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ICAR

CIRCOT

ANNUAL REPORT 1992-93

CENTRAL INSTITUTE FOR RESEAR
ON COTTON TECHNOLOGY

BOMBAY

CIRCOT

ANNUAL REPORT

1992-93

Central Institute for Research on Cotton Technology

Indian Council of Agricultural Research

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Introduction

This sixty-nineth Annual Report of Central Institute for Research on Cotton Technology (CIRCOT), covers the period April 1, 1992 to March 31, 1993.

CIRCOT was established by the Indian Central Cotton Committee (ICCC) in the year 1924 under the name of Technological Laboratory of the 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 India. When all the commodity committees including the ICCC were abolished, its name was changed to "Cotton Technological Research Laboratory" (CTRL). Since then the research activities were re-oriented and intensified to meet the challenges in respect of production and quality of cottons grown in the country. Side by side, research efforts were also directed towards better utilisation of cotton plant parts and processing wastes, etc. so as to make cotton cultivation more remunerative and provide gainful employment avenues among the rural masses.

The name of the Laboratory was changed to Central Institute for Research on Cotton Technology (CIRCOT) with effect from April 1, 1991, as per the recommendations of the Quinquennial Review Team (QRT) which realised the phenomenal increase in research component in the Institute's activities especially during the last one decade.

The important functions of CIRCOT are listed below :

1. To participate actively in the programmes for improvement in the production and quality of 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 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 seen from the organisational chart at Annexure I, the Director is the head of the Institute, assisted by a team of Scientists and Technical personnel. An Administrative Officer and two Assistant Administrative Officers provide him assistance in the general administration while the Finance and Accounts Officer looks after matters concerning accounts and audit of the Institute.

Library : An up-to-date library of books on cotton, cotton technology and allied subjects is maintained at CIRCOT. During the reporting period, the total number of books was 4679 with the addition of 85 books during 1992-93. Similarly, the number of bound volumes added to the library was 170 making the total number to 5843. Out of 200 journals pertaining to textiles and allied subjects being received by the library, 91 journals were obtained through subscription (54 foreign and 37 Indian journals) and the remaining were received as complimentary or on exchange basis. The total financial outlay on the Library for 1992-93 was Rs. 5,48,051/-. Besides the staff of this Institute, the library facilities were availed by the students and research workers from various colleges affiliated to Bombay University, sister institutions and technicians from textile industry. Inter-library loan facilities were also maintained with other libraries in Bombay.

New Equipments : A list of major equipments acquired from April 1, 1992 to March 31, 1993 are given in Annexure II.

Distinguished visitors : During this period, Dr. Russell J. Kohel, USDA Cotton Geneticist at Texas A&M University, Dr. A. Edward Percival, a USDA Geneticist and Curator of *Gossypium hirsutum* germplasm collection, Texas A & M University and Dr. Friz üolling from German Development Institute, Berlin, Germany, visited the Institute. In addition, several officials from ICAR headquarters and other research organisations visited the Institute on several occasions.

Management Committee : The Thirty-fifth meeting of the Management Committee was held on February 23, 1993. Apart from 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 projects and research highlights were considered and appropriate recommendations made.

National Science Day Celebration : National Science Day which falls on February 28 every year was celebrated this year with a talk on 'Radiation in Medicine : Physics and Safety' by Dr. P. S. Iyer, Head, Radiological Physics Division of BARC. This function was jointly sponsored by CIRCOT and the ARS Forum and was attended by scientists and technical personnel.

Awards : Shri Muntazir Ahmed, Scientist (SG) secured Fourth prize for his essay 'Steps to be Taken to Popularise Hindi in Government Offices, Banks and Other Undertakings'. The organisers of the competition, M/s. Ashirwad, Bombay, awarded him a cash prize and a memento. He also secured cash prize for a third place and a certificate of proficiency for his essay *Sui Ka Uttapan* in the All India Technical Essay competition organised by the Kendriya Sachivalaya Hindi Parishad.

Staff Research Council : The ninety-second meeting of SRC was held on August 17-19, 1992. Progress of research work during the period April 1, 1991 to March 31, 1992 and new proposals for 1992-93 were discussed and a new programme of work for 1992-93 was finalised. The joint session of SRC with the Management Committee was held on February 23, 1993.

Research Projects : In all, there were 36 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	11
2.	Post-harvest Technology of Cotton	3
3.	Structure, Property and Their Inter-Relationships in Textile Materials	10
4.	Chemical Processing and Finishing Treatments	4
5.	Utilization of By-products of Cotton and Processing Wastes	8

Hindi Day : Hindi Day was celebrated with different programmes during the period from 14.9.1992 to 26.9.1992 both at the headquarters and in the Ginning Training Centre (GTC), Nagpur. The function was inaugurated by Smt. Asmitha Bhave, Hindi Officer, R.C.F. at the headquarters.

The final day function at the headquarters was presided over by Dr. M. D. Paradkar, Vice-Chancellor, Hindi Vidyapeeth. Prizes were distributed by Dr. Paradkar to 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. Fourteen students were being guided for M.Sc. and Ph.D. Eleven scientists of the Institute are recognised guides for M.Sc. and Ph.D. in various disciplines such as, Physical Chemistry, Organic Chemistry, Bio-Physics, Microbiology, Spinning and 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, Bombay.

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) : Four meetings on February 18, May 8, August 24 and November 27, 1992 were held during the period to discuss various matters of general interest to the staff. There was also a special meeting with the Central Joint Staff Council on October 17, 1992.

Grievance Committee : One meeting of the Committee was held on October 1, 1992 to consider individual grievance of the staff members for their redressal.

Finance : A statement showing sanctioned budget grant of CIRCOT and the actual expenditure for the financial year 1992-93 has been furnished in Annexure III. As could be seen from the statement, the actual expenditure under Non-Plan was Rs. 1,61,90,282 as against actual sanctioned grant of Rs. 1,61,90,000 for 1992-93. (Compared to the previous year's actual expenditure of Rs. 1,49,91,480, the increase in allocation under Non-Plan this year was less than 8%.). Further an expenditure of Rs. 54,99,840/- was incurred under the Plan budget as against sanctioned grant of Rs. 55,00,000/- for 1992-93. During the year 1992-93, an expenditure of Rs. 30,901/- was incurred for the Emeritus Scientist Scheme of ICAR.

Significant Findings : At the appropriate panel meetings of AICCIP, one

PLATE I

HINDI DAY CELEBRATIONS

Smt. Asmitha Bhave, Hindi Officer, RCF, who inaugurated the function, is welcomed by Dr. N.B. Patil, Director

A section of the Audience

PLATE II

Dr. M. D. Paradkar, Vice-Chancellor, Hindi Vidyapeeth, speaking at the final day of the Hindi Day Celebrations

PLATE III
NATIONAL SCIENCE DAY

Dr. P. S. Iyer, Head, Radiological Physics Division of BARC speaks at the National Science Day Function

medium *desi* hybrid MDCH.201 was recommended for release in Maharashtra and Gujarat States.

A survey on the Ginning factories of Karnataka state was completed and a report encompassing all the observations and recommendations was prepared and distributed to Government officials and important ginning factory personnel.

In a study to screen popular varieties of cottons for their proneness to give out seed coat fragments in ginned lint, indicated that hybrids possess the highest proneness to give out seed coat fragments and cottons belonging to *G. hirsutum* varieties occupy an intermediate place, while considering this aspect.

Twenty cotton varieties studied for determining the strength of attachment between cotton fibres and seed revealed that the average energy required to pull a single fibre ranges from 34 ergs for Suvin (*G. barbadense*) to 105 ergs for MCU.5 (*G. hirsutum*). The energy required to separate one kg of lint varied from 1050 Joules for Suvin to 2900 Joules for MCU.5.

Yarn faults originate from three main sources : trash, fibre-fly and short fibre bunch. In a typical 40s combed yarn 21% of the faults were due to trash and 50% due to fibre-fly.

The ease of processing and finishing treatments of raw cotton depends to a large extent on the wax content of the cotton fibre. This varies not only among varieties of all the botanical species but also between the same species collected from different localities.

Experiments on the preparation of protein hydrolysates or peptones from the cotton seed meal through the use of hydrolytic enzymes papain, trypsin and pancreatin and its evaluation thereafter as a nitrogen source in culture media for the production of amylase and cellulase indicated that all these three enzymes supported better growth of cultures than commercially available meat peptones. Among the three, the hydrolysates from pancreatin gave highest yield of enzyme.

For obtaining specific products, appropriate varieties of raw linters are to be selected, as there is an apparent difference in the percentage loss on alkali boil, viscosity of alkali boiled as well as bleached linters, the percentage drop in the DP on bleaching and brightness of the bleached linters belonging to cottons of various species under identical purification conditions.

Technology developed to produce biogas from willow dust was improved through the use of bacterial consortia. A fibre glass biogas plant with two windows on the floating gas holder to allow sunlight to pass through was fabricated for the purpose. The methane content of the biogas produced increased by 80-85% and thereby there was an increase in the calorific value as well.

2

Progress of Research

A brief account of the progress of research work done during 1992-93 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 coton 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 1992-93 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 are also received for determination of quality of ginning, oil content in cotton seed, etc. and reports on these tests are also sent immediately after the tests are completed.

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

All India Co-Ordinated Cotton Improvement Project (AICCIP)

The Indian Council of Agricultural Research launched the AICCIP in April,

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 1985-89	1990	1991	1992
Fibre and Full Spinning	219	319	192	179
Fibre and Microspinning	1964	1900	1600	1480
Microspinning alone	57	—	—	—
Fibre Test alone	345	484	631	328
Mill Test	10	14	4	20
Standard Cottons	20	20	21	10
Trade Varieties :				
— Lint	40	23	28	35
— Kapas	29	12	64	40
Technological Research	17	12	269	45
Miscellaneous	3	21	—	17
Total	2704	2815	2809	2154

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

Regional Quality Evaluation Unit of CIRCOT	Quality Parameters				
	Fibre length	Fibre fineness	Fibre strength	Fibre maturity	Micro-spinning tests
Akola	963	429	429	429	—
Coimbatore	2275	2269	1575	2275	527
Dharwad	1192	1192	1192	1192	—
Guntur	709	709	709	709	—
Hisar	769	1473	1093	1732	—
Indore	467	467	467	467	—
Ludhiana	3464	1364	1124	1424	—
Nagpur	788	777	772	679	—
Nanded	676	676	676	676	—
Rahuri	1160	1205	1205	1205	—
Sirsa	319	194	194	194	—
Sriganganagar	1654	1654	1654	1654	—
Surat	10541	4066	4611	4224	116

1967 with a view to achieving closer collaboration between the scientists of various disciplines as well as bringing together Agricultural Universities, Central Institutes and the State Departments of Agriculture. The main objective of this project is 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 is systematically screened every year and only the promising material is subjected to further screening. Maintenance of 'Germ Plasm' and Initial Evaluation Trials are the preliminary stages of screening, while Co-ordinated Varietal Trial, Pilot Demonstration Trial, etc. are the advanced stages of trial under this project. Yield is 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-sixth year of the All India Co-ordinated Cotton Improvement Project.

As the cotton sowing and harvesting seasons differ widely from state to state, the breeding trials are conducted zone-wise. Thus, three cotton growing zones are identified according to agro-climatic conditions prevailing in the country. The north zone comprises the states of Punjab, Haryana, Rajasthan, Uttar Pradesh and New Delhi, the central zone includes the states of Gujarat, Madhya Pradesh and Maharashtra and the south zone is covered by the states of Andhra Pradesh, Karnataka and Tamil Nadu.

As many as 1564 samples of cotton were screened for fibre properties and spinning potential during the year. Test data on various breeding trials were presented at the panel meetings of the respective zones held at Sirsa for north zone and at Coimbatore for the combined central and south zones. The work done under 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* varieties and short staple *G. arboreum* types of cottons. The main object of the trials in this zone is to identify strains superior in yield/quality to the existing ones. Emphasis is laid in this zone to evolve strains which are early maturing and of short duration with a sowing to harvesting period of 150 days with a view to making the field available for the second crop of food grains. Trials are also conducted to evolve high yielding short duration hybrids.

G. hirsutum Trial : The Co-ordinated Varietal Trials (CVT) for Normal Plant Type as well as for Compact and Short Duration were conducted at Bhatinda, Faridkot, Hisar, Kheri, Ludhiana, Mathura, Sirsa and Sriganganagar.

Table 3 shows the ranges and the mean values of 2.5% span length, Micronaire fineness, and bundle tenacity along with the assessment of maturity and spinning performance of

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

Location	No. of samples	Ranges of					Spinning performance			
		2.5% span length (mm)	Micronaire value	Maturity (%)	Bundle Tenacity (g/t) '0' gauge	Bundle Tenacity (g/t) 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)										
Bhatinda	9 F	23.3 — 27.5 (25.4)	4.7 — 5.4 (5.0)	76 — 86 (80)	41.8 — 46.6 (43.3)	18.1 — 20.1 (19.5)	30s	4	3	LH.1134
Faridkot	8 F	22.7 — 27.0 (25.0)	4.3 — 5.4 (4.8)	72 — 87 (81)	44.5 — 48.2 (46.3)	19.8 — 22.1 (21.4)	30s	5	3	F.505
Hisar	7 M	23.3 — 26.2 (24.4)	4.5 — 5.2 (4.8)	75 — 88 (78)	41.3 — 48.2 (45.6)	18.6 — 21.6 (19.9)	30s	2	—	H.777
Kheri	8 F	23.3 — 27.4 (25.7)	—	74 — 84 (79)	43.4 — 46.6 (45.0)	19.8 — 22.4 (21.1)	30s	6	1	LH.1134
Ludhiana	8 F	22.3 — 26.9 (25.3)	4.0 — 5.2 (4.7)	74 — 82 (78)	42.9 — 46.6 (44.5)	19.6 — 22.5 (21.2)	30s	8	1	LH.1134
Mathura	6 F	23.2 — 25.9 (24.4)	4.9 — 5 4 (5.2)	85 — 90 (87)	43.4 — 46.6 (44.6)	17.5 — 18.0 (17.8)	20s	6	2	Vikas
Sirsa	6F	22.8 — 24.7 (23.9)	4.6 — 5.0 (4.8)	73 — 84 (79)	42.3 — 48.2 (46.0)	19.2 — 20.7 (20.0)	30s	2	1	H.777
Sriganganagar	9 M	23.5 — 27.1 (25.3)	4.4 — 5.5 (5.0)	80 — 88 (84)	41.3 — 45.6 (43.3)	17.1 — 20.2 (18.2)	30s	3	5	G.Ageti

1	2	3	4	5	6	7	8	9	10	11
				Early Maturing and Compact Plant Type, Br. 04(b)						
Bhatinda	6 F	24.3 — 27.6 (26.4)	4.2 — 5.0 (4.6)	74 — 88 (80)	40.7 — 47.2 (45.4)	17.6 — 22.9 (20.1)	30s	4	4	LH.900
Faridkot	7 F	24.1 — 26.6 (25.8)	4.1 — 4.8 (4.3)	72 — 82 (77)	44.0 — 48.2 (45.7)	19.0 — 23.5 (21.0)	30s	5	3	LH.900
Hisar	6 M	24.1 — 28.4 (26.2)	3.6 — 4.4 (4.2)	72 — 80 (76)	42.3 — 46.6 (44.2)	18.5 — 22.8 (20.7)	40s	1	4	LH.900
Kheri	7 F	24.0 — 28.3 (26.7)	—	71 — 80 (74)	44.5 — 49.8 (47.4)	17.9 — 23.8 (22.0)	40s	5	5	LH.900
Ludhiana	9 F	22.5 — 28.9 (26.4)	3.5 — 4.6 (4.1)	56 — 84 (74)	41.8 — 50.4 (46.4)	17.5 — 23.6 (20.4)	30s	3	4	LH.900
Mathura	6 M	26.9 — 28.7 (28.2)	3.8 — 5.0 (4.4)	65 — 81 (72)	43.4 — 47.2 (46.0)	19.3 — 23.2 (21.2)	30s	4	4	Vikas
Sriganganagar	9 M	21.9 — 29.0 (25.5)	3.8 — 6.2 (4.8)	72 — 91 (83)	42.3 — 48.2 (45.0)	18.4 — 23.8 (21.4)	30s	3	5	G.Ageti

A — Samples spinnable to the count selected.

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

F — Full spinning

M — Microspinning.

Note — Values in the bracket indicate averages.

TABLE 2 : NUMBER OF SAMPLES TESTED AT REGIONAL UNITS AND REPORTS SENT DURING 1992-93

State	Fibre and Full Spinning	Fibre and Micro Spinning	Fibre Tests alone	Total
Punjab	71(10)	83(10)	26(2)	180(22)
Hisar	13(2)	85(11)	22(4)	120(17)
Rajasthan	6(1)	36(5)	26(2)	68(8)
Uttar Pradesh	6(1)	6(1)	10(10)	22(4)
New Delhi	3(2)	25(2)	—	28(4)
Gujarat	28(6)	39(3)	—	67(9)
Maharashtra	46(8)	241(38)	10(2)	297(48)
Madhya Pradesh	5(2)	163(14)	12(1)	180(17)
Assam	—	4(1)	6(1)	10(2)
West Bengal	—	24(1)	—	24(1)
Karnataka	20(4)	238(17)	79(4)	337(25)
Andhra Pradesh	9(3)	70(7)	—	79(10)
Tamil Nadu	9(3)	105(8)	238(1)*	152(12)
Total	216(42)	1119(118)	429(19)	1564(179)

* Two hundred samples belongs to Germplasm project

the samples belonging to the above two trials. The strains which recorded encouraging spinning performance at 20s, 30s and 40s counts at different locations under both these trials are listed below:

Location	*Count*	*Promising strains*
Bhatinda	20s	HS.145, HS.164, F.1352, LH.900, LH.886 and B.N.
	30s	LH.1267, F.846, LH.1526 and F.1054
	40s	LH.1593 and Pusa 8-6
Faridkot	20s	F.1086, HS.182, F.1352 and F.1353
	30s	F.846, F.1184 and F.1054
	40s	LH.1342
Hisar	30s	RS.716 and H.777
	40s	LRK.516

Location	*Count*	*Promising strains*
Kheri	20s	F.1352 and F.846
	30s	LH.1267, F.1086 and LH.900
	40s	F.1184, LH.1526, Pusa 8-6, Pusa 26, Pusa 49 and LH.1445
Ludhiana	20s	F.1352, F.1353 and LH.900
	30s	LH.1009, F.1086, F.846, LH.1267, F.1054, LH.1134, LH.886 and B.N.
	40s	F.1184, Pusa 8-6 and Pusa 49
Mathura	20s	HS.182, RS.716, H.1021, HS.145 and Vikas
	30s	Pusa 49, Pusa 26-7, Pusa 8-6, LRK.516 and HS.183
Sirsa	20s	LH.1009, F.846, HS.145, HS.182 and HS.183
	30s	H.777
Sriganganagar	30s	LH.1009, LH.1254, Pusa 8-6, RS.921 and B.N.

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

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

Location	*Promising strains*
Faridkot	LH.1318, H.1123 and LH.1134
Hisar	LH.1318, F.1280, H.1123, H.1129 and B.N.
Ludhiana	LH.1366, F.1084, H.1123, LH.1318, LH.1134, LH.886 and B.N.
Muktsar	LH.1318 and LH. 886
Sirsa	LH.1318, LH.1366, HS.195 and H.777
Sriganganagar	RS.795, HS.195 and F.1280

The Initial Evaluation Varietal Trial (IEVT) was conducted at Hisar, Ludhiana and Muktsar. The following strains recorded satisfactory yarn strength at 30s count at the locations indicated below:

Location	*Promising strains*
Hisar	F.1341, CA.36, CA.7, RS.903, HS.209, H.1064, HS.21, HS.198, HS.204, HS.90-80 and H.777
Ludhiana	LH.1134
Muktsar	LH.1134

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

The object of this trial was to identify coarse, short staple and high ginning out-turn varieties suitable for blending purposes in place of the existing variety, G.27. The 2.5% span length of the strains tested under this trial ranged between 16.6 mm and 24.9 mm. The Micronaire value of the following samples was 7.0 and above at the locations as indicated below:

Location	*Promising strains*
Hisar	RG.8, HD.123, LD.405 and LD.327
Ludhiana	LD.484, LD.491, LD.494, RG.18, HD.123, HD.317 and LD.327
Mathura	HD.123, CSA.9-10, HD.217, LD.494 and LD.405
Sirsa	LD.484, LD.494 and DS.5
Sriganganagar	LD.405, LD.484, LD.491, LD.494, HD.123, HD.127, RG.18, CSA.9-10, LD.317 and RG.8

Samples pertaining to the Preliminary Varietal Trial under this programme were received from Hisar, Ludhiana, Mathura, Sirsa and Sriganganagar. The following strains recorded Micronaire value of 7.0 and above at

the locations mentioned below.

Location	*Promising strains*
Hisar	HD.167, LD.572, HD.303, RG.22, HD.145 and DS.5
Ludhiana	LD.559, LD.560, LD.562, LD.569, LD.572, RG.21, RG.22, RG.23, HD.303 and LD.327
Mathura	LD.572 and LD.327
Sirsa	LD.572 and DS.5
Sriganganagar	LD.562, LD.569, LD.572, HD.154, HD.167, HD.174, HD.203, HD.231, HD.303, RG.21, RG.22, RG.23 and RG.8

Hybrid Cotton Trials: The object of this trial was to identify hybrids superior in yield and technological characters to those of the local varieties. The samples belonging to *Intra-hirsutum* Hybrid Trial involving *G. hirsutum* × *G. hirsutum* crosses were received from Faridkot, Hisar, Ludhiana, Muktsar, Sirsa and Sriganganagar. The following hybrids fared well in spinning performance at the counts and the locations as indicated below:

Location	*Count*	*Promising strains*
Faridkot	30s	FHH.5, FHH.7, PCHH.31, LHH.121 and F.505
	40s	HHH.81 and LH.1134
Hisar	40s	HHH.81 and FHH.7
Ludhiana	40s	LHH.121, PCHH.31 and LHH.107
Muktsar	40s	HHH.81
Sirsa	40s	LHH.121 and FHH.7
Sriganganagar	30s	FHH.7, HHH.81 and RAJ.HH.8

Samples pertaining to the Initial Evaluation Trial of *Intra-hirsutum* hybrids of Central and South Zones in North Zone were received from Sirsa. The 2.5% span length ranged between 23.1 mm and 28.0 mm. Micronaire value varied from 4.3 and 5.1. Maturity was good and bundle tenacity values at

both the gauge lengths were satisfactory. Only two out of five hybrids, viz. PCHH.31 and Nav Bharat 1 fared well in spinning performance at 40s count.

Samples belonging Inter-specific Hybrid Trial involving *G. hirsutum* × *G. barbadense* crosses were also received from Ludhiana, Muktsar and Sriganganagar. The following hybrids recorded encouraging spinning performance at the counts and the locations as indicated below:

Location	*Count*	*Promising hybrids*
Ludhiana	60s	Pusa.HB.5, Pusa.HB.15, LHB.1, LHB.3, LHB.5 and MECH.15
Muktsar	60s	Pusa.HB.29, LHB.1 and LHB.2
Sriganganagar	40s	Pusa.HB.15, Pusa.HB.21 and Pusa.HB.45

Miscellaneous Hybrid Cotton Trial: A set of seven samples of Inter-specific Hybrid Trial was received from New Delhi. The 2.5% span length varied from 33.7 mm to 35.5 mm covering extra-long staple category of cotton with good Micronaire fineness and good bundle tenacity at both the gauge lengths. All the seven hybrids, viz. Pusa Hybrid 5, Pusa Hybrid 15, Pusa Hybrid 21, Pusa Hybrid 26, Pusa Hybrid 29, Pusa Hybrid 45 and Pusa Hybrid 112-A recorded encouraging CSP values at 60s count. When two hybrids out of the above, viz. Pusa Hybrid 5 and Pusa Hybrid 29 were further subjected to full spinning tests, it was observed that these two hybrids fared well in spinning performance at 80s count.

An *Intra-hirsutum* Hybrid Trial was conducted at Hisar. All the four hybrids, viz. HHH.11, HHH.136, HHH.137 and HHH.139 along with the local control, H.777 recorded satisfactory spinning performance at 30s count.

Miscellaneous Trial: A good number of trials having different objectives were conducted at New Delhi, Hisar, Ludhiana and Sriganganagar. The details of these trials and the test results are as given below:

Efforts were continued at I.A.R.I., New Delhi to develop high fibre strength *G. hirsutum* cultures and short duration extra-long staple *G. barbadense* cultures as well as inter-specific hybrids against the background of conventionally grown American *G. hirsutum* varieties suitable for spinning to 30s and 40s counts under the North Zone agro-climatic conditions. The details of the trials and the test results were as follows:

A sample of Pusa Culture of *G. hirsutum*, viz. Pusa 2-98-20 tried for high fibre strength was received from

New Delhi for the assessment of spinning potential. It was observed that this medium staple cotton culture recorded fibre bundle tenacity as high as 52.5 g/t at zero gauge length. In the case of spinning performance, it recorded encouraging CSP values at 30s count by open end spinning technique and 60s count by the conventional ring spinning technique. The yarn obtained by both these spinning techniques was found to be good in respect of irrigularity and imperfections when tested on the Uster Evenness Tester.

A set of high yielding Egyptian cultures of *G. barbadense* developed at I.A.R.I., New Delhi was received for evaluation. The 2.5% span length ranged between 29.1 mm and 34.2 mm covering long staple category of cotton. All the cultures were good in Micronaire fineness, average to good in maturity and in bundle tenacity at both the gauge lengths. As many as seven out of eighteen cultures, viz. 11-98, 11-124, 11-139, 11-153, 11-162 and 16-14-6 recorded encouraging spinning performance at 80s count.

Two sets comprising of twenty-three samples from *G. hirsutum* trials were received from Hisar. Only four out of fifteen strains, viz. H.974, H-1123, H.1163 and H.1176 fared well in spinning performance at 30s count from one set, while as many as three out of eight strains, viz. HS.195, HS.90-80 including the local control, H.777 recorded good CSP value at the same count of 30s from the other set.

A *G. arboreum* trial was conducted under irrigated conditions at Hisar. Only one out of the four strains, viz. HD.232 recorded Micronaire value of 7.0 and none of the strains was found suitable for spinning at 30s count.

A set of twelve samples from *G. arboreum* trial conducted under irrigated conditions was received from Ludhiana. It was observed that all the strains recorded Micronaire value below 7.0 and none of them was found to be promising in spinning performanace at 20s count.

A set of six samples comprised of five belonging to *G. hirsutum* and one to *G. arboreum* raised under irrigated conditions was received from Sriganganagar for assessment of spinning potential. It was noted that the medium staple *G. arboreum* strain, RG.8 was not found to be satisfactorily spinnable even at 6s count. Among the *G. hirsutum* strains, 2.5% span length ranged between 22.9 mm and 27.3 mm and all these five strains fared well in spinning performance at the count indicated in brackets RS.886 (16s), RST.9(20s), RS.875 (30s), B.N. (30s) and G.Ageti (30s).

Central zone:

This zone which comprises Gujarat, Madhya Pradesh and Maharashtra has the largest-area under cotton cultivation. Although emphasis is given to improve the existing American types of *G. hirsutum* cottons, a sizeable percentage of cottons from *G. arboreum* species is also under cultivation as most of the area especially in Madhya Pradesh and Maharashtra is under rinfed 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 as well as male sterile based hybrids without sacrificing the yield.

G. hirsutum Trial: Samples pertaining to the Co-ordinated Varietal Trial were received from Padegaon and Surat under irrigated conditions and from Akola, Badnawar, Diphu, Jalgaon, Khandwa and Nanded under rainfed conditions. A set of samples approved for south zone tried in the irrigated tracts of Deccan canal was received from Padegaon.

Summary of test results has been given in Table 4. The following strains fared well at the counts and the locations shown against them.

Location	*Count*	*Promising strains*
		Irrigated
Padegaon	40s	G(T).538, G.2254, CNH.36 and LRA.5166
Surat	30s	G.3945
	40s	G(T).538, G.2254, CNH.36 and LRA.5166
		Rainfed
Akola	30s	JLH.234, PH.93 and LRA.5166
Jalgaon	30s	JLH.234 and G.3907
Khandwa	40s	G.3907, JLH.168, LRA.5166 and G.Cot.10
Nanded	40s	AKH.84638 and JLH.234
		South Zone Trial
Padegaon	40s	CNHPT.4, 70-2-G, 70.E and 70-2-D

Samples pertaining to the Preliminary Varietal Trial were received from Akola, Jalgaon, Khandwa and Nanded under rainfed conditions. The following strains recorded satisfactory spinning performance at the locations and the counts given below:

Location	*Count*	*Promising strains*
		Rainfed
Nanded	30s	AKH.8635, AKH.8632, PH.99, G(B).20 and DHY.286

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					Spinning performance			
		2.5% span length (mm)	Micronaire value	Maturity (%)	Bundle Tenacity (g/t) '0' gauge	Bundle Tenacity (g/t) 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)										
Padegaon	14 M	24.1 — 28.3 (26.8)	4.1 — 4.9 (4.5)	66 — 79 (73)	41.3 — 45.0 (43.0)	14.7 — 20.6 (17.7)	40s	4	6	KOP.498
Surat	5 F	24.6 — 27.6 (26.1)	3.4 — 3.9 (3.6)	67 — 72 (69)	38.6 — 43.4 (42.1)	17.4 — 21.9 (19.4)	40s	4	—	—
Rainfed Trial — Br. 04 (b)										
Akola	5 M	23.7 — 24.8 (24.2)	3.2 — 4.0 (3.6)	67 — 74 (70)	38.1 — 45.0 (42.5)	15.3 — 19.2 (17.6)	30s	3	2	DHY.286
Badnawar	12 FT	22.3 — 24.7 (23.4)	2.7 — 3.4 (3.1)	48 — 69 (55)	37.0 — 46.6 (41.7)	16.1 — 20.3 (18.0)	—	—	—	Khandwa.3
Diphu	6 FT	24.4 — 30.8 (28.1)	3.6 — 4.8 (4.2)	68 — 84 (77)	37.0 — 44.0 (41.6)	15.6 — 20.6 (17.8)	—	—	—	—
Jalgaon	6 M	24.0 — 26.9 (25.8)	3.2 — 4.1 (3.6)	57 — 80 (69)	38.1 — 44.0 (41.5)	15.2 — 20.6	30s	2	3	LRA.5166

1	2	3	4	5	6	7	8	9	10	11
Khandwa (1990-91)	5 M	25.5 — 26.5 (26.1)	3.1 — 4.8 (3.8)	64 — 86 (72)	40.7 — 44.5 (42.3)	17.1 — 20.1 (18.7)	40s	1	—	G.Cot.10
Khandwa	13 M	24.2 — 26.6 (25.0)	2.8 — 4.4 (3.5)	56 — 80 (68)	40.7 — 47.2 (44.2)	16.4 — 22.0 (19.5)	40s	3	4	Vikram
Nanded	5 M	24.6 — 26.9 (25.6)	3.6 — 5.0 (4.2)	61 — 75 (70)	41.3 — 44.5 (43.7)	18.2 — 21.5 (19.7)	40s	2	2	PH.93
				South Zone Trial — Br. 04(c)						
Padegaon	12 M	24.5 — 30.3 (27.5)	3.3 — 4.5 (4.0)	60 — 77 (70)	40.2 — 46.6 (43.5)	18.4 — 22.1 (19.6)	40s	4	9	KOP.498

A — Samples spinnable to the count selected.

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

F — Full spinning.

M — Microspinning.

FT — Fibre Test only.

Note — Figures in the bracket indicates averages.

Location	*Count*	*Promising strains*
Khandwa	30s	JLH.168, JLH.234, AKH.8632, AKH.8635 and G.Cot.10
	40s	LRA.5166
Nanded	40s	G(B).20 and LRA.5166

Initial Evaluation Varietal Trial was conducted at Akola, Jalgaon and Khandwa under rainfed conditions. Only at Khandwa, as many as thirty strains, viz. NH.380, PH.99, AKH.8632, AKH.8624, G.1562, G(T).2680, GISC.11-17-1-25, G.3680, G(J).HS.35, G(J).HS.36, GISC.11-8658, NH.452, NH.439, AKH. 8619, NH.431, JLH.279, AKH.8624, AKH. 8632, KH.2249, AKH.8627, AKH.8828, AKH.8448, KH.2245, CH.116(MB), CNH. 117 (MB), CNH.104 (RB), G.Cot.10, LRA. 5166, PKV.081 including a local control, Khandwa 3 fared well in spinning performance at 30s count.

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

Location	*Promising strains*
Akola	G(AM).1275 and G(AM).20
Amreli	G(AM).51, AKA.8715, NA.364, AKA.8604, NA.377, UA.90-1, KWA.3, G(AM).22, G(AM).20, KWA.11, KWA.8, NA.396, M.1867, UA.90-2, AKA.8401 and Sanjay
Indore	G(AM).51, AKA.8715, AKA.8604, NA.377, UA.90-1, KWA.3, G(AM).22, G(AM).20, KWA.8, KWA.8417 and M.1867
Jalgaon	JLA.240, G(AM).51, UA.90-2 and Y.1
Nanded	G(AM).1275, G(AM).22, AKA.8715, UA.90-1, Eknath and PA.141

A separate Co-ordinated Varietal Trial for the long staple cottons with 2.5% span length between 26.0 mm and 28.0 mm, was conducted under rainfed conditions at Akola, Amreli and Nanded. The 2.5% span length ranged bet-

ween 23.7 mm and 28.0 mm. Micronaire value ranged between 4.0 and 5.7. Maturity was good and bundle tenacity value varied from 40.7 g/t to 47.2 g/t at zero gauge length. The following strains fared well in spinning performance at 20s count at the locations given below:

Location	*Promising strains*
Akola	AKA.8306, NP.362, AKA.8314 and AKA.8413
Amreli	AKA.8306, AKA.8713, AKA.8401, NP.904 and NP.367
Nanded	NP.904, AKA.8401, NP.401, NP.406, AKA.8413, AKA.8713, NA.422, PA.141 and Eknath

Hybrid Trial: The 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, Madhya Pradesh and Maharashtra. Considering the increasing demand for medium and superior medium staple categories of cottons, 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 Aurangabad, Jalna and Surat under irrigated conditions and from Akola, Aurangabad, Indore, Jalgaon, and Khandwa under rainfed conditions.

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

Location	*Count*	*Promising hybrids*
		Irrigated
Aurangabad	30s	APNHH.39
Jalna	40s	G(T).HH.35
Surat	40s	GHH.662, G(T).HH.35 and G.Cot.Hy.8
	50s	T.13 x M.12, Savitha and WHH.36

Location	*Count*	*Promising hybrids*
		Rainfed
Aurangabad	30s	NFHH.111, HCHH.515
Indore	30s	HCHH.515, HCHH.414 and GHH.662
Jalgaon	30s	G.Cot.Hy.6
Jalna	40s	HCHH.414, NFHH.111, WHH.651, PHH.253 and G.Cot.Hy.6
Khandwa	30s	GHH.756, NHH.90, MLC.9, PHH.231 and G.Cot.Hy.6
	40s	HCHH.515, PHH.253, WHH.101, HCHH.414, GHH.662, WHH.651, G.Cot.Hy.8 and JKHy.1

Intra-hirsutum Hybrid Trial for Male Sterile Based Hybrids: Samples pertaining to this trial were received from Aurangabad, Jalna, Indore and Surat under irrigated conditions and from Aurangabad, Indore, Jalgaon, Jalna, and Nagpur under rainfed conditions. A separate trial for the male sterile hybrids was conducted for the combined Central and South zones at Aurangabad and Surat 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*	*Promising hybrids*
		Irrigated
Aurangabad	30s	WHH.130, MECH.13, MECH.100 and Hybrid 4
Jalna	40s	MECH.101, MECH.100, MECH.13, WHH.130 and NFHH.110
Indore	20s	NCMHH.302, VCHH.8, NFHH.110, CAHH.468, WHH.655, MLCH.25, MECH.100, JKHy.1 and MS.G.Cot.Hy.6
Surat	30s	MLCH.25
	40s	MECH.100, WHH.130, WHH.655 and Hybrid 6

Location	*Count*	*Promising hybrids*
		Rainfed
Aurangabad	30s	CAHH.8, NFHH.110 and MECH.101
Indore	30s	CAHH.8 and WHH.192
Jalgaon	30s	WHH.198
	40s	MECH.100, WHH.170, CAHH.8 and Hybrid 4
Nagpur	30s	WHH.198 and Hybrid 4
	40s	CAHH.8, NFHH.110, NCMHH.302 and PKV.Hy.2
		Combined Central and South zones
Aurangabad	30s	CAHH.9, CINHH.106, CAHH.22, VCHH.8 and Hybrid 4
Surat	30s	NCMHH.302, CINHH.106, CMSH.3 CMSH.4
	40s	CINHH.105

Inter-specific Hybrid Trial: Hybrids involving *G. hirsutum* × *G. barbadense* crosses were tried at Jalna and Surat under irrigated conditions and those involving *G. arboreum* × *G. herbaceum* crosses at Aurangabad, Indore, Jalgaon, Jalna and Surat under rainfed conditions. The promising hybrids from the spinning point of view faring well in spinning performance at the locations and at the counts are as given below.

Location	*Count*	*Promising hybrids*
		G. hirsutum × *G. barbadense*
Jalna	60s	WHB.701, GHB.583, WHB.677, WHB.220, MECH.115, MECH.418, MECH.118, GHB.420, WHB.767, PHB.55, NBHB.11, Varalaxmi and DCH.32
Surat	60s	NBHB.11, VCHB.3, WHB.677 and DCHB.220

Location	*Count*	*Promising hybrids*
		G. arboreum × *G. herbaceum*
Aurangabad	20s	MDCH.201
Indore	20s	MDCH.201, MDCH.207, MDCH.209, GDH.267, HDH.105 and G.Cot.DH.9
Jalgaon	20s	MDCH.201, MDCH.207, MDCH.209 and GDH.267
Jalna	20s	GDH.267, MDCH.207 and MDCH.201
Surat	20s	MDCH.207 and G.Cot.DH.7
	40s	G.Cot.DH.9

Evaluation of Short Duration Dwarf Material: 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, a trial was conducted at Khandwa. It was observed that 2.5% span length ranged between 22.6 mm and 27.1 mm. All the strains were good in Micronaire value and average to good in maturity and bundle tenacity at zero gauge length. As many as seven out of fourteen strains, viz. CNHPT.1, G(T).996, 70.E, CNHPT.20, AKH.081, LRK.516, NH.262-1, 70-1.G, 70-2.D and CNHPT.2 fared well in spinning performance at 30s count.

Miscellaneous Trials: A few miscellaneous trials having different objectives were conducted at Jalgaon, Khandwa, Mudhol, Nagpur, Nanded, Padegaon, Surat and Sundarban (W.B.). The details of the test results are as given below:

In a *G. arboreum* trial, a new promising strain, JLA.187 was raised along with the control, Y.1 under the rainfed conditions at Jalgaon. It was observed that the control, Y.1 was significantly better than the new strain, JLA.187 in respect of fibre length and bundle tenacity at both the gauge lengths. In the case of spinning performance, the control variety, Y.1 recorded encouraging CSP value at 20s count, while the new genotype, JLA.187 was not found to be suitable for spinning even at 16s count.

A *G. hirsutum* strain, KH.1911 was received from Khandwa along with the control, Khandwa 3 tried under rainfed conditions. It was seen that there was no significant difference between these two medium staple cottons in fibre length, Micronaire fineness, maturity and bundle tenacity at both the gauge lengths. In the case of spinning performance, only the new strain, KH.1911 was found promising at 30s count.

In another miscellaneous *desi* trial, two strains, viz. KWA.3 and KHR.2 (Sarvottam) along with the local control variety, Maljari were raised under rainfed conditions at Khandwa. It was observed that these three medium staple *desi* cottons recorded satisfactory spinning performance at 20s count.

Four sets of *desi* cottons were received from Mudhol under the Improvement of Gaorani Cottons Scheme for evolving early maturity cotton varieties better than the existing Gaorani cottons in yield and fibre quality and suitable for cultivation in Gaorani tracts under the rainfed conditions in Andhra Pradesh.

Under the Initial Evaluation Varietal Trial, all the four strains, viz. 2310, 2315, 2261, and X.28 recorded good spinning performance at 20s count, while under the Preliminary Varietal Trial as many as five out of six strains, viz. MDL.32, 2207, 2215, 2293 and 1875 recorded good CSP value at 20s count. In an another set of samples under the Advanced Varietal Trial, as many as seven out of nine strains, viz. 1867, 1874, 1876, SB.171, 2205, 8401 including the local control, Saraswathi indicated promising spinning performance at 20s count. However, when four out of these nine strains, viz. 1867, 1874, 1875 including the control, Saraswathi were assessed for spinning potential by subjecting them to full spinning test, it was observed that the strains, 1867 and 1875 along with the local control, Saraswathi were found to give encouraging spinning performance at 20s count, while the strain, 1874 recorded good yarn strength at 30s count.

A promising *G. .hirsutum* strain, CNH.36 along with LRA.5166 as the local control was received from Nagpur. It was seen that the new strain, CNH.36 was better in maturity and bundle tenacity at both the gauge lengths as compared to the control, LRA.5166 and both the cottons were *on par* in fibre length. In the case of spinning performance, the new strain, CNH.36 was superior to the control, LRA.5166 in CSP values at both the counts of 30s and 40s. CNH.36 fared well at 40s count, while the Control, LRA.5166 recorded good yarn strength at 30s count.

A set of three samples raised under the miscellaneous trial of Dwarf and Compact Material was received from Nagpur. All the three short staple strains, viz. NISD.2, NISD.3 and NISD.5 were coarse in Micronaire fineness and good in maturity and bundle tenacity at both the gauge lengths. When these strains were subjected to spinning test by the conventional ring spinning technique and the open end spinning technique, it was observed that the strains, NISD.3 and NISD.5 were found to be suitable for spinning at 10s count, while NISD.2 recorded good CSP value at 12s count when processed by the open end spinning technique. However, when these strains were processed by the conventional ring spinning technique, only NISD.5 recorded satisfactory yarn strength at 12s count.

Six sets comprising of two sets of six samples each and four sets of five samples each pertaining to *G. arboreum* trial grown under rainfed conditions

were received from Nanded. It was observed that 2.5% span length ranged between 24.6 mm and 28.7 mm covering medium staple category of cotton. All the samples were average to good in Micronaire fineness and good in bundle tenacity at zero gauge length. All the thirty-two strains, viz. NA.336, NA.337, NA.361, NA.367, NA.376, NA.377, NA.421, NA.428, NA.429, NA.432, NA.448, NA. 453, NA.454, NA.455, PA.85/88, PA.183, PA.195, PA.241, PA.249, PA.253, PA.256 including the two control varieties, viz. PA.141 and Eknath fared well in spinning performance at 20s count.

Two sets comprising of five samples raised under the Multi Varietal Trial and seven samples under the Multilocation Hybrid Trial were received from Padegaon. Only one strain, viz. RHC.1887 from the Multi Varietal Trial and two hybrids, viz. RHH.038 and Hybrid 4 from the Multilocation Hybrid Trial recorded satisfactory spinning performance at 40s count.

A G. *herbaceum* strain, G.Cot.15 received from Surat, was of medium staple and was coarse in Micronaire fineness and good in maturity as well as in bundle tenacity at both the gauge lengths, and recorded encouraging spinning performance at 20s count.

A set of twenty-four cotton samples raised under different conditions at Sunderbans received from Ramkrishna Ashram Krishi Vigyan Kendra, South 24 — Parganas of West Bengal. It was observed that 2.5% span length varied within a narrow limits ranging from 29.9 mm to 31.1 mm. All the samples were average in Micronaire fineness and good in maturity as well as in bundle tenacity at both the gauge lengths.

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 *G. hirsutum* species cover large areas under cultivation, those belonging to 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 large scale in this zone.

G. hirsutum Trial: Co-ordinated Varietal Trial was conducted at Arabhavi, Coimbatore, Guntur, Raichur and Siruguppa under irrigated conditions and Dharwad under rainfed conditions. A separate trial for the Compact and Dwarf *G. hirsutum* Genotypes was conducted at Coimbatore, Guntur and Raichur under irrigated conditions. The ranges and the mean values of 2.5% span length, Micronaire value, maturity and bundle tenacity along with the assessment of spinning performance of the cotton samples received are given in Table 5.

The following strains were found to be promising in spinning performance at the counts and the locations as given below.

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	Bundle Tenacity (g/t) 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)										
Arabhavi	14 M	28.9 — 36.0 (30.1)	3.3 — 4.7 (4.1)	67 — 83 (74)	42.3 — 51.5 (45.1)	18.6 — 23.4 (21.4)	50s	6	9	ACP.71
Coimbatore	14 M	26.3 — 34.5 (29.7)	3.6 — 4.7 (4.3)	—	—	16.6 — 24.2 (20.0)	40s	12	11	MCU.11
Guntur	10 M	23.8 — 34.3 (28.2)	3.6 — 4.5 (4.1)	70 — 86 (75)	40.7 — 46.6 (43.6)	18.6 — 25.0 (21.2)	50s	2	5	LPS.141
Raichur	14 M	23.3 — 35.0 (28.6)	3.0 — 4.6 (3.4)	58 — 84 (73)	39.7 — 45.6 (43.1)	16.6 — 24.3 (19.2)	40s	5	13	Sharada
Siruguppa	14 M	24.9 — 32.4 (28.6)	3.2 — 4.7 (3.7)	68 — 85 (64)	36.4 — 46.6 (40.5)	15.2 — 21.6 (18.8)	30s	12	6	JK.119
Rainfed Trial, Br. 04 (b)										
Dharwad	14 M	25.1 — 29.2 (27.0)	3.0 — 4.9 (4.4)	55 — 84 (78)	38.6 — 45.0 (41.2)	16.7 — 21.6 (19.5)	40s	3	3	JK.276-4

1	2	3	4	5	6	7	8	9	10	11
				Compact Plant Trial, Irrigated, Br. 04(d)						
Raichur	24 M	23.9 — 30.4 (27.5)	3.4 — 4.4 (3.8)	62 — 83 (71)	38.1 — 49.3 (40.5)	18.7 — 24.3 (21.1)	30s	10	22	Sharada
Coimbatore	16 M	25.6 — 30.4 (28.7)	3.8 — 5.5 (4.7)	—	—	16.5 — 23.4 (19.9)	40s	12	4	MCU.11
Guntur	10 M	24.0 — 27.4 (25.7)	3.4 — 4.8 (4.0)	62 — 82 (70)	39.1 — 43.4 (4.0)	17.7 — 20.9 (19.6)	40s	4	—	—

A — Samples spinnable to the count selected.

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

M — Microspinning.

Note — Figures in the bracket indicate averages.

Location	*Count*	*Promising strains*
		Irrigated
Arabhavi	50s	NA.1325, HLS.79, HLS.72, MCU.5 and LRA.5166
Coimbatore	40s	LH.1134, S.2-48-25, JK.276-8-2, TCH.1002, NA.1325, HLS.79, HLS.72, TCH.1005-1-7, MCU.5, MCU.11 and LRA.5166
Guntur	50s	HLS.72 and MCU.5
Raichur	40s	NA.1325, NLS.79, HLS.72, MCU.5 and LRA.5166
Siruguppa	30s	S.2-29-HS, LH.1134, JK.276-8-2, TCH.1002, NA.1325, HLS.79, HLS.72, TCH.1005-1-7, LRA.5166, JK.119, ACP.71-12-3 and MCU.5
		Rainfed
Dharwad	40s	TKM.497, JK.276-8-2 and LRA.5166
		Compact G. hirsutum Genotype, Irrigated
Coimbatore	40s	LH.886, 70.E, 70-2.D, AHH.081, CNHPT.1, CNHPT.2, LRK.516, LH.1446, 70-1.G, SVPR.1 and MCU.11
Guntur	40s	JK.410-6, CNHPT.2, LH.1446 and LRK.516
Raichur	30s	70.E, 70-2.D, CNHPT.1, CNHPT.2, LRK.516, LH.1446, 70.1.G, LHB,CRS and KH.87/22-44

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

The following strains recorded encouraging CSP values at 40s count at the locations mentioned below:

Location	*Promising strains*
	Irrigated
Arabhavi	L.604, LMJ.2347, NA.1369, CPD.419, MCU.5, LRA.5166 and ACP.71

Location	*Promising strains*
Coimbatore	L.604, LMJ.2347, CPD.418, NA.1369, CPD.419, CNH.171, RAMP.218, MCU.5, LRA.5166 and MCU.11
Guntur	LMJ.2347 and MCU.5
	Rainfed
Dharwad	NA.1348 and ICMF.10
Raichur	CPD.419 and LRA.5166

Initial Evaluation Varietal Trial was conducted at Arabhavi, Coimbatore, Guntur and Raichur under irrigated conditions. The following strains fared well in spinning performance at the counts and the locations as given below:

Location	*Count*	*Promising strains*
		Irrigated
Arabhavi	30s	VRS.15, TSH.290, ICMF.20, L.610, HLS.92, CB&RH.2, 3-17, L.605, L.602, C.256-4, AH.146-4-1, L.611, 2-80-B, CNN.500 and CNH.501
Coimbatore	40s	VRS.15, L.603, ICMF.20, L.610, HLS.92, L.605, C.256-4, LH.1591, L.611, 2-80-B, AH.160-3, VRS.19, VRS.7, CBBRH.1, HLS.98-5, MCU.5, LRA.5166 and MCU.11
Guntur	40s	L.603, ICMF.20 and L.611

Intra-hirsutum Hybrid Trial for Conventional Hybrids : The hybrid trial involving *G. hirsutum* × *G. hirsutum* crosses for conventional hybrids was conducted at Guntur, Ranibennur and Siruguppa under irrigated conditions. The following hybrids recorded satisfactory yarn strength at the counts and locations indicated:

Location	*Count*	*Promising hybrids*
		Irrigated
Guntur	40s	VCHH.6, NFHH.15 and DHH.12
Ranibennur	40s	HCH.212, T.13 × M.12, NFHH.11, NFHH.15 and VCHH.6
Siruguppa	30s	DHH.12, HCH.212, NFHH.15, VCHH.6, V.54 × M.12, DHH.11, HCH.313, TCHH.53, Savitha and JKHy.1

Intra-hirsutum Hybrid Trial for Male Sterile Hybrids : The hybrid trial involving *G. hirsutum* × *G. hirsutum* crosses for the male sterile hybrids was conducted at Guntur, Ranibennur and Siruguppa under irrigated conditions and at Ranibennur under rainfed conditions. A separate combined trial for Central and South zones was also conducted for the male sterile hybrids at Guntur and Siruguppa under irrigated conditions. The following hybrids fared well in spinning performance at the counts and at the locations mentioned below:

Location	*Count*	*Promising hybrids*
		Irrigated
Guntur	40s	MECH.101, HCH.10, MECH.144 and Savitha
Ranibennur	30s	MECH.101 and MECH.102
	40s	MECH.144, CINHH.105 and ARCHH.1292
Siruguppa	30s	ARCHH.1292, VCHH.9, MECH.102, CMSH.8, NFHH.13, CINHH.105, MCM.10, CMSH.7, ARCHH.655, MECH.144, PACH.2, JKHy.1 and Savitha
		Rainfed
Ranibennur	30s	MECH.100, MECH.99, MECH.101 and CAHH.468
	50s	Savitha

Location	*Count*	*Promising hybrids*
	Combined for Central and South zones	
Guntur	40s	HCHH.11, ARCHH.53 and Savitha
Siruguppa	30s	PACH.2, ARCHH.15, NFHH.13, CINHH.105, CINHH.106, MECH.103, CMSH.4, VCHH.8, MECH.104 and Savitha

Inter-specific Hybrids : The hybrids involving *G. hirsutum* × *G. barbadense* crosses were tried at Ranibennur and Raichur under irrigated conditions. The 2.5% span length for the hybrids ranged between 27.5 mm and 37.0 mm with good Micronaire fineness. Maturity was very poor to good. Bundle tenacity values were good varying from 40.7 g/t and 50.9 g/t at "0" gauge length. Desi hybrid trial involving *G. arboreum* × *G. herbaceum* was conducted at Dharwad, Raichur and Ranibennur under rainfed conditions. The following hybrids indicated promising spinning performance at the counts and at the locations as shown below:

Location	*Count*	*Promising strains*
	G. arboreum × *G. herbaceum*	
Dharwad	20s	MDCH.207, MDCH.201, NCH.212, DDH.2, Jayadhar and G.Cot.DH.9
Raichur	30s	NCHH.212 and G.Cot.DH.9
Ranibennur	20s	MDCH.201, HDH.106, MDCH.207 and DDH.2

Miscellaneous Hybrid Cotton Trial : An *Intra-hirsutum* Hybrid Trial conducted for three hybrids, viz. JKHy.1, Savitha and T.13 × M.12 at Coimbatore under irrigated conditions indicated that these hybrids belonged to the long staple category of cotton having good Micronaire fineness, maturity and bundle tenacity at both the gauge lengths. Two hybrids, Savitha and T.13 × M.12 fared well in spinning performance at 60s count, while JKHy.1 recorded satisfactory CSP value at 50s count.

Two extra long staple inter-specific hybrid cultures, viz. CDHB.1 and CDHB.2 along with the local control,

HB.224 tried under irrigated conditions were received from Coimbatore. It was observed that although both the new hybrids were superior in CSP values at 80s count to that of the control hybrid, HB.224, only CDHB.2 was found to be satisfactorily spinnable at 80s count.

In order to find out the reasons for the deterioration in yield and quality of the inter-specific hybrid, DCH.32, a trial was conducted at Coimbatore under irrigated conditions at two different fertilizer levels, viz. 100-50-50 kg NPK/ha and 12-60-60 kg NPK/ha and samples were collected from eight different sources each from the two fertilizer levels. It was noted that at the high fertiliser levels, samples from five different sources had satisfactory spinning performance at 80s count, while at lower fertilizer levels samples from all the eight sources recorded good CSP valves for the same count.

A set of four inter specific hybrid cultures along with DCH.32 and HB.224 as control, was tried under irrigated conditions at Dharwad. It was observed that none of the four hybrids, viz. DHB.100, DHB.105, DHB.150 and DHB.155 except the control hybrids, DCH.32 and HB.224 fared well in spinning at 80s count.

A set of eight samples of inter specific hybrids tried under the Multilocation Inter-specific Hybrid Trial under irrigated conditions was received from Raichur. It was observed that 2.5% span length ranged between 30.6 mm and 33.8 mm covering long staple category of cottons with good Micronaire fineness, average to good maturity and good bundle tenacity at both the gauge lengths.

Miscellaneous Trial : A good number of trials having different objectives have been conducted at Coimbatore, Dharwad, Kovilpatti, Nandyal and Raichur. The details of the test results are given below.

With a view to developing high yielding and high spinning extra-long staple cottons, five cultures of *G. hirsutum* along with MCU.5 VT as the control variety were tried at Coimbatore under irrigated conditions. It was noted that 2.5% span length ranged between 31.1 mm and 34.6 mm covering long and extra-long staple category of cottons with good Micronaire fineness, maturity and bundle tenacity at both the gauge lengths. All the five cultures, viz. (M.5 × Z.2).104-3, (M.5 × Z.2)-104-1, (M.5 × Z.2).102-5, (M.5 × Z.2).102-4 and Z-2 recorded encouraging spinning performance at 80s count with (M.5 × Z.2).102-4 recording as high as 2920 CSP value as against the standard CSP value of 2380.

A short duration *G. hirsutum* strain, TCH.1002 along with three control varieties, viz. MCU.5, MCU.11 and LRA.5166 tried under irrigated conditions was received from Coimbatore. It was observed that the new strain, TCH.1002 was *on par* with the control varieties, MCU.11 and LRA.5166 in fibre length, maturity and bundle tenacity at both the gauge lengths, while MCU.5 was superior to TCH.1002 in fibre

length and Micronaire fineness. In the case of spinning performance, MCU.11 and LRA.5166 recorded better CSP values as compared to those of TCH.1002 at 40s and 50s counts and the new strain, TCH.1002 along with the two controls, MCH.11 and LRA.5166 were found to give good spinning performance at 50s count, while the control variety, MCH.5 recorded encouraging CSP value at still higher count of 60s.

A set of 51 samples from the experiment "Studies on the Responses of Dwarf Plant Type to Different Plant Densities" conducted under irrigated conditions were received from Coimbatore for fibre tests. It was seen that there was no significant difference between the fibre properties of different plant densities.

A set of three cultures of Suvin, viz. Suvin 5, Suvin 13 and Suvin-Bulk was received from Coimbatore. It was observed that all the three cultures fared well in spinning performance at 100s count.

A *G. arboreum* strain, TKA.188 raised along with K.10 as the local control variety under rainfed condition was received from Kovilpatti. It was noted that the control variety, K.10 was significantly better in fibre length and bundle tenacity at zero gauge length as compared to the new strain, TKA.188 and both the cottons were *on par* in Micronaire fineness and bundle tenacity at 3.2 mm gauge length. In the case of spinning performance, although the control, K.10 was superior to TKA.188 in CSP value at 20s count, both the cottons were found to be suitable for spinning at 20s count.

In an attempt to evolve high yielding short duration medium staple cotton varieties with tolerance to pests and diseases, two cotton strains, ICMF.20 and ICMF.4 were developed with Priya as a control variety at Nandyal under irrigated conditions. Both the new medium staple cotton strains, ICMF.20 and ICMF.4 along with the control, Priya were *on par* in fibre length, maturity and bundle tenacity at zero gauge length. In respect of spinning performance, ICMF.20 and ICMF.4 recorded good CSP values at 40s and 20s counts respectively, while the control, Priya recorded encouraging yarn strength at 30s count.

A set of four samples of *G. arboreum* trial conducted under rainfed conditions was received from Nandyal. It was observed that none of the new strains, viz. 2708, 2631 and 2463 fared well in spinning performance at 16s count, while the control, Srisailam recorded encouraging yarn strength at 20s count.

A set of two samples tried under the Multilocation *G. hirsutum* trial was received from Raichur. It was noted that only the control, MCU.5 VT fared well in spinning performance at 40s count.

Cotton Varieties Recommended for Release During 1992-93

(1) *MDCH*.201

This is a medium staple inter-specific *desi* hybrid cotton with 2.5% span length of 23.3, having average Micronaire fineness and maturity and good bundle

tenacity at both the gauge lengths. The spinning potential of this hybrid is between 20s and 30s count. This high yielding hybrid is suitable for cultivation in the rainfed areas of Gujarat, Madhya Pradesh and Maharashtra and has been proposed for replacing the traditional *desi* cotton varieties such as, Y.1, AKH.4 and hybrids such as, DH.7 and DH.9.

(2) *CNH.6 (Nagpur Narma)*

This is a superior medium staple cotton with good Micronaire fineness, maturity and bundle tenacity at both the gauge lengths and is found to be suitable for spinning at 40s count. It is a semi-compact plant type with high ginning out-turn of 32% and a short duration of 145-150 days. This variety is suitable for cultivation in the irrigated tracts of Gujarat, Maharashtra and South Rajasthan.

Mill Test

The new strains which are found 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 of the textile mills in the country.

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

It may be seen from the Table that the improved strain, F.1054 was received along with the control variety, LH.900. The yarn strength of these two cottons at 30s and 40s counts was higher at the mill than at the Institute. The overall spinning performance of the control variety, LH.900 was superior to that of F.1054 both at the mill as well as at the Institute. While LH.900 could be considered suitable for satisfactorily spinnable at 36s — 40s counts, F.1054 can be considered suitable for only 30s count.

The new strain, NA.1325 was received from Nandyal along with the local control variety, NA.920. It was observed that the new strain, NA.1325 and the control, NA.920 recorded encouraging spinning performance at 30s count at this Institute, while both these cottons did not fare well at 30s count at the mill in spite of the higher twist multiplier used. There was no significant difference between the two samples in the CSP values at 30s count as well as 40s count at the Institute's level, while the CSP value at 40s count for NA.1325 was higher than that for NA.920 at the mill level.

Promising strains/Hybrids

The following strains and hybrids have shown promising technological performance.

TABLE 6 : COMPARATIVE SPINNING TEST RESULTS AT MILL AND AT CIRCOT FOR THE YEAR 1992-1993

Location	Variety	Mill Test				Institute Test			
		Count	Strength (lb)	CSP	Twist Multi-plier	Count	Strength (lb)	CSP	Twist Multi-plier
Faridkot	F.1054	30s	73.0	2190	4.6	30s	71.1	2133	4.0
		40s	57.7	2308	4.7	40s	48.3	1932	4.0
	LH.900(C)	30s	85.7	2571	4.6	30s	59.0	2360	4.0
		40s	60.4	2415	4.7	40s	41.5	2075	4.0
Nandyal	NA.1325	30s	62.9	1888	4.7	30s	69.5	2073	4.0
		40s	43.8	1751	4.6	40s	46.0	1840	4.0
	NA.920(C)	30s	—	—	—	30s	69.7	2091	4.0
		40s	38.6	1546	4.6	40s	46.5	1860	4.0

C — Control Variety

State	*Promising strains/hybrids*
Punjab	F.846, F.1054, F.1352, LH.1267, LD.484, LD.494, LHH.107, LHH.121, FHH.7, LHB.1, LHB.5 and LHB.15
Haryana	HS.145, HS.182, HS.189, H.1123, H.1129, HD.123, HD.167, HD.303 and HHH.81
New Delhi	Pusa 8-6, Pusa 26, Pusa 49, Pusa HB.5, Pusa HB.15 and Pusa HB.45
Uttar Pradesh	CA.9-10
Gujarat	G(T).538, G.2254, G.3907, G(B).20, G(AM).22, G(AM).51, GHH.662, G(T).HH.35, GDH.267, GHB.583 and NBHB.11
Maharashtra	JLH.168, JLH.234, CNH.36, AKH.8632, AKH.8635, PH.99, AKA.8401, HCHH.414, HCHH.415, NFHH.100, NFHH.11, WHH.655, WHB.677, MECH.100, MECH.101, WHH.130, CAHH.8, NCMHH.302, CINHH.106, MDCH.201 and MDCH.209
Madhya Pradesh	KWA.3, KWA.8, KWA.9, UA.90-1, UA.90-2 and KH.1911
Andhra Pradesh	LMJ.2347, NA.1325, L.604, L.605, LK.861, LK.389, ICMF.20, APNNH.39, MDL.32, SB.171, X.28, 1867, 1874, 1875 and 1876
Karnataka	JK.276-8-2, CPD.419, AH.1603, CDHB.2, DHB.100, DHB.105 and DHB.150
Tamil Nadu	HLS.72, HLS.79, TCH.1002, TCH.1005-1-7, 70.E, 70-2.D, 70-1.G, TCHH.53, V.54 × M.12, (M.5 × Z.2).102-4 and TKA.188

(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, every year 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 1992-93, 22 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 procurred 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 to cotton trade and industry. Information on such Circulars issued during 1992-93 on 31 Indian Cottons is given in Chapter 3.

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

Technological Evaluation of Germ Plasm Material

During the year, 195 germplasm materials belonging to *G. barbadense* of 1991-92 season were received from the Project Co-ordinator, Coimbatore with the accession numbers given as GP/NGP/1.195. The samples were tested on High Volume Instrument system for 2.5% span length, uniformity ratio and tenacity at 3 mm. gauge, and on Micronaire for Micronaire value. The *barbadense* material was long staple with good tenacity. Some of the cultivars recorded span length above 35.0 mm and very good tenacity (above 30.0 g/t).

In all, 115 GP samples were tested at Rahuri and they were of medium staple category. About the same numbers of GP stock were tested for main quality parameters at Nagpur too and the results were submitted to the concerned breeders.

A total of 205 GP samples of *G. barbadense* (GP/CBE/1.205) also were received for the season 1991-92 from Project Co-ordinator, Coimbatore. The tests on these samples are under way.

Effect of Exposure to Weather Conditions on the Quality of Fibre in Matured Cotton Bolls

The experiment has two parts :

(i) *Effect of exposure of cotton to sunlight on the plant*

Varieties	*Pickings*
1) G.Cot.10	P1 : One Week
2) G.Cot.11	P2 : Two Weeks
3) G.Cot Hyb.6	P3 : Three Weeks
4) G.Cot Hyb.9	P4 : Four Weeks

The colour tests of the 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.

The fibre properties viz. 2.5% span length, Micronaire value, strength at 3 mm gauge length and maturity (%) do not show any significant differences between the four pickings done at one week's interval. The colour indices reflectance percentage and degree of yellowness, reveal significant decrease for later pickings which might be due to exposure of cotton for longer periods resulting in deposition of dust and subjecting the cotton to ultra radiation.

(ii) *Effect of Exposure of Cotton to Sunlight after Picking*

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

Varieties	*Stages*
1) G.Cot.10	1) immediately after picking
2) G.Cot.11	2) after one month
3) G.Cot Hyb.6	3) after two months
4) G.Cot Hyb.9	

In this experiment also, the colour indices were tested for the samples of 1991-92 season.

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

For G.Cot.10 cotton alone, convolutions, reversals, ribbon width and wall thickness were studied to assess the effect of exposure of cotton on the plant and also for the effect of exposure to sunlight for cotton after picking. The results are given in Table 7.

TABLE 7 : CROSS-SECTIONAL PROPERTIES OG 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 did not change either for different exposures of the cotton on the plant or for different stages to sunlight for cotton after picking.

Effect on Fibre Qualities and Yield Levels of Cotton due to Hormone — Biozyme Treatment

For this research trial, two varieties Eknath (*G. arboreum*) PH.93 (*G. hirsutum*) and two hybrids viz. NHB.12 and NHH.44 were sown on June 26, 1992 at Cotton Research Station, Nanded. The agricultural details and treatments were as follows :

Location	:	Nanded/Parbhani
Design	:	F.R.B.D.
Replications	:	Three
Treatments	:	Sixteen
Date of sowing	:	26-6-92
Fertilizers	:	a) 40:40:40kg NPK/ha at sowing.
		b) 40kg N at the time of flowering.
		c) 50:25:25kg NPK/ha only for Eknath.

I *Main-plot treatments*

Varieties

V_1 NHB.12
V_2 NHH.44
V_3 PH.93
V_4 Eknath

II *Sub-plot treatment* :

Growth regulators

T_1 Control
T_2 Biozymes (1ml/lit) after 45,60 and 75 days.
T_3 Perfectose (1,1/lit) 60 days
T_4 a) 250 ppm Cycocel 60 days
b) Additional 20kg n/ha 10 days after Cycocel Spray.
c) Irrigation immediatly after additional N application
d) 20 ppm NAA, 3 days after irrigation.
e) 10 ppm GA 7 days after NAA Spray.
f) 500 ppm Ethrel after 1/3rd picking of cotton.

Observations were recorded for seed cotton yield, number of bolls per plant, boll weight (gms), physiological shedding and ginning percentage.

The results are found to be stastically significant in respect of 2.5% span-length due to application of T_4. The treatment combination V_4T_4 recorded significantly higher 2.5% span length with reduced uniformity ratio coupled with significantly higher seed cotton yield (1999 kg/ha). However, the boll weight and ginning percentage remained non significant. Similarly, there was significant reduction in physiological boll shedding. The treatment with Perpectose (T_3) ranked second (1560kg/ha) in efficacy.

The results are also significant in respect of seed cotton yield, number of picked bolls/plant, boll weight and ginning percentage. The highest seed cotton yield was recorded by the variety PH.93 (1891 kg/ha), which is almost *on par* with hybrid NHH.44 (1861 kg/ha). The lowest yield was recorded by NHB.12 (1231 kg/ha). The maximum number of picked bolls/plant was obtained for 'Eknath' so also was the percentage of physiological shedding (34.13%). The hybrid NHH.44 recorded maximum boll weight at 3.35 gm. As regards ginning percentage, the variety PH.93 was found superior to the rest of the varieties (39.36%) except the variety 'Eknath' (38.22%).

The interaction effect of varieties/hybrids × spraying of growth regulators/promotors in respect of seed cotton yield and physiological boll shedding, were significant.

Effects of Defoliants on Trash Content of Seed Cotton and Quality of Lint

Ginning percentage and trash percentage of seed cotton harvested before and after spraying defoliants Ethrel and Dropp at 40% and 60% boll bursting stages are given in Table 8. There was considerable decrease in the trash content of samples after spraying defoliants. Maximum reduction in trash content, i.e. 45.67% was observed with Ethrel 5000 ppm defoliant at 40% boll bursting. Ginning percentage values after spraying defoliants were slightly higher than those before spraying defoliants.

Fibre properties of lint samples were tested for two stages of defoliants, viz. 40% and 60% boll bursting for control and Ethrel 5000 ppm, Ethrel 2500 ppm, Dropp 200 g/ha and Dropp 100 g/ha. Overall quality of fibre is not affected by using these defoliants.

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

G.Cot Hyb.8 was sown on June 25, 1992 on eight plots for different soil; profiles (Surat, Anand, Bharuch, Talod, Viramgam, Arnej, Amreli and Junagadh). Agricultural operations pertaining to weeding, irrigation and plant protection were done as per schedule and the tagging of flowers was started from October 11 and continued up to October 17, 1993 in each of the 8 plots. At the intervals of 15, 20, 25, 30, 35, 40, 45 days after pollination, 8 bolls were harvested for each soil. Volume of the bolls was measured. Fibre bundle strength at 3 mm gauge length was tested for all the samples.

TABLE 8: GINNING PERCENTAGE AND TRASH PERCENTAGE OF SEED COTTON HARVESTED BEFORE AND AFTER SPRAYING DEFOLIANTS ETHREL AND DROPP AT TWO DIFFERENT STAGES

Sr. No.	Stages of Spraying	Treatment of defoliants	Ginning Percentage		Trash Percentage	
			Before spraying (%)	After spraying (%)	Before spraying (%)	After spraying (%)
1.	40% boll bursting	T-1 Control	37.05	37.00	4.10	3.95
2.	—do—	T-2 Ethrel 5000 ppm	37.28	37.38	3.92	1.79
3.	—do—	T-3 Ethrel 2500 ppm	36.85	36.95	4.20	2.12
4.	—do—	T-4 Dropp 200 g/ha	36.87	36.92	4.10	1.97
5.	—do—	T-5 Dropp 100 g/ha	37.19	37.25	4.05	2.13
6.	60% boll bursting	T-1 Control	39.14	38.90	5.54	5.25
7.	—do—	T-2 Ethrel 5000 ppm	38.42	38.55	4.97	2.20
8.	—do—	T-3 Ethrel 2500 ppm	37.92	38.21	4.89	2.55
9.	—do—	T-4 Dropp 200 g/ha	39.90	39.97	5.23	2.50
10.	—do—	T-5 Dropp 100 g/ha	39.50	39.71	5.08	2.61

Study on Cotton Quality Parameters Contributing to Kapas Grades

During the period, about 100 samples (*Kapas*) from various centres of Maharashtra State Co-operative Cotton Growers' Marketing Federation, viz. Jalgaon, Amravati, Ganga Khed, Parbhani and Akola were received. Eighty *kapas* samples (out of 100) comprising twelve varieties, viz. LRA.5166, AKH.4, DHY.286, MECH.1, Y.1, DCH.32, AK.235, NHH.44, H.6, AHH.468, H.4. 1007 and four grades, viz. Super, FAQ, Fair and X in each variety were tested for colour, trash and fibre properties. Samples from Surat and Raichur are being processed.

THRUST AREA II : POST HARVEST TECHNOLOGY OF COTTON

This thrust area encompasses precleaning and ginning of *Kapas* and further mechanical processing of ginned lint into yarns 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 summarised below.

Strength of Attachment Between Cotton Fibre and Seed

Eight lots of seed cotton samples from different varieties were ginned on the double roller gin and the electrical energy consumed in each case was noted.

Incidence of Seed-Coat Fragments in Ginned Cotton

The work on the incidence of seed-coat fragments (SCF) was completed on 32 varieties of cotton. It was decided to extend the work to other commercially available varieties of cotton and correspondence was initiated to procure these samples from various breeding stations. About 20 samples have been procured with another 10-15 varieties being in the pipe line. The samples were hand cleaned and kept ready for regular ginning.

During the reporting period, efforts were made to identify the exact locations of the seed which are prone to shed SCF. For this purpose, 100 seeds bearing lint have been picked up from each sample and were made into 'halos'. These were hand ginned and the locations on the seed from where the SCF were shed have been noted. The SCF have been further to classified as large, small and tiny in size. The hand gin work was done on about 30 samples and the observations are given below.

The SCF mainly emerge from the chalazal region in most of the cases and to a lesser extent from the dehiscence line. The SCF from chalazal region are thin and somewhat symmetrical in shape while the ones emanating from dehiscence line are thicker and boat shaped with some proteinous matter attached to the hulls.

In general, arboreums were found to be harder to gin, though they have naked and very small seeds. The seeds have a hard touch. The SCF are smal-

ler than other types and are often very tiny and escape attention.

The *barbadense* cottons had large naked seeds and are easy to gin. Their SCF, if any, are medium sized and are bigger than the SCF of *arboreums*. Their numbers are, however, small.

The *herbaceum* cottons exhibited small and very highly fuzzy seeds and were easily ginned. In general they shed much fewer SCF and their sizes are very small.

Hirsutums as a class exhibited a wide range of properties. These are generally big to very big in size, fuzzy to very fuzzy, symmetric to highly asymmetric in shape. The ones which shed less number of SCF are, in general, easily ginnable. The contribution to SCF in MCU.7, Deviraj, Vikram, Khandwa 3, MCU.5 comes mainly from chalazal region with little or none from dehiscence line. In other varieties studied, the contribution from dehiscence line is considerable and in SRT.1, DCH.32 and G.Cot.10, it exceeds the contribution due to the chalazal portion. In others, like Sharda and F.414, it is of lesser significance compared to chalazal region.

In none of the varieties studied so far, the funicle side contribute to the SCF. Thus, it appears that only the two regions, viz. chalazal region and dehiscence line contribute to the incidence of SCF. Experiments on other cottons will be soon taken up to corroborate these findings.

The actual compilation of the number of SCF in cotton varieties is being taken up for the newly arrived cotton samples using hand ginning technique. Regular ginning on the laboratory model gin will be taken up as soon as the hand cleaning operations are completed.

Survey of Ginning Factories in Andhra Pradesh

During 1992-93, the Executive of Andhra Pradesh Cotton Association was contacted personally by visiting Guntur. After having discussions with him, he agreed to help in the filling up of the questionnaires by the factory owners at Guntur and Prakasam districts. According, the survey of these areas was planned in the month of December, 1992 and January, 1993. In Guntur and Prakasam districts almost all the cotton ginning centres were visited and about 20% of the questionnaires were got filled up from the ginning and pressing factories, apart from the useful discussions with factory managers and owners.

In Kurnool district Adoni and Nandyal are the two main cotton ginning centres.

During visits to these centres, 50 questionnaires were got filled up from the ginning factories. In all, 330 completed questionnaires (including factories in Adilabad) have been collected from Andhra Pradesh. The analysis of the collected data is under process.

There are three distinct agro-climatic zones in the state Andhra Pradesh. coastal Andhra Pradesh, Telengana and Rayalseema where different varieties of cotton are grown. The conditions of ginning and pressing factories are

also different in these three zones. Production-wise, Telengana ranks first with about 9 lakh bales followed by coastal Andhra Pradesh with 8 lakh bales and Rayalseema having a production of 2 lakh bales, thereby making the total production of Andhra Pradesh at about 19 lakh bales in the 1991-92 season.

In Coastal Andhra Pradesh, it was observed that there are about 250 ginning factories and 25 pressing factories working seasonally. The conditions of the machinery was good; gins are well maintained and ginners are aware of the different settings. Mostly, precleaning is carried out with the help of cylinderical cleaners which can remove kavadi (immature cotton), stones, sand, etc. They have, in general, sufficient godown space for storage. Cotton bales, seed and cleaned *Kapas* are stored in godowns and uncleaned *kapas* in open compound. Ginning & pressing charges were Rs. 89.00 per qt. and Rs. 1000.00 per bale, respectively.

Similarly in Telengana, it was observed that there are about 200 ginning and 23 pressing factories working seasonally. Adilabad and Bhaisa are the two main ginning centres followed by Warangal, Khammam, Nalgonda and Mehaboobnagar. In Adilabad and Bhaisa centres, two modern ginning factories have come up, where all the operations are done automatically. In general, the conditions of the ginning and pressing factories in this region are also satisfactory.

In Rayalseema region, there are about 75 ginning and 11 pressing factories. Major centres where the cotton is ginned, are Adoni and Nandyal in Kurnool district, followed by Proddatur in Cuddapah district. Remaining centres have very negligible cotton for ginning. This region pressed about 2 lakh bales during the 1991-92 season. Conditions of ginning machinery are not very good; ginners do not follow proper settings of the gins, and do not change the grid for different varieties. Conditions of the pressing factories are sub-standard; the bales are not being properly covered and stored, old rusted iron hoops are used for baling of lint and bales are stored in open compound. The ginning and pressing charges are very low at Rs. 73.00 per qt. and Rs. 78.00 per bale, respectively though the official rates are Rs. 89.00 per qt. and Rs. 100.00 per bale, respectively.

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

Fabric Formation: The five yarn samples from different cottons prepared last year were knitted as single jersey fabrics on a two feed four inch Bentley Komet foot-wear machine. While samples A,C and D (G.Cot.6, Suvin and DCH.32, respectively) were knitted easily, sample E (V.797) could be knitted only with difficulty; but sample B from G.Cot.11 could not be knitted under the same tension as used for other samples. This might have been due to the higher number of imperfections in G.Cot.11 yarn compared to V.797 yarn.

All the five cloth samples were relaxed by soaking in water for one, two, four and six hours at room tempe-

rature. Limited studies on treatment with boiling water for one and two hours were also taken up to see the effect of boiling water on relaxation. Tests for loop length and stitch density are in progress.

Yarn Preparation: One sample of 30s yarn has been prepared by introducing specific types of A, B and C faults at intervals and fabrics are being knitted to observe the effect of different types of faults on the fabric appearance and other properties in the faulty portion.

Yarn Bundle Strength Test : Improved Designs for Bundle Making and Clamping Device

Apparatus for preparing parallelised yarn bundles has been suitably modified to give better quality bundles. Jaw faces of the jaw attachment for the lea tester to test parallelised yarn bundles on the lea tester are also modified. This allows lesser tightening force on the jaws for adequate grip during test.

Parallelised yarn bundles were prepared for 14 yarn samples of varying counts on the modified apparatus. These have been tested on the lea tester using the newly fabricated jaws. Preliminary analysis showed that the CV% observed is less than that obtained while using the earlier set up.

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

The morphological and 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. Further manufacturing processes and the resultant layout of fibres in the yarn and of the yarn in the fabric depend on the properties of yarns and fabrics. The advent of newer cotton varieties and modern processing technologies have brought to fore, a wide range to combinations of fibre quality, yarn geometry and fibre design. A true understanding of structure-property relationship is essential for developing varieties suitable for various specific uses and also for determing the process sequences for the manufacture of end-products having different applications. Several research investigations are under way in this thrust area, a brief summary of which is given below :

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

The work carried out during the current year comprised measurement of cyclic bending, cyclic shear, compression and air permeability on 48 fabric samples. The fabrics included are : (i) cotton fabrics of various levels of thinckness and cover factor (ii) cotton fabrics of identical weave and similar threads in warp and weft, but with fineness of cotton varying in the weft yarn (iii) polyester fabrics of varying thickness and cover, and (iv) blends of polyester with viscose or cotton.

The fabric bending is chracterized by measurements of (i) bending rigidity (G) (ii) bending recovery (R%), and (iii) area of the cyclic bending hysteresis curve (A). While the shear hysteresis is characterized by measurement

of shear stiffness (σ), the compressibility of fabric is given by the slope (b) of the plot of log t Vs. log P where, t and P are the thickness and pressure, respectively. The sectional air permeability Ps, which is the product of air permeability (P) and thickness (t), is used as a measure of rate of air flow through a fabric.

All the results were analysed with a view to find out the causative factors such as fibre, yarn and fabric parameters which influence the fabric behaviour. Some of the salient findings based on an extensive statistical analysis are given below :

(1) The bending rigidity depends on both the fabric thickness and fabric porosity, in general, although in the case of polyester fabrics, the dependence is more on cover than on porosity.

(2) The bending recovery and the area of the hysteresis loop are found to be well related, with the bending recovery being high for a fabric whose hysteresis area is low. Further, the recovery is found to be influenced both by the thickness and fabric cover. As the thickness and cover increase, the bending recovery is found to decrease.

(3) The shear stiffness in cotton fabrics is found to be correlated with thickness (positively) and porosity (negatively). Here again, in polyester fabrics, the influence of cover is more than that of porosity. In blended fabrics also, the combined influence of fabric thickness and cover is very high.

(4) For cotton fabrics, the compressibility is strongly influenced by both the thickness and fabric porosity. A thicker and more porous fabric is found to be more compressible. However, in polyester fabrics, the fabric cover influences the compressibility more than the porosity. In blended fabrics, the compressibility values are found to depend on both thickness and porosity.

(5) The sectional permeability is found to increase with fabric porosity in the case of cotton fabrics. Even in polyeser fabrics, the fabric porosity influences the sectional permeability, unlike in other fabric measurements where the cover used to influence heavily the fabric behaviour. It is noticed that, in cotton fabrics where the fabric geometry remains the same, the sectional permeability is found to be strongly influenced by the fineness of the cotton fibres used in the weft yarn. Finer fibres in the weft yarn by virtue of their larger surface area seem to resist the flow of air more than coarse fibres. In the case of blended fabrics, the sectional permeability, to some extent, is dependent on fabric porosity. It is presumed that in addition to fabric porosity in a blended system, the intrinsic yarn porosity might influence the passage of air. Efforts are underway to examine this aspect in detail.

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

Determination of the number of morphological deformities in fibres was the programme for this year. The purpose of this determination was to examine the correlation between the number of deformities and the space constraint index determined already on all the 16 varieties chosen for the study.

The fibre mass extracted from the matured unopened bolls, during space constraint determination for each variety, was dried at room temperature. Homogenised samples of these fibres were prepared by making hand slivers and then passing the latter through a draw-box. Individual fibres were drawn from these slivers and suitably mounted on SEM specimen stubs and examined in SEM for morphological deformities.

Results on examination of 25 fibres from first variety G.Cot.15 (*G. arboreum*) showed that the fibres have very high number of deformities in comparison to the varieties on which similar tests were made in an earlier reported study. Particularly abundant were the types of deformities which fall under the class referred to as V-bends and U-bends. To ensure reliability of the results, the number of fibres to be tested from each variety was fixed at 50. Microscopic examination of fibres for the number of deformities in each variety is completed.

Physical, Structural and Biochemical Studies on Cotton Fibres During Boll Development

In the current year, degree of thickening of the cell wall of the developing fibres was measured for the variety G.Cot.10. It was noted that the wall development was very fast at the early stages of secondary growth.

In addition, various physical and fine structural properties of the fibres collected at different stages of growth for two varieties, viz. G.Cot.10 and Surat Dwarf, were measured using appropriate techniques. The fibres were subjected to both enzyme and acid hydrolysis. Gravimetric weight loss, reducing sugar (%), glucose (%), crystalline content by X-ray and IR methods and degree of polymerisation were also measured.

Almost all the fine structural parameters as well as some of the physical properties showed either no change or a small decrease in the intermediate phase that usually covered the range 25-35 days. However, DP showed substantial decrease in the intermediate phase. Results observed for Surat Dwarf, in general, showed good agreement with those for G.Cot.10, although, the exact day of the onset of the intermediate phase and its duration were not the same for the two varieties. The intermediate phase extended only for a week in G.Cot.10 (24-30 days) while the duration was 10 days (26 to 36 days) in the case of Surat Dwarf.

All the above results confirmed our earlier observation that, during the intermediate phase of development, cotton fibres show poorer crystalline and molecular organisation than during preceeding and succeeding phases.

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

A simple procedure to prepare specimens for fibre base profiling has been standardised. In the new procedure, the fibres separated from the seed by conventional alkali treatment were directly dehydrated without the intermediate step of fixation which usually consumes a lot of time. Trials have shown that fibre base profiles remain intact despite absence of fixation.

A preliminary experiment was carried out on four varieties of cotton. Fibre bases were observed in the scanning electron microscope (SEM). There was considerable variation in the fibre base size among the three specific locations on the seed surface, viz. micropylar, chalazal and side regions. By and large, the foot cell size decreased in the order Wagad Laxmi Hybrid 6 Maljari. In view of the variation in the size of the fibre bases it seems necessary to make quantitative estimate of the profile dimensions in each of the three locations on the seed so that its relation with strength of attachment and the number of seed coat fragments can be understood better.

Infrared Spectral Characterization of Amorphous and Recrystallised Cellulose with Special Reference to the New Band at 1590 cm.$^{-1}$

The effect of heating and of storage on (1) amorphous cellulose films produced from saponified cellulose triacetate and (ii) amorphous cellulose powder obtained by ball-milling hydrolysates of cotton have been studied with special reference to the development and change in intensity of the peak at 1590 cm.$^{-1}$ In both heating and storage, the film alone produced a band at 1590 cm.$^{-1}$ The study further revealed that the intensity of the band increased wih time at a fast rate in the beginning and later, somewhat slowly to reach a limiting value. Of course, with heating, the effect was faster.

In addition, cellulose powders of various amorphity levels were prepared by ball-milling of cotton for different periods. These, along with the fully amorphous powder samples, were treated exactly like CTA film with 1% alkaline alcohol and washed several times with dry alcohol and air-dried. Treated powder samples were heated in the same way as the films in the earlier experiment, along with untreated powders of different amorphous contents. While none of the untreated samples showed a peak at or near 1590 cm,$^{-1}$ the treated powders produced a peak at 1590 cm,$^{-1}$ the intensity of which changed with heating time and temperature, initially at a very fast rate and later on, very slowly.

Results made it obvious that the origin of this band has nothing to do with the amorphity of the substrate. Since the peak could be observed in cellulose hydrolysate as well as partially crystalline materials, it cannot be due to H — bonding of amorphous material. The band in all probability is due to the ionised carboxyl (COO) and results from traces of alkali left in the substrate. In other words, washing with absolute alcohol repeatedly, does not

remove the alkali, fully. This alkali reacts with acidic groups present in cellulose and gives rise to the new band. This argument is further substantiated by the finding that cotton treated with a mild alkali and not washed properly has traces of alkali present fibre also produced a band at 1590 cm^{-1} during heating.

Study of Frictional Behaviour of Cotton Fibres and its Dependance on Intrinsic Fibre Properties

Twenty cottons covering a wide range of fineness and maturity had been selected for the study. The slivers, prepared from the samples were maintained at 65% rh in a desiccator containing the saturated solution of sodium nitrite. The samples were tested to determine the frictional coefficient as follows :

From the sliver, one tuft of uniform thickness, of about 20 mg weight, was mounted on a holder specially prepared for the purpose, in such a way that one end of the tuft is held while the other end is free. This sample holder with the sample was placed on a wooden platform. Another tuft, similarly prepared was mounted on another sample holder. The latter was placed over the first one such that both the tufts were facing each other. The upper tuft holder was linked to the moving crosshead of Instron tensile tester by means of a "Kevlar" filament through a frictionless pulley. As the crosshead moved, the upper specimen holder with the sample traversed over the lower one bringing into play the frictional forces between the two tufts.

The frictional force vs. distance of traverse of upper tuft over the lower one was measured on Instron chart. With the aid of a computer, attached to the Instron, the average frictional force (F) between two chosen limits (in the present case 6 mm to 10 mm) was obtained. The normal load (R) which was equal to the weight of upper specimen holder was 30 gms. Using Amonton's equation $\mu = F/R$ the coefficient of friction μ was determined. For each sample 15 readings was taken and the average was calculated.

Stastical analysis of the results yielded the following informations:

(1) The correlation between fineness and the coefficient ($r = 0.573$) of friction is significant at 5% level.

(2) Correlation between maturity and coefficient of friction is non significant, r being 0.361.

(3) Correlation between tenacity at 0" gauge length and coefficient of friction is also non significant.

(4) Multiple correlation of coefficient of friction with fineness and maturity is found to be significant, R being 0.575.

(5) Multiple correlation of coefficient of friction with fineness and tenacity at 0" gauge is also found to be significant, R being 0.574.

(6) Multiple correlation of coefficient of friction with maturity and tenacity is non-significant, R being 0.362.

(7) When all the three fibre properties, viz. fineness, maturity and tena-

city are considered together, correlations with the coefficient of friction, is found to be non significant.

(8) The above inferences clearly indicate that the coefficient of friction depends more on the fineness of the cotton, rather than on maturity and strength.

(9) Cottons belonging to *G. barbadense* species have very low coefficients of friction.

(10) Pusa hybrid cottons have relatively high values for coefficient of friction.

Structure and Properties of Natural Cellulosic Fibres other than Cotton

Kapok and Talipot palm were the two fibres included for study in the current year's programme. Various structural and physical properties were measured for these fibres. In addition, the following measurements were completed for the different types and varieties (8 types and 17 varieties) selected for study under this project: (i) Bundle tenacity at 0 and 3.2 mm gauge lengths. (ii) Dynamic modulus (iii) X-ray crystallinity and Hermans' Orientation factor (iv) Bulk compressibility and resilience, and (v) Flexural rigidity. Further, in order to understand the failure mechanism during tensile loading, the fractural ends of the fibres broken on Instron tensile tester were examined under SEM. A few of the salient observations are discussed below :

In most, cases, bundle tenacities failed to show any abrupt decrease on going from 'zero' gauge to 3.2 mm gauge length. The tenacity at 3.2 mm gauge length was not significantly higher than that obtained at 50 mm, especially in the case of fibres like coconut (coir) and arecanut. Substantially higher tenacities at 'zero' and at 3.2 mm gauge length than that obtained at 50 mm were noted in the case of flax and ramie. This is understandable as only these fibres have single cell lengths much higher than the test length of 3.2 mm.

Dynamic modules showed wide variation among different natural fibres and correlated well with crystallinity and orientation of these fibres.

In compressibility measurements, flax fibres recorded the lowest plug thickness (highest compressibility). Work ratio (an index of resilience) varied between 0.30 and 0.46, the highest value being recorded by Kapok.

Flexural rigidity of the fibres increases with increase in the area of cross-section (thickness) of the fibre. Even after normalising with respect to the area of cross-section, thicker fibres showed higher force of bending. Among the different banana varieties *Nendran* recorded the highest flexural rigidity per unit area of cross-section.

Crystalline content of the cellulose as measured by X-ray is much higher for the single cells than for the technical fibres. This observation was true for almost all the fibres included in the study. Fibrillar orientation varied considerably among the different types of fibres. Coir gave the least value for the Hermans' orientation factor and the highest value for the spiral angle. While the reverse was true for flax X-ray angle correlated well with the fibre extensibility.

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 the aspects of processing and finishing taken-up during the year is summarised below :

An Analytical Study of Wax in Indian Cottons

During 1992-93, ten more samples of cotton were analysed for wax content (bringing the total to 64 samples). Four, out of the above ten cotton samples were Bengal *desi* obtained from different locations in Rajasthan. The wax contents were in the same range of 0.14% to 0.22% reported for Bengal *desi* samples earlier. The rest of the samples were Hybrid 4, MCU.5, DCH.32, LRA.5166 and MECH and the wax content of these cottons was also in the same range as for those reported earlier. Preliminary work on the percentage removal of wax at the end of specific period ranging from 1 hr to 6 hr for two varieties of cotton, viz. Suvin and Digvijay, indicated apparent differences in the rate of removal of wax between the above two varieties.

The compositional analysis of different fractions of wax were carried out in respect of four cotton samples, viz. H.4, Maljari, Jayadhar and LRA.5166. The wax from the above cotton samples were extracted using the standard procedures and the various fractions of wax, viz. Hydrocarbon, methyl ester and alcohol were separated, purified and quantitatively estimated by employing thin layer chromatographic technique. The percentage composition of various fractions of cotton wax from the above samples of cotton is presented in Table 9.

TABLE 9 : PERCENTAGE COMPOSITOINS OF DIFFERENT FRACTIONS OF WAX

Sl.	Variety	Hydro-carbon (%)	Methyl Ester (%)	Alcohols (%)
1.	H-4	23.48	26.46	25.28
2.	Maljari	19.07	22.12	34.77
3.	Jaydhar	17.60	23.08	41.52
4.	LRA.5166	22.67	25.33	27.99

The variation in the general composition of the wax from different varieties of cotton can be noticed from the Table 9.

Each fraction of cotton wax is not one single compound but a mixture of different homologous series of the compound. The physical and chemical nature of wax is not only dependent on the composition of different fractions but also on the composition of each fraction too. Hence, detailed analysis of the composition of each member of the homologous series of each fraction of the cotton wax were analysed using GLC Technique. The percentage composition results are listed in Table 10 to 12.

The results of the above analysis bring out the differences in the composition of each fraction of cotton wax ob-

TABLE 10 : PERCENTAGE COMPOSITION OF HYDROCARBON FRACTIONS OF WAX

Carbon No.	H.4	Maljari	Jaydhar	LRA.5166
24	0.7983	—	—	—
25	3.1993	2.8224	1.9888	0.9975
26	1.0801	2.0214	1.4960	1.3149
27	0.7983	4.5005	1.7952	1.6096
28	1.5027	2.4791	1.3376	2.5617
29	0.6340	2.7270	1.3024	2.2217
30	2.1132	2.2693	4.0832	3.4685
31	1.5497	2.2121	1.0384	2.7657
32	1.5966	NIL	1.6720	3.0378
33	3.3342	NIL	1.1264	2.2897
34	6.8562	NIL	1.7424	2.4030

TABLE 11 : PERCENTAGE COMPOSITION OF METHYL ESTER FRACTIONS OF WAX

Carbon No.	H.4	Maljari	Jaydhar	LRA.5166
14	—	—	—	8.5362
16	—	6.2378	9.0012	—
18	—	3.2295	4.6852	3.5462
20	—	0.2433	0.6693	1.1398
22	—	1.9466	1.8002	4.5594
24	4.1278	1.4820	1.0617	1.2918
26	4.7363	0.9733	0.7616	2.0011
28	1.2172	5.9945	2.308	2.1277
30	0.5027	1.9908	1.6848	1.5198
32	3.7044	—	0.8309	0.6332
34	5.5831	—	0.2308	—
36	4.6834	—	—	—
38	1.9051	—	—	—

tained from the four varieties of cotton. The analysis has to be carried out on more number of samples so as to get some meaningful information.

TABLE 12 : PERCENTAGE COMPOSITION OF ALCOHOL FRACTIONS OF WAX

Carbon No.	H.4	Maljari	Jaydhar	LRA.5166
26	0.4601	—	3.1970	—
28	1.0693	—	22.8775	—
30	1.5926	—	10.7952	12.8194
32	12.3619	—	3.8198	8.7329
34	7.2402	—	0.9134	6.4377
36	2.5786	—	NIL	NIL

Development of Durable Soil-Release Finish

Cotton fabric samples were given anticrease and antisoiling finishing treatments. For anticrease finish, dimethylol dihydroxy ethylene urea (DMDHEU) and glyoxal were used as crosslinking agents along with catalyst and softener. Carboxymethyl cellulose (CMC) was added to treating bath for imparting antisoiling and soil release property. Zinc acetate, sodium hydroxide and a commercial fixing agent were the chemicals used in the treatments for improvement of washfastness of finish. The finished fabric samples were evaluated for add-on, strength and wettability.

The washfastness was determined by estimating carboxyl group content. For determining degree of soiling and soil-release, the reflectances of control, treated and soiled fabrics were measured on a spectrophotometer. For determining the degree of soil-release, reflectance measurements were done on periodically washed samples. Following are the observations made :

Strength: Among the two crosslinking agents, DMDHEU treated fabrics showed higher strength retention. Addition of CMC and zinc acetate improved the strength of the fabric. The test results were obtained with zinc acetate treated fabric. This fabric showed breaking strength retention to the extent of 72% and tearing strength retention of 104%.

Carboxyl Group Content: Treatments in which zinc acetate was used showed higher retention of carboxyl groups and hence better washfastness of the finish.

Degree of Soiling: It was observed that addition of zinc acetate to the treatment bath enhanced the soil pick-up of the fabric.

Degree of Soil Removal: It was observed that the degree of soil removal decreased as the number of washes increased. Furher, CMC treated fabrics showed better soil-removal in the absence of zinc acetate.

Wettability : Wettability of the fabric was measured by drop absorbency mehod. The glyoxal treated fabric showed highest wettability which was followed by untreated control. Wettability deteriorated with the addition of DMDHEU, CMC and zinc acetate. The deterioration was highest with zinc acetate and lowest with DMDHEU.

Effect of Laundering on Physical and Mechanical Properties of Chemically Treated Fabrics

Two experiments were undertaken : (1) To optimise the washing temperature, and (2) to study the effect of laundering on physical and mechanical properties of fabrics treated with antisoiling and softner finishes. For the first experiment, three types of fabrics, viz., Cotton (C), Polyester (P) and 67 P/33C, were soiled artificially following BIS method (5785-1970). The soiled samples were washed five times using 2 detergent powder, 3 detergent cakes and 2 soaps separately on Launderometer at three temperatures, viz. 40°, 60°, and 80°C.

In the second experiment, two types of fabrics, viz. Cotton (C) and 67 P/33C, were desized and given antisoiling treatment (with 2% softener, 10% DMDHEU and 2% CMC). The control, treated, soiled and washed samples (15 times) were tested for reflectance %, abrasion resistance, tear strength and crease recovery.

It was observed that cleaning efficiency increased at higher temperature for all the three fabrics. The detergents were more efficient compared to detergent cakes and soaps. There was decrease in abrasion resistance at higher temperatures. It may be concluded that 60°C temperature may be considered as optimom for efficient cleaning performance for all the fabrics. Surf detergent powder, Rin detergent cake and OK soap cake performed better.

In the study of antisoiling treatments, it was observed that softener alone increased tear strength, which further improved on soiling; DMDHEU improved crease recovery as expected but decreased tear strength and abrasion resistance. Further, CMC treatment slightly improved tear strength and abrasion resistance. Chemical treatments did not improve the reflec-

tance % value on washing compared to corresponding control; tear strength and abrasion resistance also decreased.

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

During the period, carded yarn samples of 20s count (Ne) belonging to 20 different cotton varieties were collected for knitting. These were identically knitted to single jersey fabrics on a 2 feeder 4" diameter Bentley Komet footwear machine having 168 needles. The knitted fabrics were kiered by open boiling with 1% sodium hydroxide solution. Kiered samples were bleached with sodium hypochlorite solution having 2 g/l available chlorine. For determination of the whiteness of the fabric at different stages of processing, reflectances of grey, kiered and bleached fabrics were measured at different wavelengths. Further work is in progress.

Studies on Continuous Fermentation of Cellulase by Pencillium funiculosum

Earlier work on cellulase by *Penicillium funiculosum* showed that the enzyme could be used in the saccharification of cellulosic wastes, production of single cell protein, clarification of fruit juice, etc. In the present studies, another application of this enzyme, viz. release of intracellular materials of plant origin, is attempted.

The cellulase was prepared by growing *P. funiculosum* in 5 litre modular fermenter under optimum conditions of growth using *Trichoderma viride* (TV) medium. The enzyme produced had shown a filter paper activity equivalent to 2.8 mg of reducing sugar per ml of system.

The above enzyme filtrate was used to release the starch from potato. Potato (10g) was subjected to degradation in 100 ml enzyme-buffer system. The amount of enzyme added was 1, 2, 4, 8 and 16 ml. The control system was devoid of any enzyme. The system was incubated at 50°C for 4 hr and filtered to separate the starch released from unreacted residue. It was then washed, dried and weighed. It was observed that the amount of starch released had an increase with an increase in enzyme concentration and reached a maximum level of 63% to 65%. The control system (without enzyme) showed only 5% release of starch.

The above experiment was repeated using 10 ml of enzyme in the system and was incubated at 50°C for 1, 2, 4 and 6 hr. The released starch was determined as described above. The results indicated that the release of starch increased steadily upto 4 hr and thereafter slowed down to a certain extent. The amount of starch released at 4 hr and 6 hr was 63% and 68%, respectively.

The above results show that the cellulase produced by *P. funiculosum* could hydrolyse plant cell walls and release the intracellular material. The results also indicated that the rate of release of starch from potato was dependent on enzyme concentration and incubation period. The advantage of the use of cellulase in the isolation of starch from potato is that better quality

as the shape and size of the starch could be recovered granules remain intact. Further work is in progress to recover starch from cassave and proteins and oil from seeds of cotton and soybean.

P. funiculosum when grown in TV medium produces several enzymes other than cellulase during the growth period. Hemicellulases may be the major enzymes produced by this organism. Xylan degrading activity, i.e. xylanase, was determined using *P. funiculosum* filtrate. Half ml xylan (1%) was incubated with 0.5 ml enzyme filtrate at 50°C for 30 min and reducing sugar (as xylose) produced was determined. It was observed that enzyme activity equivalent to 2.9 mg of reducing sugar as xylose, could be obtained.

Xylanase is an industrially important enzyme. Since it is produced in adequate quantities by *P. funiculosum* along with cellulase, the crude filtrate of *P. funiculosum* could find better applications in industry.

Apart from the above studies, work was carried out on the production of cellulase in 1 litre modular fermenter by both controlling and uncontrolling the pH of broth during fermentation. It was observed that in uncontrolled system, pH shifts slowly from 5.6 to 2.5/3.0 due to production of acids during the growth. The results showed that the enzyme activity of the broth remains almost the same under controlled pH as well as uncontrolled pH. Attempts are also being made to grow the organism in continuous fermentation.

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 had been one of the priority items in CIRCOT's research programms for the past one decade. The on-going research work in this thrust area during 1992-93 is as follows :

Amino Acid Analysis of the Cottonseed Proteins and Cottonseed Meal Hydrolysates . .

In connection with the screening of varieties of cottonseed proteins for amino acid analysis from the germplasm collections of CICR, Nagpur, amino acid analysis on 57 varieties belonging to *G. barbadense, G. hirsutum* and *G. arboreum* species were completed and results tabulated. The results indicated that glutamic acid is the dominant fraction irrespective of species and varieties and the least is cyteine. Proline is high in a few varieties. Breeders are generally looking for varieties rich in Proline since the pest and drought tolerance are very much Proline dependent. The results will be sent to CICR, Nagpur for the use of breeders in their future breeding programmes.

Thermal Stability of Cottonseed Oil

Intermittent heating of oils : In many cases where deep fat frying is employed, the oil used is not subjected to continuous heating. Therefore, the effect of intermittent heating on the stability of cottonseed oil was investigated to study the extent of deterioration of the oil under normal user conditions.

Cottonseed oil was heated at 200°C for 2 hr and then allowed to stand at room temperature. Iodine value, peroxide value and viscosity of the oil was determined. After 3 days, the oil was again heated at 200°C for 2 hr and the above parameters determined after cooling. This process was continued for eight cycles. Portions of the same soil was heated at 200°C continuously for various periods from 1 to 24 hr and the above properties determined in each case. Intermittent heating showed more deterioration compared to the oil samples heated continuously for the same period at the same temperature.

Oil uptake in fried food : Actual frying of dry potato chips in cottonseed oil was carried out using the same oil for a period of two weeks. Frying was done every alternate day during this period. Peroxide value, Iodine value and viscosity of the oil was determined after each frying. Oil uptake of the fried chips was estimated using a soxhlet apparatus for extracting the oil. Oil uptake increased steadily from 7% (for fresh oil fried chips) to 15% (for 2 weeks old used oil). Taste of the fried chips deteriorated with increase in heating period of the oil. Oil as well as the potato chips fried after two weeks period showed organoleptic deterioration.

Changes in the Properties of Cottonseed Oil and its blends due to heating: Small portions of fresh cottonseed oil and its blends with coconut oil (50:50) and til oil (50:50) were heated at 200°C for various periods upto 24 hrs. Peroxide value, Iodine value, viscosity, colour, refractive index and polymer content of these samples were determined (Table 13).

Peroxide value increased irregularly indicating the formation and breaking down of the oil peroxides. Iodine values decreased. Viscosity and polymer content increased with increase in heating time. Refractive index also increased slightly. Colour of the oil samples darkened. Increase in viscosity and polymer content was less in the case of blends of cottonseed oil as compared to the original cottonseed oil. Thus, the oil blends showed better thermal stability compared to the unmixed cottonseed oil. Fatty acid composition of the cottonseed oil was also determined for different heated samples with the help of gas chromatograph. Amount of linoleic acid in the oil samples decreased steadily with increase in heating time.

Inter-esterification of Oil Blends : Blends of cottonseed oil with coconut oil were inter-esterified using freshly prepared sodium methoxide as the catalyst. These samples were also heated at 200°C for different periods and their properties determined. Inter-esterified samples showed better thermal stability than the simple blends as indicated by the polymer content of the samples (Table 14).

TABLE 13 : PROPERTIES OF REFINED COTTONSEED OIL HEATED AT 200°C

Heating Time(%)	Peroxide value	Anisidine value	Totox value	Iodine value	Polymer content (%)	Kinematic viscosity (in centi-stocks)	Refractive index	Lovi Bond colour index
0	23.55	12.56	59.66	101.21	0.00	61.47	1.4700	4.1R 21Y
1	32.71	67.44	132.86	99.79	0.76	64.01	1.4700	4.1R 22Y
2	36.05	96.55	168.65	97.82	2.19	66.09	1.4702	4.1R 22Y
4	36.06	111.64	183.76	94.31	3.50	67.43	1.4705	4.1R 23Y
8	35.29	131.79	202.37	89.64	10.49	69.79	1.4710	4.1R 23Y
12	42.01	156.23	240.25	84.82	16.21	73.73	1.4715	4.2R 24Y
16	55.24	189.46	299.94	78.31	23.56	91.18	1.4720	4.3R 25Y
24	66.33	211.74	344.40	70.64	34.46	118.25	1.4725	4.5R 29Y

TABLE 14 : POLYMER CONTENT OF HEATED OIL SAMPLES

Sl. No.		Heating time in hours							
		0	1	2	4	8	12	16	24
1.	Refined cottonseed oil (Soke)	0.00	0.93	2.19	4.07	11.03	16.14	22.71	33.65
2.	Refined cottonseed oil (Maruti)	0.00	0.76	1.59	3.50	10.49	16.21	23.56	34.46
3.	Maruti + Coconut oil (50 : 50)	0.00	0.00	0.00	1.43	8.00	10.53	15.27	18.09
4.	Inter-esterified blend of coconut oil and cottonseed oil (50 : 50)	0.00	0.00	0.00	0.00	4.93	7.78	11.43	13.30

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

Delinting of fifteen varieties of cottonseeds was completed. The linter samples were cleaned on a Shirley analyser and linter %, trash % and cage loss % values were calculated.

On the basis of earlier trials, each linter sample was kiered at 1.5%, 2.5% and 3.5% NaOH concentrations and bleached with 1 gm available chlorine/ litre for two hours at three different pH values, viz. 8.4, 9.0 and 10.0. Samples of LRA.5166, H.8, Bikaneri Narma, SRT.1 and DCH.32 were kiered under the three above mentioned conditions. Kiering loss values, apart from whiteness and DP values, of the samples of LRA.5166, H.8 and Bikaneri Narma have been determined. These samples have also been bleached under three different bleaching conditions and whiteness values of kiered and bleached samples have been determined. The kiered and bleached samples are being evaluated for DP.

Kraft Paper from Cotton Plant Stalks for Use in the Manufacture of CFB Boxes for Packaging of Fruits

For carrying out large scale pulping trial for the manufacture of kraft paper from cotton plant stalks, various paper mills were contacted and discussions held. M/s. Ellora Paper Mills Ltd., Tumsar have agreed to provide facilities for conducting the above trial. About 8 tonnes of cotton stalks have been collected from CICR, Nagpur and the chipping work is completed; the trial will be undertaken.

On suggestions from the Technical Director of the mills, some laboratory scale trials were undertaken to carry out pulping of cotton stalks using 12% Urea instead of NaOH. Though the yield of the pulp was high, the quality was not satisfactory. Hence, another trial was conducted using Urea-NaOH combination (10% Urea + 2% NaOH). The quality of the pulp obtained was satisfactory. The paper sheets thus prepared are being analysed for various quality parameters.

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

It has already been established that good quality paper sheets can be prepared from cotton stalks after processing through anaerobic digestion.

In order to find out the feasibility of the process, large scale trials were undertaken on 20 kg of bleached pulp of cotton stalks processed through anaerobic digestion. Hand made paper sheets of various dimensions were prepared at the Hand Made Paper Institute, Pune and evaluated for various quality parameters. The quality of the paper sheets was found to be satisfactory and the process economical. Marbling was done on the paper sheets and file covers were made. They look attractive and acceptable.

With a view to popularise the technology, further large scale trials were undertaken for producing about 50 kg of bleached pulp from cotton stalks by anaerobic digestion in different bat-

ches. Hand made paper sheets were prepared, as described earlier and marbling was done with different colour combinations. Greeting cards were made for Director General, ICAR, New Delhi, Hon'ble Minister of State for Agriculture and Director, CIRCOT. The feed back on these cards has been very much encouraging. A project was prepared and submitted to D.S.T., New Delhi for financial support for further scale up trials and sanction is awaited.

Scale up Trials of Oyster Mushroom Crop on Cotton Stalks

The study has brought out a new finding that cotton plant stalks can be used as a substratum for spawn preparation with nutrient supplementation. Spawn, thus produced, will be inexpensive, apart from their higher shelf-life compared to the conventional grain spawn and this will definitely revolutionaise the grain spawn preparation in the near future.

The study has also indicated that smaller size of the substratum (1 kg) is better during both ideal and slightly adverse conditions in Bombay with regard to yield of the mushroom, whereas, the maximum size (5 kg) of the same material is good only under ideal conditions; under adverse conditions, the yield was found to be very erratic. The yield and the quality of the mushroom fruiting bodies is dependent on the nutrient supplementation. In any case, the yield of the mushrooms will not be less than 50% of the dry wt. of the material. Cottonseed meal and soybean meal were found to be better than the other nutrients tested at 3% concentration.

Improving the Efficiency of Biogas Production from Willow-Dust and other Solid Cellulosic Waste

The studies on production of biogas from willowdust were continued during the year and a new and efficient process for biogas production has been developed. This process involved utilisation of mixed microbial consortia obtained by enrichment culture technique. By this process, it is now possible to get about 400 Cu.M of biogas from one tonne of willow-dust in 60 days as against 250 Cu.M of biogas obtained from the earlier process. In order to popularize this technology, various co-operative spinning mills in Ichalkaranji (Maharashtar) were contacted.

Subsequently, a detailed project report was prepared to set up a biogas plant based on willow-dust at Deccan Co-op. Spinning Mill, Ichalkaranji and submitted to Ministry of Non-Conventional Energy Sources (MNES) for financial support. (Presently, the Ministry of MNES is financing willow-dust based biogas plants under their new subsidy scheme — 70:30 cost sharing basis). Their sanction is awaited.

The salient features of the proposed plant are given below:

(a) Total capacity of the plant	:	100 tonnes/ annum
(b) Total area	:	100 sq.m.
(c) Total gas generation	:	100 Cu.M/day
(d) Total biomanure	:	40 tonnes/ annum
(e) Total capital cost	:	3 lakhs
(f) Pay back period	:	5 years

3

Publications

A. Annual Report

Annual Report of the Central Institute for Research on Cotton Technology for the calendar year 1991-92.

B. Technologcal Circular

Technological Circulars on Trade and Standard Varieties of Indian cottons for the season 1990-91.

C. Research Publications (CIRCOT Publications — New series)

483 S. B. Jadhav, S. Banerjee and Rajesh Julka — *An Assessment of Fibre Quality of Cotton Attacked by New-Wilt Phenomenon*, (Reprinted from the Journal of Indian Society for Cotton Improvement, Vol. 17, No. 2, p. 133, September 1992).

484 Muntazir Ahmed, S. K. Chattopadhyay and B. Srinathan — *Effect of Noil Extraction Level on Single Jersey Cotton Fabrics*, (Reprinted from The Indian Textile Journal, Vol. 102, No. 10, p. 18, July 1992).

485 S. G. Vinzanekar and V. Sundaram — *A Study of Rotor Spun Doubled Yarns*, (Reprinted from paper presented at the International Conference of Textile Science '91 held at Liberec, Czechaslovokia during September 16-18, 1991).

486 M. S. Parthasarathy, G. R. Anap and S. K. Chattopadhyay — *Influence of Pre-cleaning and Ginning Treatments on Fibre and Yarn Quality from Medium Staple Cottons* (Reprinted from paper presented at the 32nd Joint Technological Conference held at SITRA, Coimbatore on June 22 and 23, 1991).

487 M. Mukundan, K. V. Janardhanan and A. S. Reddy — *Effect of Sowing Dates and Spacings on Yield and Fibre Quality of Cotton*, (Reprinted from the Journal of Indian Society for Cotton Improvement, Vol. 18, No. 1, March 1993).

D. Other Publications

1. G. S. Patel, P. Bhama Iyer, S. Sreenivasan and K. R. Krishna Iyer — *Reversals in Cotton : A Study with Scanning Electron Microscope*, (Reprinted from Textile Research Journal, Vol. 60, p. 771, 1990).

2. A. J. Shaikh — *Home-made Paper from Green Cotton Plant Stalks*, (Reprinted from Indian Farming, Vol. 40, No. 11, p. 9, February 1991).

3. D. Rama Rao and V. B. Gupta — *Molecular Mobility in Wool Fibres as Determined from Nuclear Magnetic Resonance Studies*, (Reprinted from Journal of Applied Polymer Science, Vol. 44, No. 4, p. 623, February, 1992).

4. H. T. Lokhande, A. N. Saligram, S. R. Shukla, N. B. Patil, P. K. Chidambareswaran and J. K. S. Warrier — *Improved Dyeing of Nylon 6 with Basic Dyes*, (Published in American Dyestuff Reptr., Vol. No. 81, page No. 40, February, 1992).

5. Munshi Singh and N. B. Patil — *Development of Cotton Varieties for High Speed Rotor Spinning Technology*, (Reprinted from Indian Textile Journal, Vol. 102, No. 7, p. 62, April 1992).

6. S. P. Bhatawadekar, S. Sreenivasan, R. H. Balasubramanya and K. M. Paralikar — *Effect of Alkali Treatment on the Enzymolysis of Never-dried Cotton Cellulose*, (Reprinted from Textile Research Journal, Vol. 62, No. 5, p. 290, May 1992).

7. J. K. S. Warrier, P. K. Chidambareswaran and V. Sundaram — *Toxic Elements in Respirable Cotton Dusts* (Reprinted from Indian Textile Journal, Vol. 102, No. 8, p. 54, May 1992).

8. Muntazir Ahmed, S. K. Chattopadhyay and B. Srinathan — *Effect Noil Extraction Level of Comber on Dimensional and Mechanical Properties of Single-Jersey Cotton Fabrics*, (Reprinted from Indian Textile Journal, Vol. 102, No. 10, p. 18, July 1992).

9. S. K. Chattopadhyay — *Instrumental Detection and Evaluation of Yarn Faults*, (Reprinted from Textile Industry and Trade Journal, Vol. 30, p. 5, September 1992).

10. S. Aravindnath, P. Bhama Iyer and S. Sreenivasan — *Layer Morphology and its Relation to Swelling and Structure, Part I : Cotton Fibres Treated in Alkali*, (Reprinted from Journal of Applied Polymer Science, Vol. 46, p. 2239, December 1992).

11. S. Aravindnath, P. Bhama Iyer and S. Sreenivasan — *Layer Morphology and its Relation to Swelling and Structure, Part II : Cotton Fibres Treated with Ethylene Diamine and Zinc Chloride*, (Reprinted from Journal of Applied Polymer Science, Vol. 46, p. 2245, December 1992).

12. S. P. Bhatawadekar, A. A. Kathe, R. H. Balasubramanya and V. G. Khandeparkar — *Preparation of Protein Hydrolysates (Peptones) from Cottonseed Meal*, (Reprinted from All India Cotton Seed Crushers' Association Newsletter, Vol. 2, p. 6, February 1993).

13. P. K. Chidambareswaran and J. K. S. Warrier — *Can Cotton Fibre Tensile Properties Be Predicted More Effectively From Structural Parameters*, (Published in Asian Textile Journal, Vol. 1, No. 2-3, p. 32, 1993).

14. R. M. Gurjar — *Effect of Different Binders on Properties of Particle Boards from Cotton Seed Hulls with Special Emphasis to Water Repellency*, (Reprinted from Bio Resource Technology, Vol. 43, No. 2, p. 177, 1993).

E. Papers presented at Seminars/ Conferences/Symposia/Workshops

1. N. B. Patil — *Potential of Cotton By-products in Developing Agro-Industries in Maharashtra* (Presented at the Symposium on Agro-based Industries in Maharashtra held in Punjabrao Krishi Vidyapeeth, Akola on May 18, 1992).

2. G. R. Anap — *Development of Seed Cotton Pre-cleaner* (Presented at the Silver Jubilee Celebration of the All India Co-ordinated Cotton Improvement Project held in Coimbatore during September 17-19, 1992).

3. P. Bhama Iyer, S. Sreenivasan and Y. Subrahmanyam — *Structural Charactrisation of Developing Cotton Fibres* (Presented at the Silver Jubilee Celebration of the All India Co-ordinated Cotton Improvement Project held in Coimbatore during September 17-19, 1992).

4. S. P. Bhatawadekar, A. A. Kathe, R. H. Balasubramanya and V. G. Khandeparkar — *Preparation of Protein Hydrolysates from Cottonseed Meal* (Presented at the Silver Jubilee Celebration of the All India Co-ordinated Cotton Improvement Project held in Coimbatore during September 17-19, 1992).

5. S. K. Chattopadhyay, B. Srinathan and M. S. Parthasarathy — *An Introspection into the Faults of Coton Yarns in Relation to Some Fibre Properties* (Presented at the Silver Jubilee Celebration of the All India Co-ordinated Cotton Improvement Project held in Coimbatore during September 17-19, 1992).

6. R. M. Gurjar — *Three-layered Particle Boards from Cotton Plant Stalk* (Presented at the Silver Jubilee Celebration of the All India Co-ordinated Cotton Improvement Project held in Coimbatore during September 17-19, 1992).

7. I. K. P. Iyer, S. J. Guhagarkar and V. G. Munshi — *Evaluation of Short Fibre Content by HVI* (Presented at the Silver Jubilee Celebration of the All India Co-ordinated Cotton Improvement Project held in Coimbatore during September 17-19, 1992).

8. I. K. P. Iyer, C. R. S. Moni and V. G. Munshi — *Cotton Quality Parameters in Relation to Kapas Grades* (Presented at the Silver Jubilee Celebration of the All India

Co-ordinated Cotton Improvement Project held in Coimbatore during September 17-19, 1992).

9. A. A. Kathe, R. H. Balasubramanya and V. G. Khandeparkar — *Mushroom Spawn and Mushroom Crop on Cotton Plant Stalk* (Presented at the Silver Jubilee Celebration of the All India Co-ordinated Cotton Improvement Project held in Coimbatore during September 17-19, 1992).

10. K. R. Krishna Iyer, N. C. Vizia and N. B. Patil — *Strength of Attachment between Cotton Fibre and Seed* (Presented at the Silver Jubilee Celebration of the All India Co-ordinated Cotton Improvement Project held in Coimbatore during September 17-19, 1992).

11. Munshi Singh and N. B. Patil — *Development of High Strength Medium Long Staple Upland Cotton (G. hirsutum L.) Varieties for High Speed Rotor Spinning* (Presented at the Silver Jubilee Celebration of the All India Co-ordinated Cotton Improvement Project held in Coimbatore during September 17-19, 1992).

12. M. S. Parthasarathy, S. K. Chattopadhyay and G. R. Anap — *Kapas Cleaning — Its Effect on Fibre and Yarn Quality with Special Reference to Imperfections and Faults* (Presented at the Silver Jubilee Celebration of the All India Co-ordinated Cotton Improvement Project held in Coimbatore during September 17-19, 1992).

13. A. J. Shaikh, P. V. Varadarajan — *Writing Grade Paper and Corrugated Boxes from Cotton Plant Stalk* (Presented at the Silver Jubilee Celebration of the All India Co-ordinated Cotton Improvement Project held in Coimbatore during September 17-19, 1992).

14. Y. Subrahmanyam, M. C. Bhalod, V. G. Munshi, P. G. Patel and U. G. Patel — *Variation in the Quality of Cotton Lint in Different Pickings of Different Hybrids Groups* (Presented at the Silver Jubilee Celebration of the All India Co-ordinated Cotton Improvement Project held in Coimbatore during September 17-19, 1992).

15. N. C. Vizia, S. B. Jadhav and K. R. Krishna Iyer — *Estimation of Seed Coat Fragments in Ginned Lint* (Presented at the Silver Jubilee Celebration of the All India Co-ordinated Cotton Improvement Project held in Coimbatore during September 17-19, 1992).

16. J. K. S. Warrier, P. K. Chidambareswaran and V. Sundaram — *Elemental Composition of Cotton Plant Parts* (Presented at the Silver Jubilee Celebration of the All India Co-ordinated Cotton Improvement Project held in Coimbatore during September 17-19, 1992).

17. S. P. Bhatawadekar, A. A. Kathe, R. H. Balasubramanya and V. G. Khandeparkar — *Preparation of Protein Hyrolysates from Cottonseed Meal* (Presented at the 33rd Annual Conference of the Associa-

tion of Microbiologists of India held in Goa on November 5, 1992).

18. S. G. Gayal and V. G. Khandeparkar — *Studies on Cellulase Fermentation by Penicillium funiculosum and Utilisation of the Enzyme* (Presented at the 33rd Annual Conference of the Association of Microbiologists of India held in Goa on November 5, 1992).

19. Prema Nair, A. J. Shaikh and R. H. Balasubramanya — *An Antibacterial Finish for Cotton Fabrics* (Presented at the 33rd Annual Conference of the Association of Microbiologists of India held in Goa on November 5, 1992).

20. N. B. Patil and M. S. Parthasarathy — *Indian Cottons — Quality Requirements for Export Yarns* (Presented at the Seminar on Fibres for International Quality Yarns and Fabrics held in New Delhi on October 30-31, 1992).

21. S. Venkatakrishnan and A. K. Antony — *A Preliminary Study on the Processing Behaviour of Interspecific Hybrid TCHB-213 in Blends of Polyester Using Shirley Minature Spinning plant* (Presented at the National Seminar on Cotton Development in India held at Nagpur on December 5-6, 1992).

22. S. K. Chattopadhyay and M. S. Parthasarathy — *Comparative Quality of Air-jet and Ring Spun Yarns* (Presented at the Seminar on Modern Trends in Textile Technology held at Cuttack on March 15-16, 1993).

F. Technological Circulars on Trade Varieties of Indian Cottons

T.C. No.	Variety	Place
2498	Digvijay	Kapadwanj
2499	G.12	Surendranagar
2500	Deviraj	Surendranagar
2501	Hybrid 6	Bharuch
2502	Hybrid 4	Surat
2503	Hybrid 8	Surat
2504	Bikaneri Narma	Sriganganagar
2505	Hybrid 6	Vadodara
2506	V.797	Surendranagar
2507	Hybrid 6	Surat
2508	Hybrid 4	Vadodara
2509	170 CO2	Gokak
2510	Hybrid 6	Surendranagar
2511	Ganganagar Ageti	Sriganganagar
2512	Hybrid 4	Bayad
2513	Hybrid 6	Bodeli

T.C. No.	Variety	Place
2514	Sankar 5	Dholka
2515	Digvijay	Bharuch
2516	Hybrid 6	Mehsana
2517	SRT.1	Botad
2518	Digvijay	Baroda
2519	G.Cot.13(2)	Dhandhuka
2520	G.Cot.13	Dhandhuka
2521	Hybrid 4	Botad
2522	Wagad	Surendranagar
2523	Gujarat 11	Baroda
2524	B.797	Mehsana
2525	Jayadhar	Hubli
2526	DCH.32	Gokak
2527	MCU.5	Gangawati
2528	Hybrid 6	Himatnagar

G. Technological Circulars on Standard Cottons

S.C. No.	Variety	Place
400	Deviraj	Junagadh
401	G.Cot.11	Surat
402	G.Cot.10	Surat
403	AH.107	Arabhavi
404	G.Cot.10	Bharuch
405	G.Cot.12	Surat
406	170 CO2	Arabhavi
407	LH.900	Abohar
408	LH.1134	Abohar
409	ACP.71	Arabhavi
410	G.Cot.15	Amreli
411	G.Cot.11	Bharuch
412	G.Cot.11	Bharuch
413	Digvijay	Bharuch
414	Y.1	Jalgaon
415	V.797	Chharodi
416	G.Cot.13	Chharodi
417	Srisailam	Nandyal
418	DHY.286	Rambhapur
419	LRA.5166	Nagpur
420	Hy.8	Surat
421	Hy.9	Surat

4

Extension

CIRCOT has no agricultural farm attached to it at the headquarters. However, its Regional Quality Evaluation Units are located in different cotton growing tracts of the country within the agricultural university premises; thereby they collaborate closely with the cotton scientists in these Universities as well as with the state nepartments of agriculture through collaborative research projects pertaining to the problems faced by the farming community. However, indirect assistance used to be continuously given to them by way of development of useful equipments for field experiments and also by arranging discussions, suggestions, etc. on the technological aspects of cotton at different stages of crop development and post-harvest technology operations.

The Director and many of the Principal Scientists are members of several committees constituted by the Bureau of Indian Standards for cotton and textiles and they also participate in the preparation of specificaions for various cotton products using their knowledge and expertise. Similarly, the Director and a few Principal Scientists are active members in many advisory panels of other textile research institutions like, ATIRA, BTRA, and SITRA. Being experts in the field of cotton technology, some of the scientists are also invited from time to time to deliver lectures and to participate in research programmes of institutions, such as VJTI, BUDCT, DKTE, etc. The scientists and technical officers participate in conferences and symposia and present papers so as to transfer the research results to different user groups.

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

CIRCOT conducts training courses in cotton technology at the headquarters mainly on the evaluation of the quality of cotton fibres, yarns and fabrics as well as elementary statistical methods applicable to quality parameters. At the Ginning Training Centre (GTC) of CIRCOT at Nagpur, training is imparted to gin fitters, supervisors and officers sponsored by the factory owners from all over the country. The GTC is equipped with different types of precleaners, roller and saw gins, and a modern bale press. Here, practical training on different aspects of ginning operations is

given keeping in view the maintenance of cotton quality characters. There is also a hostel capable of accommodating about 20 trainees, at GTC Nagpur. Research problems in precleaning, ginning and design and development of allied machinery also form part of the activities of GTC.

The nature of extension work in CIRCOT is confined to supply of reliable and accurate data on the quality aspects of cottons, yarns, fabrics, consultancy services and publication of research results for the benefit of user groups.

Technical Queries:

Several queries of technical nature received from private organisations, individuals, government and semi-government organisations on various aspects of testing, instrument fabrication, new products and processes, by products ann waste utilisation, etc. were replied. Replies were also sent for queries from visitors to the Institute on matters relating to cotton and cotton technology.

Paid Tests:

CIRCOT has been receiving a 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 industries on payment of prescribed test fees. The demand for testing on High Volume Instrument (HVI) has considerably increased and the clientele includes M/s Cotton Corporation of India Ltd., various State Co-op. Cotton Marketing Institutions, many leading textile mills and private organisations.

The number of samples received for tests during 1992-93 together with samples tested for the year 1990-92 and average for quinquennium 1986-1990, are given in the following table.

Type of Tests	Average for the quinquennium 1986-90	1990-91	1991-92	1992-93
Spinning	95	38	45	120
Fibre	1481	1469	2059	2812
Yarn	159	290	377	259
Fabric	106	306	271	211
Moisture	14	—	—	24
Miscellaneous	20	25	17	7
Total	1875	2128	2769	3433

The total test fees received for paid tests on samples was Rs. 4,76,598.00.

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

1. Two (sized and unsized) samples of yarn received from M/s. Bombay Dyeing Mills Ltd., Bombay were tested for wax content percentage.
2. Six samples of cotton received from M/s. CIMMCO Spinners Ltd., Solapur, were tested for wax content percentage.

3. Twelve samples of cotton were received from M/s. CIMMCO Spinners Ltd., Solapur, for determining the extent of honey dew contamination.

4. Eleven samples of viscose fibres received from Orissa Synthetic Pvt. Ltd., Bombay were tested for determination of denier by cutting and weighing method and breaking load and elongation on Instron.

5. Four samples of Cotton and Recron received from M/s. Reliance Industries Ltd., Bombay, were blended to specified composition and spun for different counts and tested for lea strength, single yarn strength and Uster evenness.

Training:

(a) Integrated Training course on Cotton Testing Methods and Evaluation

In four batches each of six weeks duration from 6.7.1992 to 19.12.1992, 42 sponsored personnel from cotton trade and industry were trained They were from Maharashtra State Cotton Growers Marketing Federation Ltd., (MSCGMF) and National Textile Corporation (NTC). There were also traders and personnel from private mills.

(b) Short-Term Training

Five batches each of two weeks duration were conducted from 6.7.1992 to 9.10.1992 in which 31 sponsored personnel from MSCGMF and CCI were trained. There were traders and personnel from private mills also.

(c) Special Training

Twelve personnel from NTC, Aravind Mills and Ichalkaranji Co. Op. Mills were imparted training in the use of High Volume Instrument for quality assessment, from 6.4.92 to 16.10.92. In all, there were three batches each of one week duration.

(d) Special general in-house training of one month duration was given to three technical personnel of CIRCOT.

(e) Two trainees from SASMIRA and one from Ichalkaranji Institute were given free training for a month.

The total fees received by way of training was Rs. 89,900/- at the headquarers.

(f) Ginning Training :

During this period around 50 sponsored personnel from trade and industry 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 Scientist(s) and Technical Personnel who attended the conference/Meeting, etc.
1.	Discussions with small-scale industry entrepreneurs on preparation of particle boards from cotton stalks	RIICO, Sriganganagar	9-4-92	Dr. N. B. Patil
2.	Total Quality Management in Manufacturing	Bombay	11-4-92	Shri N. Thejappa
3.	Agro-based Industries in Maharashtra	P.K.V., Akola	18-5-92	Dr. N. B. Patil
4.	Polyester Blends, Quality Upgradation and Product Diversification	Bombay	30-7-92	Dr. V. G. Munshi Shri A. V. Ukidve
5.	Silver Jubilee Celebration of AICCIP	Coimbatore	17-9-92 to 19-9-92	Dr. N. B. Patil Shri M. S. Parthasarathy Dr. N. C. Vizia Shri R. M. Gurjar Shri Y. Subrahmanyam Shri S. N. Nagwekar
6.	National Seminar on Standardisation and Quality Upgradation of Cotton Linters and Allied Products	Bombay	19-10-92	Shri P. V. Varadarajan Smt. Prema Nair Shri A. J. Shaikh

Sl. No.	Meetings/Conferences/ Seminars/Symposia, etc.	Place	Date	Name(s) of the Scientist(s) and Technical Personnel who attended the conference/Meeting, etc.
7.	National Textile Seminar on Fibres for International Quality yarns and Fabrics	New Delhi	30-10-92 and 31-1-92	Dr. N. B. Patil
8.	Thirty-third Annual Conference of the Association of Micro-biologists' of India	Goa	5-11-92 to 7-11-92	Dr. V. G. Khandeparkar Dr. R. H. Balasubramanya Dr. S. G. Gayal Shri A. J. Shaikh
9.	VIII Carbohydrate Conference	Trivandrum	18-11-92 to 20-11-92	Shri P. V. Varadarajan
10.	National Seminar on Cotton Development in India	Nagpur	5-12-92 to 6-12-92	Shri S. Venkatakrishnan
11.	ICAR Regional Committee Meeting	CICR, Nagpur	21-1-93 and 22-1-93	Dr. N. B. Patil
12.	Seminar on Modern Textile Technology	Cuttack	15-3-93 and 16-3-93	Shri S. K. Chattopadhyay
13.	Seminar on Water-Jet Loom Weaving	Bombay	19-3-93	Shri M. S. Parthasarathy Shri Muntazir Ahmed

6

Summary of the Report

This is the Sixty-ninth Annual Report of CIRCOT and covers the period April 1, 1992 to March 31, 1993.

The CIRCOT, formerly known as CTRL, was established in the year 1924 under the name Technological Laboratory of the Indian Central Cotton Committee (ICCC). With the abolition of commodity committees including ICCC in 1966, the administrative control of CIRCOT was passed on to the ICAR and since then, the research activities were re-oriented and intensified.

In all about 3,500 cotton samples were tested at the head quarters for various quality parameters, while at Regional Quality Evaluation Units more than 25,000 samples belonging to different trials were tested. CIRCOT continued as the co-ordinating centre for technology under the All India Coordinated Cotton Improvement Project (AICCIP). The number of books and bound volumes of journals added to the Library were 85 and 170, respectively. While 90 sponsored personnel were trained at Bombay in Cotton Testing Methods and Evaluation, 50 sponsored personnel from ginning factories were trained in quality ginning at the Ginning Training Centre of CIRCOT at Nagpur. The recognition granted to CIRCOT by the University of Bombay as a post-graduate institution in various subjects was continued during the year. The on-going research activities at CIRCOT during 1992-93 are summarised below :

One hundred and ninety-five Germplasm cultivars belonging to *G. barbadense* species were technologically evaluated for important fibre characters and the results were summarised and reported along with data received from Nagpur and Rahuri on Germplasm material tested by them.

In connection with the study on the effect on exposure to weather conditions on the quality of fibre in matured cotton bolls, four genotypes were subjected to observations and subsequent tests as part of this investigation. The fully opened bolls were exposed to different weather conditions on the plant and cottons were collected in four pickings keeping one week inerval and analysed for fibre properties and colour indices. In the second part, 1.5 kg. seed cotton was collected for each variety and exposed to direct sunlight, daily. At three stages, the lint samples were tested keeping an interval of one month.

In both the experiments the colour indices, reflectance percentage and degree of yellowness show significant decrease for later exposures. The decrease in reflectance percentage might be due to the deposition of dust and the decrease in yellowness due to the colour fading of the cotton caused by ultraviolet radiation of sunlight. The structural parameters like convolutions, reversals, ribbon width and wall thickness are not influenced by exposures to sunlight. The chief fibre properties, viz. fibre length, fineness, maturity and strength are also unaffected in both the experiments.

The variety G.Cot Hybrid 8 was sown on 25-6-92 in eight different soil profiles for studying the effect of different soil profiles on phasic development of cotton fibres. All the agricultural operations were suitably looked after. Eight bolls from each plot were collected at the ages of 15, 20, 25, 30, 35, 40 and 45 days after anthesis and their volume was measured. Fibre bundle strength at 3 mm gauge was tested for all the samples.

With a view to study the cotton quality parameters which contribute to *kapas* grades, about 80 *kapas* samples were received from various marketing centres of the Maharashtra State Co-operative Cotton Marketing Federation and were tested for colour, trash and fibre properties.

Spraying of defoliants is found to reduce trash percentage and increases the ginning percentage without affecting the overall quality of the fibre.

A survey of the conditions of ginning factories of Andhra Pradesh was completed. The important findings are tabulated below :

Zone	No. of Ginning Factories	No. of Pressing Factories	Conditions of machines, etc.
Coastal Andhra Pradesh	250	25	Good with adequate maintenance; pre-cleaners are used; sufficient godown facility. Ginning and Pressing charges Rs. 89 per qnt. and Rs. 100/- per qnt., respectively.
Telengana	200	23	The general conditions are quite satisfactory.
Rayalseema	75	11	Not satisfactory.

SUMMARY OF THE REPORT

In connection with the study on Influence of Yarn Faults on the Knittability and knitted Fabric Quality, five yarn samples from different cottons were subjected to knitting trials and it was observed that while yarn samples from G.Cot.6, Suvin and DCH.32 were knitted easily, yarn from V.797 could be knitted only with difficulty and the yarns from G.Cot.11 could not be knitted at all under the same tension.

The device for preparing parallel seed yarn bundles as well as the jaw faces of the jaw attachment for lea test were modified to yield better results.

The incidence of seed coat fragments (SCF) in ginned cotton was investigated on 20-30 more samples. It was observed that the chalazal and dehiscence zones are primarily responsible for the incidence of SCFs, with chalazal zone alone accounting for more than 90% of SCFs. The only varieties which exhibited higher incidence of SCFs due to dehiscence zone weakness were DCH.32 and SRT.1.

The investigations on the mechanical properties and wear comfort of apparel fabrics and their inter-relationships were continued during the year by undertaking measurements of cyclic bending, cyclic shear, compression and air permeability on 48 fabric samples. Fabric bending, shear and compression behaviour were found to be well correlated with fabric properties such as, thickness and either fabric porosity or the cover factor. Air permeability is found to be increased by fabric porosity, in general. However, in blended fabrics, the intrinsic yarn porosity seemed to influence the passage of air through the fabric in addition to fabric porosity.

For the enumeration of morphological deformities of cotton fibres in relation to space constraint in developing cotton bolls, homogenous samples were prepared from dried fibres extracted from unopened bolls of 16 varieties used for the determination of space constraint index. Individual fibres of three varieties from among these samples were examined under SEM. It was seen that a large number of various types of deformities were present, especially the types which fall under V-bend and U-bend categories.

Analysis of the results obtained from measurements of physical and fine structural properties of cotton fibres colleced at different stages of growth indicated that during the inermediate phase ranging for about 10 days from 25 days post-anthesis, cotton fibres show poorer crystalline and molecular organisation than during preceeding and succeeding phases.

A simple method has been standarised for preparing specimens for the study of fibre base profiles in cotton by electron microscopy. The method comprises treatment of seed cotton in alkali followed by dehydration thus avoiding the intermediate step of fixation as in conventional methods.

An investigation was undertaken for the infrared spectral characteristics of amorphous and recrystallized cellulose

with special reference to the new band at 1590 cm^{-1} and it was observed that the band that appears at 1590 cm^{-1} during storage/heating in the infrared spectrum of amorphous cellulose films prepared by saponification of cellulose triacetate films does not seem to be due to H-bonding as claimed by earlier workers. Studies made with cellulose powders of various amorphity levels suggested that the peak might be due to ionised carboxy group (COO^-) produced by the reaction of residual alkali present in the film with acidic groups already present in cellulose.

The study on frictional behaviour of cotton fibres and its dependence on intrinsic fibre properies were continued during the year. Twenty cottons covering various levels of maturity and fineness were subjected to test for determination of coefficient of friction by adopting the procedure standardised at CIRCOT. The analysis of the data indicated that (i) among the fibre properties, only fineness has a significant correlation with coefficient of friction (ii) multiple regression of fineness and tenacity on one hand and maturity on the other with coefficient of friction is also statististically significant (iii) among the cottons tested, *G. barbadense* varieties have low coefficient of friction of the order of 0.395, whereas, PUSA hybrid varieties have very high values of the order of 0.540.

The study on the structure and properties of natural cellulosic fibres other than cotton was continued during the year and it was observed that bundle tenacities of the natural fibres did not show abrupt fall on increasing the gauge length from zero to 3.2 mm. Tenacities of single fibres at 50 mm gauge length was either higher than that at 3.2 mm or remained nearly the same except for flax and ramie fibres. In each case after normalising with respect to the area of cross section, thicker fibres showed higher force of bending. X-ray angle correlated well with fibre extensibility, while dynamic modulus showed good correlations with crystallinity and extensibility.

In connection with an analytical study of wax in Indian cottons, quantitative estimation of wax on ten more samples were carried out. Major fractions of cotton was also determined using thin layer chromatographic technique ann quantitatively estimated. Detailed composition of each fraction of wax was also estimated employing gas liquid chromatography technique. There was considerable variation in the composition of wax among different varieties.

Cotton fabric samples were given anti-crease/anti-soiling finishing treatments. DMDHEU/Glyoxal were used as crosslinking agents. Carboxymethyl cellulose was used as antisoiling agent. To improve wash fastness of the finish, sodium hydroxide, zinc acetate and a commercial fixing agent were used. Control and finished samples were evaluated for add-on strength, wash fastness of the finish, degree of soiling, degree of soil removal and wettability.

For a study on the effect of laundering on physical and mechanical properties of chemically treated fabrics, two

experiments, one for optimising the washing temperature and the other for assessing the effect of laundering on properties of antisoil treated fabrics were conducted on cotton, polyester, polyester/cotton fabrics. In the first experiment it was observed that cleaning efficiency was higher at higher temperature with a decrease in abrasion resistance. Detergents were more efficient compared to detergent cakes and soaps. It was found that 60°C temperature was optimum for washing performance for all soaps/detergents. In the second experiment it was observed that antisoiling treatments did not improve the reflectance % values on washing compared to corresponding control and fabric quality deteriorated in terms of tearing strength and abrasion resistance.

In connection with the investigation for the assessment of finishing conditions for knitted fabrics from different varieties of cotton, carded cotton yarns spun to 20s count from different varieties were knitted to single jersey fabrics under identical conditions. The knitted fabric samples were kiered by open boiling with 1% alkali and then bleached with sodium hypochorite solution. Reflectance measurements were carried out on gray, kiered and bleached fabrics.

Cellulase produced by *Penicillium funiculosum* in a 5 litre fermenter under optimum conditions of growth was used to isolate starch from potato at various enzyme concentrations and incubation periods. The results indicated that the cellulase could hydrolyse readily the cell walls of potato tissue and release the starch in the system. Further the release of starch increased with increase in enzyme concentration as well as with time. In 4 hr, 63% starch could be released. Xylanase activity of filterate was also studied. Production of cellulase in one litre fermenter was studied under both controlled and uncontrolled pH. The results show that there was no effect on cellulase production due to change in pH.

Screening of cottonseed proteins for amino acid analysis from the germ plasm collections of CICR indicated that glutamic acid is the dominant factor and the least dominant is cystein Proline is high in a few varieties.

Studies on the thermal stability of cotton seed oil revealed that (i) Intermittent heating of oil results in more deterioration of the oil than the continuous heating (ii) Heating of cottonseed oil at 200°C results in increased peroxide value and increased anisidine value (iii) Viscocity of the oil increases on heating and the increase is proportional to the heating time. (iv) Iodine value of the heated oils decreases with increase in heating time. (v) The polymers which was detected in cottonseed oil increase with increase in heating time. (vi) Oil uptake of the fried food increases with increase in the exposure time of the oil to heat. (vii) Blending cottonseed oil with coconut oil and tile oil showed better thermal stability as compared to cottonseed oil alone. (viii) Inter-esterification of the blends further improved the thermal stability.

In order to study the effect of pretreatments on the properties of linters of different cotton varieties, delinting and completed for all the linter samples. Linter samples of LRA 5166, H.8, Bikaneri Narma, SRT.1 and DCH.32 were kiered under three conditions, viz. 1.5% 2.5% and 3.5% NaOH concentration and kiering loss was determined. Whiteness and D.P. values of kiered samples of LRA.5166, H.8 and Bikaneri Narma were also determined. Bleaching was done on three conditions and whiteness values determined.

For the execution of the large scale trials planned at M/s. Ellora Paper Mills Ltd., Tumsar for the manufacture of Kraft paper from cotton plant stalk for CFB boxes preparation, about 8 tonnes of cotton stalks have been collected and are being chipped at CICR, Nagpur. Laboratory scale pulping trial was conducted to prepare pulp from cotton stalks using 12% Urea and a combination of Urea and NaOH (10% Urea and 2% NaOH).

With a view to explore the possibility of preparing good quality paper sheets from cotton stalks on a large scale through anaerobic digestion, trials were undertaken on 20 kg of bleached pulp of cotton stalks processed through anaerobic digestion. Hand-made paper sheets were made using the pulp and greeting cards were printed using the above paper after marbling using different colours.

Scale up trials of oyster mushrooms crop on cotton stalks revealed that cotton plant stalks can be used as a substratum for spawn preparation with nutrient supplementation and that smaller size (1 kg) of the substrate is better during both ideal and adverse climatic conditions in respect of yield of mushroom. Cotton seed meal and soyabean meal are better than other nutrients tested at 3% concentration.

The studies on the production of biogas from willowdust were continued and an efficient process for gas generation has been developed involving mixed microbial consortia with which about 400 cu. m. of biogas could be obtained from one tonne of willow dust in 60 days. Popularisation of the technology is under-way.

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Personnel

Major events during 1992-93 under personnel function at CIRCOT are given below:

A. Appointments

Sr. No.	Name	Grade	Effective date of appointment
		Technical Staff	
1.	Shri E. A. Pachpinde	Technical Officer T-6	9-04-1992
2.	Shri Amar Pal	Sr. Technical Assistant T-4	9-04-1992
3.	Kum. S. S. Nagwekar	Technical Assistant T-II-3	7-05-1992
4.	Shri V. N. Bhorkar	Technical Assistant T-II-3	25-05-1992
5.	Shri D. R. Kunder	Technical Assistant T-II-3	6-06-1992
6.	Shri D. U. Kamble	Technical Assistant T-II-3	10-06-1992
7.	Kum. Bindu Chellapan	Technical Assistant T-II-3	5-11-1992
8.	Kum. P. B. Subasri	Technical Assistant T-II-3	16-11-1992
9.	Shri C. V. Shivgan	Technician G.T-I	1-03-1993
		Administrative Staff	
1.	Shri S. V. Kasbe	Junior Clerk	12-05-1992
2.	Shri J. I. Parmar	Senior Clerk	3-11-1992
		Auxiliary Staff	
	Shri B. H. Umredkar	Machine Operator	6-06-1992
		Supporting Staff	
1.	Shri C. D. Acharekar	Supporting Staff Gr. I	8-06-1992
2.	Shri K. D. Rathod	Supporting Staff Gr. I	1-03-1993

B. ASSESSMENTS

Scientific Staff

The five yearly assessment of eligible ~~technical~~ Scientific staff was made and promotions/advance increments granted as given below :

Sr. No.	Name	Grade to which promoted	Effective date of promotion
	Dr. V. G. Khandeparkar	Scientist S-3	1-07-1982

Technical Staff

The five yearly assessment of eligible ~~scientific~~ Technical staff was made and promotions/Advance increments granted as given below :

Promotions

Sr. No.	Name	Grade to which promoted	Effective date of promotion
1.	Shri V. M. Kulmethe	Technical Officer T-5	1-7-1992
2.	Shri P. K. Mandhyan	Technical Officer T-5	1-7-1992
3.	Shri D. L. Upadhye	Sr. Technical Assistant T-4	1-7-1984
4.	Smt. K. K. Kale	Technician T-I-3	1-7-1992
5.	Shri P. G. Kadam	Wireman T-2	1-7-1992

Advance Increments

Sr. No.	Name	Grade	No. of advance increments	Effective date of increment
1.	Smt. S. V. Sukhi	T-5	One more advance increment (Total 3)	1-7-1992
2.	Shri V. B. Suryanarayan	T-5	One more advance increment (Total 3)	1-7-1992
3.	Shri R. M. Modi	T-5	One more advance increment (Total 3)	1-7-1992
4.	Smt. P. A. Dabholkar	T-5	Two advance increments	1-7-1992
5.	Shri G. G. Mistry	T-4	One advance increment	1-7-1992
6.	Shri M. T. Danolli	T-4	Three advance increments	1-7-1992

Sr. No.	Name	Grade	No. of Advance Increments	Effective date of increments
7.	Shri N. V. Bansode	T-4	Two advance increments	1-7-1992
8.	Shri P. B. Gurjar	T-4	One advance increment	1-7-1991
9.	Shri D. L. Upadhye	T-II-3	Two advance increments	1-7-1981
10.	Shri D. L. Upadhye	T-II-3	One more advance increment (Total 3)	1-7-1982
11.	Shri H. B. Tambe	T-I-3	One more advance increment (Total 3)	1-7-1992
12.	Shri B. B. Gaykar	T-2	One advance increment	1-1-1992
13.	Shri S. B. Kamble	T-2	One advance increment	1-1-1992
14.	Shri P. N. Raut	T-1	Two advance increments	1-7-1992

C. PROMOTIONS

Administrative Staff

1. Smt. S. D. Ambre to the post of Assistant w.e.f. 8-4-1992.

2. Shri N. V. Kambli to the post of Senior Clerk w.e.f. 8-4-1992.

Auxiliary Staff

Shri A. R. Bane and T. S. Mhaske to the post of Machine Operator w.e.f. 16-1-1993.

Supporting Staff

1. Shri B. K. Sawant to the post of S.S. Gr. III w.e.f. 10-4-1992.

2. Shri Satyanarayan Gope to the post of S.S. Gr. II w.e.f. 9-6-1992.

3. Smt. Birmo Ramkishan Balmiki to the post S.S. Gr. II with effect from 23-11-1992.

4. Shri N. J. Kharat and M. Y. Chandanshive to the post of S.S. Gr. III w.e.f. 23-1-1993.

D. TRANSFER

Technical Staff

1. Shri M. T. Danolli, Technical Assistant T-II-3 from Q.E. Unit, Sirsa to Q.E. Unit, Dharwad w.e.f. 16-4-1992.

2. Shri K. Venkanna, Technical Assisant T-II-3 from Q.E. Unit, Dharwad to Q.E. Unit, Guntur w.e.f. 14-5-1992.

3. Shri K. Thiagarajan, Technical Assistant T-II-3 from Q.E. Unit, Guntur to Q.E. Unit, Coimbatore w.e.f. 1-6-1992.

4. Shri Jal Singh, Technical Assistant T-II-3 from Q.E. Unit, Hissar to Q.E. Unit, Sirsa w.e.f. 2-11-1992.

5. Shri A. K. Singh, Technical Assistant T-II-3 from Q.E. Unit, Sirsa to IARI, New Delhi w.e.f. 7-11-1992.

6. Shri P. N. Raut, Electrician T-1 from GTC, Nagpur to Q.E. Unit, Coimbatore w.e.f. 15-3-1993.

E. RESIGNATION/TERMINATION OF SERVIVE

1. Shri Jayaprakash Narayan H.S., Sr. Technical Assistant T-4 resigned from service w.e.f. 8-6-1992.

2. Shri D. R. Kunder, Technical Assistant T-II-3 resigned from service w.e.f. 12-10-1992.

Administrative Staff

Shri Niraj Kumar Dixit, Assistant (Hindi) resigned w.e.f. 7-11-1992.

Supporting Staff

Shri V. T. Tambade S.S. Gr. I resigned w.e.f. 4-5-1992.

F. RETIREMENT

Scientific Staff

1. Shri B. Srinathan, Principal Scientist, retired voluntarily from service w.e.f. 30-4-1992 (1-5-1992 F N).
2. Smt. J.K.S. Warrier, Scientist (Sr. Scale) retired from service w.e.f. 30-6-1992.

Technical Staff

1. Shri C. P. Venugopalan, Technical Officer T-5 retired from service w.e.f. 30-11-1992.

2. Shri N. O. Anthony, Sr. Technical Assistant Gr. T-4 retired from service w.e.f. 31-3-1993.

G. DEPUTATION

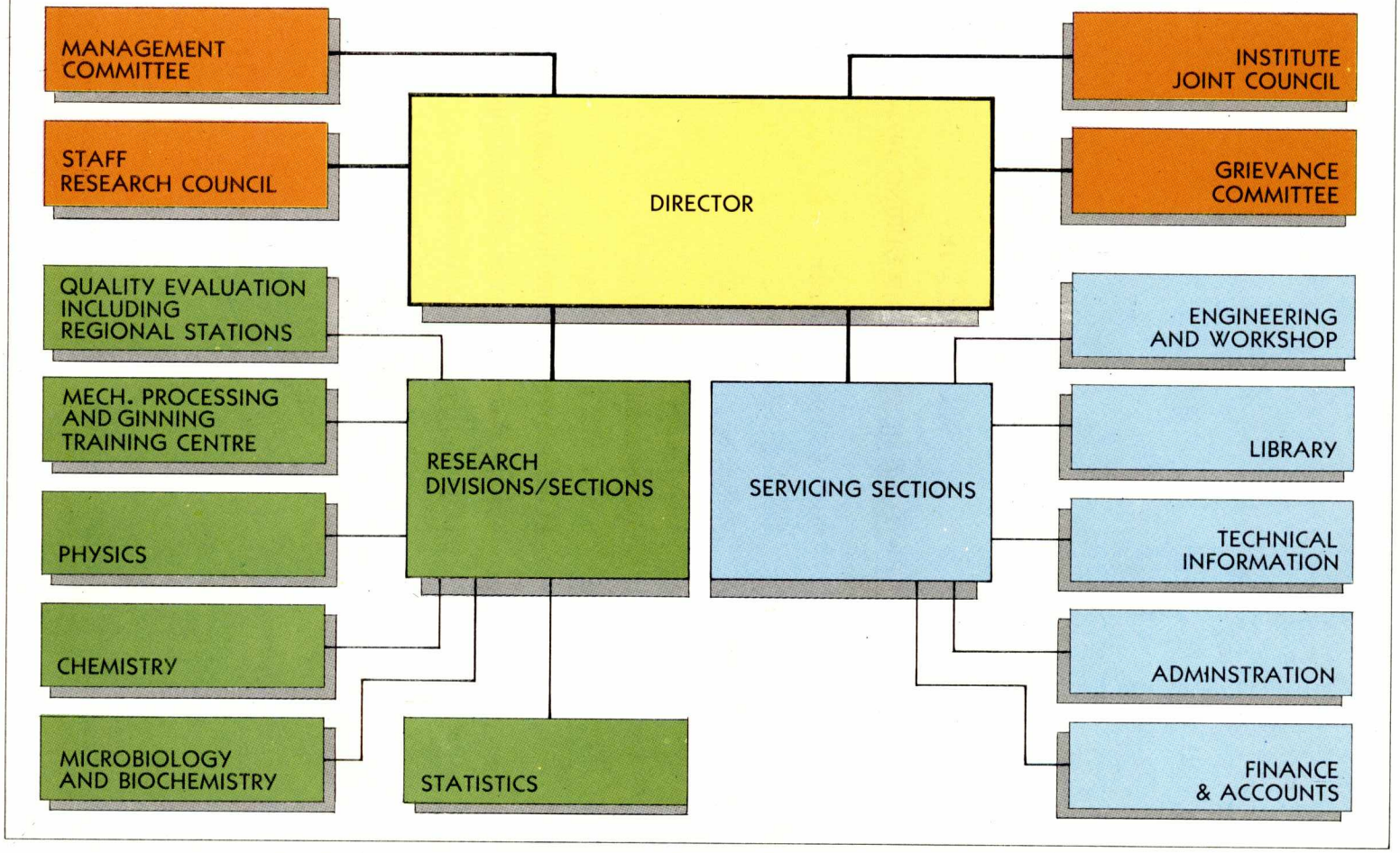
Shri A. J. Shaikh, Scientist (S.G.) was deputed Singapore for three days for training in the operation and maintenance of Gas Liquid Chromatograph from October 21-23, 1992.

8. Annexures

ANNEXURE — I

CENTRAL INSTITUTE FOR RESEARCH ON COTTON TECHNOLOGY

ORGANISATION CHART



ANNEXURE – II

NEW EQUIPMENTS ADDED DURING 1992-93

Star Yarn Evenness Tester

Shrinkage Tester

Stelometer

Yarn Fatigue Tester

Air Permeability Tester

Fatigue Tester for Fabrics

Electronic Thermal Conductivity Apparatus

Modular Dual Column Gas Chromatograph

PERL'X–3 Fusion Bead Machine

Personal Computer PC/AT with Printer

ANNEXURE — III

FINANCIAL STATEMENT

EXPENDITURE AND RECEIPTS OF THE INSTITUTE DURING 1992-93

		Sanctioned Grant	Actual Expenditure	Savings(—) Deficit(+)
		Rs.	Rs.	Rs.
	A. EXPENDITURE			
I.	CIRCOT including Q.E. Units (Non-Plan)			
	(a) Capital expenditure including expansion of the Institute	3,14,156	3,14,156	—
	(b) Working expenditure	1,58,75,844	1,58,76,126	(+) 282
		1,61,90,000	1,61,90,282	(+) 282
II.	(Plan)			
	(a) Capital expenditure including expansion of the institute	42,77,534	42,77,534	—
	(b) Working expenditure	12,22,466	12,22,306	(—) 160
		55,00,000	54,99,840	(—) 160
III.	Emeritus Scientist Scheme of ICAR	33,866	34,901	(+) 1,035

B. RECEIPTS	
Sale proceeds of farm produce	41,770
Sale proceeds of vehicles, machines, tools, and plant and other non-consumable materials	25
Analytical and testing fees	5,11,850
Rent	1,38,184
Application fees from candidates in connection with recruitment and training	95,600
Sale of publications	1,034
Interest on loans and advances granted to Council's employees	58,523
Leave salary and pension contributions, etc.	10,435
Miscellaneous receipts	35,744
Summer Institute	—
Receipts for services rendered by the institute	—
Total	8,93,165

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Appendices

APPENDIX — I

STAFF WORKING AT THE CENTRAL INSTITUTE FOR RESEARCH ON COTTON TECHNOLOGY AS ON MARCH 31, 1993

(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. Dr. V. G. Munshi, M.Sc., Ph.D., F.T.A.
5. Shri M. S. Parthasarathy, M.Text (Bom.), M.Sc. Tech (Manch.), A.M.C.S.T. Rashtrabhasha Ratna

Senior Scientist/ Scientist (Selection Grade)

1. Shri Muntazir Ahmed, B.Sc., B.Text. (Text. Tech.)
2. Dr. R. H. Balasubramanya, M.Sc. (Agri)., Ph.D.
3. Smt. S. P. Bhatawadekar, M.Sc.
4. Dr. S. G. Gayal, M.Sc., Ph.D.
5. Shri G. F. S. Hussain, M.Sc.
6. Dr. (Smt.) P. Bhama Iyer, M.Sc., Ph.D.
7. Smt. J. K. Iyer, M.Sc.
8. Smt. Vatsala Iyer, M.Sc., M. Phil.
9. Dr. R. P. Nachane, M.Sc., Ph.D.
10. Smt. Prema Nair, M.Sc. (Agri.).
11. Dr. K. M. Paralikar, M.Sc., Ph.D., F.R.M.S.
12. Shri B. M. Petkar, M.Sc., D.C.M.
13. Kum. C. R. Raje, M.Sc.
14. Shri A. J. Shaikh, M.Sc.
15. Dr. S. Sreenivasan, M.Sc., Ph.D.
16. Dr. A. V. Ukidve, M.Sc., Ph.D., F.T.A.
17. Shri P. V. Varadarajan, M.Sc.
18. Dr. N. C. Vizia, M.Sc., Ph.D.

APPENDICES

Scientist (Sr. Scale)

1. Shri R. M. Gurjar, M.Sc.
2. Shri N. Thejappa, M.Sc.

Scientist

1. Shri P. Bhaskar, M.Sc.
2. Shri S. K. Chattopadhyay, B.Sc. Tech. (Text.), M. Tech. (Text. Engg.)
3. Shri A. K. Gupta, M.Sc., L.L.B., W.P.M.M.T.
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. Dr. (Smt.) Sujata Saxena, M.Sc., Ph.D.

Technical Personnel

Technical Officer T-6

Engineering

1 Shri H. U. Gangar, B.E. (Elect.) Grad. I E.T.E.

Quality Evaluation

1. Shri K. S. Bhyrappa, L.T.T., A.T.A.
2. Shri B. S. Ganvir, B.Sc.
3. Kum. I. K. P. Iyer, M.Sc.
4. Shri S. N. Nagwekar, B.Sc.

Technical Information

Shri T. K. M. Das, B.Sc., D.B.M., D.E.I.M., Dip. J., D.P.R., Cert. I.S.R.S.

Technical Officer T-5

Library

Smt. R. K. Shahani, B.Sc., B.Lib.

Photography

Shri R. M. Modi, S.S.C., Cert. in Photography

Quality Evaluation

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. & Air-Cond., 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, B.Sc.
9. Shri H. R. Laxmivenkatesh, D.T.T., A.T.A., L.T.I.
10. Shri P. K. Madhyan, B.Sc., A.T.A.
11. Smt. N. D. Nachane, B.Sc.
12. Dr. S. D. Pai, M.Sc., Ph.D.
13. Shri R. S. Pathare, B.Sc.
14. Shri D. Radhakrishnamurthy, M.Sc., M.Phil.
15. Shri K. B. Rajagopal, B.Sc.
16. Shri S. Sekar, B.Sc.
17. Smt. S. V. Sukhi, M.Sc., D.F.L. (German)
18. Shri V. B. Suryanarayanan, B.Sc., Dip. Ger.
19. Shri S. Vancheswaran, B.Sc.
20. 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. Shri D. N. Moon, B.Sc.
5. Shri D. L. Upadhye, S.S.C. (Tech.), N.C.T.V.T., I.T.I. & C.T.I.
6. Shri T. Venugopal, B.E. (Civil)
7. Shri G. Vijayan Iyer, Dip. Mech. Engg., Dip. Prod. Mgt., A.M.I.E. (Mech.)

Technical Assistant T-II-3

1. Smt. N. M. Ashtaputre, B.Sc.
2. Shri V. N. Bhorkar, B.Sc.
3. Kum. Bindu Chellappan, B.Sc.
4. Shri R. R. Chhagani, B.Sc.
5. Shri U. D. Devikar, B.Sc.
6. Shri Gopal B. Hadge, B.Sc.
7. Shri S. N. Hedau, B.Sc.
8. Shri V. D. Kalsekar, B.Sc.
9. Shri D. U. Kamble, B.Sc.
10. Kum. S. S. Kamerkar, B.Sc., M.Lib.
11. Shri H. S. Koli, B.Sc.
12. Shri M. Mohan, M.Sc., Dip. J.
13. Shri V. V. Murudkar, L.T.M.
14. Shri R. D. Nagarkar, M.Sc.
15. Kum. S. S. Nagwekar, M.Sc.
16. Smt. Nirupama Panda, M.Sc.
17. Shri R. S. Prabhudesai, B.Sc., D.C.M.
18. Shri B. R. Pawar, B.Sc.
19. Shri P. N. Sahane, D.I.F.T.
20. Smt. Sheela Devi Raj, M.Sc.
21. Kum. P. B. Subasri, B.Sc.
22. Shri S. Kumar Subramaniam, B.Sc.
23. Smt. Sugatha Padmanabhan, M.Sc.
24. Shri M. V. Vivekanandan, B.Sc.

Technical Assistant 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)

APPENDICES

Auxiliary Personnel

1. Shri V. V. Kshirsagar,* S.S.C., I.T.C., Cert. Elec. 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. Nokhai* (Operator, T-I-3)
8. Shri H. K. Pawar* (Operator, T-I-3)

Operator T-2

1. Shri D. B. Gadankush*
2. Shri S. G. Shinde*

Driver

Shri B. B. Gaykar* 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. Kadam
7. Shri R. R Khurdekar
8. Shri 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

Administrative Personnel

Administrative Officer

Shri M. K. Jain, B.Sc.

Finance and Accounts Officer

P. Bhaskaran, M.A., L.L.B.

Assistant Administrative Officer

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

Superintendent

1. Shri K. Sudhakaran
2. Shri D. P. Naidu
3. Shri G. Moosad, B.Com.

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* Holding Technical post as Personal.

Assistant

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

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. Kum. K. B. Patne

Senior Clerk

1. Smt. S. M. Desai
2. Shri A. P. Natu
3. Smt. J. J. Karanjavkar
4. Shri E. T. Gurav
5. Shri K. Parleshwar
6. Smt. S. R. Shirsat, B.A.
7. Shri N. V. Kambli (Ad-hoc)

Junior Clerk

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

APPENDICES

Supporting Staff Gr. III

1. Shri Chatrapal Mhatri
2. Shri S. A. Waghela
3. Shri B. K. Sawant
4. Shri N. J. Kharat
5. Shri M. Y. Chandanshive

Supporting Staff Gr. II

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

Supporting Staff Gr. I

1. Shri M. A. Rashid
2. Shri C. S. Salvi
3. Shri C. P. Solanki
4. Shri M. J. Sumra
5. Shri K. T. Mahida
6. Shri R. R. Gosai
7. Shri R. S. Rane
8. Shri T. B. Khan
9. Shri H. B. Vesmiya
10. Shri P. G. Ghogale
11. Shri S. S. Angane
12. Shri L. S. Takkar
13. Shri M. M. Katpara
14. Shri G. N. Mayawanshi
15. Shri S. K. Bobate
16. Shri P. P. Patil
17. Shri Ramnivas G. Tak
18. Shri R. P. Karkate
19. Shri S. B. Worlikar
20. Shri N. D. Walzade
21. Shri M. M. Kadam
22. Shri S. G. Phalke
23. Shri S. N. Bandre
24. Shri D. G. Gole
25. Shri S. K. Parab
26. Shri C. D. Aacharekar

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 (Quality Evaluation)	:	Shri A. K. Antony, B.Sc.
Technical Officer T-5 (Quality Evaluation)	:	Smt. Santa V. Nayar, B.Sc.
Senior Technical Assistant T-4	:	Shri S. Venkatakrishnan, M.Sc., A.T.A.
Technical Assistant T-II-3 Auxiliary Staff	:	Shri K. Thiagarajan, M.Sc.
Operator T-I-3	:	Shri K. V. Nair
Electrician T-1	:	Shri P. N. Raut, S.S.C. (Tech.), H.S.C., Dip. Elect. Eng., N.T.C., N.A.C., N.C.T.V.T.
Supporting Staff Grade IV	:	Shri N. Arumugham
Supporting Staff Grade III	:	Shri V. M. Subramanyan

DHARWAD

Technical Officer T-6 (Quality Evaluation)	:	Shri E. S. Abraham, B.Sc.
Sr. Technical Assistant T-4	:	Shri M. T. Danoli
Technical Assistant T-II-3	:	Shri K. Narayanan, B.Sc.
Supporting Staff Grade I	:	1. Shri C. J. Bagalkoti 2. Shri A. F. Gudadur

GUNTUR

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

APPENDICES

HISAR

Technical Officer T-5	:	Dr. V. K. Madan, M.Sc., Ph.D.
Senior Technical Assistant T-4	:	Shri Amarpal, B.Sc.
Supporting Staff Grade IV	:	Shri Gian Singh

INDORE

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

LUDHIANA

Technical Officer T-8 (Quality Evaluation)	:	Shri Ram Parkash, B.Sc., L.L.B.
Technical Assistant T-II-3	:	Shri Hamid Hasan, M.Sc.
Supporting Staff Grade III	:	Shri Kammikkar Singh
Supporting Staff Grade II	:	Shri Satyanarayan Gope

NAGPUR

Scientist (Selection Grade)	:	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. Yadav, Dip. Mech, Engg. 3. Shri M. Bhaskar, Dip. in 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. Palorkar, B.A. 3. Shri S. A. Telpande, M.Com.
Driver (Auxiliary)	:	Shri R. A. Suddawar
Machine Operator	:	Shri B. H. Umredkar
Supporting Staff Grade 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 I. P. Tomaskar 7. Shri M. P. Tohokar

NANDED

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

SIRSA

Technical Officer T-6	:	Shri E. A. Pachpinde, M.Sc.
Technical Assistant T-II-3	:	Shri Jalsingh, M.Sc.
Supporting Staff Grade 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 Grade IV	:	Shri Vijendra Singh
Supporting Staff Grade III	:	Shri Sanwarmal Saini

SURAT

Scientist	:	Shri Y. Subramanyam, M.Sc.
Technical Officer T-5	:	Shri M. C. Bhalod, B.Sc.
Senior 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 Grade 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, 1993

Group/Class	Permanent / Temporary	Total No. of employees	Scheduled Castes	Scheduled Tribes	Remarks
Gr. A. (Class I)					
Permanent					
(i) Other than lowest rung of Cl. I		28	1	—	—
(ii) Lowest rung Cl. I		19	3	—	—
Total		47	4		
Temporary					
(i) Other than lowest rung of Cl. I		—	—	—	* Fin & Accounts Officer
(ii) Lowest rung Cl. I		3*	1	—	* on deputation
Total		3	1		
Gr. B. (Cl. II)	Permanent	45	5	1	
	Temporary	2	—	—	
Gr. C. (Cl. III)	Permanent	108	23	7	
	Temporary	14	—	—	
Gr. D. (Cl. IV) (Excluding Safaiwala)	Permanent	63	12	4	
	Temporary	3	1	—	
Gr. D. (Cl. IV) Safaiwala	Permanent	8	8	—	
	Temporary	1	1	—	

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 1992-93

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+1)
			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	1	1	1	—	1	—	—	—	—	—	—
Lowest rung of Group A	—	—	—	—	—	—	—	—	—	—	—
Group B	—	—	—	—	—	—	—	—	—	—	—
Group C	13	13	4	—	3	—	—	—	—	—	—
Group D (Exc. Sweepers)	4	4	1	—	1	—	—	—	—	—	—
Group D (Safaiwalas)	—	—	—	—	—	—	—	—	—	—	—

SCHEDULED TRIBES

	No. of vacancies reserved Out of Col. 2	Out of Col. 3	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)
	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	—	—	—	—	—	—
Group D (Encl. 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+1)
			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	4	4	2	—	2	—	—	—	—	—	—
Group D (Exc. Sweepers)	4	4	1	—	1	—	—	—	—	—	—
Group D (Safaiwalas)	1	1	1	—	1	—	—	—	—	—	—

SCHEDULED TRIBES

	No. of vacancies reserved Out of Col. 2	Out of Col. 3	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)
	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 (Encl. 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+1)
			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 (Exc. Sweepers)	—	—	—	—	—	—	—	—	—	—	—
Group D (Safaiwalas)	—	—	—	—	—	—	—	—	—	—	—

SCHEDULED TRIBES

	No. of vacancies reserved Out of Col. 2	Out of Col. 3	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)
	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 (Encl. Sweepers)	—	—	—	—	—	—	—	—	—
Group D (Safaiwalas)	—	—	—	—	—	—	—	—	—