scientific Officer, BARC and Dr. H. V. S. Murthy, Professor, VJTI, Bombay on "Bio-technology for Genetically Altered Plants" and "Relevance of ISO 9000 Series in

PLATE I

NATIONAL SCIENCE DAY



Dr. Susan Eapen, Scientific Officer, BARC giving a talk on
Bio-Technology for Genetically Altered Plants



Lecture by Dr. H.V.S. Murthy, Professor, V.J.T.I., Bombay on
Relevence of ISO 9000 Series in the Indian Textile Scenario

PLATE II

HINDI DAY

Dr. Tribhuwan Rai, Head of Hindi Division, Khalsa College, Bombay, who inaugurated the Hindi Day function, judging the ***Tatkalic Bhasan Spardha***

Shri K.V. Pathak, Film Story Writer, delivering presidential address at the concluding function of the Hindi Day Celebrations

the Indian Textile Scenario", respectively. This function was organised by the Institute and the ARS Forum jointly and was attended by scientific and technical personnel.

World Cotton Research Conference : Dr. N. B. Patil, Director was deputed to Brisbane, Australia for participation in the "World Cotton Research Conference" for a period of 15 days from 11-02-1994 to 25-02-1994.

Staff Research Council : The ninety-third meeting of Staff Research Council (SRC) was held on July 3, 5, and 9, 1993. Progress of research work during April 1, 1992 to March 31, 1993 and new project proposals for 1993-94 were discussed and a new programme of work for 1993-94 was finalised. The joint session of SRC with the Management Committee was held on December 18, 1993.

Research Projects : In all, there were 34 on-going research projects grouped under different Thrust areas, the details of which are as follows :

	Thrust Area	No. of Research Projects
1	Technological Research for Cotton Quality Evaluation and Improvement	10
2.	Post-harvest Technology of Cotton	4
3.	Structure, Property and their Inter-relationships in Textile Materials	9
4.	Chemical Processing and Finishing Treatments	2
5.	Utilisation of By-products of Cotton and Processing Wastes	8
6.	Studies on Cotton Plants and Processing Dusts in Relation to Occupational Hazards	1

Implementation of Official Language : Smt. J. R. Chavkute, Jr. Clerk underwent training in Hindi typewriting in July 1993.

Smt. S. S. Dongre, Assistant and Kum. T. M. Sawant, Hindi Assistant, underwent three months training in Hindi Translation at the Central Translation Bureau, Bombay from 1-7-1993 to 30-9-1993 and 1-1-1994 to 31-03-1994, respectively. They were awarded diplomas after completion of the course.

Hindi Day : Hindi Day was celebrated with different programmes during the period from September 4 to 14, 1993 at the headquarters. The function was inaugurated by Dr. Tribhuwan Rai, Head, Hindi Division, Khalsa College, Bombay. The final day function at the headquarters was presided over by Shri K. V. Pathak, Film story writer and prizes were distributed by him to the winners of various competitions.

Post-Graduate Training : The recognition granted to CIRCOT by the University of Bombay as a Post-Graduate Institution was continued during the period. Ten students were being guided for M.Sc. and six for Ph.D. Eleven scien-

tists of the Institute are recognised guides for M.Sc. and Ph.D. on various disciplines such as, Physical chemistry, Organic chemistry, Bio-physics, Microbiology, Spinning, Textile physics and Textile bio-physics.

Membership of Director to other organisations : The Director, CIRCOT continued to be a Member of the following Committees/Bodies during the reporting period :

1. Cotton Advisory Board of the Office of the Textile Commissioner, Government of India, Ministry of Commerce.
2. Board of Directors of the Cotton Corporation of India, Bombay.
3. Research Advisory Committee of the South India Textile Research Association (SITRA), Coimbatore.
4. Various Standing Committees of VJTI, Bombay.
5. Cotton Development Council (Government of India) and Member of the Sub-Committees on :
   (i) Research and Development
   (ii) Trade, Pricing and Exports
6. Member of the Textile Commissioner's Cotton Certification Committee.
7. Member of the ICAR Scientific Panel for Post-Harvest Technology.

In addition, the Director and scientists of CIRCOT continued to represent CIRCOT/ICAR in various Committees of the Bureau of Indian Standards and other organisations.

Institute Joint Council (IJC) : Three meetings were conducted on July 19 and September 28, 1993 and on January 25, 1994 to discuss various matters of general interest to the staff.

Grievance Committee : One meeting of the Committee was held on August 13, 1993 to consider individual grievences of the staff members for their redressal.

Finance : A statement showing sanctioned budget grant of CIRCOT and the actual expenditure for the financial year 1993-94 has been furnished in Annexure IV. As could be seen there from, the actual expenditure under the Non-Plan was Rs. 208 lakhs as against the actual sanctioned grant of Rs. 2,05,91,655/-. Further, an expenditure of Rs. 83,39,901/- was incurred under the Plan budget as against a sanctioned grant of Rs. 83.40 lakhs.

Significant Findings : At the appropriate panel meeting of AICCIP, the following five new cotton varieties were recommended for release :

Sl. No.	Variety	Spinning Potential	State
1.	AHH.468	30s-40s	Maharashtra, Andhra Pradesh and Gujarat
2.	CAHH.48	40s	Maharashtra and Gujarat
3.	L.389	40s and 50s	Andhra Pradesh
4.	L.K.86	50s and 60s	Andhra Pradesh
5.	L.861	50s and 60s	White-fly prone areas of Andhra Pradesh

INTRODUCTION

A new test method for determining the strength of cotton yarn has been evolved in which the yarn is made into a bundle of 100 parallel strands with the help of a mechanical device and it is gripped between specially made clamps and tested on the conventional lea testing machine and the breaking strength determined. The results of trials conducted showed that the coefficient of variation of CSP in bundle test is very low of the order of 1% as against 3-7% for normal lea test and only five tests are sufficient per sample as against 50 in the case of lea tester.

Correlations were worked out between fibre, yarn and fabric properties of the knitted fabrics and the varietal effect on the mechanical properties of knitted fabrics was also assessed. It was found that there existed good relationship at 1% level between the Micronaire value and air-permeability of knitted fabrics. Air-permeability decreases by about 19% after scouring and further 1.7% after bleaching. Fabrics made from finer cottons show lower air-permeability and the bursting strength was directly proportional to (CSP/U%) value. It was also found out that the chemical treatments decrease the bursting strength; however, there was no varietal influence on the mechanical properties of knitted fabrics.

Based on the test results of 288 cotton samples, a prediction equation was arrived at, with which Pressley Strength Index (PSI) could be estimated from tenacity values from HVI.

Studies on the dyeing behavior of unmercerised, causticised and variously mercerised rotor (OE) and ring-spun (RS) cotton yarns were undertaken using a number of direct, vat and reactive dyes. The percentage exhaustion was calculated from the absorption values. It was found that the dye uptake was maximum for slack - mercerised samples. The following trend was observed, in general: Slack - mercerised > tension - mercerised > slack - mercerised & stretched - washed under stretech > causticised - unmercerised.

There was no significant differences in the percentage of exhaustion values for two yarns whether they are dyed separately or together. OE yarns showed significantly higher dye uptake values compared to the RS yarns with the exception of slack mercerised OE yarns dyed with vat dyes. Significant differences in relative dye uptake values were not obtained when the yarns were dyed in separate baths.

An infrared Spectroscopic method for estimating the amount of non cellulosic matter in natural ligno-cellulosic fibres, like, jute, banana, coir, sisal, pineapple, palm, kapok, etc. has been developed; the results of this trial agree well with chemical estimation of non-cellulosic content.

Studies on the application of cellulase enzyme *Pencillium funiculosum* was continued by stepping up the previously evolved method to release as much as 90-98% starch in 2-3 hours. It was observed that the enzyme could be used effectively to isolate intra-cellular materials of plant origin if applied with appropriate enzyme(s). Attempts to de-

ink waste paper and waste paper pulp using cellulase enzyme of *Pencillium funiculosum* has revealed that the enzyme degraded newspaper pulp to fibrillar level releasing the ink, evincing possibilities for fibrillation as well as de-inking at the same time by using this enzyme.

As the cellulase from *Pencillium funiculosum* exhibited pectolytic activity, it was used to clear apple pulp into a clear juice when incubated at 50°C. for 2 hours.

Both laminated and non-laminated corrugated boxes for packaging of fruits have been prepared using kraft paper prepared from cotton plant stalks. The technology for particle board preparation from cotton plant stalk was transferred to the Particle Board Manufacturers' Co-Operative Society at Chikanargund at Dharwad District, Karnataka. The plant, having a capacity of 20 tonnes/day is being commissioned with a financial outlay of Rs. 296 lakhs using indigenous machinery.

Improvements were made in the technology of bio-gas production by generating 600 1/kg gas with a methane content of 60-65% by using mixed microbial consortia in the anaerobic fermentation chamber. Thus, apart from phenomenal increase in gas production, the calorific value of the gas also went up by 10%.

2

Progress of Research

A brief account of the progress of research work during 1993-94 at CIRCOT and its Regional Units including the Ginning Training Centre at Nagpur, is given below :

THRUST AREA I: TECHNOLOGICAL RESEARCH FOR COTTON QUALITY EVALUATION AND IMPROVEMENT

This thrust area encompasses three distinct facets of technological research:

(a) Evaluation of the quality of cotton samples received from agricultural trials and the All India Co-ordinated Cotton Improvement Project (AICCIP),

(b) Tests on Standard and Trade varieties of Indian Cottons, and

(c) Research work on specific agricultural and technological aspects relevant to the cotton improvement.

(a) Evaluation of the Quality of Cotton samples received from Agricultural Trials and All India Co-ordinated Cotton Improvement Project

Large number of cotton samples are being received every year for technological evaluation from trials conducted by the AICCIP, Agricultural Universities and State Agricultural Departments. The number of samples received during 1993-94 for different tests has been given in Table 1 (a). The total number of samples tested at each Regional Quality Evaluation Unit of CIRCOT is presented in Table 1 (b).

The samples received were tested in the order of their receipt and test reports on them were sent soon after the tests were over. The test results on Trade Varieties and Standard Indian Cotton samples are reported in the form of periodical Technological Circulars and at the end of the year, these are compiled for the whole season and published as Technological Reports separately for Trade Varieties and Standard Varieties of Indian Cottons.

A few samples were also received for determination of quality of ginning, oil content in cotton seed, etc. and reports on these tests were also sent immediately after the tests were completed.

The number of samples tested statewise, for various fibre characters and reports issued on them have been given in Table 2.

TABLE 1(a) : NUMBER OF COTTON SAMPLES RECEIVED FROM AGRICULTURAL TRIALS FOR DIFFERENT TESTS AT THE HEAD QUARTERS OF CIRCOT

Type of Test	Average for quinquennium 1986-90	1991	1992	1993
Fibre and Full Spinning	239	192	179	147
Fibre and Microspinning	1898	1600	1480	1815
Microspinning alone	56	—	—	—
Fibre Test alone	392	631	328	311
Mill Test	11	4	20	3
Standards Cottons	19	21	10	17
Trade Varieties :				
— Lint	43	28	35	—
— Kapas	24	64	40	—
Technological Research	15	269	45	5
Miscellaneous	7	—	17	—
Total	2708	2809	2154	2131

TABLE 1(b) : NUMBER OF SAMPLES TESTED AT THE REGIONAL QUALITY EVALUATION UNITS

Regional Quality Evaluation Unit	Quality Parameters				
	Fibre length	Fibre fineness	Fibre strength	Fibre maturity	Micro-spinning tests
Akola	838	541	541	541	—
Coimbatore	1976	1970	1982	1976	449
Dharwad	1405	1399	1405	1405	—
Guntur	731	731	731	731	—
Hisar	932	764	770	770	—
Indore	533	527	533	533	—
Ludhiana	2925	1092	1382	958	—
Nagpur	1332	1324	1332	1299	—
Nanded	862	856	856	862	—
Rahuri	1130	1070	1430	1076	—
Sirsa	593	38	422	422	—
Sriganganagar	1355	1344	1344	1344	—
Surat	11666	5416	5428	5536	90

TABLE 2: NUMBER OF SAMPLES FROM VARIOUS STATES TESTED AND REPORTS SENT DURING 1993-94

State	Fibre and Full Spinning	Fibre and Micro-spinning	Fibre Tests only	Total
Punjab	52(55)	109(12)	—	161(19)
Haryana	—	25(5)	12(2)	37(7)
Uttar Pradesh	12(2)	6(1)	12(2)	30(5)
Rajasthan	7(3)	32(5)	41(3)	78(9)
New Delhi	—	70(6)	—	70(6)
Gujarat	39(27)	102(9)	—	118(13)
Maharashtra	34(10)	213(26)	87(5)	333(40)
Madhya Pradesh	5(1)	257(19)	25(1)	287(21)
Karnataka	9(9)	293(20)	—	293(20)
Andhra Pradesh	9(2)	40(8)	—	49(10)
Tamil Nadu	—	43(2)	200(1)*	43(2)
Total	170(64)	1190(113)	377(14)	1737(191)

* Sample belonging to Germ Plasm Project.
Note: Figures in brackets indicate reports sent.

ALL INDIA CO-ORDINATED COTTON IMPROVEMENT PROJECT (AICCIP)

The Indian Council of Agricultural Research launched the AICCIP in April 1967, with a view to achieving closer collaboration between the scientists of various disciplines as well as bringing together Agricultural Universities, Central Institutes and State Departments of Agriculture. The main objective of this project has been to look into the problems of production, productivity and quality of cotton with a multidisciplinary approach.

The breeding material available with the cotton breeders of various states are systematically screened every year and only the promising material will be subjected to further screening. Maintenance of 'Germ Plasm' and Initial Evaluation Trials formed the preliminary stages of screening, while, Co-ordinated Varietal Trial, Pilot Demonstration Trial, etc. are the advanced stages of trial under this project. Yield would be the main criterion in the Initial Evaluation Trial while both yield and quality are the criteria for further selections as well as subsequent trials.

This is the twenty-seventh year of the All India Co-ordinated Cotton Improvement Project.

As the cotton sowing and harvesting seasons differ widely in various regions of the country, the breeding programmes are formulated separately for each zone. Thus, three zones have been identified according to agro-climatic conditions. The North Zone comprises

the states of Punjab, Haryana, Rajasthan, Uttar Pradesh and New Delhi, the Central Zone includes the states of Madhya Pradesh, Gujarat and Maharashtra and the South Zone covers the states of Andhra Pradesh, Karnataka and Tamil Nadu.

As many as 1499 samples were screened for fibre properties and spinning potential during the year. Data on the test results of various trials were presented at the panel meetings of the respective zones held at Sirsa for North Zone, Akola for Central Zone and Dharwad for South Zone. The work carried out on various breeding trials is summarised below :

North Zone

As most of the area in this zone is under irrigation, the yield levels are appreciably higher as compared to other zones. This zone is mainly known for its medium and superior medium staple American *G. hirsutum* and short staple and coarse *G. arboreum* types of cottons. The main object of the trials in this zone is to identify strains superior in quality/yield to the existing ones. The emphasis here is to evolve strains which are early maturing or short duration with a sowing to harvesting period of 150 days with a view to make the field available for the second crop of food grains. Trials are also conducted to evolve high yielding short duration hybrids. Trials of the North Zone are also conducted at Padegaon which is in the Deccan Region of Maharashtra, where cotton is grown under irrigated conditions and the crop is sown in April without waiting for the onset of monsoon.

G. hirsutum Trials :

The Co-ordinated Varietal Trials (CVT) for Normal Plant Type as well as Short Duration Compact Plant Type were conducted at Faridkot, Kheri, Ludhiana, Mathura, Sirsa and Sriganganagar. Table 3 shows the ranges and the mean values of 2.5% span length, Micronaire value, maturity, bundle tenacity at both the gauge lengths alongwith the assessment of spinning potential of the samples belonging to these trials. The strains which recorded encouraging spinning performance at various counts at different locations under both the trials, are given below:

Location	*Count*	*Promising strains*
Faridkot	20s	F.1270, F.1084, H.1156 and F.1054
	30s	LH.1318, F.1086, LH.1342, B.N. and LH.900
	40s	F.846, Pusa 26, Pusa 8-6 and F.1352
Kheri	30s	LH.886
	40s	LH.1009, LH.1318, LH.1267, F.1084, LH.1254, LH.1134, B.N. and LH.900
	50s	LH.1445, LH.1342, RS.921, RS.938 and F.1054

Location	*Count*	*Promising strains*
Ludhiana	30s	LH.1009, LH.1254, LH.1267, F.1084, HS.195, LH.1256, LH.1342, RS.875, B.N. and LH.900
	40s	LH.1318, LH.1134, LH.1445, RS.921 and F.1054
	50s	LH.1556
Mathura	30s	F.1084, LH.1254, RS.810, Pusa 26, RS.921, Pusa 37 and Vikas
	40s	LH.1318, LH.1556 and RS.938
Sirsa	20s	HS.178, LH.1254, HS.164, F.1084, HS.182 and HS.6
Sriganganagar	20s	HS.78, LH.1254, H.1117, RS.810, RS.921, CSH.683-1, H.1156, RS.875, RS.938, B.N. and RST.9

Samples pertaining to Preliminary Varietal Trial (PVT) were received from Faridkot, Ludhiana, Mathura, Muktsar, Sirsa and Sriganganagar.

The following strains fared well in spinning performance at 20s and 30s counts at the locations indicated below:

Location	*Count*	*Promising strains*
Ludhiana	30s	LH.1592, LH.1366, B.N. and LH.1134
Mathura	30s	F.1280 and F.1378
Muktsar	30s	LH.1366, F.1341, LH.1591, LH.1343 and B.N.
Sirsa	20s	RS.903, RS.209, F.1328, LH.1366 and B.N.

TABLE 3: SUMMARY OF TEST RESULTS OF COTTON STRAINS TRIED IN CO-ORDINATED VARIETAL TRIAL OF G. HIRSUTUM IN NORTH ZONE

Location	No. of samples	2.5% span length (mm)	Micronaire value	Maturity (%)	Bundle tenacity (g/t)		Spinning performance			
					0' gauge	3.2 mm gauge	Count	A	B	Control Variety
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Normal Plant Type, Br. 04(a)										
Faridkot	8 F	22.8 — 27.9 (25.1)	3.5 — 4.8 (4.4)	72 — 86 (80)	42.9 — 47.2 (45.2)	19.5 — 22.1 (20.6)	30s	4	—	F.846
Kheri	10 F	24.0 — 27.3 (25.6)	4.2 — 5.3 (4.8)	67 — 82 (74)	41.8 — 46.6 (44.2)	19.4 — 22.0 (20.6)	40s	7	5	LH.1134
Ludhiana	10 F	23.4 — 28.8 (26.3)	4.8 — 5.3 (4.9)	76 — 88 (80)	40.2 — 48.8 (44.8)	17.8 — 24.5 (21.1)	30s	8	1	LH.1134
Mathura	6 F	23.0 — 27.5 (25.6)	4.4 — 4.9 (4.7)	75 — 82 (78)	42.3 — 50.9 (46.6)	17.5 — 22.1 (20.4)	30s	5	5	Vikas
Sirsa	6 M	23.8 — 26.6 (25.1)	4.6 — 5.3 (5.1)	76 — 87 (83)	42.9 — 48.2 (45.6)	19.2 — 22.5 (21.2)	20s	6	4	HS.6
Sriganganagar	6 M	24.0 — 26.6 (25.3)	4.4 — 5.1 (4.6)	71 — 80 (75)	46.6 — 52.5 (48.8)	17.7 — 20.8 (19.2)	20s	4	5	RST.9

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
				Short Duration and Compact Plant Type, Br. 04(b)						
Faridkot	7 F	22.4 — 27.9	3.7 — 5.1	71 — 89	42.9 — 48.8	20.1 — 23.7	30s	5	5	F.1054
Kheri	7 F	23.4 — 29.4	3.7 — 4.6	60 — 75	41.8 — 44.5	18.5 — 23.2	40s	6	4	F.1054
Ludhiana	8 F	24.0 — 29.4 (26.8)	4.0 — 4.7 (4.4)	62 — 82 (72)	41.3 — 47.7 (45.0)	19.1 — 20.9 (20.4)	40s	4	2	F.1054
Mathura	6 F	26.0 — 28.2 (27.0)	4.1 — 4.8 (4.4)	67 — 78 (74)	40.7 — 48.8 (44.7)	19.0 — 23.1 (20.7)	30s	6	2	Vikas
Sriganganagar	6 M	23.2 — 26.8 (24.8)	3.9 — 5.1 (4.6)	68 — 83 (77)	42.9 — 47.2 (45.3)	18.0 — 19.7 (19.1)	20s	3	4	RST.9

F — Full spinning
M — Microspinning
A — Samples spinnable to the count selected
B — Samples having spinning performance on par or better than the control
Note : Values in the brackets indicate averages.

The Initial Evaluation Varietal Trial (IEVT) was conducted at Ludhiana and Muktsar. As many as six strains, viz. LH.1568, LH.1470, LH.1537, LH.886, LH.1134 and B.N. from Ludhiana and three strains, viz. F.1394, LH.846 and B.N. from Muktsar recorded satisfactory spinning performance at 30s count.

G. arboreum Trials :

The Co-ordinated Varietal Trial was conducted at Ludhiana, Mathura, Sirsa and Sriganganagar.

The object of this trial was to identify coarse, short staple and high ginning out-turn (GOT) varieties suitable for mixing purposes in the place of the existing variety, G.27, The 2.5% span length of the strains tested under this trial ranged between 16.9 mm and 23.0 mm. The Micronaire value of the following samples was 7.0 and above at the locations indicated below:

Location	*Strains*
Ludhiana	RG.22, LD.491, HD.167, LD.572, RG.23, LD.494 and LD.327
Mathura	HD.123, RG.10, RG.20, LD.569 and Shamali
Sirsa	RG.22, LD.491, LD.569, LD.560, LD.572 and DS.5
Sriganganagar	RG.22, LD.560, LD.491, HD.123, HD.167, LD.572, RG.18, LD.569, RG.23, LD.494, RG.71, RG.8 and LD.327

Samples pertaining to Preliminary Varietal Trial were received from Ludhiana, Mathura, Sirsa and Sriganganagar. The object of this trial was to evolve high yielding superior cottons for spinning coarser counts. The 2.5% span length for samples under this trial varied from 17.0 mm to 26.0 mm. The following samples recorded Micronaire value of 7.0 and above at the locations given below :

Location	*Strains*
Ludhiana	RG.41, RG.32 and HD.303
Mathura	RG.32 and RG.35
Sirsa	RG.32, HD.259, RG.34, RG.35, LD.325 and DS.5
Sriganganagar	HD.298, RG.34, HD.141, LD.621, HD.259, RG.41, RG.32, HD.303, LD.623, HD.269, LD.620, LD.627, LD.626, RG.29, RG.35, LD.327 and RG.8

None of the strains recorded desired yarn strength at 20s count.

Hybrid Trials :

Intra-hirsutum Hybrids involving *G. hirsutum* × *G. hirsutum* crosses were tried at Faridkot, Ludhiana, Muktsar, Sirsa and Sriganaganagar. The range of 2.5% span length was between 21.1 mm and 30.7 mm. Micronaire values ranged between 3.9 and 5.4. Maturity was good and bundle tenacity values at both the gauge lengths were satisfactory. The following hybrids fared well in spinning performance at the counts and at the locations indicated below :

Location	*Count*	*Hybrids*
Faridkot	30s	LHH.120, FHH.7, NBHH.1 and LHH.107
Ludhiana	30s	LHH.107, LHH.144, FHH.7, LHH.121, LHH.120, LH.1134 and B.N.
Sirsa	30s	CSH.33
Sriganganagar	20s	LHH.29, CSHH.29, HHH.111 and RAJ.HH.18

Samples pertaining to the Initial Evaluation Trial of *Intra-hirsutum* hybrids of Central and South Zones in North Zone entries were received from Sirsa. The 2.5% span length ranged between 22.9 mm and 26.2 mm. Micronaire value varied from 4.5 to 5.8. Maturity was good and bundle tenacity values were satisfactory varying from 45.6 g/t to 48.8 g/t at zero gauge length and from 17.9 g/t to 20.3 g/t at 3.2 mm gauge length. Only two out of four hybrids, viz. CSHH.1 and CICR.HH.1 fared well in spinning performance at 30s count.

Samples belonging to Inter-specific Hybrid Trial involving *G. hirsutum* × *G. barbadense* crosses were received from Ludhiana, Sirsa and Sriganganagar. The 2.5% span length ranged between 22.5 mm and 34.4 mm. Micronaire values ranged between 3.3 and 4.9. Maturity was good and bundle tenacity was satisfactory varying from 42.9 g/t to 49.8 g/t at zero gauge length and from 17.4 g/t to 26.5 g/t at 3.2 mm gauge length. As many as five out of seven hybrids, viz. Pusa HB.45, Pusa HB.5, Pusa HB.15, Pusa HB.124 and Pusa HB.118 from Sriganganagar fared well in spinning performance at 60s count, while two out of four hybrids, viz., Pusa HB.24 and HB.224 from Sirsa recorded encouraging CSP values at 30s count.

Miscellaneous Trials :

A good number of trials with different objectives were conducted at New Delhi and Sriganganagar. The details of trials and the test results are

given below:

During the season, efforts to develop superior medium staple *G. hirsutum* cultures with high fibre strength and spinning potential of 60s count under the North Zone agro-climatic conditions were continued at IARI, New Delhi. Under the trial, eight cultures of Pusa 2-95 were received for the assessment of spinning potential. It was observed that 2.5% span length of these cultures ranged between 26.5 mm and 28.4 mm and fibre bundle tenacity varying from 53.1 g/t to 55.7 g/t at zero gauge length and from 22.3 g/t to 26.4 g/t at 3.2 mm gauge length. Only two cultures, viz. Pusa 2-95-33 and Pusa 2-95-38 recorded encouraging spinning performance at 60s count.

A set of twenty one different Pusa cultures of *G. hirsutum* tried under irrigated condition was received from IARI, New Delhi. All the cultures were average to coarse in Micronaire fineness and good in maturity as well as in bundle tenacity at both the gauge lengths. Only five cultures, viz. Pusa 45-3-6-99-37, Pusa 54-3-1-40-9, Pusa 54-3-1-40-15, Pusa 54-3-1-40-16 and Pusa N.3-39 fared well in spinning performance at 50s count.

Another set of seven cultures of Pusa 45-3-6 of *G. hirsutum* raised at New Delhi indicated that all the fibre characters, viz. 2.5% span length, Micronaire fineness, maturity and bundle tenacity values at both the gauge lengths varied within narrow limits and as many as five cultures, viz. Pusa 45-3-6-14-20, Pusa 45-3-6-14-18, Pusa 45-3-6-14-8, Pusa 45-3-6-14-6 and Pusa 45-3-6-14-21 recorded satisfactory spinning performance at 50s count.

Two sets of Pusa cultures of *G. hirsutum* received from New Delhi belonged to the trials conducted under two different conditions of sowing, viz. one under normal summer sowing and the other under late summer sowing. It was observed that the range of values of all the fibre characters, viz. 2.5% span length, Micronaire value, maturity and bundle tenacity at both the gauge lengths for cultures grown under late summer sowing conditions was at a lower level as compared to that for those grown under normal summer sowing conditions. Only one out of seven cultures, viz. Pusa 19-27-7-12-1-27 grown under late summer sowing conditions fared well in spinning performance at 40s count, while as many as four out of six cultures, viz. Pusa 15-2-6-3-1, Pusa 19-27-6-13-2, Pusa 15-2-1-12-1-93 and Pusa 19-27-7-12-1-27 grown under normal sowing conditions recorded good CSP values at the same 40s count.

An inter specific hybrid trial was conducted at New Delhi under irrigated conditions. It was observed that 2.5% span length ranged between 31.1 mm and 35.6 mm covering long and extra-long staple category of cotton with good Micronaire fineness, maturity and excellent bundle tenacity at both the gauge lengths. As many as eighteen out of twenty-one hybrids, viz. Pusa Hybrid 5, Pusa Hybrid 15, Pusa Hybrid 26, Pusa Hybrid 29, Pusa Hybrid 45, Pusa Hybrid 118, Pusa Hybrid 124, Pusa Hybrid 142, Pusa Hybrid 151, Pusa Hybrid 158, Pusa

Hybrid 209, Pusa Hybrid 210, Pusa Hybrid 218, Pusa Hybrid 219, Pusa Hybrid 221, Pusa Hybrid 222 A, Pusa Hybrid 228 and Pusa Hybrid 223, recorded promising spinning performance at 60s count.

A set of nine samples comprising five from *G. hirsutum* and two each from *G. arboreum* and *intra-hirsutum* trials was received from Sriganganagar. Of the five *G. hirsutum* samples, the strain, RS.716 was superior to the other four cottons, viz. RS. 875, RST.9, RST.9 (Improved) and B.N. in respect of fibre length and bundle tenacity at 3.2 mm gauge length. The strain, RS. 716 was found to give satisfactory spinning performance at 30s count, while RST.9 (Improved) and the Control, B.N. recorded good CSP values at 20s count. Of the *G. arboreums* the control, Ganganagar Ageti was superior to the new strain, RG.8 in all the fibre characters, viz. 2.5% span length, Micronaire value and bundle tenacity at both the gauge lengths. The control, Ganganagar Ageti recorded good spinning performance at 30s count, while RG.8 did not fare well even at 6s count due to its coarseness (Micronaire value — 7.7). The two *intra-hirsutum* hybrids, viz. RAJ.HH.16 and RAJ.HH.17 were *on par* in fibre length and bundle tenacity at 3.2 mm gauge length. The hybrid, RAJ.HH.17 recorded better CSP values than RAJ.HH.16 at 30s and 40s count due to better Micronaire values.

Under the Miscellaneous Trial of Desi Hybrids conducted at Sriganganagar under irrigated conditions, eight samples were received for evaluation of fibre characters only. The 2.5% span length varied from 17.5 mm to 23.7 mm with good bundle tenacity at both the gauge lengths. It was also observed that all the hybrids, viz. RDHy.1, RDHy.3, RDHy.7, LDH.11, LDH.14, LDH.15, LD.327 and RG.8 recorded Micronaire value more than 7.0.

Central Zone

This zone, comprising Madhya Pradesh, Gujarat and Maharashtra, has the largest area under cotton cultivation. Although emphasis is given to improve existing American types of *G. hirsutum* cottons, a sizeable percentage of cotton from *G. arboreum* species is also under cultivation as most of the area, especially in Madhya Pradesh and Maharashtra, is under rainfed cultivation. For the last many years, hybrids such as Hybrid 4, Hybrid 6, JKHy.1, Godavari, etc. are being cultivated on a large scale. However, attempts are being made to identify early maturing hybrids without sacrificing the yield. Trials are conducted for improvement in *G. herbaceum* species which is traditionally cultivated in some pockets in Gujarat State.

G. hirsutum Trials :

Samples pertaining to the Co-ordinated Varietal Trial were received from Banswara, Rahuri and Talod under irrigated conditions and from Badnawar, Indore, Khandwa and Nanded under rainfed conditions.

Summary of the test results incorporated in Table 4 gives the ranges

TABLE 4 : SUMMARY OF TEST RESULTS OF COTTON STRAINS TRIED IN CO-ORDINATED VARIETAL TRIAL OF G. HIRSUTUM IN CENTRAL ZONE

Location	No. of samples	Ranges of			Bundle Tenacity (g/t)		Spinning performance			Control variety
		2.5% span length (mm)	Micronaire value	Maturity (%)	0' gauge	3.2 mm gauge	Count	A	B	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
				Irrigated Trial, Br. 04(a)						
Banaswara	7 F	24.0 — 28.4 (25.9)	3.8 — 4.6 (4.3)	62 — 87 (77)	41.8 — 49.3 (45.0)	19.1 — 22.5 (20.5)	—	—	—	B.N.
Rahuri	7 F	26.0 — 27.9 (27.0)	3.3 — 4.3 (3.6)	51 — 70 (64)	42.3 — 49.3 (46.5)	18.8 — 23.1 (21.2)	—	—	—	KOP.498
Surat	7 F	24.2 — 27.6 (26.4)	3.3 — 4.4 (4.0)	69 — 82 (73)	41.8 — 49.3 (46.2)	16.5 — 25.9 (20.2)	40s	4	3	Hybrid 6
Talod	6 M	25.8 — 27.8 (26.7)	4.0 — 4.9 (4.6)	71 — 86 (81)	45.0 — 52.0 (47.4)	19.8 — 23.8 (21.7)	40s	5	4	G.Cot.14
				Rainfed Trial, Br. 04(b)						
Badnawar	14 M	21.0 — 26.2 (23.5)	2.6 — 3.7 (3.2)	52 — 73 (61)	38.6 — 45.6 (42.2)	16.8 — 23.2 (20.6)	40s	5	1	Khandwa 3
Indore	14 M	22.2 — 26.1	3.2 — 4.0	60 — 80	39.7 — 44.5	15.5 — 20.6	30s	5	5	Khandwa 3

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Khandwa	14 M	23.9 — 27.5 (25.4)	3.2 — 4.3 (3.7)	58 — 80 (48)	41.3 — 47.2 (44.0)	18.1 — 24.7 (21.3)	30s	6	8	Khandwa 3
Khandwa (1991-92)	5 M	23.4 — 26.5 (24.8)	2.9 — 4.7 (3.6)	53 — 76 (67)	42.3 — 45.6 (43.6)	16.7 — 20.7 (18.7)	40s	2	—	—
Nanded	5 M	24.7 — 28.3 (26.2)	4.5 — 4.8 (4.7)	75 — 91 (81)	40.2 — 43.4 (41.2)	17.3 — 22.7 (19.8)	30s	3	—	—

F — Full Spinning

M — Microspinning

A — Samples spinnable to the count selected

B — Samples having spinning per formance on par or better than the control

Note — Values in the bracket indicate averages.

and the mean values of 2.5% span length, Micronaire value, maturity and bundle tenacity at both the gauge lengths alongwith their assessment of spinning potential. The following strains fared well in spinning performance at the locations and at the counts as given below :

Location	*Count*	*Strains*
		Irrigated
Surat	30s	G.1707 and LRA.5166
	40s	G.3302, G(B).20, CNH.36 and G.Cot.14
Talod	40s	G.3302, LRA.5166 and G.Cot.14
		Rainfed
Badnawar	40s	AKH.8635, LRA.5166 and Khandwa 3
Indore	30s	G(B).20, KH.2237, AKH.8635, JLH.34 and K.2MB.
Khandwa	30s	G.3907, JLH.234, JLH.168, PH.99, NH.418 and LRA.5166
Nanded	30s	AKH.8635, JLH.234 and LRA.5166

Samples pertaining to Preliminary Varietal Trial were received from Talod under irrigated conditions and from Amreli, Khandwa and Nanded under rainfed conditions. The promising strains from the spinning point of view for the counts and the locations are given below :

Location	*Count*	*Strains*
		Irrigated
Talod	40s	G(T).2714, G(T).14, LRA.5166 and G.Cot.14
		Rainfed
Amreli	20s	JLH.279, AKH.8828 and LRA.5166
Khandwa	40s	JLH.279 and LRA.5166
Nanded	30s	JLH.279, AKH.8828 and PH.93

Initial Evaluation Varietal Trial was conducted at Khandwa only under rainfed conditions. The 2.5% span length ranged between 21.7 mm and 28.4 mm. Micronaire value ranged between 3.4 and 5.2 and bundle tenacity values varied from 41.3 g/t to 48.8 g/t at zero gauge length. As many as fifteen strains, viz. JLH.259, AKH.8052, KH.101, AKH. 8837, G(J).HC.19, GISC.867, G.BUV.89, G.2708, G(J).HS.35, KH.103, CNH.503, KH.105, CNH.299, LRA.5166 and Khandwa 3 fared well in spinning performance at 30s count.

G. arboreum Trial :

Co-ordinated Varietal Trial was conducted at Amreli, Indore, Khandwa and Nanded under rainfed conditions. The following strains recorded satisfactory spinning performance at 20s count at the locations given below :

Location	*Strains*
Amreli	G(AM).22, G(AM).1275, KWA.8, NA.377, KWA.15, KHR.2, G(AM).31, G(AM).20, PA.183 and Sanjay
Indore	G(AM).22, G(AM).1275, KWA.8, NA.377, KHR.2, G(AM).31, G(AM).20, PA.183, PA.218, AKA.8812 and AKA.8816
Khandwa	AKA.8812, AKA.8815, PA.219, G(AM).20, NA.377, G(AM).22, G(AM).1275, KWA.8, KHR.2, G(AM).31, AKA.8811, PA.183, KWA.15 and AKA.8816
Nanded	AKA.8812, PA.219, KWA.15 and PA.141

A separate Co-ordinated Varietal Trial for long staple cottons with 2.5% span length between 26.0 mm and 28.0 mm, was conducted under rainfed conditions at Amreli, Jalna, Khandwa and Nanded. The 2.5% span length ranged between 24.0 mm and 27.2 mm. Micronaire value ranged between 3.4 and 5.6 and bundle tenacity values varied from 41.3 g/t to 50.4 g/t at zero gauge length. The following strains fared well in spinning performance at 20s count at the locations mentioned below :

Location	*Strains*
Amreli	NA.362, AKA.8314, NA.367, PA.245 and Sanjay
Jalna	NA.362, PA.249, PA.245, AKA.8314 and AKA.8401
Khandwa	NA.362, PA.249, PA.245, AKA.8314, AKH.4 and AKA.8401
Nanded	PA.247, PA.245, AKA.8314 and PA.141

G. herbaceum Trials :

Samples pertaining to Co-ordinated Varietal Trial were received from Badnawar and Bharuch under rainfed conditions. The 2.5% span length ranged between 21.8 mm and 26.9 mm. Micronaire value ranged between 3.2 and 4.6 and bundle tenacity values varied from 42.9 g/t to 53.1 g/t at zero gauge length and from 19.2 g/t to 26.9 g/t at 3.2 mm gauge length. The following strains at Bharuch recorded satisfactory spinning performance at the count indicated in the bracket : G(B).20(40s), G.Cot.10(40s), G.Cot.11 (30s), Bhv. 46 (20s) and Digvijay (20s).

Hybrid Trials

Object of this trial was to identify early maturing hybrids superior in yield and quality to the existing local hybrids such as Hybrid 4, Hybrid 6, JKHy.1, Godavari, etc. in Gujarat, Maharashtra and Madhya Pradesh. Considering the increase in demand for medium and superior medium staple categories of cotton, attempts are also made to identify *desi* hybrids.

INTRA-HIRSUTUM HYBRID TRIAL FOR CONVENTIONAL HYBRIDS

Samples pertaining to *Intra-hirsutum* Hybrid Trial for Conventional Hybrids were received from Akola, Aurangabad, Jalna, Surat and Talod under irrigated conditions and from Aurangabad, Indore, Jalna, Khandwa, Nagpur and Nanded under rainfed conditions.

The promising hybrids which fared well in spinning performance at the counts and at the locations are mentioned below :

Location	*Count*	*Hybrids*
		Irigated
Aurangabad	30s	RCH.2, NBHH.1 and G.Cot.Hy.6
	40s	NFHH.128 and GHH.15
Jalna	30s	RH.0390, G(T).HH.30, T.13xM.12, NBHH.1 and VCHH.16
Surat	40s	G(T).HH.35, T.13xM.12, G.Cot.Hy.6 and G.Cot.Hy.8
Talod	40s	G(T).HH.35, NFHH.128, HCHH.22, T.13xM.12, VCHH.16, G.Cot.Hy.6 and G.Cot.Hy.8
		Rainfed
Aurangabad	30s	NFHH.20, WHH.651 and RCH.2
	40s	HCHH.414 and NBHH.1

Location	*Count*	*Hybrids*
Indore	30s	GHH.662, KHH.15, NFHH.120, NFHH.121, HCHH.616, HCHH.414, HCHH.515, RHH.0188, T.13xM.12, WHH.651, WHH.641, WHH.1004, NBHH.1, RCH.1, RCH.2, SUNCOT.201, SUNCOT.203, SILHH.1 and Hybrid 6
Jalna	40s	RCH.1, T.13xM.12, HCHH.616, KHH.15, RHH.0188, NFHH.121, HCHH.515, NFHH.128, WH.651 and Hybrid 6
Khandwa	30s	HCHH.616, KHH.15, GHH.662, HCHH.515, and WHH.651
	40s	T.13xM.12, HCH.616, NFHH.121, GHH.662, HCHH.515, NFHH.120, WHH.651, HCHH.414, WHH.641, NBHH.1, RCH.2, SUNCOT.201, RCH.1, SILHH.1, SUNCOT.203 and Hybrid 6
Nagpur	50s	WHH.641
Nanded	40s	WHH.651, NBHH.1, HCHH.515 and Hybrid 6

Intra-hirsutum Hybrid Trial for Male Sterile Based Hybrids

Samples belonging to this trial were received from Aurangabad, Badnawar, Jalna, Nanded and Rahuri under irrigated conditions and from Aurangabad, Indore, Jalna, Nagpur and Nanded under rainfed conditions. A separate trial for the male sterile based hybrids was conducted for the combined Central and South Zones at Aurangabad, Nagpur and Nanded under irrigated conditions.

The following hybrids were found to be promising in spinning performance at the locations and at the counts, as follows :

Location	*Count*	*Hybrids*
		Irrigated
Aurangabad	30s	MSRHH.24, NFHH.101 and CMHH.15
	40s	VCHH.19 and CAHH.22

Location	*Count*	*Hybrids*
Badnawar	40s	JAISHRI, WHH.130, CAHH.22, HCHH.101, VCHH.17, VCHH.19, MECH.58, MECH.79, MECH.100, MECH.10 and MECH.4
Nanded	40s	VCHH.19, MSRHH.24, NCMHH.71 and Hybrid 6
		Rainfed
Aurangabad	20s	MECH.105 and CAHH.25
	30s	VCHH.11 and WHH.109
	40s	CMSHy.6
Indore	40s	CINHH.106, CAHH.25, CAHH.48, NCMHH.70, HCHH.20, JAISHRI, CAHH.468, JICH.4 and CMSHy.6
Jalna	40s	CAHH.25, WHH.109, CINHH.106, CAHH.48, MSRHH.22 and JAISHRI
Nanded	40s	WHH.109, CAHH.8, WHH.1250 and MECH.160
		Combined Central and South Zones Trial
		Irrigated
Aurangabad	20s	MLCH.22
	30s	HCHH.10
	40s	MECH.101 and G.Cot.Hy.8
Nanded	40s	ARCHH.1292, MECH.101, SAVITHA and G.Cot.Hy.8

Inter-specific Hybrid Trial

Hybrids involving *G. hirsutum* × *G. barbadense* crosses were tried at Badnawar, Jalna and Surat under irrigated conditions, while *desi* hybrids involving *G. arboreum* × *G. herbaceum* crosses were tried at Indore only under rainfed conditions. The promising hybrids from the spinning point of view that fared well for the locations and at the counts, were as follows :

Location	*Count*	*Hybrids*
		G. hirsutum × *G. barbadense*
Badnawar	60s	GHB.583, CIHB.224, MECHB.121, MECHB.122, DHB.20, DHB.105, NFHB.101, NFHB.11, DHB.220 and DCH.32
Jalna	60s	MECHB.123, GHB.583, WHB.787, NFHB.105 and DCH.32
Surat	30s	G.Cot.Hy.8
	60s	NFHB.101, NFHB.123, NFHB.105 and DCH.32
		G. arboreum × *G. herbaceum*
Indore	20s	MDCH.201, MDCH.207, PHA.46, GDH.267, MDCH.210, GDH.318, GDH.392, IDCH.1, DDH.2 and G.Cot.DH.9

Evaluation of Short Duration Dwarf and Compact Type of Material, Br.52-2

Dwarf and Compact type of plants of *G. hirsutum* have certain advantages in respect of yield over the normal plant types. In order to study the yield and the technological characters of such plant types, trials were conducted at Khandwa, Nanded, Pedegaon and Rahuri under irrigated conditions. It was observed that 2.5% span length ranged between 21.0 mm and 31.6 mm. Micronaire value ranged between 2.7 and 5.1. Maturity was average to good and bundle tenacity values varied from 36.4 g/t to 50.4 g/t at zero gauge length and from 14.3 g/t to 23.2 g/t at 3.2 mm gauge length. The following strains fared well in spinning performance at the locations and at the counts as indicated below :

Location	*Count*	*Strains*
Khandwa	30s	70.E, G.BHV.108, 70.G, 70.D, G.BHV.86 and LRK.516
Nanded	30s	CNHPT.203, CNHPT.5, G.BHV.108, LRK.516 and LRA.5166
Padegaon	40s	70.E, CNHPT.254, G.BHV.26, LRK.516 LRA.5166

Miscellaneous Trials :

A few miscellaneous trials having different objectives were conducted at various locations such as Akola, Chharodi, Jalgaon, Khandwa, Mudhol, Nanded, Padegaon and Uttarsarda. The details of the test results are as given below :

An *intra-hirsutum* hybrid trial for the male sterile based hybrid was conducted for CAHH.468 alongwith the local hybrid, AHH.468 under rainfed conditions at Akola. It was observed that both the medium staple hybrids were *on par* in fibre length and maturity. The control hybrid, AHH.468 was significantly better than the male sterile hybrid, CAHH.468 in Micronaire fineness and bundle tenacity at zero gauge length. In the case of spinning performance, the control hybrid, AHH.468 recorded significantly better CSP values at both the counts viz. 30s and 40s counts. However, only the control hybrid, AHH.468 was found to record good CSP value at 40s count.

Two sets of five samples each belonging to *intra-hirsutum* hybrid trials conducted under irrigated conditions were received from Nanded. As many as eight hybrids, viz. NCMHH.58, NCMHH.302, NCMHH.69, NCMHH.43, NCMHH.54, NCMHH.53, NCMHH.66 and NCMHH.40 recorded satisfactory spinning performance at 30s count.

An *inter-specific* hybrid, NBHB.11 raised alongwith the control, DCH.32 under irrigated conditions was received from Uttarsarda (G.S.). It was observed that the extra-long staple *inter-specific* hybrid, NBHB.11 was significantly longer in fibre length, coarser in Micronaire value and more mature as compared to the control hybrid, DCH.32. Both the hybrids were *on par* in bundle tenacity at both the gauge lengths. In the case of spinning performance, both the hybrids were almost identical in CSP values at 60s and 80s counts and recorded encouraging spinning performance at 80s count.

Three sets consisting of 48 samples belonging to three different trials of *G. herbaceum* conducted under rainfed conditions were received from Chharodi. Only five strains, viz. 1143, 1187, 1297, 624-1 and 1248 fared well in spinning performance at 20s count.

A new promising strain, JLH.168 raised alongwith the local control, LRA.5166 under rainfed conditions was received from Jalgaon. Both the cottons were almost *on par* in fibre length and maturity. In respect of spinning performance, the control, LRA.5166 recorded better CSP value than the new strain JLH.168 at 30s count. However, only LRA.5166 was found to be satisfactorily spinnable at 30s count.

A set of five samples comprising Maljari, KWA.3 and KHR.2 belonging to *G. herbaceum* and KH.2160 and Khandwa 3 belonging to *G. hirsutum* raised under rainfed conditions, was received from Khandwa. In the case of *G. herbaceum* samples, the strain, KWA.3 was significantly better than the other two cottons, KHR.2 and Maljari in fibre length and these three cottons

were almost *on par* in maturity and bundle tenacity at 3.2 mm gauge length. All the three cottons, KWA.2, KHR.2 and Maljari were found to be suitable for spinning at 20s count. In the case of *G. hirsutum* samples both, KH.2160 a new strain and Khandwa 3, the control, were almost *on par* in fibre length, maturity and bundle tenacity at 3.2 mm gauge length, while, KH.2160 was coarser than Khandwa 3 in Micronaire value. In respect of spinning performance, the new strain, KH.2160 was found to be satisfactorily spinnable at 20s count, while the control, Khandwa 3 recorded good CSP value at 30s count.

A set of seven samples of *G.arboreum* was received from Mudhol under the scheme for Improvement of Gaorani cottons and evolving early maturing cotton varieties better than Gaorani in yield and fibre quality and suitable for cultivation in Gaorani Tract under rainfed conditions in Andhra Pradesh. It was observed that 2.5% span length ranged between 24.8 mm and 28.1 mm covering medium staple category of cottons. All the strains were average to coarse in Micronaire fineness and good in bundle tenacity at both the gauge lengths. The following strains fared well in spinning performance at the counts indicated in brackets 8401 (20s), 1876 (20s), 1875 (20s), 1874 (30s), SB.171(40s), and the control, Saraswathi (30s).

A promising medium staple strain, NH.452 alongwith the local control, Nagnath (PH.93) raised under rainfed conditions was received from Nanded. It was observed that the new strain, NH.452 was almost *on par* with the control, PH.93 in respect of fibre length, maturity and bundle tenacity at both the gauge lengths and NH.452 was significantly coarser in Micronaire value than the control, PH.93. In the case of spinning performance, both the cottons recorded CSP values *on par* at 20s and 30s counts and both were satisfactorily spinnable at 20s count.

A miscellaneous trial of *G. hirsutum* was conducted under rainfed conditions at Nanded. Only one out of five strains, viz. NH.470 recorded good yarn strength at 30s count.

Four sets of six samples each belonging to different trials of *G. arboreum* conducted under rainfed conditions were received from Nanded. It was observed that 2.5% span length varied from 24.2 mm to 28.7 mm covering medium staple category of cottons and all the new strains, viz. NA.364, NA.367, NA.376, NA.377, NA.393, NA.427, NA.428, NA.432, NA.436, PA.183, PA.208, PA.215, PA.261, PA.281 including the controls, Eknath, and PH.141 fared well in spinning performance at 20s count.

A miscellaneous Multilocation Varietal Trial of *G. hirsutum* was conducted at Padegaon. The 2.5% span length for the five samples of cotton included in the trial varied within narrow limits from 27.6 mm to 28.7 mm. All the strains were average in Micronaire fineness, good in maturity and average to good in bundle tenacity at zero gauge length. However, none of the strains recorded desired CSP values at 30s count.

South Zone

This zone comprises the states of Andhra Pradesh, Karnataka and Tamil Nadu and is known for its long and superior long-staple cottons. Although cottons belonging to *G. hirsutum* species cover large area under cultivation, those belonging to the other three species are also grown in some areas of this zone, in both irrigated and rainfed tracts. In addition, *intra-hirsutum* and inter-specific hybrid cottons are also cultivated on a large scale in this zone.

G. hirsutum Trials :

Co-ordinated Varietal Trial was conducted at Dharwad, Guntur and Siruguppa under irrigated conditions and at Dharwad under rainfed conditions. A separate trial was also conducted for Dwarf and Compact Plant Type under irrigated conditions at Dharwad and Guntur. The ranges and the mean values of 2.5% span length, Micronaire value, maturity and bundle tenacity alongwith assessment of spinning performance are incorporated in Table 5.

The following strains recorded satisfactory spinning performance at the locations and at the counts as given below :

Location	*Count*	*Strains*
		Irrigated
Dharwad	30s	HLS.79, LMJ.2347, TCH.1002, HLS.72, TCH.1005-1-7, L.604, CNH.71, NA.1325, LRA.5166 and MCU.5
Guntur	40s	NA.1325, HLS.72, L.604 and LMJ.2347
Siruguppa	40s	S.2-48/25, HLS.79, TCH.1002, HLS.72, L.604 and MCU.5
		Rainfed
Dharwad	20s	ICMF.70, JK.276-8-2, NA-1325, RAS.299-1 and Sharada
		Dwarf and Compact Plant Type
Dharwad	30s	70.D, LAM.15, CNHPT.1, 70.G, 70.E and ANJALI
Guntur	40s	NA.1325 and LRK.516

Preliminary Varietal Trial was conducted at Guntur, Raichur and Siruguppa under irrigated conditions and at Raichur under rainfed conditions.

The following strains recorded encouraging CSP values at the locations and at the counts as indicated :

TABLE 5 : SUMMARY OF TEST RESULTS OF COTTON STRAINS TRIED IN CO-ORDINATED VARIETAL TRIAL OF G. HIRSUTUM IN SOUTH ZONE

Location	No. of samples	Ranges of					Spinning performance			
		2.5% span length (mm)	Micronaire value	Maturity	Bundle Tenacity (g/t) 0' gauge	3.2 mm gauge	Count	A	B	Control Variety
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Irrigated Trial, Br. 04(a)										
Dharwad	18 M	22.8 — 31.0 (26.3)	3.1 — 3.9 (3.5)	54 — 77 (68)	38.1 — 44.0 (41.2)	16.2 — 21.6 (18.8)	30s	10	11	Sharada
Guntur	5 M	26.5 — 31.4 (28.7)	3.7 — 4.5 (4.2)	72 — 88 (79)	40.7 — 45.6 (44.1)	19.1 — 23.1 (21.3)	40s	4	—	—
Siruguppa	16 M	24.6 — 31.6 (28.0)	3.7 — 4.8 (4.4)	73 — 86 (79)	38.6 — 44.5 (41.6)	15.9 — 22.1 (18.2)	40s	6	7	JK.276-4
Rainfed Trial, Br. 04(b)										
Dharwad	12 M	20.6 — 26.5 (24.0)	2.9 — 4.1 (3.5)	58 — 75 (67)	40.2 — 44.0 (42.1)	13.9 — 18.0 (15.9)	20s	5	2	Sharada
Compact Plant Type, Irrigated, Br. 04(d)										
Dharwad	20 M	21.7 — 27.3 (24.6)	3.0 — 3.6 (3.4)	55 — 74 (64)	38.6 — 47.7 (41.7)	15.1 — 21.0 (17.2)	30s	6	8	Sharada
Guntur	5 M	22.8 — 29.3 (25.9)	3.5 — 4.5 (4.1)	72 — 81 (76)	40.7 — 46.6 (44.3)	20.2 — 22.0 (20.8)	40s	2	1	LRK.516

M — Microspinning

A — Samples spinnable to the count selected

B — Samples having spinning performance on par or better than the control

Note — Values in bracket indicate averages.

Location	*Count*	*Strains*
		Irrigated
Guntur	40s	ICMF.20 and VRS.7
Raichur	30s	ICMF.20
Siruguppa	30s	ICMF.20, C.256-4, VRS.7, VRS.15, MCU.5 and LRA.5166

Initial Evaluation Varietal Trial was conducted at Arabhavi, Guntur and Siruguppa under irrigated conditions and at Dharwad under rainfed conditions. The following strains showed satisfactory yarn strength at the counts and at the locations as mentioned below :

Location	*Count*	*Strains*
		Irrigated
Arabhavi	40s	CNH.115, CGRS.1, RAC.21, RAC.16, CGRA.1, VRS.19, ICMF.16, AH.160-3, VRS.9, ICMF.31, CNH.275, LAM.617, RB.447, AH.131-1, LRA.5166 and MCU.5
Guntur	30s	ICMF.31, CNH.275, TSH.288, RB.281 and AH.140
Sirguppa	20s	CNH.115, RAC.21, RAC.16, CGRS.1, TSH.288, CPD.92-7, NA.1363, NA.1348, VRS.19, ICMF.16, AH.140, CGRA.1, AS.104-35, AH.160-3, VRS.9, ICMF.31, TVTH.4144, CNH.101(RB), CNH.102(RB), CNH.275, CNH.299, CBBRH.3, PS.10-22-3-1, CLS.1, LAM.613, LAM.614, LAM.617, RB.281, RB.423, RB.447, AH.135-5-1, AH.131-1, LRA.5166 and MCU.5
		Rainfed
Dharwad	40s	CBBRH.2, NA.1422, NA.1373, CNH.275, ICMF.31, NLP.46, CNH.299, SLB.1, NA.1520, ICMF.23, M.5-KD.26, TKH.391, CPD.431, ICMF.16, CPD.92-36, JK.276-8-2, LRA.5166 and Sharada

Hybrid Trials—Intra-hirsutum Hybrids:

The hybrid trial involving *G. hirsutum* × *G. hirsutum* crosses for conventional hybrids was conducted at Guntur and Siruguppa under irrigated conditions and at Raichur under rainfed conditions. The following hybrids recorded satisfactory spinning performance at the counts and at the locations as given below :

Location	*Count*	*Hybrids*
		Irrigated
Guntur	40s	DHH.10 and NHH.44
Siruguppa	40s	MECH.19, T.13 × M.12, RCH.1, LAHH.2, NHH.302 and SAVITHA
		Rainfed
Raichur	30s	MCH.515, T.13 × M.12 and SAVITHA

The hybrid trial involving *G.hirsutum* × *G. hirsutum* crosses for the male sterile based hybrids was conducted at Dharwad and Guntur under irrigated conditions and at Dharwad and Ranibennur under rainfed conditions. The following hybrids indicated promising spinning performance at the counts and at the locations as given below :

Location	*Count*	*Hybrids*
		Irrigated
Dharwad	40s	CMSH.10, CMSH.15, JAISHREE, MECH.77, ARCHH.1262, CMSH.3, MECH.144 and SAVITHA
Guntur	50s	ARCHH.36 and MECH.144
		Rainfed
Dharwad	40s	JAISHREE, NHH.44, MECH.101, MECH.27, CAHH.468, MECH.67 and SAVITHA
Ranibennur	30s	JAISHREE, MECH.101, MECH.27 and SAVITHA

A separate *Intra-hirsutum* Hybrid Trial for the Combined Central and South Zone entries was also conducted for the male sterile based hybrids at Dharwad and Ranibennur under irrigated conditions. Only three hybrids, viz. NCMHH.302, CINHH.106 and SAVITHA at Dharwad fared well in spinning performance at 40s count.

Inter-specific hybrids :

The hybrids involving *G.hirsutum* × *G. barbadense* crosses were tried at Dharwad, Guntur, Raichur and Ranibennur under irrigated conditions. The following hybrids fared well in spinning performance at 60s count at the locations mentioned below :

Location	*hybrids*
Dharwad	PHB.15, PHB.45, MECH.120, DHB.155, CDHB.2, NBHB.11, DHB.105, CDHB.1, MECH.22, TCHB.213, HB.224, DHB.100 and NHB.12
Guntur	PHB.45, DHB.105 and PHB.105
Raichur	PHB.15, MECH.120, CDHB.2, NBHB.11, CDHB.1, DHB.105, MECH.22 and HB.224
Ranibennur	PHB.15, MECH.121, CDHB.2, DHB.105, CDHB.1, DHB.100 and HB.224

Miscellaneous Trials :

During the period, only two miscellaneous trials having different objectives were conducted at Coimbatore.

A set of ten samples six from the trial of *Verticillium* wilt resistant cottons and four from the study of bacterial blight on cotton was received from Coimbatore. It was observed that 2.5% span length ranged between 32.8 mm and 34.7 mm with good Micronaire fineness and maturity for the samples of *Verticillium* wilt resistant cottons, while 2.5% span length ranged between 28.2 mm and 28.8 mm with average Micronaire fineness and good maturity for the samples of bacterial blight trial. Bundle tenacity varied from 44.0 g/t to 46.6 g/t at zero gauge length and from 19.6 g/t to 22.1 g/t at 3.2 mm gauge length for samples of *Verticillium* wilt resistant cottons, while it varied from 38.6 g/t to 43.4 g/t at zero gauge length and from 17.6 g/t to 18.9 g/t at 3.2 mm gauge length for samples of bacterial blight trial. In the case of spinning performance, it was seen that all the six samples including the control, MCU.5 VT from the *Verticillium* wilt resistant cottons were found to give satisfactory yarn strength at 60s count, while none of the samples of the bacterial blight trial except the control, LRA.5166 recorded good CSP value at 40s count.

A set of thirty-three samples belonging to the trial for development of extra-long staple high spinning hybrids of inter-specific origin with wider adaptability, conducted under irrigated conditions was received from Coimbatore. It was observed that 2.5% span length ranged between 33.2 mm and 37.1 mm covering long and extra-long staple categories of cotton with good length uniformity. All the hybrid cultures were good in Micronaire fineness, average to good in maturity and excellent bundle tenacity at both the gauge lengths. As many as twenty-five hybrid cultures, viz. T.10 × P.13, T.10 × P.16, T.10 × P.19, T.10 × P.20, M.54 × P.15, M.54 × P.17, M.55 × P.18, V.69 × P.14, V.69 × P.15, V.69 × P.18, V.69 × P.19, V.88 × P.15, V.88 × P.20, V.89 × P.13, V.89 × P.14, V.89 × P.15, V.89 × P.16, V.89 × P.17, V.89 × P.19, V.89 × P.20, V.91 × P.18, V.92 × P.14, V.92 × P.19 including the two hybrids, HB.224 and TCHB.213 as control, recorded encouraging spinning performance at 80s count.

Cotton Varieties Recommended for Release During 1993-94

1. CAHH.468:

This is a medium staple category of male sterile based *intra-hirsutum* hybrid cotton suitable for satisfactory spinning between 30s and 40s count. It is *on par* with AHH.468 in yield potential. This hybrid was released for cultivation in the irrigated areas of Maharashtra, Gujarat and Andhra Pradesh.

2. L.389 :

This is a long staple cotton with good Micronaire fineness, maturity and bundle tenacity and found to give encouraging spinning performance between 40s and 50s count. This promising cotton was found to be suitable for the blackarm disease prone irrigated area of Nagarjuna Sagar Project of Andhra Pradesh.

3. 861 :

This is a long staple category of cotton with good Micronaire fineness, maturity and bundle tenacity. This cotton was found to record encouraging spinning performance between 50s and 60s counts and released for the Nagarjuna Sagar Project tract of Andhra Pradesh and Whitefly prone areas of South Zone.

Mill Test :

The new strains of cotton which are found to be promising in yield and technological performance after being subjected to full spinning test for two to three seasons successively, are tested under mill conditions before these are released for large scale cultivation. This Institute arranges mill test on new promising strains/hybrids in co-operation with some textile mills in the country.

During the period mill tests were arranged for samples received from Faridkot and Guntur and the test results are compiled in Table 6.

It may be seen from the table that the new strain, F.846 and the control variety, F.505 received from Faridkot recorded good CSP values at 40s count both at the mill and at the Institute. F.846 was superior to F.505 in CSP value

TABLE 6 : COMPARATIVE SPINNING TEST RESULTS AT MILL AND AT CIRCOT FOR THE YEAR 1993-94

Location	Variety	Mill Test				Institute Test			
		Count	Strength (lb)	CSP	Twist Multiplier	Count	Strength (lb)	CSP	Twist Multiplier
Faridkot	F.846	40s	55.0	2200	4.6	40s	53.1	2117	4.0
	F.505(C)	50s	—	—	—	50s	38.4	1920	4.0
		30s	—	—	—	30s	74.7	2241	4.0
		40s	51.2	2048	4.6	40s	55.1	2204	4.0
Guntur	L.861	40s	52.9	2116	4.7	40s	59.5	2380	4.0
	L.389	40s	50.2	2008	4.7	40s	56.2	2248	4.0
	MCU.5(C)	40s	53.2	2128	4.7	40s	65.1	2604	4.0

C — Control Variety

at 40s count at the mill level, while F.505 was superior to F.846 at this count at the Institute level.

Two new promising strains, L.861 and L.389 along with the local control variety, MCU.5 were received from Guntur. It was observed that all the three cottons, L.861, L.389 and MCU.5 recorded superior CSP values at the Institute to those at the mill at 40s count inspite of the higher twist multiplier used at the mill level. The strain, L.861 at 40s count was *on par* with the control, MCU.5 at the mill, while the control, MCU.5 was superior to the new strain, L.861 in CSP value at 40s count at the Institute. In the case of strain, L.389, it recorded encouraging CSP value at 40s count at the Institute, only. However, the CSP values recorded by MCU.5 were superior to those of L.389 at 40s count both at the mill and at the Institute.

Promising strains/hybrids :

The following strains and hybrids have shown promising technological performance :

State	*Promising strains/hybrids*
Punjab	LH.1318, LH.1445, LH.1267, LH.1254, LH.1342, LH.1366, LH.1556, F.1352, LHH.107, FHH.7, LHH.121, LHH.120, LD.415, LD.494, LD.572, LD.569, LDH.11, LDH.14.
Haryana	H.1156, HS.178, HS.182, HD.123, HD.167, HD.259, HHH.111 and CSHH.33
New Delhi	Pusa 26 and Pusa 8-6
Sriganganagar	RS.938, RS.810, RS.921, RS.875, RG.22, RF.23, RG.32, RG.34, RDHy.1, RDHy.3, RDHy.7, RAJ.HH.17 and RAJ.HH.18.
Maharashtra	AKH.8635, JLH.234, PH.99, JLH.279, NA.362, AKH.8828, AKA.8812, PA.183, NA.377, PA.249, PA.245, AKA.8314, WHH.651, NFHH.120, NFHH.128, VCHH.16, HCHH.515, HCH.616, HCHH.414, VCHH.19, MSRHH.24, CAHH.25, CINHH.106, WHH.109, MECH.101, NFHB.105, SB.171 and 1874.
Madhya Pradesh	KH.2237, KWA.8, KWA.15 and KRH.2

State	*Promising strains*
Gujarat	G(B).20, G.3302, 3907, G(T).2714, G(T).14, G(AM).20, G(AM).31, G(AM).1275, G.BHV.46, NBHH.1, G(T).HH.35, GHH.662, GHB.583, G.BHV.86 and G.BHV.108
Andhra Pradesh	L.604, NA.1325 and ICMF.20
Karnataka	JK.276-8-2, DHB.100, DHB.105 and DHB.155
Tamil Nadu	HLS.79, HLS.72, TCH.1002, LMJ.2347, VRS.7, VRS.15, 70.D, 70.E, CNHPT.1, T.13 × M.12, CDHB.1 and CDHB.2.

(b) Tests on Standard and Trade Varieties of Indian Cottons

(i) *Standard Indian Cottons* : To assess seasonal fluctuations in the characteristics of Indian cottons and to gauge comparative superiority of the newly evolved strains, a number of selected varieties of Indian cottons called Standard Cottons are tested every year. These varieties are grown in Government farms and cotton research stations under the supervision of senior cotton scientists of agricultural universities, under identical conditions. Extensive fibre and spinning tests are regularly being done on such samples and the test results are published as Technological Circulars for information of cotton breeders and other research workers as early in the season as possible. During 1993-94, 17 such circulars were issued.

(ii) *Trade Varieties of Indian Cottons* : Lint samples of fair average quality of the major Trade Varieties of Indian Cottons are being obtained for each season through East India Cotton Association, Bombay. Representative *Kapas* samples of these varieties are also procured from the State Departments of Agriculture for determination of ginning percentage. The fibre and the spinning test results, ginning percentage and other test results on each variety of cotton are being published as Technological Circulars as early in the season as possible for information of cotton trade and industry. Information on such Circulars issued during 1993-94 on 21 Indian Cottons is given in chapter 3.

(c) Research work on Agricultural and Technological Aspects Relevant to Cotton Improvement Work

Technological Evaluation of the Germ Plasm Material

Gossypium barbadense accessions raised at Coimbatore during the season 1991-92 were technologically evaluated for the main fibre quality parameters like 2.5% span length, fibre fineness and

tenacity at 1/8" gauge, on High Volume Instrument.

The 2.5% span length was in the range between 26.7 mm and 38.0 mm and the fibre fineness was in the overall range of 2.2 to 4.3.

The bundle tenacity at 3.2 mm gauge varied between 20.0 g/t and 38.8 g/t.

Another 193 *G. barbadense* germplasm materials received from the Project Co-ordinator, Coimbatore, were qualitatively analysed on High Volume Instrument and the 2.5% span length ranged from 26.0 mm to 36.1 mm, fibre fineness between 2.5 μg/in and 5.3 μg/in and bundle tenacity from 20.1 g/t to 33.0 g/t. Though these GP stocks had shown good length and tenacity, they lacked in Micronaire value.

The fibre fineness of these samples was in the Micronaire value range of 2.5 to 4.0. Forty-eight samples recorded above 4.0 Micronaire value. Majority of the accessions had Micronaire value 3.0 or above. Also, nos. 4,49, 236, 242, 51, 105, 41 and 45 recorded good Micronaire between 3.5 and 4.0. Control Suvin had a Micronaire value of 3.0 .

The Bundle tenacity at 3.2 mm gauge ranged between 20.4. g/t and 33.0 g/t.

All the data obtained after quality evaluation of the genetic material tested were compiled and documented for further use by the cotton breeders.

A few such documents prepared were as follows :

1. Technological properties of *Gossypium herbaceum* Germplasm — Germplasm Series No. 13, May 1984 (216 *G. herbaceum* samples).
2. Technological Properties of *Gossypium hirsutum* Germplasm — Germplasm series No. 16, March, 1986 (671 entries).
3. A catalogue of cotton Genetic Resources in India — CICR, Nagpur, 1989, about 500 pages and 6000 entries.
4. Technological Properties of *Gossypium hirsutum* Germplasm from Punjab and Hisar — (465 Entries).
5. Technological Properties of *Gossypium herbaceum* Germplasm (26 entries).

and

Technological properties of Exotic Germplasm (81 entries)

Effect on Fibre Qualities and Yield Levels of Cottons due to Hormone — Biozyme Treatments

In this trial, the prominent locally adopted hybrid NHH.44 was sown on June 20, 1993 in three replications in RBD at Cotton Research Station, M.A.U., Parbhani. The details of treatments are as follows :

Treatments : Nine (9)

T_1 : Control

T_2 : Biozymes (1ml/lit) (Two sprays i.e. at the time of square formation and 50% flowering).

T_3 : Perfectose (1ml/lit) (Two sprays i.e. at the time of square formation and 50% flowering).

T_4 : 100 ppm mapiquate chloride (Chamatkar-Growth retardant) at the time of 10% flowering.

T_5 : 100 ppm Cycocel 60 days after sowing.

T_6 : T5 + 20 kg N/ha 10 days after Cycocel spray.

T_7 : T6 + 20 ppm NAA, 15 days after Cycocel spray.

T_8 : T7 + 10 ppm GA, 20-25 days after Cycocel spray.

T_9 : T8 + 500 ppm Ethrel after 1/3 picking.

Other agricultural details were :

1.	Plot size (m)	:	7.2 × 5.4, Net — 5.4 × 3.6
2.	Date of sowing	:	20.6.1993
3.	Date of harvesting	:	10.12.93, 25.12.93, & 10.1.94.
4.	Plant protection	:	3 + 3
5.	Plants/hill	:	Two
6.	Spacing (cm)	:	90 × 90
7	Fertilizers	:	a) 40:40:40 kg NPK/ha at the time of sowing b) 40 kg N at the time of flowering.

Impact of various treatments on fibre properties, seed cotton yield, ginning out-turn and yield contributing characters on NHH.44 are presented in Table. 7.

A perusal of data revealed that the effects of treatment were statistically significant for 2.5% span length, fibre fineness, maturity coefficient, *kapas* yield, ginning out-turn and yield contributing characters.

The treatment T7 and T5 showed desirable effect by exhibiting moderate increase in 2.5% span length over control followed by treatment T9, T8 and T3.

Various treatments except T3 have shown negative effects on fibre fineness. Fibres became coarse in most of the treatments, except perhaps for the Perfectose treatment (T_3). Marginal improvement in maturity coefficient was recorded in the case of T5, T6, and T7. Bundle strength and uniformity ratio did not show much change.

The results were found to be statistically significant for seed cotton yield and yield contributing characters.

The treatment T_8 (T_7 + 10 ppm GA) had given highest seed cotton yield (2708 kg/ha) and was superior to the rest of the treatments. The control (T_1) recorded the lowest seed cotton yield (2158 kg/ha). The treatment T_8 had shown 25.5% higher seed cotton yield over the control. The number of picked bolls per plant and the boll weight were significantly higher in T_8 followed by T_9 and T_7.

The maximum percentage of physiological boll shedding was observed in treatment T_5 (21.85%) and it was *at par* with the treatments T_4 (21.18%) and T_1 (19.95%) whereas, minimum physiological boll shedding was recorded by T_9 (9.94%) and T_8 (10.02%). The treatment T_3 (Perfectose) had given higher ginning percentage (34.33%) followed by T_4 (mapiquate chloride) (33.66%) and T_1 (33.00%).

In general, treatment T_7, T_8 and T_9 recorded significantly higher yield potential with moderate improvement in fibre length.

Effect of exposure to weather conditions on the quality of fibre in matured cotton bolls

The experiment has two parts:
Effect of exposure of cotton to sunlight on the plant

Varieties
1) G. Cot. 10
2) G. Cot. 11
3) G. Cot. Hyb. 6
4) G. Cot. Hyb. 9

Pickings *Rep : 2*
P_1 : one week
P_2 : two weeks
P_3 : three weeks
P_4 : four weeks

During the year under report, the colour tests of cotton, 'Rd' and 'b' were done for the samples of 1991-92 season. The mean values of the fibre characteristics and colour values for the two years were statistically analysed and given in the following Table :

The fibre properties, viz. 2.5% span length, Micronaire value, strength at 3 mm gauge length and matured fibre % do not show any significant differences between the four pickings done at one week interval for each picking. The colour indices, reveal significant decrease for later pickings for both reflectance percentage and degree of yellowness. When the cotton is exposed on the plant for a longer period, naturally, there is a likelihood of deposition of dust. As a consequence of this the reflectance percentage of cotton is reduced. Reduction in the degree of yellowness might be due to the effect of ultra violet radiation of sun's rays on the exposed cotton.

(b) : *Effect of Exposure of Cotton to Sunlight After Picking*

About 1.5 kg. seed cotton was collected separately for each variety and exposed to sunlight daily. The lint was tested at three stages with an interval of one month.

TABLE 7 : DATA ON FIBRE PROPERTIES, SEED COTTON YIELD AND YIELD CONTRIBUTING CHARACTERS OF NHH.44 COTTON UNDER DIFFERENT TREATMENTS

Treatments	2.5% span length (mm)	Uniformity ratio	Micronaire value naire µg/inch	M.C.	Bundle strength at '0'" gauge (g/tex)	Seed cotton yield (kg/ha)	No. of picked bolls per plant	Boll weight (g)	Physiological boll shedding (in %) (ATV)	Ginning Percentage
T-1	25.2	48	3.6	0.70	43.9	2158	42.53	3.31	19.95	33.00
T-2	25.1	50	3.8	0.71	43.8	2430	54.20	3.44	17.91	33.00
T-3	25.9	48	3.5	0.67	43.9	2383	53.00	3.48	17.90	34.33
T-4	25.4	50	3.8	0.70	43.6	2370	47.60	3.58	21.18	33.66
T-5	26.4	49	3.9	0.72	43.6	2362	46.40	3.60	21.85	32.00
T-6	25.7	49	3.7	0.71	44.5	2395	56.13	3.76	18.87	31.33
T-7	26.6	49	3.9	0.73	43.8	2610	61.86	3.87	10.48	31.33
T-8	25.9	50	3.7	0.68	42.7	2708	62.93	3.97	10.02	31.66
T-9	26.3	50	3.7	0.69	42.4	2665	62.05	3.96	9.94	31.66
SE	0.3284	0.8079	0.056	0.0090	0.5085	63.94	1.81	0.091	0.778	0.663
CD at 5%	0.9649	NS	0.1665	0.0269	NS	191.72	5.44	0.272	2.884	1.99
CV%	2.17	2.84	2.59	2.24	2.02	13.67	—	—	—	—

TABLE 7(a) : EFFECT OF EXPOSURE FOR COTTON ON THE PLANT

Fibre Property	1990-91	CD	1991-92	CD	1990-91 & 1991-92	CD
2.5% SL (mm)	27.6	0.5	28.5	NS	28.1	NS
	28.0		28.0		28.0	
	28.0		28.4		28.2	
	27.3		28.5		27.9	
MIC Value	4.2	NS	4.5	NS	4.3	NS
	4.4		4.3		4.3	
	4.3		4.2		4.2	
	4.2		4.1		4.2	
3 mm Strength (g/t)	26.9	NS	28.4	NS	27.6	NS
	25.8		28.9		27.4	
	25.4		28.2		26.8	
	26.1		28.3		27.2	
Mature Fibre %	74	NS	77	NS	76	NS
	79		74		76	
	80		71		75	
	76		71		73	
Colour Rd	74.6	1.4	75.0	2.1	74.8	2.1
	72.9		73.0		73.0	
	70.7		71.0		70.9	
	68.6		70.8		69.6	
Colour +b	9.6	0.3	9.1	0.4	9.3	0.3
	9.2		9.0		9.1	
	8.8		8.6		8.7	
	8.4		8.4		8.4	

Varieties
1) G. Cot. 10
2) G. Cot. 11
3) G. Cot. Hyb. 6
4) G. Cot. Hyb. 9

Stages *Rep : 3*
1) immediately after picking
2) after one month
3) after two months

In this experiment also the colour indices were tested for the samples of 1991-92 season. The fibre properties of the two seasons alongwith the colour indices were analysed and are presented in the following table :

Fibre Property	1990-91	CD	1991-92	CD	1990-91 & 1991-92	CD
2.5% SL (mm)	28.0	NS	27.6	0.5	27.8	0.6
	28.1		27.1		27.6	
	27.8		26.2		27.0	
Mic. Value	4.6	NS	4.9	NS	4.8	NS
	4.6		4.9		4.8	
	4.6		5.0		4.8	
3 mm Strength (g/t)	24.9	NS	27.3	1.4	26.1	1.5
	24.3		25.2		24.7	
	23.7		25.5		24.6	
Mature Fibre %	78	NS	81	NS	79	NS
	78		80		79	
	80		79		80	
Colour Rd	76.6	NS	73.6	2.5	75.1	2.0
	77.1		70.3		73.7	
	75.4		67.5		71.5	
Colour +b	9.3	0.6	8.9	0.3	9.1	0.4
	8.8		8.3		8.6	
	8.4		7.9		8.2	

In the year 1991-92, the values of fibre length and strength at 3 mm gauge length for the third stage were significantly lower than for the first stage. The same trend was noticed in the pooled analysis also. The colour values gave highly significant differences between different stages. Longer exposures show lower reflectance percentage and lower degree of yellowness as revealed by the values of the first part. Pooled results confirm this. Here also for longer exposures, the lower reflectance percentage was due to the deposition of dust and foregin matter and the lower degree of yellowness was because of

the colour fading due to ultraviolet-radiation.

For a single variety G. Cot. 10, cross sectional properties, viz. convolutions, reversals, ribbon width and wall thickness were studied. The test results are given below:

CROSS-SECTIONAL PROPERTIES OF G. COT. 10 (1990-91 SEASON)

	Convo-lutions	Rever-sals	Ribbon width	Wall Thick-ness
Picking I	68.8	28.1	15.7	3.7
Picking II	79.1	27.7	15.9	3.6
Picking III	66.6	27.4	16.0	3.2
Stage I	78.2	29.4	16.0	4.0
Stage II	83.1	28.0	16.2	4.2
Stage III	77.9	25.3	16.2	3.8

These parameters do not change either for different exposures of the cotton on the plant to sunlight or for different stages after picking.

Effect of Different Soil Profiles on Phasic Development of Cotton Fibre in G. Cot. Hyb.8.

G. Cot. Hyb. 8 was sown on 25-6-1992 on eight experimental plots having different soil profiles (soils from Surat, Anand, Bharuch, Talod, Viramgam, Arnej, Amreli and Junagadh). Agricultural operations such as weeding, irrigation and plant protection were undertaken at appropriate timings. Tagging of flowers was started from October 11 and continued up to October 17, 1992 in each plot of eight soils. At the ages of 15, 20, 25, 30, 35, 40, 45 days after pollination, eight bolls were harvested for each soil. Volume of bolls was measured. Fibre bundle strength at 3 mm gauge length was determined for all the 128 samples.

Study on Cotton Quality Parameters Contributing to Kapas *Grades*

During the period' 31 *kapas* samples were received from marketing centres of Maharashtra (Akola and Nagpur) and Karnataka (Davangare and Bijapur). Samples received from Maharashtra State Co.op. Cotton Growing Marketing Federation, Ltd. were marked as Sup, FAQ, Fair, 'X' and Kavdi (Sup, indicates the highest grade and kavdi the lowest grade). Varieties such as NHH.44, had 5 grades, AKH.4, had 4 grades, AHH.468, LRA.5166, DHY.286, H6 had 3 grades and Y.1, DCH.32, MECH.1 and 1007 had only 2 grades.

Samples received from Agricultural Produce Marketing Committee Centres, Karnataka were marked as AI, AII, AIII and BI (AI = Best quality), covering varieties such as DCH.32, Myco-A6-44 and LRA.5166.

These samples were ginned and tested for color and fibre properties. The range of Micronaire and Trash % values of all cotton samples (1992-94) received so far from Maharashtra state, are presented in the Table 8. Increase in trash present in the cotton seemed to contribute mainly to the deterioration in grade whereas, no trend was noticed in case of Micronaire value and grade.

TABLE 8 : RANGE OF MICRONAIRE AND % TRASH VALUES OF COTTON SAMPLES RECEIVED FROM MSCCGM FEDERATION

Sl. No.	Variety	No. of samples	Grade	Range of	
				Micronaire	% Trash
1.	NHH.44	9	Sup	2.5 — 4.2	1.5 — 3.8
		1	FAQ	3.1	4.3
		1	Fair	2.9	4.9
		1	X	3.2	12.0
		1	Kavdi	4.0	7.5
2.	AHH.468	7	Sup	2.4 — 4.3	2.1 — 7.7
		5	FAQ	3.4 — 4.4	3.6 — 6.4
		4	Fair	3.3 — 4.7	5.6 —11.1
3.	Y.1	5	Sup	4.8 — 5.2	1.8 — 4.7
		1	FAQ	2.9	8.0
4.	LRA.5166	15	Sup	3.1 — 4.6	2.2 — 8.1
		7	FAQ	3.0 — 4.2	3.7 — 5.7
		6	Fair	3.1 — 3.5	4.6 — 9.1
5.	AKH.4	6	Sup	4.7 — 5.4	3.6 — 8.2
		4	FAQ	3.9 — 5.4	6.9 —11.3
		2	Fair	4.1 — 4.4	6.7 —10.2
		2	X	3.6 — 4.7	5.1 —13.9
6.	DHY.286	3	Sup	3.9 — 4.3	3.1 — 6.2
		2	FAQ	3.4 — 3.6	3.8 — 7.4
		1	X	3.5	11.6
7.	H.6	4	Sup	3.3 — 3.9	2.4 — 7.0
		1	FAQ	3.5	4.1
		1	Fair	3.3	5.2
8.	DCH.32	2	Sup	2.6 — 2.8	2.5 — 8.3
		3	FAQ	2.6 — 3.5	5.6 — 6.9
9.	MECH.1	2	Sup	3.2 — 3.3	2.6 — 5.6
		5	FAQ	3.1 — 3.9	2.9 — 4.2
10.	1007	1	Sup	3.7	5.1
		1	FAQ	3.8	8.5

THRUST AREA II : POST HARVEST TECHNOLOGY OF COTTON

This thrust area encompasses pre-cleaning and ginning of *Kapas* and further mechanical processing of ginned lint into yarn and fabrics. Full realisation of the quality of cotton produced by the farmer can be achieved only through proper post-harvest operations and thus, it has a direct bearing on the income of the agricultural community. Several research investigations with specific objectives have been taken-up/continued during the reporting period and a brief summary of each of those investigations is given in this section.

Incidence of Seed-Coat Fragments in Ginned Cotton

Twenty-four cotton samples including eight desi varieties, three desi hybrids, nine *hirsutum* and four *hirsutum* hybrids were ginned on the Laboratory Model Gin set for an overlap of 3/8. The number of seed coat fragments (SCFs) were estimated on 3g lots of the ginned cotton. The weight percentage (Wf) and the number No of the SCFs were determined. The SCF number (N) was also calculated from the seed dimensions and seed weight by using the procedure described earlier. The samples were also subjected to hand ginning and the SCF weight and the number were determined. The results are presented in Table 9.

The following are the highlights of the observations.

(i) The weight percentage Wf and number No have a high degree of correlation (R^2 = 0.93). The corresponding correlation between observed number No and calculated number N is equally good (R^2 = 0.94). This signifies the soundness of the method of calculating SCF number from Wf and other parameters as indeed shown by earlier data on 32 cottons tested last year.

(ii) For *G. arboreum* cottons, Wf ranged from 0.01% (AKH-4 RG-8) to 0.7% (LD.327). The low incidence of SCFs in *arboreum* is in conformity with our earlier observations on 32 cottons.

(iii) The nine *hirsutum* cottons among the current lot of 24 recorded SCF in the range of 0.14 — 2% and this is close to the range reported for other cottons.

(iv) The record for *desi* hybrids is quite similar to that of *desi* varieties (0.04-0.28%), while *hirsutum* hybrids ranged from 0.17-1.42% which fell within the range reported earlier.

(v) *G. hirsutum* cottons, G. Cot. 14, LH.1134, LH.886, LH.900 and F.505 (five out of nine varieties) gave more than 0.5% contribution to the SCFs in both machine and hand ginned samples. In *desi* varieties, however, LD.327 alone gave a similar performance.

TABLE 9: DATA ON SEED COAT FRAGMENTS IN SOME COTTONS

Sr. No.	Name	Mean Fibre Length (mm)	SCF by wt % Machine gin	No. of SCF/s lint Obser-ved	Cal-culated
		G. arboreum			
1.	AKH.4	24.0	0.01	11.2	19.3
2.	RG.8	16.5	0.02	0.7	12.4
3.	Raichur.51	20.5	0.04	1.1	5.3
4.	Eknath	21.5	0.05	2.4	4.3
5.	G.Cot.13	23.0	0.16	4.6	2.0
6.	LD.230	18.0	0.43	14.4	17.3
7.	LD.327	16.0	0.70	11.2	16.6
		G. herbaceum			
8.	G.Cot.11	23.5	0.06	1.8	3.5
		G. hirsutum			
9.	G. Ageti	23.5	0.14	5.7	6.4
10.	AKH.081	24.5	0.14	2.1	9.6
11.	G.Cot.12	24.0	0.21	3.0	7.1
12.	PH.93	25.0	0.36	5.2	3.9
13.	G.Cot.14	26.5	0.58	8.2	8.5
14.	LH.1134	26.6	0.99	16.4	7.1
15.	LH.886	22.5	1.20	13.9	17.8
16.	LH.900	22.0	1.93	25.1	12.1
17.	F.505	22.0	2.01	33.4	12.5
		Hybrid			
18.	DB.3-12	21.5	0.04	1.8	10.6
19.	G.Cot.9	28.0	0.04	1.4	7.4
20.	G.Cot.7	22.0	0.28	5.8	7.5
21.	G.Cot.8	30.5	0.17	5.0	1.1
22.	NHH.44	24.0	0.30	4.4	5.0
23.	NHH.302	24.8	0.42	6.4	3.7
24.	AHH.468	24.0	1.42	19.9	11.9

(vi) The hand ginning of samples confirmed that the SCFs arise mostly from chalazal end and a few from dehiscence line. This is in agreement with earlier observations.

(vii) In general, hand ginned lint gave much higher values for Wf as compared to machine ginned lint. Further, there appears to be no correlation between the two (R^2 = 0.40) though some of the top scorers in SCF(%) in hand ginning experiment have recorded high values in the other experiment too. The results suggest that apart from the varietal influences, the shedding of SCF is also dependent on the manner in which the fibre is separated from the seed. While, a technically sound explanation cannot be put forward at present for want of experimental data, it would seem likely that the speed of fibre separation (whether slow or ballistic), the number of fibres held during each stroke, the average length of the fibres, etc. will also influence the occurrence of SCFs. These aspects are being studied.

Influence of Yarn Faults on the Knittability and Quality of Cotton Knitted Fabrics

Four more cottons (170 CO2, Hybrid 4, F.414 and LRA.5166) were selected and their chief fibre properties, i.e. 2.5% S.L., fibre fineness, bundle strength and maturity were determined. They were processed through blowroom, card, two drawframe passages, canfed intermediate and spun to 40s count on conventional ring frame with SKF drafting system. Yarn properties and Classimat faults of 170 Co2 and Hybrid 4 were determined while, samples belonging to other two varieties, viz. F.414 and LRA.5166, were being spun and analysed.

Six yarn samples spun from G.Cot.6, G.Cot.11, DCH.32, V.797, 170 CO2 and Hybrid 4 were identically knitted into single jersey fabric on a 26 inch diameter, 28 gauge Cheminist Camber Knitting Machine with 78 positive feeders at constant speed of 14 rpm keeping yarn tension at 4.5 gf. Three types of defects were mainly observed during knitting of these samples :

— very thick loops continuing for a few consecutive wales.

— small holes in the fabric.

— large hole in the fabric due to machine stoppage and discontinuation of knitting.

Sources of these major defects will be identified and correlated with Classimat yarn faults after knitting is over for all the eight samples.

It was decided to study the physical properties of knitted fabrics at two stages of relaxation. For wet relaxation treatment an experiment was conducted comparing plain water and water containing 0.1 percent wetting agent, keeping different wetting times of two hr, four hr and six hr intervals. In the case of plain water, maximum area shrinkage of 23% was achieved after four hr, whereas, with wetting agent, 24% area shrinkage was noticed in two hr, and the same remained constant even after increasing the wetting time.

Studies on Splicing of Cotton and Blended Yarns

The cotton chosen for this study was LRA.5166 having the following fibre characteristics :

2.5% span length	: 25.3 mm
Uniformity ratio	: 48%
Micronaire value	: 3.6
Mature fibre	: 64%
Bundle tenacity (at 3.2 mm gauge length)	: 21.3 g/tex

About 7 kg of cotton was processed through the spinning preparatory sequence so as to produce a roving of 1.6 hk. From this, 40s yarns were spun with five different levels of twist.

An experimental design involving 5 variables was chosen for the preparation of splice samples. The experimental plan was as shown below :

Factors	Level Codes				
	—2	—1	0	+1	+2
1. Twist Multiplier (X1)	3.46	4.23	5.0	5.77	6.54
2. Air-pressure (X2) kg/cm²	4	5	6	7	8
3. Blast Index (X3)	0.5	1.25	2	2.75	3.5
4. Tail Index (X4)	2	3	4	5	6
5. End Preparation Index (X5)	0	1	2	3	6

The experimental design needed preparation of splice samples with 32 specified treatment combinations for determining the optimum conditions for the preparation of the best splice.

So far, 22 experiments have been completed. Twenty-five splice specimens from each sample were tested for strength on the Uster Tensorapid. Separately, 10 splice specimens from each sample were tested for the splice length and diameter. It was observed that at Zero Blast Index, i.e. without any blast of air in the chamber, splicing is not possible. Besides, the average strength of splice varies widely over the different treatment combinations.

Comparative Performance of Roller and Saw Gins on Maharashtra Cottons

The detailed information about ginneries in Vidarbha Region of Maharashtra was collected and is presented in Table 10. There are a total of 189 ginning units, 70 ginning and pressing units and 7 pressing units in the Vidarbha Region. The number of single roller (SR), double roller (DR) and Saw Gins installed in this region are 2030, 2496 and 14, respectively. About 66% of the SR gins are installed in the private sector and the remaining are in the co-operative sector. In Akola, Yeotmal, Buldhana and Amaravati districts, there are more SR gins. About 70% of the DR gins are installed in co-operative sector. In Nagpur district, all the gins are of double roller type. Most of the DR gins are manufactured by Bajaj Steel Industries. The remaining ones are from Jadhav Gears (Amaravati), NIPHA (Calcutta), etc.

The Wardha district co-operative spinning mills have installed a 20 DR Automatic Integrated Gin & Press Unit manufactured by NIPHA. This factory was in operation during 1993-94 cotton season.

Information about ginneries in Marathwada Region is also partly collected. In this region, 14 saw gin machines are installed in the co-operative sector. All, except two machines, are imported units and their details are given below:

Name of the Factory	*Saw Gin Type*
1. Maharashtra Rajya Biyane Mahamandal Ginning Factory, Kamgaon Distt. Buldhana.	Two stands, 90 saw/stand. 30.5 cm (1 floot) dia. of each saw, manufactured by Kay Bee Industries, New Delhi. Installed in 1982.
2. Maharashtra State Co-operative Cotton Growers' Marketing Federation Ginning & Pressing Factory, Buldhana, Yeotmal.	Three stands, 80 saws/stand. 45.25 cm (1.5 feet) dia. of each saw. Manufactured by Murray Co., U.S.A. Installed in 1992.

3	M.S.C.C.G.M.F. Ginning Factory, Balapur Distt. Akola.	Five saw stands, 90 saws/stand 30.5 cm dia. of each saw. Manufactured by Continental Co., U.S.A. Installed in 1993.
4.	Indira Co-operative Spinning Mills' Ginning-Pressing Factory, Wardha.	164 saws/stand, 30.5 cm dia. of each saw. Manufactured by Consolidated Engineers, U.S.A. Installed in 1993.
5.	Co-operative Spinning Mills' Ginning-Pressing Factory Daryapur Distt. Amaravati.	164 saws/stand, 30.5 cm dia. of each saw. Manufactured by Consolidated Engineers, U.S.A. Installed in 1993.
6.	Co-operative Spinning Mills, Ginning & Pressing Factory, Akot, Distt. Akola.	—do—
7	Co-operative Spinnig Mills Ginning-Pressing Factory, Pusad, Distt. Yeotmal.	—do—

Ginning Studies : *Kapas* samples of three varieties, viz. NHH.44, LRA.5166 and AKH.4 were ginned on DR gin (Bajaj) and saw gin. Two types of saw gins, (Murray and Continental) were used for this study.

Murray gin : Normal machinery sequence in pneumatic suction, stone catcher, air separator, pre-cleaner (Inclined type), screw feeder, super extractor, saw gin, lint flue, lint cleaner condensor, lint slide and press box.

1. In this case, *kapas* was bypassed through inclined cleaner and lint samples were collected.

2 Complete machinery sequence was used including pre-cleaner. After saw ginning, lint samples were collected.

3. *Kapas* samples were bypassed through pre-cleaner and after ginning, lint was bypassed through lint cleaner.

4. Some *kapas* samples were ginned on DR gin and pressed into bale. After pressing, lint samples were collected.

Continental gin :

1. LRA.5166 *kapas* was passed through the following machinery sequence: Pneumatic suction, stone catcher, air separator impact cleaner, inclined cleaner, super unit, saw gin, lint flue, and condensor. Lint is then filled into bora and taken to the press house for bale packaging. Lint samples were collected for this study.

TABLE 10: DISTRIBUTION OF GINNING, GINNING-PRESSING AND PRESSING UNITS AND SR, DR AND SAW GINS UNDER CO-OPERATIVE AND PRIVATE SECTORS IN VIDARBHA REGION

District	Number of Ginning Units			Number of Ginning-Pressing Units			Number of Pressing Units			Number of Ginning Machines Installed					
										Co-operative Sector			Private Sector		
	Co-op	Pvt.	Total	Co-op.	Pvt.	Total	Co-op.	Pvt.	Total	SR	DR	SG	SR	DR	SG
Nagpur	9	0	9	3	0	3	0	1	1	0	134	0	0	0	0
Wardha	17	6	23	4	7	11	0	3	3	0	306	1	67	226	0
Yeotmal	40	11	51	8	8	16	0	1	1	254	492	4	223	224	0
Akola	23	21	44	6	11	17	0	1	1	133	303	6	436	124	0
Amaravati	18	8	26	8	7	15	0	0	0	171	321	1	231	114	0
Buldhana	17	19	36	3	5	8	1	0	1	123	185	2	392	67	0
Total	124	65	189	32	38	70	1	6	7	681	1741	14	1349	755	0

Ginning Units = 189 + 70 = 259
Pressing Units = 70 + 7 = 77
Total = 259 + 7 = 266

Type of Gin	Co-op.		PVT.		Total
SR	681	+	1349	=	2030
DR	1741	+	755	=	2496
SG	14	+	0	=	14
					4540

2. Same as above for AKH.4 *kapas.*

3. LRA.5166 *kapas* was ginned in DR gin and lint was pressed on conventional press. Lint samples were collected for this study.

4. Same as 3 for AKH.4 cotton.

These lint samples were being tested for fibre properties and spinning potential. Seed samples were being tested for fuzz percentage, germination percentage, etc.

Yarn Bundle Strength Test : Redesigning of Bundle making and Clamping Devices

Modifications in the device fabricated for preparing parallelised yarn bundles have been carried out. With this modified version, it is possible to prepare better quality yarn bundles, wherein overlapping of the yarns has been minimised.

Ten yarn samples from standard varieties were chosen varying in count from 16s to 60s. Six parallelised yarn bundles were prepared for each of these samples and were tested on the tester with the help of specially fabricated jaw attachments. Normal lea testing (50 leas per sample) was also carried out. The results showed that the C.V. of CSP in bundle test was very low, of the order of 1%, even when only six tests were carried out per sample. C.V. of CSP in the case of normal lea test was between 3% and 7% in spite of 50 tests being carried out per sample, evincing the superiority of the bundle test.

Single thread testing on tensorapid for these samples was also carried out. Hundred tests per sample were done and it was found that single thread tenacity (CSP) as obtained from tensorapid tests has poor correlation with both the bundle CSP and the normal lea CSP. This observation has been in agreement with the earlier observations made in this institute.

Study of the intra-bobbin and inter-bobbin variation in the yarn bundles was carried out on a 30s yarn. The PYB consisted of 100 strands, all drawn from the same bobbin and prepared using the apparatus fabricated for the purpose. Ten such bundles per bobbin from each of the ten bobbins were prepared and tested on the lea tester. Analysis of these results were being carried out.

THRUST AREA III : STRUCTURE, PROPERTY AND THEIR INTER-RELATIONSHIPS IN TEXTILE MATERIALS

The morphological and the fine structural parameters collectively determine the physical and mechanical properties of the fibre as well as of the yarn and the fabrics produced from them. The advent of newer cotton varieties and modern processing technologies have brought to fore, a wide range of combinations of fibre quality, yarn geometry and fabric design. A true understanding of structure-property relationship is essential for developing varieties suitable for various specific uses and also for determining the process sequences for the manufacture of end

products having different applications. Several research investigations are underway in this thrust area, a brief summary of which is given below :

Mechanical Properties and Wear Comfort of Apparel Fabrics and their Inter-Relationships

During the year tensile and compression tests were carried out on all the 48 fabric samples comprising cotton, polyester and their blends. The present tests formed a part of the various tests carried out on fabrics with a view to evaluate fabric handle. In the tensile test, the fabric pieces were subjected to a specified extension of 4% by using Instron, unlike in usual tests where they are taken upto the breaking point. From the cyclic tensile curve so obtained, (i) the tensile energy (WT) (ii) linearity of the tensile curve (LT) and (iii) tensile resilience (RT) were evaluated.

The cyclic compression-decompression curves obtained for the fabrics between load limits of 0 — 50 gf/cm^2 were analysed to arrive at (i) the compression energy (WC) (ii) linearity of the compression curve (LC) and (iii) compressional resilience (RC). In addition, compressibility of fabrics has also been evaluated by measuring thickness at different pressures.

Some of the salient findings of the tensile and compressional tests are presented below :

(i) In the case of cotton fabrics, as both warp and weft yarns became finer, the tensile energy required to stretch the fabric along warp was found to decrease rapidly.

(ii) As the Micronaire value (μ) of cotton fibres in the weft yarn was increased from 3.3 to 5.0, the tensile energy (warp) required to stretch the fabric showed a linear decrease. On the other hand, when the cotton used was finer (μ 3.3 the tensile energy was found to increase with Micronaire value. A similar trend was seen in tensile resilience (RT) also.

(iii) The tensile resilience (RT) of cotton fabrics was found to increase with increase in yarn count. The trend was exactly the reverse with thickness wherein increase in fabric thickness resulted in reduced resilience.

(iv) The tensile energy required for a specified extension, normalised for fabric cover and yarn count, is higher for polyester fabrics than for cotton fabrics. Thus, between identical fabrics of polyester and cotton, the former will demand higher energy for a specified stretch.

(v) Tensile resilience is generally higher for polyester fabrics than cotton fabrics. Whereas, in polyester, the resilience increases with fabric thickness, a reverse trend is found in cotton. The poor elastic recovery of the cotton fibre might be the cause for this behaviour.

(vi) The tensile energy, in general, increases with increase in fabric cover irrespective of the blend system. If the cover could be held constant then it is noted that the tensile energy increases in the order Cotton 20s > Viscose 20s > Cotton 60s > P/c 65/35 60s. Finer yarns in the weft, by and large seem to offer greater resistance to the stretch in the warp direction.

(vii) The tensile resilience for a given blend system decreased with increase in fabric cover. For a given fabric cover, the resilience increased in the order Viscose 20s > Cotton 20s > Cotton 60s > P/c 65/35 60s.

(viii) The compressibility values were in general, lower for polyester fabrics as compared to both cotton and blends. Irrespective of the fibre type, the compressibility decreased with increase in fabric cover and thickness. Whereas, the compressional energy showed a reverse trend for cotton fabrics alone. Fabrics made of finer yarns with a given number of ends and picks will require less energy for compression as they are more open.

(ix) As in the case of tensile energy, the energy for compression (WC) also seems to have a complex relationship with the fibre finenes. WC value increase as μ increases from 2.8 to 4.2, beyond which WC falls with increase in μ.

(x) In the case of cotton fabrics, the tensile energy depended positively on the bending rigidity (rwt.B = 0.87). However, in polyester fabrics the tensile energy was found to be influenced by both the shear rigidity as well as bending rigidity with the multiple correlation ^{R}GB.WT had a value of 0.82. This was especially true when the tensile energy in the bias direction was considered.

(xi) In cotton fabrics, the values of resilience in deformations such as, stretching (RT), compression (RC) and bending (RB) were found to be interdependent such that increase in yarn count was found to increase all the three.

(xii) An interesting aspect of the behaviour of polyester fabrics was that, its resilience in shear was inferior to that of cotton despite the fact that it performed well in tensile, bending and compressional deformations.

A Study of Morphological Deformities in Cotton Fibres in Relation to Space Constraint in the Developing Boll

Work on enumeration of morphological deformities taking 50 to 100 fibres from each of the fifteen varieties of cottons from first lot of samples (crop year 1991-92) chosen for the study has been completed. Data collected so far on boll size and its components, the space constraint and deformities are being analysed.

It may be noted that the fibres taken from unopened bolls of all the varieties used for space constraint measurements have registered much higher deformities than expected, especially the types of deformities which include v-bends, u-bends, sharp twist and spur. This is possibily due to handling of never dried fibres during the volumetric measurements of various boll components as there is no suitable alternative method for the same. Further, it is observed that bolls of *desi* hybrid and *hirsutum* hybrid cottons have comparatively low space constraint and also less number of deformities as compared to others. Boll size/volume appears to have no relationship with space constraint when all the varieties are considered together.

Morphology of Fibre Bases of Cotton and its Relation to the Strength of Attachment and the Seed Coat Removal During Ginning

The earlier work was mainly standardisation of technique of examining fibre base removed from seed coat using the procedure in which the fixation and dehydration steps were omitted. It was shown that there is no change in morphology of fibre base without fixation and after fixation.

The technique, thus, standardised, was used for a detailed study of the fibre bases in different varieties of cotton. Emphasis was to obtain quantitative information on the size of fibre bases from different regions of the seed surface, viz. chalazal, sides, and micropylar to assess the likely variations.

For obtaining specimens from the chalazal region, a bunch of basal fibres was pulled with a jerk to separate them from the seed, together with the chalazal cap. Fibres in the bunch not originating from the chalazal cap were discarded. It is thus made certain that all the fibres in the bunch belong to the chalazal region. This bunch was suitably tied and the adhering seed coat was dissolved with 4% NaOH at boiling temperature. The fibres were washed gently and mounted on specimen stub after drying at room temperature.

For micropylar and side regions small seed coat sections were cut from respective places by using a surgical blade without exerting any pull on the fibres and the seed coat components were separated by treatment with boiling alkali. The fibres were dried and mounted on the specimen stub for examination of basal profiles.

The specimens from all the three regions of the seed were coated with Au/pd before examination under SEM. The size of the fibre base was measured from electron micrographs. Ten measurements were made (fibre base) from each region.

The average values of fibre base from different regions of the seeds for six varieties are shown in the Table 11.

TABLE 11 : FIBRE BASE DIMENSIONS AT THREE REGIONS (μm) OF SIX COTTON VARIETIES

Varieties		Chalazal	Side	Micropylar
1.	Vikram	40.2	41.8	47.6
2.	AK.235	46.8	59.9	59.3
3.	Maljari	50.5	70.0	73.9
4.	Hybrid-4	35.8	40.0	71.3
5.	DCH.32	43.1	49.6	56.9
6.	LRA.5166	41.8	45.8	38.6

It is observed that the size of the fibre base at the chalazal region is the lowest in all the varieties. Fibre base at the micropylar region is the largest in all the varieties except LRA.5166. The general trend with respect to size of fibre base is chalazal region < sides < micropylar.

A Study of Structural Weak Links in Cotton

Twenty varieties of cotton drawn from all the four cultivated species and hybrids were selected for this investigation. Choice of varieties was made in such a way that the entire range of tenacity both at zero and 3.2 mm gauge lengths among cottons was represented. During the period under report, aqueous treatment and measurement of tensile properties in respect of ten samples were completed.

Aqueous treatment comprised swelling of fibres on water, stretching them to a desired level and drying them, either in the wet condition or in slack condition. Using a stretching frame and accessories available, a flat bundle of parallelised fibres was prepared on the frame and its initial length was noted on a scale available in this device. The fibre bundle was allowed to slacken and was then immersed together with the frame, in water to which a wetting agent was added. After 3 min, the bundle was stretched by 15% over the initial length and maintained in that state for 3 min. It was then rinsed with tap water to remove traces of wetting agent and dried in an oven at 80°C in the taut condition. Fibres treated in this manner are referred to as "Ast" (A for aqueous, st for stretch and dried). A set of slack dried fibres was also prepared by permitting the swollen and stretched bundle to slacken during the oven drying stage. Results on this set of samples are not being reported for the sake of brevity. Bundle strength tests were carried out at zero and 3.2 mm gauge lengths by using Instron machine in the standard atmosphere (65 ± 3% rh and 27 ± 2°C). Breaking extension at 3.2 mm gauge length was also noted.

Test results are summarised in Table 12 for the ten cottons currently taken up for the study. The significant features of data are the following :

(i) Aqueous swelling followed by stretch results in enhanced fibre strength in all varieties at zero and 3.2 mm gauge lengths. The increase ranges from 34% for Pusa to 50% for Mech.1 at zero gauge.

(ii) The percentage increase is more impressive in the tenacity at 3.2 mm gauge length. In this case, the increase ranges among the

varieties from 48% for Pusa to 107% for CJ.73. As a result, the Strength Uniformity Index (SUR) increases after the aqueous treatment.

(iii) There is significant reduction in the extensibility as a result of the treatment.

(iv) The improvement in strength resulting from aqueous treatment is generally found to be more in the case of cottons with lower strength.

The improvement of fibre strength resulting from aqueous treatment is attributable to structural changes produced by swelling and stretching. The altered structure is "frozen" by the removal of water by oven drying. To check whether the structural changes thus produced are stable, the modified fibres were rewetted in water in the slack state and allowed to dry. The results of tests on the rewetted film showed a small reduction in strength over that of the treated fibres and this difference in some varieties is statistically significant at 3.2 mm gauge length. Ignoring the small loss in strength caused by rewetting and drying, it could be said that the structural changes brought about by aqueous swelling and stretching are quite stable.

A Study on the Measurement of True Maturity of Cotton Fibres

Wall thickness and ribbon width have been measured for the same set of fibres, for seven *hirsutum*/hybrid cottons and of four *desi* (*arboreum/herbaecum)* cottons both in the raw state and after swelling in 18% NaOH. One hundred fibres have been examined in each case and the wall thickness and ribbon width were measured at ten different places at the widest regions of each fibre. Fibres from all length groups have been included in the study.

Table 13 gives the average values of ribbon width, wall thickness, and wall-ribbon ratio (W/R) before swelling and after swelling (W'/R'), and the values of swelling coefficient defined as the percentage increase in the wall-ribbon ratio resulting from swelling. The increase in swelling coefficient is found to be slightly lower for cotton numbers 1 to 5 in the Table, which were examined after mounting the fibres on both sides (leaving the central region, slack) than those for 6-11 which were mounted on one side only. The correlations between W/R and W'/R' for the same set of fibres vary from 0.42 to 0.89 for the different varieties. The low values of 'r' suggest that swelling can be influenced not only by the original wall thickness but also by other parameters like wall structure and fibre morphology.

Analysis of the results on different fibres within each variety showed that swelling coefficient of individual fibres is influenced by the initial value of W/R. The lower the initial value of W/R, the higher was the swelling coefficient. With increase in W/R, the swelling coefficient decreases and approaches zero. This aspect is brought out very clearly when swelling coefficient is plotted against W/R for the variety DCH.32. (Fig. 1).

TABLE 12 : EFFECT OF AQUEOUS TREATMENT ON VARIOUS COTTONS AT DIFFERENT GAUGE LENGTHS

Sample	Nature	0 gauge		3.2 mm GL			
		Tenacity g/t	% increase over control	Tenacity g/t	% increase over control	Extension %	Strength uninformity index
Suvin	Control	55	—	39	—	6.8	70
	Ast	78	41	68	77	5.2	88
Pima	Control	49	—	32	—	7.2	65
	Ast	67	35	56	75	3.9	86
170 CO_2	Control	40	—	20	—	5.5	50
	Ast	59	47	37	87	3.7	63
Pusa	Control	58	—	38	—	5.7	65
	Ast	78	34	56	48	4.3	72
V 797	Control	44	—	23	—	5.6	53
	Ast	59	35	42	79	3.7	70
Digvijay	Control	48	—	27	—	5.3	57
	Ast	65	36	49	78	3.7	75
AK 235	Control	48	—	23	—	5.7	49
	Ast	66	38	41	77	3.8	63
CJ 73	Control	48	—	23	—	4.9	46
	Ast	70	46	46	107	3.7	66
Mech.1	Control	45	—	29	—	5.1	64
	Ast	68	51	47	64	3.7	70
DCH.32	Control	47	—	32	—	6.7	69
	Ast	67	41	55	63	4.0	79

TABLE 13 : AVERAGE RIBBON WIDTH, WALL-THICKNESS, WALL-RIBBON RATIO AND CORRELATION COFFICIENTS BETWEEN WALL-RIBBON RATIOS BEFORE AND AFTER SWELLING

Sr. No.	Name of Cotton	Ribbon Width (μ)		Wall thickness (μ)		Wall Ribbon Ratio		% Increase in wall-ribbon ratio	(W/R) (—/—) W/R
		Control (R)	NaOH (R')	Control (W)	NaOH (W)	Control (W/R) (—/—)	NaOH (W/R) (—/—)		
1.	Varalaxmi	19.01	23.10	4.24	6.77	0.23	0.29	26.1	0.42
2.	DCH.32(1)	18.97	22.58	4.44	6.95	0.23	0.31	34.8	0.89
3.	Hybrid 4	21.42	25.4	4.50	7.30	0.22	0.29	31.8	0.86
4.	Digvijay	21.11	27.83	4.95	7.36	0.24	0.27	12.5	0.69
5.	Virnar	20.76	27.37	6.78	9.76	0.33	0.36	9.1	0.81
6.	DCH.32(2)	18.53	21.97	4.27	7.07	0.23	0.33	43.5	0.84
7.	G.Cot. Hybrid 6	19.53	24.69	5.17	8.87	0.27	0.36	33.3	0.80
8.	G.Cot.10	19.79	24.54	4.60	7.77	0.24	0.32	33.3	0.84
9.	MCU.5	18.62	24.00	5.27	8.72	0.28	0.36	28.6	0.70
10.	AKH.4	20.49	27.6	6.11	10.46	0.30	0.38	26.7	0.66
11.	G.Cot.11	22.16	28.8	5.75	9.30	0.26	0.32	23.1	0.63

Each point represents the average of ten fibres. The general appearance of this graph was the same for all varieties studied. In other words, in each variety of cotton, relatively immature fibres show a higher swelling than mature fibres. Swelling is highly influenced by the original wall thickness and hence the results of maturity measurements based on observations of swollen fibres can be at variance with the true fibre maturity obtained from raw fibre measurements.

Maturity determination based on fibre cross-sectional measurements has been initiated and experimental work has been completed in respect of four cottons. In these experiments, after measuring the perimeter of the sections, the diameter of the equivalent circle D is calculated. The average thickness of the wall(d) is found by measurements at two or three different places on the section. The ratio d/D which gives another measure of maturity has been worked out. Degree of thickening (Q) has also been estimated for these four cottons. Among the four cottons tested (d/D) was found to be the lowest for DCH.32. The same was true for Q (average degree of thickening). These

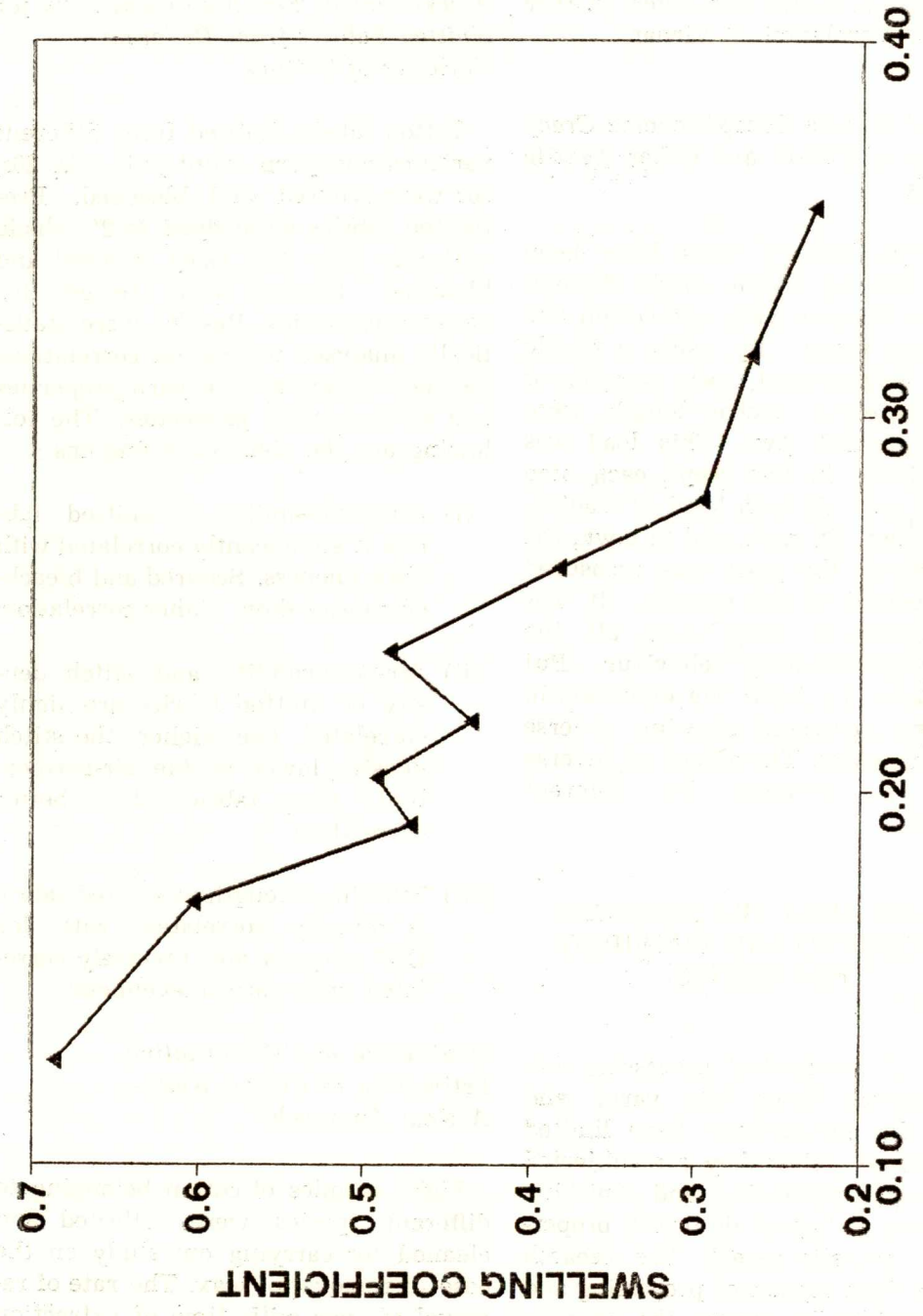


Fig 1 : Swelling Co-efficient Vs. Wall-Ribbon Ratio for DCH.32 Cotton

parameters followed the order DCH.32 < H.4 < Varalaxmi < Virnar.

Study of Inverse Creep/Reverse Creep Property of Cotton and Other Textile Materials

Some preliminary tests have been carried out in nylon single filment, polyester filament yarn and cotton and wool spun yarns. By using a simple loading arrangement, yarn samples of approximately 3 metre length were loaded upto 112 g.wt. This load was then reduced in two steps, each step being 50 g.wt. At each level of loading, viz. 112 g.wt., 62 g.wt., and 12 g.wt., the extension in the yarn was measured over a period of 200 seconds. It was observed that at 112 g. load, all the samples showed creep behaviour. But at 62 g and 12 g loads the extension in the yarns decreased showing inverse creep behaviour. The extent of inverse creep was different for different materials.

THRUST AREA IV: CHEMICAL PROCESSING AND FINISHING TREATMENTS

Although mechanical processing converts cotton fibres into yarns and fabrics, the end-products have limited utility value, unless they are subjected to chemical processing and finishing treatments to impart desirable properties and aesthetic appeal. The research work on these aspects of processing and finishing taken-up during the year is summarised below :

Assessment of Finishing Conditions for Knitted Fabrics from Different Varieties of Cottons

Cotton fabrics knitted from different varieties and yarn counts, viz. 16s, 20s, 30s were scoured and bleached. Pretreated fabrics were dyed to 2% shade with Sky Blue 6BS. Grey, scoured and bleached fabrics were tested for various properties. Results were statistically analysed to find out correlations between different fibre/yarn properties and knitted fabric properties. The following are the significant findings :

(i) Air-permeability of knitted fabrics is significantly correlated with fibre fineness. Scoured and bleached fabrics show higher correlation.

(ii) Air-permeability and stitch density of knitted fabrics are highly correlated. The higher the stitch density, lower is the air-permeability. Grey fabrics show better correlation.

(iii) Bursting strength of knitted fabric is directly correlated with lea CSP of yarn and inversely correlated with yarn unevenness.

Qualitative and Quantitative Estimation of Cotton Wax — A New Approach

Eight samples of cotton belonging to different species were collected and cleaned for carrying out study on the ease of removal of wax. The rate of removal of wax with time of extraction was studied for all the samples. The

results indicated, in general, the existance of variation in the ease of removal of wax under the same extraction conditions. The effect of washing with water on the wax content of the cotton was also studied on the two cottons and the results showed that washing with water did not alter the percentage of wax significantly.

Screening of Indian Cottons for Water Absorbency

Fourteen cotton samples belonging to short and medium staple categories, and coarser in nature having Micronaire value over 5.0 (197 militex) were collected. These samples were cleaned on Shirley Analyser and further purified by kiering with 1.5% sodium hydroxide, keeping a material-to-liquor ratio of 1:20 under 15 lbs pressure for 4 hr in an autoclave. The samples were then bleached with sodium hypochlorite using 1.5 g/l available chlorine and keeping pH around 10.1 and a material-to-liquor ratio of 1:20.

These samples were then washed and scoured with 0.25% HCl for 15 mins. Samples were washed again with water and then antichlored with 1% sodium-metabisulphite for 30 min. Finally they were washed with tap water and dried in air.

The purified samples were tested for different properties such as, Percent Ash Content, Moisture Regain, Water Imbibition as per the standard test methods and also tested for absorbent properties such as, Water Holding Capacity (WHC) and Sinking Time (ST) as per Pharmacopeia standards.

THRUST AREA V: UTILISATION OF BY-PRODUCTS AND PREPARATION OF NEW PRODUCTS FROM CELLULOSE AND RELATED MATERIALS

Full exploitation of by-products generated during post-harvest technological operations on *Kapas* would increase the returns to the cotton growers and producers of value added products from cotton and therefore, this area has been one of the priority items in CIRCOT's research programmes for the past one decade. The on-going research work in this thrust area during 1993-94 was as follows :

Studies on Continuous Fermentation on Cellulase of Penicillium funiculosum

Earlier studies on the application of cellulase from *Penicillium funiculosum* to isolate strach from potato showed that the enzyme could release about 68% of starch at 50°C in 6 hr. Further work was continued to enhance the release of starch from potato using a combination of cellulase from *P. funiculosum* along with pectinase enzyme.

Ten grams of potato were subjected to degradation at 50°C in 100 ml enzyme — buffer system (pH 4.8) containing cellulase plus pectinase and pectinase alone. Pectinase used at a concentration of 0.3% was a commercial preparation. It was observed that the control system containing only pectinase could release starch from potato only to the extent of 50% in 3 hr while the system that contained cellulase and pectinase released starch upto 90% in 2 hr and about 98% in 3 hr.

The above results indicate that *P. funiculosum* cellulase could be used effectively to isolate intracellular materials of plants origin, if applied along with other appropriate enzyme(s).

Simultaneously isolation of starch from cassava was studied using *P. funiculosum* cellulase and pectinase. The cellulase from *P. funiculosum* could not release oil from cottonseed. It seems, other enzymes like hemicellulases, pectinase, proteases may also be required for the purpose. Attempts were made to use cellulase in deinking of waste-paper and waste-paper pulp. *P. funiculosum* cellulase degraded news paper pulp to fibrillar level releasing the ink. Thus, both fibrillation as well as deinking is possible by using the cellulase.

A strain from *Aspergillus foetidus* was procured from National Chemical Laboratory, Pune for the production of pectinase. The organism was grown in a medium containing pectin as carbon source for 3-4 days, filtered and the filtrate was used as enzyme. The pectin degrading activity of *A. foetidus* enzyme and *P. funiculosum* cellulase was tested by using 1% pectin solution at 40°C and 50°C, respectively. It was observed that pectinase as well as cellulase filtrate could degrade the pectin and remove the turbidity of the pectin solution. These studies revealed that cellulase filtrate also contains pectolytic activity. Therefore, both these enzymes were tried for clarification of apple fruit juice by incubating pectinases of *A. foetidus* and cellulase of *P. funiculosum* with apple pulp at 40°C and 50°C, respectively. It was observed that cellulase and pectinase could hydrolyse pectin present in the apple juice and could give clear juice in 2 hr.

Triglyceride Structure of Cottonseed Oil

Methods of enzymatic hydrolysis of triglycerides (TAG) of cottonseed oil and separation of TAG and 2 monoglycerides (2MG) by thin layer chromatography (TLC) were standardised. Fresh cottonseeds of a few commercially grown varieties were collected and the oil extracted. About 200 mg of TAG was collected. Of this, 50 mg was subjected to enzymatic hydrolysis at 37°C using phosphate buffer (pH7) and Lipase-S, which is 1-, 3- specific. 2MG formed was obtained by preparative TLC.

Fatty acid composition of TAG and 2 MG were determined by gas chromatography (GLC). Variation in fatty acid composition of TAG of different varieties was observed. 2 MG of the oils had higher percentage of linoleic and oleic acids and lower percentage of stearic and palmitic acids as compared to the respective TAGs.

Preparation and Characterization of Protein Hydrolysates (Peptones) from Cottonseed Meal

It has already been shown at this Institute that good quality peptone can be prepared from cottonseed meal (meal of mixed varieties). Studies on the effect of cottonseed meal prepared from different species of cotton on the quality of peptone were undertaken. The fifteen

varieties shown in Table 14 belonging to all the four cultivated species of cotton and some of the hybrids were selected for the study.

The seeds were defatted and the meal passed through 25 mesh sieve was defatted again for further work. Before proceeding for the preparation of peptone from cottonseed meal, it is essential to know the chemical composition of cottonseed meal. Therefore, analysis of the meal was carried out during the period under report. The presence of various constituents, viz. nitrogen, gossypol, lignin, crude fibre, ash and moisture were analysed and the results are given in Table 15.

Effect of Pretreatments on the Properties of Linters of Different Cotton Varieties

Linter samples from two more varieties (seven in total) were kiered under three different kiering conditions and kiering loss values were determined. These values ranged from 6.6% to 18.6%. Bleaching of all the kiered samples under the three bleaching conditions was completed. Kiered as well as kiered and bleached samples were analysed for D.P. and whiteness.

Whiteness of kiered samples ranged from 50.32% in DCH.32 to 67.38% in SRT.1, both kiered at 1.5% NaOH concentration. Varietal differences were observed in kiered and bleached samples. The lowest whiteness value of 80.10% was recorded for linters of DCH.32 kiered with 3.5% NaOH solution and bleached at 9.0 pH, whereas, under similar conditions linters from MCU.5 variety showed the highest whiteness value of 91.14%.

The D.P. of kiered samples varied from 2249 in LRA.5166 kiered with 2.5% NaOH solution to 2901 in Bikaneri Narma kiered with 1.5% solution. The D.P. of kiered and bleached linter samples was in the range of 1292 in DCH.32 kiered at 2.5% NaOH concentration and bleached at 8.4 pH to 2201 in Bikaneri Narma kiered at 1.5% NaOH

Scale up Trials on the Preparation of Pulp and Paper from Cotton Stalks and other Cellulosic Materials via. Anaerobic Digestion

During the period under report, bagasse, the cellulosic waste material generated by sugar industries, was tried to make paper after processing through anaerobic digestion and adopting the novel technology standardized earlier at CIRCOT to prepare pulp and paper from cotton plant stalks. The results indicated that open boiling of bagasse with 4% NaOH followed anaerobic fermentation for one week and then boiling the fermented material in 1% NaOH produced good quality pulp. The paper prepared from bleached pulp had a breaking length of 3015 metres, a burst factor of 25, a tear factor of 112 and double folds of 15. The results are given in Table 16.

Kraft Paper from Cotton Plant Stalks for use in the Manufacture of Corrugated Fibre Board Boxes for Packaging of Fruits

1. *Collection of Raw Materials*: About

TABLE 14 : SPECIES-WISE DISTRIBUTION OF VARIETIES

Sl. No.	Variety	Species	Place
1	AK.235	G. arboreum	Bellary
2	Sanjay (CJ.73)	—do—	Botad
3	Digvijay	G. herbaceum	Jambusar
4	V.797	—do—	Mehsana
5	Jayadhar	—do—	Hubli
6	Gujarat 11	—do—	Jambusar
7	G.Cot.13	—do—	Dhanduka
8	Deviraj	G. hirsutum	Surendranagar
9	LH.900	—do—	Abohar
10	170 CO2	—do—	Hubli
11	SRT.1	—do—	Botad
12	Gujarat 12	—do—	Surendranagar
13	Suvin	G. barbadense	Tamil Nadu
14	Hybrid 6	Hybrid — G. hirsutum × G. hirsutum	Surat
15	DCH.32	Hybrid — G. hirsutum × G. barbadense	Hubli

TABLE 15 : CHEMICAL COMPOSITION OF DEFATTED COTTONSEED MEAL

Sl. No.	Varieties	Nitrogen %	Protein % N x 6.25	Gossy-pol %	Ash %	Lignin %	Crude fibre %	Moisture %	pH %
1.	AK.235	8.4	52.4	1.3	6.4	5.4	4.1	7.4	6.0
2.	Sanjay (CJ.73)	8.6	53.9	1.8	5.7	5.3	3.8	7.8	6.0
3.	Digvijay	7.4	46.2	1.6	8.9	6.8	5.6	7.9	6.2
4.	V.797	8.5	52.8	2.6	8.0	6.1	3.0	6.9	6.0
5.	Jayadhar	8.2	51.4	1.8	8.7	5.0	6.9	6.4	6.1
6.	Gujarat 11	7.6	47.8	2.8	8.9	6.3	3.7	6.6	6.0
7.	G.Cot.13	8.3	52.0	1.9	8.0	5.6	2.8	4.5	6.0
8.	Deviraj	9.2	57.4	1.8	7.0	5.0	4.5	5.6	5.9
9.	LH.900	8.3	52.1	2.5	7.6	5.7	4.4	8.0	6.0
10.	170 CO2	8.6	53.8	3.1	7.5	6.5	3.5	5.6	6.0
11.	SRT.1	8.8	54.9	1.7	7.7	3.6	2.9	6.3	6.0
12.	Gujarat 12	9.0	56.2	2.0	7.0	4.2	3.6	6.5	6.0
13.	Suvin	8.2	51.2	2.2	8.7	4.5	2.9	5.7	6.2
14.	Hybrid 6	9.4	58.5	2.2	7.5	3.6	3.0	6.4	6.0
15.	DCH.32	8.4	52.4	2.3	9.7	5.2	3.7	5.8	6.1

TABLE 16 : PROPERTIES OF PAPER PREPARED FROM BAGASSE

Sl. No.	Basic Wt. (g/m^2)	Burst Factor	Breaking length (m)	Tear Factor	Double Fold
1	141.0	4.3	1002	59.6	5.0
2	63.0	20.0	1821	88.9	16.0
3	66.0	20.2	2779	84.8	15.0
4	52.0	10.8	2244	107.7	12.0
5	60.0	4.7	1489	140.0	4.0
6	50.0	24.5	3014	112.0	15.0
7	60.0	4.7	1489	140.0	4.0
8	153.0	7.3	1116	65.4	10.0

1 = No anaerobic fermentation (a.f.)

2 = 3% NaOH followed by a.f.

3 = 3% NaOH + a.f. + 1% NaOH

4 = 3% NaOH No a.f.

5 = 4% NaOH + a.f.

6 = 4% NaOH + a.f. + 1% NaOH

7 = 4% No a.f.

8 = Only a.f.

16 tonnes of dry cotton plant stalk was collected from CICR, Nagpur and mechanically cut into small chips of about 1.5 cm to 2.0 cm size with the help of an electric chaff cutter.

2. *Standardisation Trials prior to Large Scale Trial* : A large scale trial was planned at Ellora Paper Mills Ltd., Tumsar, for manufacture of kraft paper from cotton stalks. Since the maximum pressure that could be achieved in the Mills' digester was only about 6.5 kg/cm^2 as against 7.5 kg/cm^2 required by us, some more laboratory scale pulping trials were conducted to simulate the Mills' conditions. The modified pulping conditions comprise cooking of the chips with 17% - 18% kraft liquor at 160°C at 6.5 kg/cm^2 pressure with a material-to-liquor ratio of 1:3 for 5½ hrs.

3. *Large Scale Trial* : Large scale pulping trials were carried out using about 15 tonnes of raw material in four different batch digestions, the details of which are given below:

(i) *Pulping* : About 3 tonnes of cotton stalk chips were digested in a rotary digester having capacity of 29 cm^3 with 17% kraft liquor oven dry weight of the raw material at 20% sulphidity, 160°C temperature, 6.5 kg/cm^2 pressure for 5½ hr. The material-to-liquor ratio was 1:2.5. After the cooking, the digester was degossed and brought to room temperature and then the cooked material was dumped and manually transferred to the beater, where it was washed and beaten simultaneously to get the pulp of desired freeness.

(ii) *Manufacture of Kraft Paper*: The pulp was refined by passing through the disc refiner in two passes and then transferred to the chest, where the stock was prepared by adding various additives like rosin, alum, etc. The pulp from the stock was screened to remove the rejects and then kraft paper of various grammages viz. 48, 100 and 120 was manufactured on a fourdrinier paper making machine. About 3 tonnes of kraft paper were manufactured.

(iii) *Testing of Paper Samples*: The kraft paper prepared was evaluated for various strength properties, viz. breaking length, burst factor, tear factor, cobb test, etc. The quality of the paper was satisfactory. Corrugation trials on the kraft paper produced, are underway.

4. *Planning of Packaging Trials* : For evaluating the suitability of the corrugated boxes prepared from kraft paper of cotton plant stalks for packaging of various types of fruits, the Central Institute for Horticulture for Northern Plains and National Research Centre for Citrus were visited and discussions

were held with the concerned scientists and packaging trials have been planned.

Production of Biogas from Solid Cellulosic Wastes by Dry Fermentation

The work carried out over the past 15 years on the production of biogas from willow-dust, a solid cellulosic textile mill waste, resulted in the preparation of Detailed Project Report and the Techno-Economic Feasibility Report. The Ministry of Non-Conventional Energy Sources (MNES), Govt. of India has recognised this work and adopted this technology in their subsidy programme for installing willow-dust based biogas plants.

The above technology was extended to process sugarcane bagasse and press-mud, the cellulosic wastes from sugar industries for the production of biogas. It is reported that bagasse is available to the extent of 42 million tonnes per annum, whereas press-mud is available to the extent of 9 million tonnes. Though it is shown that pulp and paper can be made from bagasse, most of the bagasse is being used as fuel in the sugar industries. However, press-mud does not have much use immediately after discharge from the mills though it can be used as manure after storing for a long time.

The trials carried out on the bench scale and on an experimental plant of 25 kg indicated that biogas can be produced from bagasse and press-mud in 1:1 combination at low moisture levels. It is possible to obtain about 600 l of biogas from 1 kg of the combined material in three months. Scale up trials are underway.

THRUST AREA VI: STUDIES ON COTTON PLANTS AND PROCESSING DUSTS IN RELATION TO OCCUPATIONAL HAZARDS

A knowledge of the origin of cotton dust and its composition is essential to effectively combat the problem of mill fever caused by hazardous respirable dusts present in the processing areas and also to enhance the life of the installed machinery in mill, which become unfunctioned gradually, if timely attention is not given to solve the dust problem. Similarly, elemental composition of different parts of cotton plants, can generate sufficient information on the nutrient transport and related areas of plant physiology. Therefore, the following investigation has been taken up, the progress of which is summarised below:

Incidence of Toxic Inorganic Elements and Associated Agents in Respiratory Organs of Workers Exposed to Cotton Dusts

A method of loading BAL (Broncheo Alveolar Lavage) in the spectrometer has been finalised after various trials. Analysis of as little as 100 micro litres of liquid specimens is possible with this method. Preliminary trials have indicated that the concentrations of elements such as Cl, Ca, K, S, Ti, Al, Mg, Na, Si, Cd and Mo may be significant in BAL samples.

3

Publications

A Annual Report

Annual Report of the Central Institute for Research on Cotton Technology for the calendar year 1992-93.

B. Technological Circular

Technological Circulars on Trade and Standard Varieties of Indian Cottons for the season 1989-90 & 1990-91.

C. Research Publications (CIRCOT Publications — New Series)

488 S. Sreenivasan, P. Bhama Iyer and G. S. Patel — *Studies on the Swelling of Cotton Fibers in Alkali Metal Hydroxides III. Structure-Property Relations in Fibers Swollen at 0°C* (Reprinted from the Journal of Applied Polymer Science, Vol. 48, p. 393-404, April, 1993).

489 K. R. Krishna Iyer, N. C. Vizia and N. B. Patil — *Measurement of Energy Required to Detach Cotton Fibres from Seed — Some Practical Considerations* (Reprinted from the Indian Journal of Fibre & Textile Research, Vol. 18, No. 2, p. 57 - 61, June, 1993).

490 S. K. Chattopadhyay — *Instrumental Detection and Evaluation of Yarn Faults* (Reprinted from the Textile Industry & Trade Journal, Vol. 30, No. 9-10, p. 59, September-October, 1992 — India ITME'92 Special Issue).

491 M. S. Parthasarathy and S. K. Chattopadhyay — *An Analysis on the Occurrence of Faults in Cotton Yarns* (Reprinted from the Asian Textile Journal, Vol. I, No. 7, p. 17-20, May, 1993).

492 G. Vijayan Iyer, N. C. Vizia and K. R. Krishna Iyer — *A Simple Device to Prevent Backlash in Roller Gins* (Reprinted from the Journal of the Textile Association, Vol. 54, No. 3, p. 129-130, September, 1993).

493 S. K. Chattopadhyay — *Problems Relating to Ring Spinning of Quality Yarns with Low Micronaire and Low Maturity Cottons* (Reprinted from the Textile Industry & Trade Journal, Vol. 31, No. 7-8, p. 79-82, July-August, 1993).

494 G. Vijayan Iyer and M. S. Parthasarathy — *Some Prcatical Hints on*

Precleaning and Ginning (Reprinted from The Indian Textile Journal, Vol. 104, No. 1, p. 28-32, October, 1993).

495 R. M. Gurjar — *Furfural from Cottonseed Hulls and Other Agricultural Residues — A Comparison* (Reprinted from the Journal of Research & Industry Vol. 38, No. 3, p. 144-145, September, 1993).

496 P. Bhama Iyer, K. R. Krishna Iyer and N. B. Patil — *What is the True Spiral Angle in Cotton? Does Solvent Exchange Alter it?* (Reprinted from the Journal of Applied Polymer Science, Vol. 50, p. 1295-1297, November, 1993).

497 R. M. Gurjar — *Effect of Different Binders on Properties of Particle Board from Cotton Seed Hulls with Emphasis on Water Repellency* (Reprinted from the Bioresource Technology, Vol. 43 No. p. 177-178, 1993).

498 S. K. Chattopadhyay and S. Sengupta — *Quality Improvement by Analysis of Variance — Length Curve* (Reprinted from The Indian Textile Journal, Vol. 104 No. 4, p. 10-14, January, 1994).

499 Munshi Singh, N. B. Patil and V. P. Singh — *Improvement in Fibre Bundle Strength in Medium Staple Varieties of Upland Cotton (Gossypium hirsutum)* (Reprinted from the Indian Journal of Agricultural Sciences, Vol. 63, No. 11, P. 719-722, November, 1993).

500 H. V. Sreenivasamurthy, S. K. Chattopadhyay, M. S. Parthasarathy and B. Srinathan — *Feasibility of Air-Jet Spinning Technology for Spinning of Indian Cottons and their Blends with Polyester* (Reprinted from the Book of Papers, the 49th All India Textile Conference held at Coimbatore on December 16-17, 1993).

501 R. M. Gurjar — *Chemical Composition of Cotton Seed Hull of Cultivated Species* (Reprinted from the Journal of Indian Society for Cotton Improvement, Vol. 18, No. 2, p. 145-148, September, 1993).

502 N. B. Patil, M. S. Parthasarathy and V. Sundaram — *A Critical Examination of Technological Performance of Hybrid Cottons in India* (Reprinted from the Journal of the Indian Society for Cotton Improvement, Vol. 18, No. 2, p. 135-144, September, 1993).

503 V. V. Singh, S. S. Narayanan, V. M. Kulmethe, G. R. Anap and S. N. Nagwekar — *A Brief Review on Coloured Linted Cottons Documenting Selected Genotypes of Gossypium hirsutum* (Reprinted from the Journal of the Indian Society for Cotton Improvement, Vol. 18, No. 2, p. 91-94 September, 1993).

504 M. S. Parthasarathy, S. K. Chattopadhyay and B. Srinathan (CIRCOT) & H.V.S. Murthy (VJTI) & T. M. Venkatapathi (NITRA) — *Combed Cotton Comparisons* (Reprinted from the Textile Asia Jour-

nal Vol. 24, No. 8, p. 35-38, August, 1993).

505 P. K. Mandhyan, G. Viswanathan and A. V. Ukidve — *Influence of Rotor Diameter and Twist on OE Yarn* (Reprinted from the Tecoya Technical Update Vol. 2, No. 11, p. 42-45, February, 1994).

506 M. Ahmed, D. B. Shakyawar, K. S. Bhyrappa and M. S. Parthasarathy — *Effect of Tightness Factor on Physical Properties of Cotton Knitted Fabrics* (Reprinted from the 35th Technological Conference held at IIT, New Delhi, sponsored by NITRA, BTRA & SITRA in February, 1994).

507 A. V. Ukidve, P. K. Mandhyan and G. Viswanathan — *The Effect of Ring Frame Draft on Yarn Hairiness* (Reprinted from the Journal of the Textile Association, Vol. 54, No. 6, p. 287-289, March, 1994).

508 I. K. P. Iyer, J. K. Iyer, V. G. Munshi and M. S. Parthasarathy — *Estimation of Skein Strength from HVI Data* (Reprinted from the Asian Textile Journal, Vol. 11, No. 3, p. 47-51, January, 1994).

D. Other Publications

1 P. K. Chidambareswaran and J.K.S. Warrier — *Can Cotton Fibre Tensile Properties be Predicted More Effectively from Structural Parameters* ? (Published in the Asian Textile Journal, Vol. 1, No. 2-3, p. 32-36, December '92 — January '93).

2 J. K. S. Warrier, P. K. Chidambareswaran and V. Sundaram — *Toxic Inorganic Elements in Cotton Lint* (Published in the Asian Textile Journal, Vol. 2, No. 7, p. 26-27, May, 1993).

3. N. C. Vizia, S. B. Jadhav and K. R. Krishna Iyer — *Incidence of Seed Coat Fragments in Some Trade Varieties of Cotton* (Published in the Journal of the Textile Association, Vol. 54, No. 2, p. 67-72, July, 1993).

4. K. M. Paralikar, J. K. S. Warrier and P. K. Chidambareswaran — *Effect of Temperature on Mercerized Cotton* (Published in the Indian Textile Journal, Vol. 103, No. 12, p. 82-84, September, 1993).

5. V. Iyer — *A Study on the Water Absorbency of Indian Cottons* (Published in the Indian Textile Journal, Vol. 104, No. 1, p. 18-20, October, 1993).

6. V. Iyer, R. M. Gurjar, K. S. Bhyrappa and V. A. Shenai — *Effect of Causticisation and Mercerization on the Dyeing Behaviour of Rotor and Ring Spun Yarn* (Published in the Indian Journal of Fibre and Textile Research, Vol. 18, No. 3, p. 120-128, 1993).

7. P. K. Chidambareswaran, S. Sreenivasan, B. Srinathan and M. S. Parthasarathy — *Ring Spun Cotton Yarns under X-rays* (Published in the Asian Textile Journal, Vol. 2, No. 2, p. 33-35, December, 1993).

8. Prema Nair, P. V. Varadarajan, A. W. Shringarpure and I. G. Bhatt — *A Study on the Behaviour of Different Varieties of Cotton Linters under Identical Purification Conditions* (Published in the Journal of the Indian Society for Cotton Improvement, Vol. 19, No. 1 p. 87-92, March, 1994).

9. S. P. Bhatwadekar, R. H. Balasubramanya (CIRCOT) V. V. Singh and S. S. Narayanan (CICR). — *Characterisation of Cottonseed Proteins in Selected Germplasm of Diploid Cultivated Cottons* (Published in the Journal of the Indian Society for Cotton Improvement, Vol. 19, No. 1, p. 93-87, March, 1994).

E. Papers presented at Seminar/ Conference/Symposia/Workshop

1. D. N. Makwana and V. G. Munshi — *Electrical Conduction in Cotton Fabrics* (Presented at the 48th All India Textile Conference held at ATIRA, Ahmedabad on April 4-5, 1944).

2. S. Sreenivasan, P. Bhama Iyer and K. R. Krishna Iyer — *The Spiral Structure of Coir Fibres* (Presented at the National Seminar on Recent Developments in Natural Fibres, held at JTRL, Calcutta on May 6-7, 1993).

3. P. Bhama Iyer, M. V. Vivekanandan and Sreenivasan — *Influence of Structure on the Tensile Properties of Banana Fibres* (Presented at the National Seminar on Recent Developments in Natural Fibres, held at JTRL, Calcutta on May 6-7, 1993).

4. P. Bhama Iyer, S. Sreenivasan and K. R. Krishna Iyer — *A Comparative Study of IR Spectra of Few Natural Ligno Cellulosic Fibres* (Presented at the National Seminar on Recent Developments in Natural Fibres, held at JTRL, Calcutta on May 6-7, 1993).

5. K. M. Paralikar, G. B. Hadge and K. R. Krishna Iyer — *Fracture Morphology of some Natural Fibres* (Presented at the National Seminar on Recent Developments in Natural Fibres, held at JTRL, Calcutta on May 6-7, 1993).

6. S. K. Chattopadhyay and M. S. Parthasarathy (CIRCOT), G. Basu and S. Sengupta (JTRL) — *An Analysis on the Occurance of Faults in Cotton Yarns* (Presented a the National Seminar on Recent Developments in Natural Fibres held at JTRL, Calcutta on May 6-7, 1993).

7. S. Sreenivasan, P. Bhama Iyer and K. R. Krishna Iyer — *Application of Physics to Fibre/Textile Evaluation* (Presented at the Seminar on Recent Developments in Physics, held at Trivandrum on July 29-31, 1993).

8. N. B. Patil, R. M. Gurjar and A. J. Shaikh — *Technologies developed at CIRCOT for Utilisation of Cotton Plant by-products* (Presented at one day Seminar on 'Appropriate Technologies for Agro-processing,

Organised by the Central Institute for Post Harvest Engineering and Technology held at Abohar on August 23, 1993).

9. P. V. Varadarajan and A. J. Shaikh (CIRCOT) and H. T. Lokhande (UDCT) — *A New Guar gum Derivative as a Wet-end Additive for Improving the Mechanical Properties of Paper* (Presented at the IX Carbohydrate Conference held at Lucknow on November 24-26, 1993).

10. G. R. Anap — *Status of Ginning and Pressing Industry in North Zone and Suggestions for Improvement in Lint Quality* (Presented at the National Seminar on Cotton Organised by North India Textile Mill Owners' Association and Punjab Agricultural University held at Ludhiana on December 19, 1993).

11. R. P. Nachane and G. F. S. Hussain — *Inverse Creep in Polymeric Mateials* (Presented at Polymers '94 held at Baroda on February 8-10, 1994).

12. P. Bhama Iyer, S. Sreenivasan, K. R. Krishna Iyer and N. B. Patil — *An Infrared Spectroscopic Method for Quick Estimation of Cellulose in Ligno-Cellulosic Polymers* Presented at Polymer '94 held at Baroda on February 8-10, 1994).

13. M. Ahmed, D. B. Shakyawar, K. S. Bhyrappa and M. S. Parthasarathy — *Effect of Tightness Factor on Physical Properties of Cotton Knitted Fabrics* (Presented at the 35th Joint Technological Conference held at IIT, New Delhi on February 11-12, 1994).

14. H. V. S. Murthy (VJTI), S. K. Chattopadhyay, M. S. Parthasarathy and B. Srinathan (CIRCOT) — *Feasibility of Air-jet Spinning Technology for Spinning of Indian Cottons and their Blends with Polyester* (Presented at the 49th All India Textile Conference held at Coimbatore on December 16-17, 1993).

15. B. L. Bhattak, A. A. Gupte (VJTI) and S. K. Chattopadhyay (CIRCOT) — *Influence of Preparatory Processes on Blend Irregularities of Rotor Spun Blended Yarns* (Presented at the 35th Joint Technological Conference held a IIT, New Delhi on February 11-12, 1194).

16. N. B. Patil and Munshi Singh — *Development of Medium and Staple High Strength Cotton Suitable for Rotor Spinning Systems* (Presented at the World Cotton Research Conference held at Brisbane, Australia on February 13-17, 1994).

17. G. R. Anap — *Cotton Processing Establishments of Ginning Units — A Modernised Automatic Integrated Ginning-Pressing Factory* (Presented at the National Seminar on the Development of Cotton Complexes in Maharashtra State at he Department of Economics, D.B.A. Marathwada University, Aurangabad on March 21-22, 1994).

F. Technological Circulars on Trade Varieties of Indian Cottons

T.C. No.	Variety	Place
2529	Gujarat 11	Jambusar
2530	SRT.1	Botad
2531	CJ.73	Botad
2532	Hybrid 6	Surat
2533	G.Cot.13	Dhandhuka
2534	Deviraj	Surendranagar
2535	Gujarat 12	Surendranagar
2536	Digvijay	Jambusar
2537	AK.235	Bellary
2538	V.797	Mehsana
2539	Hybrid 6	Baroda
2540	RG.8	Sri Ganganagar
2541	Ganganagar Ageti	Sri Ganganagar
2542	DCH.32	Hubli
2543	170 CO 2	Hubli
2544	Digvijay	Vadodara
2545	LRA.5166	Wardha
2546	Jayadhar	Hubli

G. Technological Circulars on Standard Cottons

S.C. No.	Variety	Place
422	LH.886	Abohar
423	LH.1134	Abohar
424	LH.900	Abohar
425	G.Cot.12	Surat
426	Deviraj	Junagadh
427	Laxmi	Raichur
428	DB-3-12	Raichur
429	G.Cot.10	Surat
430	R.51	Raichur
431	Sanjay	Amreli
432	G.Cot.15	Amreli
433	Hybrid 4	Surat
434	G.Cot.Hy.6	Surat
435	G.Cot.Hy.8	Surat
436	G.Cot.10	Bharuch
437	G.Cot.11	Bharuch
438	Digvijay	Bharuch

4

Extension

CIRCOT has no agricultural farm attached to it at the headquarters. However, its Regional Quality Evaluation units are located either within the premises of agricultural universities or in the major cotton growing tracts in the country. The staff at these units collaborate closely with the cotton scientists in the universities and also with the State departments of agriculture through collaborative research programmes, which by and large pertain to the problems faced by the farming community. Apart from this, assistance is rendered to the farmers through the development of useful equipments required by them, through suggestions, discussions, etc. on the technological aspects of cotton at different stages of crop development, posthargest technology operations and gainful utilisation of by-products and agricultural wastes.

The Director and many Principal scientists are members of several committees constituted by the Bureau of Indian Standards for cotton and textiles and they also participate in the formulation of specifications. Many textile research institutions like, ATIRA, BTRA and SITRA have the Director and many Principal scientists of CIRCOT as the active members in their various advisory panels.

Being experts in the field of cotton technology and allied areas, some of the scientists are invited from time to time to deliver lectures and o participate in research programmes of institutions, such as VJTI, BUDCT, DKTE, etc. The scientists and technical officers participate in national and international conferences and symposia and present papers based on research work in their field of interest. The Institute also participates in various exhibitions with new technologies developed, improvement in processes, by-products and waste utilisation, etc.

Periodical publication of original research articles based on the research findings in national and international journals also form part of extension work.

Having realised the futuristic needs of the textile sector, CIRCOT conducts regular training courses (both long and short duration) in cotton technology at the headquarters on the evaluation of the quality of cotton fibres, yarns and fabrics and on the elementary statistical methods applicable to textiles. At its

PLATE III

CIRCOT PARTICIPATES IN THE FOUNDATION STONE LAYING CEREMONY OF THE REGIONAL CAMPUS OF CIPHET

CIRCOT has actively participated in the foundation stone laying ceremony of the Regional Campus of Central Institute of Post Harvest Engineering and Technology (CIPHET), Abohar campus and its Krishi Vigyan Kendra, held on August 22, 1993. CIRCOT's participation was by way of (i) displaying different types of particle boards, corrugated fibre board and boxes, hand made paper (craft and writing grade), etc. at the exhibition organised on the above occasion, and (ii) by giving a talk by Shri R.M. Gurjar, Scientist of CIRCOT, on technologies developed at CIRCOT for utilisation of cotton stalk and willow dust at a seminar on **Appropriate Technologies for Agro-Processing** held on August 23, 1993.

The exhibition was declared open by Shri Sajjan Kumar Jakhar, Hon'ble Minister of Co-Operation, Govt. of Punjab.

Shri Sajjan Kumar Jakhar, Hon'ble Minister of Co-Operation, Government of Punjab is being briefed by Dr. N.B. Patil, Director, on the technology of corrugated box preparation from cotton plant stalk

Dr. N.B. Patil, Director is showing sample of chipped cotton stalk to Shri Sajjan Kumar Jakhar, Hon'ble Minister

Shri R.M. Gurjar, Scientist, with exhibits from CIRCOT

Ginning Training Centre (GTC) at Nagpur training is imparted on different aspects of ginning operations, maintenance of different types of ginning machinery, quality considerations during ginning, etc. A hostel having capacity to accommodate 20 trainees is also provided at GTC. This training course is basically meant for gin fitters, supervisors and officers associated with the ginning operations who are sponsored by the factory owners from different parts of the country. The GTC has different types of pre-cleaners, roller and saw gins and the training includes both practical and theoretical aspects of ginning.

In CIRCOT, extension work is mostly confined to the supply of reliable and accurate data on the quality aspects of cotton, yarns, fibre, fabrics, consultancy services and publication of research results for the benefit of appropriate user group.

Technical queries : Many queries of technical nature received from private organisations, state central and semi-government organisations on new cotton varieties developed, technological properties of different cotton varieties, various aspects of testing, instrument fabrication, new product and processes developed, by-product and waste utilisation, etc. were replied.

Queries from visitors to the Institute on matters relating to cotton and cotton technology were attended to.

Paid tests : CIRCOT has been receiving fairly large number of samples of fibre, yarn and fabric for paid tests from textile mills, government and semi government organisations as well as cotton trade and industry, on payment of prescribed test fees. Different types of fabric samples for various tests were received as paid tests from office of the Controller of Stores and office of the Dy. Engineer (stores), Vigilance Cell, Municipal Corporation of Greater Bombay, etc. on a regular basis. The demand for testing samples for honey dew, resistance to microbial attack, pH determination, as well as testing on your samples on classinat etc. considerably increased.

The number of Samples received for tests during the period April 1993 to March 1994, together with samples tested for the year 1992-93 and average for the quinquennium 1986-1990 are given in table.

TABLE 16 : TYPES OF TESTS AND THE NUMBER OF SAMPLES TESTED AND REPORTED DURING 1993-94

Sl. No.	Type of tests	Average for the quinquennium 1986-90	1992-93	1993-94
1.	Spinning	95	120	90
2.	Fibre	1481	2812	410
3.	Yarn	159	259	336
4.	Fabric	106	211	212
5.	Moisture	14	24	—
6.	Miscellaneous	20	7	30
7.	Classimat	—	—	251
	Total	1875	3433	1329

The total test fees received during the year 1993-94 from paid tests was Rs. 2,86,696/- (Rupees two lakh eighty six thousand six hundred ninety six only).

Besides routine tests, the following tests were also carried out on samples received from various organisations :

1. Three samples of cotton received from M/s. CIMMCO Spinners Ltd., Solapur were tested for honey dew.
2. Two samples of polyester fibre received from M/s. JCT Fibre, Ltd., Bombay were tested for crystallinity by X-ray diffraction method.
3. One sample of cotton received from M/s. Surgical and Allied product Pvt. Ltd., Bombay was tested for wax content.
4. Eight cotton samples received from M/s. Perfect Cotton Co. Bombay were tested for honey dew.
5. Two cotton samples received from M/s. Cotton Corporation of India, Bombay were tested for honey dew.
6. One bleached cotton sample received from M/s India International Cleaning Aids, Bombay was subjected to mechanical processing to get slivers of 1.5 g/m and 6.0 g/m.
7. Six synthetic fibre samples received from M/s. Orissa Synthetic (P) Ltd., Bombay were subjected to determination of denier, breaking load and elongation on Instron.
8. Eleven samples of woolen felt received from M/s. Gujarat Woolen Felt Mills, Baroda were subjected to the determination of pH value.
9. Two samples of cloth received from M/s. New Bombay Dyeing and Bleaching Mills, New Bombay were tested for the resistance to microbial attack.
10. One woolen felt sample received from M/s. Gujarat Woolen Felt Mills, Baroda was tested for the resistance to microbial attack.
11. Four samples of cellulose received from M/s. Standard Alkali Ltd., Thane were tested for particle length and diameter.

Training :

(a) Integrated Training Course on Cotton Testing Methods and Evaluation :

In three batches of six weeks duration from June 7, 1993 to October 8, 1993, 19 sponsored personnel from cotton trade and industry were trained. They were from East India Cotton Association (EICA), South India Cotton Association (SICA), and from private mills.

(b) Special Training :

Four B.Text final year students from Sri Guru Gobind Singhji College of Engineering & Technology, Nanded were imparted one month training in fibre testing and spinning from June 30, 1993 to January 25, 1994 in two batches.

(c) Ginning Training :

During this period around 50 sponsored personnel from Ginning Ginning Factories were trained.

5

Conference and Symposia

Director, Scientists and Technical Personnel of CIRCOT participated in the following scientific and technological conferences besides meetings connected with the work of this Institute.

Sl. No.	Meetings/Conferences/ Seminars/Symposia, etc.	Place	Date	Name(s) of the Scientis(s) and Technical Personnel who attend the ConferenceMeeting, etc.
1.	48th All India Textile Conference	Ahmedabad	4-4-1993 and 5-4-1993	Dr. V. G. Munshi
2.	34th Joint Technological Conference	Ahmedabad	6-4-1993 and 7-4-1993	Dr. V. G. Munshi
3.	National Seminar on Recent Developments in Natural Fibres	Calcutta	6-5-1993 and 7-5-1993	Dr. S. Sreenivasan
4.	2-Day Seminar/Exhibition (Colourage in Collaboration with BUDCT) on Dyestuff and Intermediates for Export	Bombay	28-5-1993 and 29-5-1993	Smt. V. Iyer and Miss C. R. Raje
5.	Half-day Seminar on Predictive Maintenance (Pdm) Technology	Bombay	18-6-1993	Shri S. K. Chattopadhyay
6.	Development of Diversified Jute Products by Chemical Technology	Bombay	30-6-1993	Shri M. S. Parthasarathy and Dr. K. R. Krishna Iyer

Sl. No.	Meetings/Conferences/ Seminars/Symposia, etc.	Place	Date	Name(s) of the Scientist(s) and Technical Personnel who attend the Conference, Meeting, etc.
7.	One day Seminar on 'Eco-friendly Textile Problems & Prospects	Bombay	7-8-1993	Dr. N. B. Patil and Dr. P.K. Chidambareswaran
8	Training Course on 'Planning and Production of Instructional Video-tapes	Hyderabad	7-9-1993 to 18-9-1993	Shri T. K. M. Das
9.	IX Carbohydrate Conference	Lucknow	24-11-1993 to 26-11-1993	Shri P. Varadarajan and Shri A. J. Shaikh
10.	A One day Seminar on Appropriate Technologies for Agro-processing	Abhor	23-8-1993	Shri R. M. Gurjar
11.	21st Annual Convention of Indian Agricultural Universities	Goregaon	28-10-1993 and 29-10-1993	Shri R. M. Gurjar
12.	National Seminar on Cotton	Ludhiana	19-12-1993	Dr. G. R. Anap
13.	A One day Seminar on Image Processing and its Application	Bombay	7-2-1994	Dr. P. Bhama Iyer
14.	35th Joint Technological Conference	Delhi	11-2-1994 and 12-2-1994	Shri M. Ahmed and Shri S. K. Chattopadyay
15.	World Cotton Research Conference — 1	Australia	13-2-1994 to 17-2-1994	Dr. N. B. Patil
16.	4-day Post Conference Field Trip	Australia	18-2-1994 to 21-2-1994	Dr. N. B. Patil
17.	National Seminar on the Development of Cotton Complexes in Maharashtra State	Aurangabad	21-3-1994 and 22-3-1994	Dr. G. R. Anap
18.	Specialist Group Meeting and Symposium on Solid State Fermentation	Trivandrum	23-3-1994 and 24-3-1994	Dr. R. H. Balasubramanya

6

Summary of the Report

This seventieth Annual Report of CIRCOT covers the period April 1, 1993 to March 31, 1994.

The CIRCOT which was formerly known as CTRL, was established in the year 1924 under the name Technological Laboratory of the Indian Central Cotton Committee (ICCC). When all the commodity committees including ICCC were abolished in 1966, the administrative control of CIRCOT was passed on to ICAR. New mandates were formulated for intensifying research and reorienting the activities in consonance with the research activities of ICAR.

Over 2,000 cotton samples from various trials were evaluated at the headquarters, while 12,000 samples from initial stages of trials were screened at the Regional Units of CIRCOT. It continued to function as the co-ordinating centre for technology under the AICCIP, and in 1993-94, five new cotton varieties were released for general cultivation. The total number of books in the library stands at 4,781 and of bound volumes of journals at 5,968. The recognition granted to CIRCOT by the Bombay University as a post graduate Institution has been continued during the year. More than 20 sponsored personnel from cotton trade and industry were trained in cotton testing methods and in evaluation, while, over 50 sponsored personnel from ginning factories were trained in quality ginning and gin maintenance. Research activities during the reporting period were as follows :

Two hundred and five germplasm cultivars belonging to *G. barbadense* species from Coimbatore and one hundred and ninety-three cultivars of *G. barbadense* species from Nagpur were technologically evaluated for important fibre characters and the results were summarised and reported.

The study on Effect in Fibre Qualities and Yield levels of cottons due to Hormone - Biozyme treatment revealed significant improvement in 2.5% span length, marginal increase in maturity coefficient, significant increase in *Kapas* yield as well as ginning out-turn. However, the fibres became coarser due to the treatments.

A study on effect on exposure to weather conditions on the quality of fibre in matured cotton bolls consisted of two parts. In the first part the fully

opened bolls of four genotypes were exposed to different weather conditions on the plant and cottons were collected in four pickings keeping one week interval and analysed for fibre properties and colour indices. In the second part, 1.5 kg seed cotton of each variety was exposed to direct sunlight daily. The lint samples were tested at three stages, with an interval of one month between each stage. The pooled analysis of the data revealed that the fibre properties viz. fibre length, fineness, maturity and strength were unaffected in the first experiment while the fibre length and 3 mm gauge strength values were lower for the third stage in the second experiment. In both the experiments the colour indices, reflectance percentage and degree of yellowness show significant decrease for longer exposures. The decrease in reflectance might be due to deposition of dust and colour fading due to ultra violet radiation. The structural parameters like convolutions, reversals, ribbon width and wall thickness are not influenced by exposure to sunlight.

The study on effect of different soil profiles on phasic development of cotton fibres in G.Cot.Hyb.8 was continued this year also. G.Cot.Hyb.8 was sown on 25-6-92 on eight experimental plots having different soil profiles. Timely agricultural practices like weeding, irrigation, plant protection measures, etc. were carried out. Flowers were tagged between 11-10-92 and 17-10-92. Eight bolls from each soil profile were collected for age between 15 and 45 days after pollination at intervals of 5 days. The samples were tested for volume of bolls and fibre bundle strength at 3 mm gauge. The structural properties of these samples are being tested.

For a study on cotton quality parameters contributing to *Kapas* grades, different grades of *Kapas* samples belonging to LRA.5166, AHH.468, NHH.44, AKH.4, DHy.286, Hybrid 4 and DCH.32 varieties were procured from Maharashtra State Co-Op. Cotton Growers' Marketing Federation Centres at Akola and Nagpur and from Agricultural Produce Market Committee Centres at Davangere and Bijapur. This *Kapas* samples were tested for colour parameters on HVI. The *Kapas* samples were ginned and ginning percentage, trash percentage, fibre properties like 2.5% SL, U.R., Micronaire value, strength and elongation at 3 mm gauge as well as the colour parameters were determined. The ginning percentage was higher and the trash was less for super grade cottons. There was not much variation in the fibre properties between super & FAQ grade cottons whereas the fibre quality was poorer in case of fair grade cottons.

Work on determination of seed coat fragments in machine ginned lint has been completed on a fresh batch of 24 cottons under the study. Also, an experiment on hand ginning of Also, an experiment on hand ginning of lint from these varieties was also conducted to determine the exact location on the seed from which seed coat fragments emanate. Five out of nine *G. hirsutum* samples gave over 0.5% seed coat fragments by weight in both the

methods of ginning. This indicated the possibility of genetic characteristics of these cottons leading to seed coat generation rather than the method of ginning. Further study, is to be carried out to understand the role of fibre length and other parameters on seed coat fragment shedding.

For the study on comparative performance of roller and saw gins in case of Maharashtra cottons, a survey of ginning factories, ginning and pressing factories and pressing units in the Vidharbha region has been carried out. Some information about ginning units in Marathwada region was also collected. *Kapas* samples of three varieties viz. NHH.44, LRA.5166 and AKH.4 were ginned on both saw gins and roller gins and pressed. Lint samples were collected from the pressed bales and are being evaluated for their fibre properties. The seeds are being tested for properties like fuzz percentage, germination percentage, etc.

The study on the influence of yarn faults on the knittability and quality of cotton knitted fabrics was continued during the year and four more cottons 170 CO2, Hybrid 4, F.414 and LRA.5166 were included in the study. Knitting of six samples was completed. Three types of defects were mainly noticed during knitting of these samples. This data is to be analysed and correlated with classimat faults.

In the study on splicing of cotton and bended yarns, 40s yarns with five different levels of twist were spun from LRA. 5166 cotton and used for splice preparation. A central composite rotatable experimental design involving 5 variables was chosen for the optimisation programme. Out of the 32 specified experiments required, 22 could be completed. It was observed that splicing was not possible without the air blast in the chamber. Also, wide variation was observed in the strength of the splice prepared with different experimental combinations. Data analysis will be carried out after the remaining 10 experiments are completed.

The studies on yarn bundle strength test: redesigning of bundle making and clamping devices was continued and the device for preparing parallelised yarn bundles has been suitably modified. Bundles prepared by using the apparatus were tested on lea tester and compared with normal lea test values as well as single thread tests on Tensorapid. While the tenacity results of bundle tests showed less variation, there was poor correlation with single thread tenacity obtained from Tensorapid tests.

Tensile and compressional properties of fabrics comprising cotton, polyester and its blend were measured to study the mechanical properties and wear comfort of apparel fabrics and their inter-relationships. The parameters measured were fibre fineness, yarn count and fabric weight thickness and cover. The mechanical properties of fabrics evaluated included tensile energy, tensile resilience, compressional energy, resilience and compressibility. Several relationships could be established between fibre, yarn and

fabric parameters as well as, mechanical properties of fabric.

The study of morphological deformities in cotton fibres in relation to space constraint in the developing boll was continued and work on space constraint measurements and enumeration of morphological deformities for all the fifteen varieties of cottons selected, has been completed. Higher number of deformities like V-bend, U-bend, sharp twist and spur were registered by the fibres from unopened bolls used for space constraint measurements. It is proposed to collect fresh lots of unopened and field opened bolls of all the varieties from the 1993-94 crop for obtaining further data.

Under a study on morphology of fibre bases of cotton and its relation to the strength of attachment and the seed coat removal during gining, the size of fibre bases on seeds from chalazal, side and micropylar regions of six varieties of cottons was determined. The general trend of size of fibre base in chalazal region is less than that of sides, which in turn is less than that at micropylar region.

The study of structural weak links in cotton revealed that the tenacity of cotton fibres subjected to aqueous swelling followed by stretch, increased at both 0 and 3.2 mm gauge length, the magnitude of increase being more at 3.2 mm gauge length. Consequently the strength uniformity index also increased. The structural changes brought about by re-wetting the fibres in water and drying them, were, by and large, stable and permanent.

Maturity evaluation of eleven different varieties of cottons based on detailed measurement of wall thickness (W) and ribbon width (R) was carried out with special emphasis on hybrid/*hirsutum* varieties for a study on the measurement of true maturity of cotton fibres. Swelling Coefficient (SC) is defined as SC = (W1/R1 — W/R)/(W/R), taken as an index of swelling, decreased with increase of W/R. A highly significant correlation is noted between W/R and W1/R1 for the same set of fibres irrespective of the variety, even-though, the value of the correlation coefficient 'r' varied to some extent for the different varieties (range of r — 0.42 to 0.89). In other words, swelling is highly influenced by the original wall thickness and that maturity measurements on swollen fibres can be at variance with the true fibre maturity based on raw fibre measurements, more so in the case of hybrid cottons.

Under the study of inverse creep/reverse creep property of cotton and other textile materials, single nylon filament, polyester filament yarn and cotton and wool spun yarns showed inverse creep behaviour when the load was decreased from 112g to 62g and further to 12g.

Cotton fabrics knitted from yarns of different counts and different varieties were pre-treated and dyed for assessment of proper finishing conditions for knitted fabrics with respect to the variety. Physical properties of all the fabrics were determined and the results were statistically analysed.

In a new approach to qualitative and quantitative estimation of cotton wax, considerable variation in the case of removal of wax was observed between different varieties of cotton. The ease of removal was maximum for hybrid varieties, while water washing did not affect the wax content of cotton.

For a study on screening of Indian cottons for water absorbency, coarse cotton samples (micronaire value more than 5.0) belonging to different short and medium staple varieties were precleaned on Shirley Analyser. The samples were further purified by standard methods of kiering and bleaching. The purified samples were tested for ash content, moisture regain, water imbibition and also for absorbent properties such as water holding capacity and sinking time as per pharmacopeial standards. The results are being analysed.

The studies on continuous fermentation on cellulase of *Penicillium funicolosum* was continued and it was observed that 98% of starch could be released from potato in 3 hrs using cellulase of *P. funiculosum* and pectinase (commercial) at 0.3% concentration while 68% of starch could be released in 6 hrs without pectinase. The cellulase was also used to release starch from cassava. The cellulase was not found suitable to isolate oil from cotton seed. The attempts to de-ink newspaper waste and newspaper pulp showed that the cellulase could hydrolyse the newspaper to fibrillar level and remove ink, thus improving the quality of paper. Pectinase activity of *P. funiculosum* cellulase was also assessed.

Triglycerides of oils extracted from cotton seeds of a few commercially grown varieties separated and subjected to enzymatic hydrolysis using Phosphate buffer and "lipase - S", which is 1-, 3- specific, for the study of Triglyceride structure of cotton seed oil. TAG and 2 MG were separated by preparative TLC. Fatty acid composition of TAG and 2MG was determined by Gas Chromatography.

For the study on preparation and characterisation of protein hydrolysates (Peptones) from cotton seed meal, fifteen varieties belonging to all four cultivated species as well as hybrids were selected. The seeds were dehulled and the meal passed through 25 mesh sieve, was defatted and analysed for various constituents like nitrogen, gossypol, lignin, crude fibre, ash, moistures, etc.

Linter samples from two more varieties (total seven) were kiered under three kiering conditions for a study on the effect of pre-treatments on the properties of linters of different cotton varieties. Kiering loss ranged from 6.6% to 18.6%. All the kiered samples were bleached under three different conditions and analysed for whiteness and D.P. Whiteness values ranged from 50.3% to 67.4% for kiered samples while for the kiered and bleached samples, they ranged from 80.1% to 91.1%. The D.P. values of kiered samples varied from 2250 to 2901, while the variation was from 1292 to 2202 for kiered and

bleached samples.

The scale-up trials on the preparation of pulp and paper from cotton stalks and other cellulosic materials showed that it was possible to prepare good quality pulp and paper from bagasse by subjecting it to anaerobic fermentation.

For production of kraft paper from cotton plant stalks for use in the manufacture of corrugated fibre board boxes for packaging of fruits, about 8 tonnes of cotton plant stalk was mechanically cut into small chips by an electric chaff cutter. Some preliminary trials were conducted to simulate paper mills conditions and later large scale pulping trials were conducted using 17% kraft liquor oven dry weight of raw material. About 3 tonnes of kraft paper of 48, 100 and 120 g/m^2 was produced and the paper was evaluated for various strength properties. The quality of the paper was found to be satisfactory.

The study on production of Biogas from solid cellulosic wastes by dry fermentation revealed that bagasse and press-mud, the solid cellulosic wastes, generated from sugar industries, can be profitably used for the production of biogas by solid state fermentation. It is possible to obtain 600 l of biogas from 1 kg of bagasse and press-mud in 1:1 combination in 3 months.

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Personnel

Major events during 1993-94 under personnel function at CIRCOT are given below :

A. APPOINTMENTS

Sl. No.	Name	Grade	Effective date of appointment
		Technical Staff	
1.	Smt. N. A. Sonkusale	Technical Assistant T-II-3	15-06-1993
2.	Shri R. M. Sonake	Technical Assistant T-II-3	07-10-1993
3.	Kum. Binu Prasad Surendran	Technical Assistant T-II-3	27-10-1993
4.	Shri P. S. Anil Kumar	Technical Assistant T-II-3	30-11-1993
5.	Shri P. C. Chowdhari	Technician Gr.T-1	04-11-1993
		Administrative Staff	
1.	Shri R. D. Shambharkar	Jr. Stenographer	05-08-1993
2.	Kum. T. M. Sawant	Hindi Assistant	23-09-1993
		Supporting Staff	
1.	Shri M. K. Prabhulkar	Supporting Staff Gr. I	13-04-1993
2.	Shri J. D. Sakpal	Supporting Staff Gr. I	30-04-1993
3.	Shri V. Murugan	Supporting Staff Gr. I	15-05-1993
4.	Shri S. D. Magar	Supporting Staff Gr. I	21-05-1993
5.	Shri V. B. Khandeshe	Supporting Staff Gr. I	22-05-1993
6.	Shri A. D. Sonawane	Supporting Staff Gr. I	07-06-1993
7.	Shri R. G. Matel	Supporting Staff Gr. I	15-09-1993
8.	Shri M. G. Sosa	Supporting Staff Gr. I	01-11-1993
9.	Shri S. R. Tondse	Supporting Staff Gr. I	28-01-1994

B.. ASSESSMENTS

Scientific Staff

The five yearly assessment of eligible scientific staff was made and promotions/advance increments granted, as given below :

Sr. No.	Name	Grade to which promoted	Effective date of promotion
1.	Shri M.S. Parthasarathy	Personal Grade of Scientist S-5 in the scale of pay 2000-2500 (Pre revised)	01-01-1985
2.	Dr. A. V. Ukidve	Scientist S-3 1500-2000 (Pre revised)	01-01-1986

Technical Staff

The five yearly assessment of eligibletions/advance increments granted as technical staff was made and promo-given below :

Promotions

Sr. No.	Name	Grade to which promoted	Effective date of promotion
1.	Shri S. Venkatakrishnan	Technical Officer T-5	01-01-1993
2.	Shri D. L. Upadhyay	Technical Officer T-5	01-01-1993
3.	Shri M. T. Danolli	Technical Officer T-5	01-07-1993
4.	Shri T. Venugopal	Technical Officer T-5	01-07-1993
5.	Smt. N. M. Ashtaputre	Sr. Technical Assistant T-4	01-01-1993
6.	Shri Hamid Hasan	Sr. Technical Assistant T-4	01-07-1993
7.	Shri S. Kumar Subramaniam	Sr. Technical Assistant T-4	01-01-1993
8.	Shri R. D. Nagarkar	Sr. Technical Assistant T-4	01-01-1993
9.	Smt. Sheela Raj	Sr. Technical Assistant T-4	01-01-1993
10.	Shri M. V. Vivekanandan	Sr. Technical Assistant T-4	01-01-1993
11.	Shri B. B. Gaykar	Driver T-I-3	01-01-1993

PLATE IV

ICAR INTER INSTITUTIONAL SPORTS MEET 1993

At the ICAR Inter Institutional Sports Meet 1993 (Zone I), hosted by CIAE, Bhopal, CIRCOT was the winner in the following events :

★ Table Tennis Team Championship
★ Badminton Team Championship
★ Relay race (4 x 100 metres)

CIRCOT Contingent with the Director

CIRCOT ***Badminton Team*** *with the Director*

CIRCOT ***Table Tennis Team*** *with the Director*

Advance Increments

Sl. No.	Name	Grade	No. of advance increments	Effective date of increment
1.	Shri K. S. Bhyrappa	T-6	Two more advance increments	01-01-1993
2.	Smt. P. A. Dabholkar	T-5	One more advance increment (Total 3)	01-07-1993
3.	Shri V. V. Kshirsagar	T-5	One advance increment	01-07-1993
4.	Smt. N. D. Nachane	T-5	Three advance increments	01-07-1992
5.	Smt. S. R. Kamath	T-4	One advance increment	01-07-1993
6.	Shri G. G. Mistry	T-4	One more advance increment	01-07-1993
7.	Shri N. V. Bansode	T-4	One more advance increment (Total 3)	01-07-1993
8.	Shri P. B. Gurjar	T-4	One more advance increment One more advance increment (Total 3)	01-07-1992 01-07-1993
9.	Shri S. M. More	T-II-3	One advance increment	01-01-1993
10.	Shri Matish Chandra	T-II-3	Three advance increments	01-01-1993
11.	Shri V. D. Kalsekar	T-II-3	One advance increment	01-01-1993
12.	Shri Adil Zubair	T-II-3	Two advance increments	01-01-1993
13.	Shri V. L. Rangari	T-II-3	Two advance increments	01-01-1993
14.	Shri Udai Vir Singh	T-II-3	Two advance increments	01-01-1993
15.	Shri S. L Bhanuse	T-II-3	Two advance increments	01-01-1993
16.	Shri M. B. Patel	T-II-3	Two advance increments	01-01-1993
17.	Shri K. Thiagarajan	T-II-3	Two advance increments	01-01-1993
18.	Shri S. Banerjee	T-II-3	Three advance increments	01-01-1993
19.	Shri R. S. Prabhudesai	T-II-3	Two advance increments	01-07-1993
20.	Shri V. V. Murudkar	T-II-3	Two advance increments	01-01-1993
21.	Shri R. C. Yadhav	T-II-3	One advance increment	01-01-1993
22.	Shri M. Mohan	T-II-3	Two advance increments	01-01-1993
23.	Shri P. J. Ahire	T-I-3	Two advance increments	01-07-1993
24.	Shri S. S. Patekar	T-I-3	Two advance increments	01-07-1993
25.	Shri G. D. Narkar	T-I-3	Two advance increments	01-07-1993
26.	Shri S. B. Kamble	T-2	Two more advance increments	01-01-1993
27.	Shri D. B. Gadankush	T-2	Two advance increments	01-07-1993
28.	Shri D. L. Upadhye	T-4	One advance increment Two advance increments (Total 3)	01-01-1990 01-01-1991

C. PROMOTIONS

Administrative Staff

1. Shri M. Z. Bhagat to the post of Superintendent w.e.f. 15-01-1994.

2. Smt. S. M. Desai to the post of Assistant w.e.f. 01-02-1994.

3. Shri B. D. Dhengale to the post of Senior Clerk w.e.f. 01-02-1994.

Auxiliary Staff

Shri S. A. Waghela to the post of Senior operative w.e.f. 09-03-1994.

Supporting Staff

1. Shri C. S. Salvi to the post of S.S. Gr. II w.e.f. 12-04-1993.

2. Shri M. P. Tohokar to the post of S.S. Gr. II w.e.f. 16-04-1993.

D. TRANSFER

Technical Staff

1. Smt. N. M. Ashtaputre, Sr. Tech. Assistant from CIRCOT, Bombay to IARI Regional Station, Pune w.e.f. 21-08-1993.

2. Smt. Sugatha Padmanabhan, Tech. Assisstant T-II-3, CIRCOT, Bombay to CPCRI, Kasargod w.e.f. 15-12-1993.

3. Shri Jal Singh, Tech. Assistant, T-II-3 from Q.E. Unit of CIRCOT, Sirsa to Q.E. Unit of CIRCOT, Hisar w.e.f.

4. Dr. V. K. Madan, Technical Officer T-5 from Q.E. Unit of CIRCOT, Hisar to CCSAU, Hisar.

E. RETIREMENT

Scientific Staff

Dr. V. G. Munshi, Principal Scientist & Head of Q.E. Division retired from service w.e.f. 30-09-1993.

Technical Staff

Shri E. S. Abraham, Technical Officer T-6 retired from service w.e.f. 30-09-1993.

Administrative Staff

Shri D. P. Naidu, Superintendent (A&A) retired from service w.e.f. 31-12-1993.

Auxiliary Staff

Shri Bechan Nokhai, Sr. Operative retired voluntarily from service w.e.f. 31-01-1994 (01-02-1994 FN).

F. RESIGNATION/TERMINATION OF SERVICE

Shri S. L. Gawde, S.S. Gr. II was terminated from service w.e.f. 02-08-1993.

G. DEPUTATION

1. Smt. Nirupama Panda, Technical Assistant, T-II-3 joined the Dept. of Bio-Technology, New Delhi on 24-10-1993 on deputation for a period of one year.

2. Smt. V. V. Janaskar, Jr. Clerk joined Seamen Employment Office, Ballard Estate, Bombay on 21-02-1994 (FN) on deputation for a period of one year.

H. AWARDS

1. Shri Muntazir Ahmed, Scientist (SG) received consolation prize in the form of cash and a momento in an elocution contest organised by M/s Ashirwad, Bombay. The topic was "Aaz Ki Shiksha Kitani Sarthak."

2. Shri G. Vijayan Iyer, Senior Technical Assistant was awarded certificate of proficiency for his essay "Development in Ginning" in Hindi. The essay competition was organised by the Central Hindi Secretariat Council, as part of the 15th All India Scientific and Technical Hindi Essay Competition.

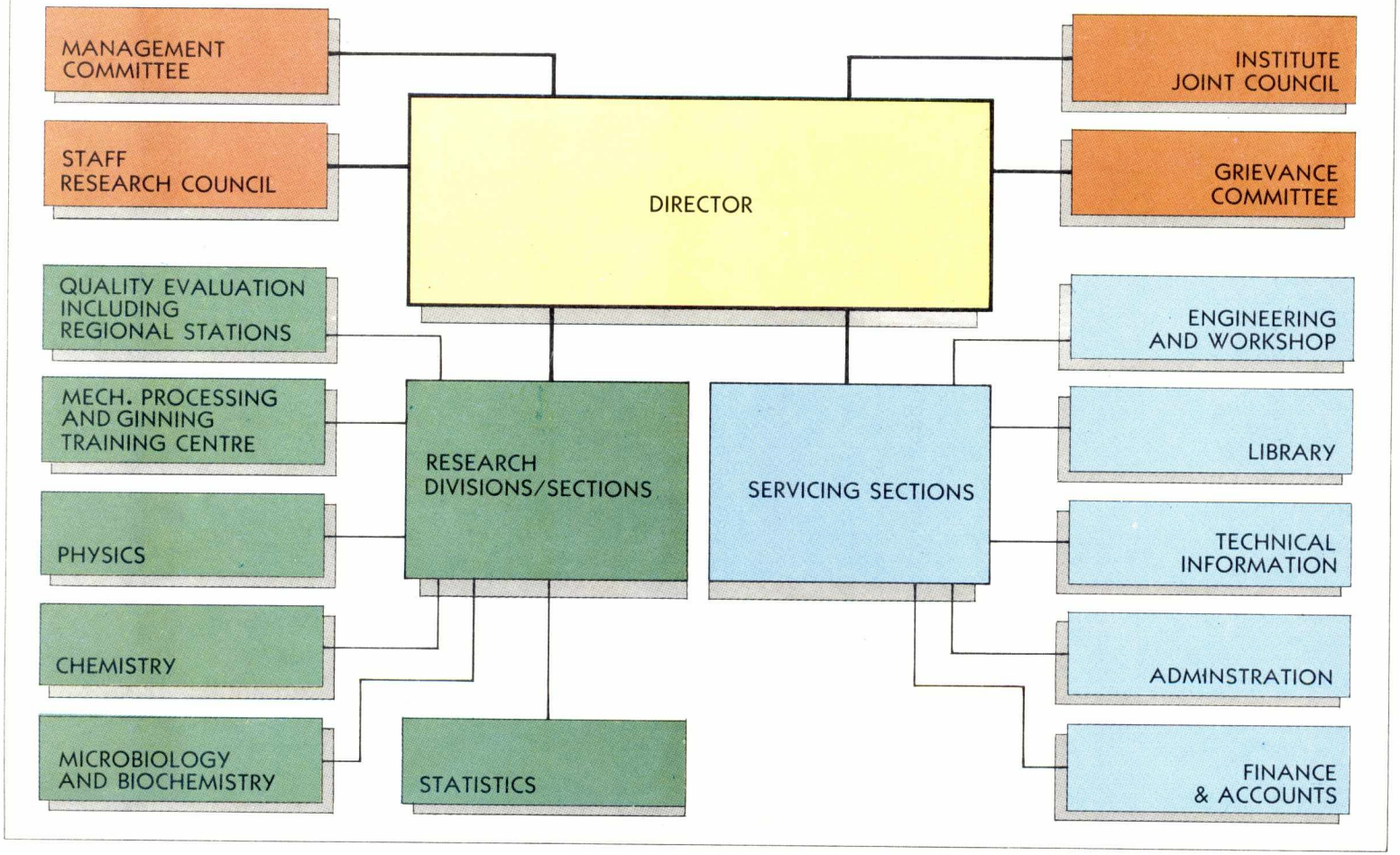
3. Under the scheme of National Accredition initiated by DST under the auspices of National Accredition of Testing and Calibration Laboratory (NABL), Dr. (Smt.) P. Bhama Iyer, Senior Scientist, participated in an on-the-spot assessment of the quality System of "Central Testing Laboratory" as an expert member of the NABL team from February 24 to 26, 1994.

8. Annexures

ANNEXURE – I

CENTRAL INSTITUTE FOR RESEARCH ON COTTON TECHNOLOGY

ORGANISATION CHART



ANNEXURE — II

NEW EQUIPMENTS ADDED DURING 1993-94

Fibre Bundle Strength Tester
Lawrence and Mayo Projection Microscope
Fibre Fineness Tester
Lea Tester
Star Digital Auto Span with Auto Sampler
Yarn Friction Tester
Coarse Length Tester
Auto Clave
Shrinkage Tester
Yarn and Fabric Fatigue Tester
Thermal Conductivity Apparatus
Modular Dual Column Gas Chromatograph, Perl 'X-3 Model
Amino Acid Analyser
Torsion Balance
Trash Apparatus
Tensile Strength Tester for Paper
Bursting Strength Tester for Paper
Cobb Tester
Humitherm 842 MC
Kawabata Fabric Testing Instrument
Image Analysis System
Public Address System
Colour T.V. and V.C.R.
Laserjet Printer

ANNEXURE III

LIST OF DISTINGUISHED VISITORS

Jaber, Ahmed Rateb	Consultant to Agriculture Minister, Syria
Dr. Gebara, Ahmed Souhed	President and Director General of Cotton Marketing Organisation, Syria
Dr. Khouri, Faris	Director of Cotton Bureau, Syria
Dr. Chokey Singh	Retd. Director, CICR, Nagpur
Dr. T. H. Singh	Dean, Post Graduate Studies, Punjab Agricultural University, Ludhiana
Dr. S. M. Sahni	Retd. Joint Commissioner, Ministry of Agriculture, Govt. of India
Dr. S. N. Bharadwaj	Retd. Sr. Scientist, IARI, New Delhi
Dr. A. M. Narula	Sr. Scientist, ICAR, New Delhi
Prof. Alimkhameolor Sultan	Head. Inst. of Plant Protection, Sci. Uzb. Republic
Prof. Abdu Karimov Abdusattor	Head, Inst. of Genetics, Sci. Uzb. Republic

ANNEXURE — IV

FINANCIAL STATEMENT

EXPENDITURE AND RECEIPTS OF THE INSTITUTE DURING 1993-94

		Sanctioned Grant Rs.	Actual Expenditure Rs.	Savings(—) Deficit(+) Rs.
	A. EXPENDITURE			
I.	CIRCOT including Q.E. Units (Non-Plan)			
	(a) Capital expenditure including expansion of the Institute	48,79,000	13,50,895	(—) 2,08,345
	(b) Working expenditure	1,59,21,000	1,92,40,760	
II.	(Plan)			
	(a) Capital expenditure including expansion of the institute	69,00,000	56,31,137	(—) 99
	(b) Working expenditure	14,40,000	27,08,764	

B. RECEIPTS

Sale proceeds of farm produce	25,440
Sale proceeds of vehicles, machines, tools and plant and other non-consumable materials	1,550
Analytical and testing fees	3,02,177
Rent	1,20,528
Application fees from candidates in connection with recruitment and training	1,04,752
Sale of publications	695
Interest on loans and advances granted to Council's employees	98,148
Leave salary and pension contributions, etc.	3,336
Miscellaneous receipts	20,509
Summer Institute	—
Receipts for services rendered by the institute	5,54,447
Total	6,40,317

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Appendices

APPENDIX — I

STAFF WORKING AT THE CENTRAL INSTITUTE FOR RESEARCH ON COTTON TECHNOLOGY AS ON 31-03-1994

(List does not include vacant posts)

LIST OF STAFF IN THE HEADQUARTERS

Scientific Personnel

Director

Dr. N. B. Patil, M.Sc., Ph.D.

Principal Scientist

1. Dr. P. K. Chidambareswaran, M.Sc., Ph.D.
2. Dr. V. G. Khandeparkar, M.Sc., Ph.D.
3. Dr. K. R. Krishna Iyer, M.Sc., Ph.D., F.T.A.
4. Shri M. S. Parthasarathy, M.Text. (Bombay), M.Sc. Tech (Manch.)., A.M.C.S.T., Rashtrabhasha Ratna

Scientist (Selection Grade)

1. Dr. R. H. Balasubramanya, M.Sc. (Agri.), Ph.D.
2. Dr. S. G. Gayal, M.Sc., Ph.D.
3. Dr. (Smt.) P. Bhama Iyer, M.Sc., Ph.D.
4. Dr. R. P. Nachane, M.Sc., Ph.D.
5. Dr. K. M. Paralikar, M.Sc., Ph.D., F.R.M.S.
6. Dr. S. Sreenivasan, M.Sc., Ph.D.
7. Dr. A. V. Ukidve, M.Sc., Ph.D., F.T.A.
8. Dr. N. C. Vizia, M.Sc., Ph.D.

Senior Scientist

1. Shri M. Ahmed, B.Sc., B.Text (Text. Tech.)
2. Smt. S. P. Bhatawadekar, M.Sc.
3. Shri G. F. S. Hussain, M.Sc.
4. Smt. J. K. Iyer, M.Sc.
5. Smt. Vatsala Iyer, M.Sc., M. Phil.
6. Smt. Prema Nair, M.Sc. (Agri.)
7. Shri B. M. Petkar, M.Sc., D.C.M.
8. Kum. C. R. Raje, M.Sc.
9. Shri A. J. Shaikh, M.Sc.
10. Shri P. V. Varadarajan, M.Sc.

Scientist (Senior Scale)

1. Shri P. Bhaskar, M.Sc.
2. Shri S. K. Chattopadhyay, B.Sc. Tech. (Text.)., M. Tech. (Text. Engg.)
3. Shri R. M. Gurjar, M.Sc.
4. Shri S. B. Jadhav, M.Sc.
5. Dr. D. N. Makwana, M.Sc., Ph.D.
6. Shri D. V. Mhadgut, M.Sc.
7. Shri G. S. Patel, M.Sc.
8. Shri K. H. Sawakhande, M.Sc.
9. Shri N. Thejappa, M.Sc.

Scientist

1. Shri A. K. Gupta, M.Sc., L.L.B., W.P.M.M.T.
2. Dr. (Smt.) Sujatha Saxena, M.Sc., Ph.D.

Technical Personnel

Technical Officer T-6

1. Shri K. S. Bhyrappa, L.T.T., A.T.A.
2. Shri T. K. M. Das, B.Sc., D.B.M., D.E.I.M., Dip. J., D.P.R., Cert. I.A.R.S.
3. Shri B. S. Ganvir, B.Sc.
4. Shri H. U. Gangar, B.E. (Elect.) Grade (I.E.T.E.)
5. Kum. I. K. P. Iyer, M.Sc.
6. Shri S. N. Nagwekar, B.Sc.

Technical Officer T-5

1. Shri K. V. Ananthakrishnan, M.Sc., D.B.M.
2. Shri S. Chandrasekhar, L.T.M., A.T.A., Cert. S.Q.C.
3. Smt. P.A. Dabholkar, B.Sc.
4. Shri S. G. Dalvi, S.S.C., Cert. Wireman, Cert. Ref & A.C., Govt. Elect. Sup.
5. Shri S. J. Guhagarkar, M.Sc.
6. Shri I. H. Hunsikatti, B.Sc. A.T.A.
7. Shri C. R. Sthanu Subramony Iyer, B.Sc.
8. Smt. A. A. Kathe, M.Sc.
9. Shri H. R. Laxmivenkatesh, D.T.T., A.T.A., L.T.I.
10. Shri P. K. Mandhyan, B.Sc., A.T.A.
11. Shri R. M. Modi, S.S.C., Cert. Photography
12. Smt. N. D. Nachane, B.Sc.
13. Smt. S. D. Pai, M.Sc.
14. Shri R. S. Pathare, B.Sc.
15. Shri D. Radhakrishnamurthy, M.Sc., M. Phil.
16. Shri K. B. Rajagopal, B.Sc.
17. Shri S. Sekar, B.Sc.
18. Smt. R. K. Shahani, B.Sc., B.Lib.
19. Smt. S. V. Sukhi, M.Sc., D.F.L. (German)
20. Shri V. B. Suryanarayanan, B.Sc., D.F.L. (German)
21. Shri D. L. Upadhye, S.S.C. (Tech.)., N.C.T.V.T. (I.T.I. & C.T.I.)
22. Shri S. Vancheswaran, B.Sc.
23. Shri T. Venugopal, B.E. (Civil)
24. Shri G. Viswanathan, M.Sc., A.T.A.

Senior Technical Assistant T-4

1. Shri S. M. Gogate, B.Sc.
2. Shri P. B. Gurjar
3. Smt. S. R. Kamath, B.Sc.
4. Smt. Sheela Devi Raj, M.Sc.
5. Shri S. Kumar Subramanian, B.Sc.
6. Shri D. N. Moon, B.Sc.
7. Shri G. Vijayan Iyer, Dip. Mech. Engg., Post. Dip. Prod. Mfg., A.M.I.E. (Mech.)
8. Shri M. V. Vivekanandan, B.Sc.

Technical Assistant T-II-3

1. Shri V. N. Bhorkar, B.Sc.
2. Kum. Bindu Chellappan, B.Sc.
3. Shri R. R. Chhagani, B.Sc.
4. Shri U. D. Devikar, B.Sc.
5. Shri G. B. Hadge, B.Sc.
6. Shri S. N. Hedau, B.Sc.
7. Shri V. D. Kalsekar, B.Sc.
8. Shri D. U. Kamble, B.Sc.
9. Kum. S. S. Kamerkar, B.Sc., M.Lib.
10. Shri H. S. Koli, B.Sc.
11. Shri M. Mohan, M.Sc., Dip. J.
12. Shri V. V. Murudkar, L.T.M.
13. Shri R. D. Nagarkar, M.Sc.
14. Kum. S. S. Nagwekar, M.Sc.
15. Smt. Nirupama Panda, M.Sc.
16. Shri R. S. Prabhudesai, B.Sc., D.C.M.
17. Shri B. R. Pawar, B.Sc.
18. Shri P. N. Sahane, D.I.F.T.
19. Kum. P. B. Subasri, B.Sc.
20. Smt. N. A. Sonkusle, B.Sc.
21. Shri R. M. Sonke, B.Sc.

Technical Assisstant T-I-3

1. Shri R. K. Landge
2. Smt. K. K. Kale, B.A.

Technical Assistant T-2

1. Shri S. B. Kamble
2. Shri D. V. Kambli
3. Shri P. G. Kadam (Wireman)

Technical Assistant T-1

1. Shri M. B. Chandanshive, Cert. Cot. Spin. (Machinist/Fitter)
2. Shri D. M. Correia, S.S.C., I.T.I., N.C.T.V.T. (Mechanic)
3. Shri C. V. Shivgan, H.S.C., Cert. Wireman, Cert. Electrician, N.C.T.V.T., Cert. Elec. Supr. (PWD)., Cert. M. & A.W. (Technician)

Auxiliary Personnel

1. Shri V. V. Kshirsagar*, S.S.C., I.T.C., Cert. Elect. Super., Cert. F. & S., Conditioning Plant Operator, T-5
2. Smt. K. R. Joshi, M.A., Hindi Translator
3. Shri H. B. Tambe*, Plumber, T-I-3
4. Shri G. D. Narkar*, Carpenter, T-I-3
5. Shri S. S. Patekar*, Driver, T-I-3
6. Shri P. J. Ahire*, Operator, T-I-3
7. Shri B. B. Gaykar*, Driver, T-I-3
8. Shri H. K. Pawar*, Operator T-I-3
9. Shri D. B. Gadankush*, Operator, T-2
10. Shri S. G. Shinde*, Operator T-2

Operator

1. Shri K. D. Mohite
2. Shri K. K. Kasar
3. Shri S. V. Patil
4. Shri M. B. Thokrul
5. Shri R. G. Chiplunkar
6. Shri T. R. Kadm
7. Shri R. R. Khurdekar
8. Shdi G. S. Deorukhkar
9. Shri B. R. Jadhav
10. Shri V. Y. Unhalekar
11. Shri A. B. Sawant
12. Shri G. G. Ambare
13. Shri M. R. Nevrekar
14. Shri A. R. Bane
15. Shri T. S. Mhaske
16. Shri S. A. Waghela

* Holding Technical post as personal

Administrative Personnel

Administrative Officer

Shri M. K. Jain, B.Sc.

Assistant Administrative Officer

Shri P. D. Sonawane, B.A., L.L.B.

Superintendent

1. Shri K. Sudhakaran
2. Shri G. Moosad, B.Com.
3. Shri M. Z. Bhagat

Assistant

1. Smt. S. S. Dongare, B.A.
2. Smt. Jayagouri Sivaramakrishnan
3. Smt. M. V. Kamerkar, B.A.
4. Shri K. W. Khamkar, B.A.
5. Shri S. N. Salve
6. Shri B. D. Sawant
7. Shri A. B. Dalvi
8. Shri D. G. Kulkarni
9. Shri B. S. Bhenwal
10. Smt. S. S. Shanbhag
11. Smt. V. V. Desai
12. Smt. S. Koshy, B.Com.
13. Smt. S. D. Ambre
14. Smt. S. M. Desai

Senior Stenographer

Shri Venu Thanikal

Stenographer

1. Smt. S. D. Dudam, M.A.
2. Smt. T. T. Souz

Junior Stenographer

1. Smt. U. N. Bhandari
2. Smt. R. R. Tawde

Senior Clerk

1. Shri A. P. Natu
2. Smt. J. J. Karanjavkar
3. Shri E. T. Gurav
4. Shri K. Parleshwar
5. Smt. S. R. Shirsat, B.A.
6. Shri N. V. Kambli

Junior Clerk

1. Shri J. R. Mangale, B.Com.
2. Shri S. D. Ambolkar
3. Shri R. K. Pallewad, B.A.
4. Shri P. V. Jadhav
5. Smt. S. G. Parab
6. Kum. S. V. Pai
7. Shri V. M. Sable
8. Smt. J. R. Chavkute
9. Shri A. K. Kunjipalu
10. Kum. B. G. Menon
11. Shri S. V. Kasabe

APPENDICES

Supporting Staff Gr. III

1. Shri C. Mhatri
2. Shri B. K. Sawant
3. Shri N. J. Kharat
4. Shri M. Y. Chandanshive

Supporting Staff Gr. II

1. Shri T. B. Thapa
2. Shri R. B. Jadhav
3. Shri S. M. Sawant
4. Shri M. B. Gurve
6. Shri A. R. Gujar
6. Shri O. T. Thapa
7. Shri B. R. Satam
8. Shri D. M. Chougule
9. Smt. T. V. Bhowar
10. Shri N. R. Kamble
11. Shri S. D. Gurav
12. Shri M. K. Ghadge
13. Shri M. Z. Rathi
14. Shri N. Singh
15. Shri D. B. Temgire
16. Shri D. M. Raje
17. Smt. B. R. Balmiki
18. Shri C. S. Salvi

Supporting Staff Gr. I

1. Shri M. A. A. Rashid
2. Shri C. P. Solanki
3. Shri M. J. Sumra
4. Shri K. T. Mahida
5. Shri R. R. Gosai
6. Shri R. S. Rane
7. Shri T. B. Khan
8. Shri H. B. Vesmiya
9. Shri P. G. Ghogale
10. Shri S. S. Angane
11. Shri L. S. Takkar
12. Shri M. M. Katpara
13. Shri G. N. Mayawanshi
14. Shri S. K. Bobate
15. Shri P. P. Patil
16. Shri R. G. Tak
17. Shri R. P. Karkate
18. Shri S. B. Worlikar
19. Shri N. D. Walzade
20. Shri M. M. Kadam
21. Shri S. G. Phalke
22. Shri S. N. Bandre
23. Shri D. G. Gole
24. Shri S. K. Parab
25. Shri C. D. Acharekar
26. Shri M. K. Prabhulkar
27. Shri J. D. Sakpal
28. Shri V. B. Khandeshe
29. Shri A. D. Sonawane
30. Shri S. D. Magar
31. Shri V. Murugan
32. Shri S. R. Tondse

LIST OF STAFF AT THE QUALITY EVALUATION UNITS

AKOLA

Senior Technical Assistant T-4	:	Shri N. V. Bansode, B.Sc.
Technical Assistant T-II-3	:	Shri Adil Zubair, B.Sc.
Supporting Staff Grade I	:	Shri S. R. Patode

COIMBATORE

Technical Officer T-6	:	Shri A. K. Antony, B.Sc.
Technical Officer T-5	:	1. Smt. Santa V. Nayar, B.Sc. 2. Shri S. Venkatakrishnan, M.Sc., A.T.A.
Technical Assistant T-II-3	:	Shri K. Thiagarajan, M.Sc.
Auxiliary Staff		
Operator T-2	:	Shri K. V. Nair
Electrician T-1	:	Shri P. N. Raut, S.S.C. (Tech). H.S.C., Dip. Elect. Eng., NT.C., N.A.C., N.C.T.V.T.
Supporting Staff Grade IV	:	Shri N. Arumugham
Supporting Staff Grade III	:	Shri V. M. Subramanian

DHARWAD

Technical Officer T-5	:	Shri M. T. Danoli
Technical Assistant T-II-3	:	Shri K. Narayanan, B.Sc.
Supporting Staff Gr. I	:	1. Shri C. J. Bagalkoti 2. Shri A. F. Gudadur

GUNTUR

Senior Technical Assistant T-4	:	Shri S. Mukundan, B.Sc.
Technical Assistant T-II-3	:	Shri K. Venkanna, M.Sc., B.Ed.
Supporting Staff Gr. IV	:	Shri Ch. Thimmanna
Supporting Staff Gr. II	:	Shri V. Y. M. Suvarchala Rao

HISAR

Senior Technical Assistant T-4	:	Shri Amarpal B.Sc.
Technical Assistant T-II-3	:	Shri Jal Singh
Supporting Staff Gr. IV	:	Shri Gian Singh

INDORE

Technical Assistant T-II-3	:	1. Shri S. Banerjee, B.Sc. 2. Shri Nehrulal Meena, B.Sc.
Supporting Staff Gr. IV	:	Shri John Robert
Supporting Staff Gr. III	:	Shri H. S. Bhabar

APPENDICES

LUDHIANA

Technical Officer T-8	:	Shri Ram Parkash, B.Sc., L.L.B.
Senior Technical Assistant T-4	:	Shri Hamid Hasan, M.Sc.
Technical Assistant T-II-3	:	Shri P. S. Anil Kumar
Supporting Staff Gr. III		Shri Kammikar Singh
Supporting Staff Gr. I	:	Shri Satyanarayan Gope

NAGPUR

Sr. Scientist	:	Dr. G. R. Anap, M.Tech, Ph.D.
Technical Officer T-5	:	Shri V. M. Kulmethe, B.Sc.
Technical Assistant T-II-3	:	1. Shri S. L. Bhanuse, B.Sc. 2. Shri R. C. Yadhav, Dip. Mech. Engg. 3. Shri M. Bhaskar, Dip. Ref. & Air-Cond.
Operator (Auxiliary)	:	Shri B. V. Shirsath, B.A., I.T.I.
Assistant Administrative Officer	:	Shri G. Sasidharan, B.A., L.L.B.
Junior Clerk	:	1. Shri B. D. Dhengale 2. Smt. G. G. Parlorkar, B.A. 3. Shri S. A. Telpande, M.Com.
Driver (Auxiliary)	:	Shri R. A. Suddawar
Machine Operator	:	Shri B. H. Umredkar
Supporting Staff Gr. I	:	1. Shri A. R. Chutale 2. Shri J. P. Patel 3. Shri C. L. Mundale 4. Shri R. B. Kautkar 5. Shri P. S. Panchbudhe, M.A. 6. Shri M. P. Tohokar 7. Shri R. G. Matel

NANDED

Scientist	:	Shri L. D. Deshmukh, M.Sc.
Technical Assistant T-II-3	:	1. Shri R. K. Jadhav, B.Sc. 2. Shri R. G. Dhakate, B.Sc.
Supporting Staff Gr. III	:	Shri L. R. Indurkar
Supporting Staff Gr. I	:	Shri S. N. Umare

RAHURI

Technical Officer T-5	:	Shri R. S. Darade, B.Sc.
Technical Assistant T-II-3	:	Shri C. M. More, B.Sc.
Supporting Staff Gr. I	:	Shri D. G. Kamble

SIRSA

Technical Officer T-6	:	Shri E. A. Pachpinde, M.Sc.
Technical Assistant T-II-3	:	Kum. Binu Prasad Surendran
Supporting Staff Gr. I	:	Shri Mahabir Singh

SRIGANGANAGAR

Technical Assistant T-II-3	:	1. Shri Matish Chandra, M.Sc. 2. Shri Udai Vir Singh, B.Sc., B.Ed.
Supporting Staff Gr. IV	:	Shri Vijendra Singh
Supporting Staff Gr. III	:	Shri Sanwarmal Saini

SURAT

Scientist	:	Shri Y. Subrahmanyam, M.Sc.
Technical Officer T-5	:	Shri M. C. Bhalod, B.Sc.
Sr. Technical Assistant T-4	:	Shri G. G. Mistry, B.Sc.
Technical Assistant T-II-3	:	1. Shri M. B. Patel, B.Sc. 2. Shri V. L. Rangari, B.Sc.
Senior Clerk	:	Shri J. I. Parmar, B.Com.
Operator (Auxiliary)	:	Shri J. B. Dhodia
Supporting Staff Gr. III	:	Shri K. M. Rathod

APPENDIX — II

Statement showing the total number of Government Servants and the number of Scheduled Castes and Scheduled Tribes amongst them as on March 31, 1994

Group/Class		Total No. of employees	Scheduled Castes	Scheduled Tribes	Remarks
Gr. A. (Class I)					
Permanent					
(i) Other than lowest rung of Cl. I		35	3	—	—
(ii) Lowest rung Cl. I		11	1	—	—
Total					
Temporary					
(i) Other than lowest rung of Cl. I		—	—	—	—
(ii) Lowest rung Cl. I		1	1	—	—
Total					
Gr. B. (Cl. II)	Permanent	49	7	1	—
	Temporary	2	1	—	—
Gr. C. (Cl. III)	Permanent	96	19	6	—
	Temporary	29	7	1	—
Gr. D. (Cl. IV)	Permanent	54	7	4	—
(Excluding Safaiwala)	Temporary	12	5	—	—
Gr. D. (Cl. IV)	Permanent	9	9	—	—
Safaiwala	Temporary	—	—	—	—

APPENDIX — III

Part I : Posts filled by direct recruitment

Statement showing the number of reserved vacancies filled by members of Scheduled Castes and Scheduled Tribes during the year 1993-94

SCHEDULED CASTES

Name of post	Total No. of Vacancies Notified	Filled	No. of vacancies reserved		No. of SC candidates appointed	Short fall	No. of ST candidates appointed against vacancies reserved for SCs in the year	No. of SC vacancies carried forward to the next year	No. of reservations lapsed after carrying forward for 3 years	No. of reservations lapsed from 1980 till the end of the year previous to the year of review	Progressive total of reservation lapsed (Col. 10+11)
			Out of Col. 2	Out of Col. 3							
1	2	3	4	5	6	7	8	9	10	11	12
Group A Other than Lowest rung of Group A	—	—	—	—	—	—	—	—	—	—	—
Lowest rung of Group A	—	—	—	—	—	—	—	—	—	—	—
Group B	—	—	—	—	—	—	—	—	—	—	—
Group C	2	2	2	—	2	—	—	—	—	—	—
Group D (Excl. Sweepers)	3	3	1	—	1	—	—	—	—	—	—
Group D (Safaiwalas)	—	—	—	—	—	—	—	—	—	—	—

SCHEDULED TRIBES

	No. of vacancies reserved		No. of ST candidates appointed	Short fall	No. of SC candidates appointed against vacancies reserved for STs in the 3rd year of carry forward	No. of STs vacancies carried forward to the next year	No. of reservations lapsed after carrying forward for 3 years	No. of reservation lapsed from 1980 till the end of the year previous to the year of review	Progressive total of reservation lapsed (Col. 19+20)
	Out of Col. 2	Out of Col. 3							
	13	14	15	16	17	18	19	20	21
Group A Other than Lowest rung of Group A	—	—	—	—	—	—	—	—	—
Lowest rung of Group A	—	—	—	—	—	—	—	—	—
Group B	—	—	—	—	—	—	—	—	—
Group C	1	1	1	—	—	—	—	—	—
Group D (Excl. Sweepers)	—	—	—	—	—	—	—	—	—
Group D (Safaiwalas)	—	—	—	—	—	—	—	—	—

Part-II Posts filled by Promotion (on seniority-cum-fitness)

SCHEDULED CASTES

Name of post	Total No. of Vacancies Notified Filled	No. of vacancies reserved		No. of SC candidates appointed	Short fall	No. of ST candidates appointed against vacancies reserved for SCs in the year	No. of SC vacancies carried forward to the next year	No. of reservations lapsed after carrying forward for 3 years	No. of reservations lapsed from 1980 till the end of the year previous to the year of review	Progressive total of reservation lapsed (Col. 10+11)
		Out of Col. 2	Out of Col. 3							
1	2	3	4	5	6	7	8	9	10	11	12
Group A Other than Lowest rung of Group A	—	—	—	—	—	—	—	—	—	—	—
Lowest rung of Group A	—	—	—	—	—	—	—	—	—	—	—
Group B	—	—	—	—	—	—	—	—	—	—	—
Group C	2	2	2	—	2	—	—	—	—	—	—
Group D (Excl. Sweepers)	3	3	1	—	1	—	—	—	—	—	—
Group D (Safaiwalas)	—	—	—	—	—	—	—	—	—	—	—

SCHEDULED TRIBES

	No. of vacancies reserved		No. of ST candidates appointed	Short fall	No. of SC candidates appointed against vacancies reserved for STs in the 3rd year of carry forward	No. of STs vacancies carried forward to the next year	No. of reservations lapsed after carrying forward for 3 years	No. of reservation lapsed from 1980 till the end of the year previous to the year of review	Progressive total of reservation lapsed (Col. 19+20)
	Out of Col. 2	Out of Col. 3							
	13	14	15	16	17	18	19	20	21
Group A Other than Lowest rung of Group A	—	—	—	—	—	—	—	—	—
Lowest rung of Group A	—	—	—	—	—	—	—	—	—
Group B	—	—	—	—	—	—	—	—	—
Group C	—	—	—	—	—	—	—	—	—
Group D (Excl. Sweepers)	—	—	—	—	—	—	—	—	—
Group D (Safaiwalas)	—	—	—	—	—	—	—	—	—

Part-III Posts filled by promotion (by selection)

SCHEDULED CASTES

Name of post	Total No. of Vacancies Notified	Filled	No. of vacancies reserved		No. of SC candidates appointed	Short fall	No. of ST candidates appointed against vacancies reserved for SCs in the year	No. of SC vacancies carried forward to the next year	No. of reservations lapsed after carrying forward for 3 years	No. of reservations lapsed from 1980 till the end of the year previous to the year of review	Progressive total of reservation lapsed (Col. 10+11)
			Out of Col. 2	Out of Col. 3							
1	2	3	4	5	6	7	8	9	10	11	12
Group A Other than Lowest rung of Group A	—	—	—	—	—	—	—	—	—	—	—
Lowest rung of Group A	—	—	—	—	—	—	—	—	—	—	—
Group B	—	—	—	—	—	—	—	—	—	—	—
Group C	—	—	—	—	—	—	—	—	—	—	—
Group D (Excl. Sweepers)	—	—	—	—	—	—	—	—	—	—	—
Group D (Safaiwalas)	—	—	—	—	—	—	—	—	—	—	—

SCHEDULED TRIBES

	No. of vacancies reserved		No. of ST candidates appointed	Short fall	No. of SC candidates appointed against vacancies reserved for STs in the 3rd year of carry forward	No. of STs vacancies carried forward to the next year	No. of reservations lapsed after carrying forward for 3 years	No. of reservation lapsed from 1980 till the end of the year previous to the year of review	Progressive total of reservation lapsed (Col. 19+20)
	Out of Col. 2	Out of Col. 3							
	13	14	15	16	17	18	19	20	21
Group A Other than Lowest rung of Group A	—	—	—	—	—	—	—	—	—
Lowest rung of Group A	—	—	—	—	—	—	—	—	—
Group B	—	—	—	—	—	—	—	—	—
Group C	—	—	—	—	—	—	—	—	—
Group D (Excl. Sweepers)	—	—	—	—	—	—	—	—	—
Group D (Safaiwalas)	—	—	—	—	—	—	—	—	—