COTTON TECHNOLOGICAL RESEARCH LABORATORY

Indian Council of Agricultural Research

Annual Report
1985

BOMBAY

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1. INTRODUCTION

Cotton Technological Research Laboratory (CTRL) formerly known as the Technological Laboratory was founded in the year 1924 by the *erstwhile* Indian Central Cotton Committee — one of the Commodity Committees established under the Ministry of Food and Agriculture, Government of India to look into agriculture and marketing activities of cotton in India. When the idea of establishing a Cotton Research Laboratory was conceived and implemented, the objectives were two-fold:

(a) to undertake spinning tests on various strains of cotton received from Departments of Agriculture in different parts of the country;

(b) to carry out tests for the fibre properties of cotton so as to relate these fibre properties with the spinning values of cotton; and

the Laboratory was functioning in close collaboration with the Departments of Agriculture in various states for accomplishing the tasks assigned to it. With the abolition of Commodity Committees including ICCC in 1966, CTRL came under the administrative control of Indian Council of Agricultural Research (ICAR). Since then, research efforts were reoriented, well coordinated and intensified keeping in line with the overall responsibility of ICAR to undertake, aid, promote and coordinate agricultural and animal husbandry research and education and its application in practice. The years that followed witnessed concerted efforts to produce more and better quality cottons and also to increase better utilisation of cotton lint as well as cotton plant by-products in collaboration with Cotton Breeders and Agricultural Scientists in the country. These endeavours not only made cotton cultivation more lucrative and created employment avenues to rural masses, but also created a general impact on the economy of the country by way of saving in foreign exchange by reduced import of cotton and increased export of cotton and finished textile goods.

The chief functions of CTRL are:

1. To participate actively in the programmes for improvement in 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 carrry out research investigation on the ginning problems of cotton.
4. To investigate the greater and better utilisation of cotton, cotton waste, 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

Director is the head of the institution assisted by a team of Senior and Junior Scientists and Technical Officers in various grades. One Administrative Officer and two Assistant Administrative Officers assist Director in matters of General Administration, while for financial aspects and internal audit, he is assisted by an Assistant Accounts Officer. An organisational chart is given in Annexure I.

Library

CTRL maintains an up-to-date library of books on cotton, cotton technology and allied subjects. The total number of books by the end of December, 1985 remained at 3729 with the addition of 98 books during the year. With the addition of 196 bound volumes of journals in 1985, the total number of bound volumes of journals in the library was 4716. The library received regularly about 200 journals covering a wide range of topics related to various areas of science including Textiles; of which 105 (66 foreign and 39 Indian) were received by way of subscription and the remaining by exchange basis or as complimentary. Apart from scientists and technical personnel of the laboratory, the library facilities were utilised by students from colleges, other research institutions and personnel from industry. Inter-library loan facilities were maintained with other libraries in Bombay.

ODA Books Presentation Programme:

CTRL received 96 books on textiles and other fields under the book presentation programme of the Overseas Development Administration of Her Majesty's Government of U.K., which was mainly meant to provide books to important educational training and research institutions to supplement their existing resources. We are thankful to the British Council Division of the British High Commission for this cordial jesture of recommending the name

of CTRL for availing of the facility of the book presentation programme. We look forward to such patronage in future also.

New Equipments Purchased

A list of some of the new equipments purchased during 1985 has been given in Annexure II.

Distinguished Visitors

Many dignitaries from India and abroad which included ICAR officials, visited the Laboratory during 1985, apart from group visits by students of various colleges and research workers. A list of some of the distinguished visitors to the Laboratory is given in Annexure III.

Management Committee

The Management Committee of CTRL met twice during the year, first in May and the second in September, 1985.

In the first meeting, inauguration of the Ginning Training Centre of CTRL was discussed and a decision was taken that the inauguration may be held some time in the month of November-December, 1985. The Committee also discussed in detail, certain modifications suggested to the present allotment rules for staff quarters and accepted certain pertinent suggestions.

The second meeting was held on September 12, 1985 and various items like progress of expenditure on Plan/Non-Plan were discussed. The Committee also discussed about the inadequacy in the funds position in CTRL and suggested that ICAR may be approached to provide additional funds to tide over the prevailing situation.

A detailed discussion on the multi-storeyed building took place at the meeting. While concluding the discussion, the Committee suggested that the matter regarding NOC may be taken up at the Municipal Commissioner's level to obtain NOC to enable the old lease deed amended.

The Management Committee also recommended to initiate action to have the inauguration of the Ginning Training Centre some time in the month of December, 1985.

Purchase of a photocopier machine was recommended by the Management Committee. A few suggestions to modify the emblem of the Laboratory was also made.

Staff Research Council

The eighty-fourth meeting of the Staff Research Council was held in five preliminary sessions on April 10, 12, 17, 22 and 29, 1985 and a final session with the Management Committee on September 12, 1985. At the preliminary sessions held discipline-wise, progress of research on the on-going projects as well as new research project proposals for the year 1985 was discussed in detail and observations/recommendations, etc. were made. At the final session, the observations/recommendations of the preliminary sessions were placed for approval. Dr. V. Sundaram, Director chaired all the sessions. While Divisional Heads and Management Committee members from CTRL attended all the discipline-wise sessions, scientists, Quality Evaluation and Technical Officers attended only the concerned sessions. In the final session with the Management Committee Members, where a programme of work for 1985, was finalised, scientists S-2 and above attended.

In addition, at every meeting of the Management Committee, progress of research and consideration of new project proposals, if any, used to be one of the items in the agenda and detailed discussions on them were regularly being carried out at the Management Committee Meetings.

Research Projects

There were 31 on-going research projects during 1985 apart from six common laboratory projects and two inter-institutional projects. The two inter-institutional projects were as follows:

1. Durable Flame Retardant (FR) finishes for textiles.
2. Technological evaluation of germ plasm material.

Extension work for the former project has been taken up as a result of the success of the development of the new process, at different textile mills using various types of fabrics, apart from undertaking processing work for imparting flame retardancy on about 20,000 metres of special type fabric having initial high tear strength supplied by Defence authorities, from Poona.

As far as the latter project is concerned, considerable amount of germ plasm materials has already been screened and reports issued.

Integrated Cotton Development Project

As reported in earlier years, an Integrated Cotton Development Project was initially sanctioned for a period of 5 years with effect from November 30, 1976 and under this Project, CTRL had been entrusted with the responsibility for

organising a Ginning Training Centre at Nagpur, with a total provision of 32.32 lakhs. Subsequently, the project was extended for a further period upto March 31, 1985, and an amount of Rs. 20.40 lakhs was sanctioned during the Fourth Plan period from 1980 to 1985. Major activities during the extended period of one year were as follows:

Construction work

(i) *Buildings*

As already mentioned in the last Report, the Punjabrao Krishi Vidyapeeth (PKV) had placed at the disposal of ICAR land on the Nagpur-Amravati Road for construction of buildings for ICAR Institutes. Construction of godown for **kapas** storage was completed a couple of years ago. The construction of building for housing Ginning and Pressing Machinery is also over. Some additions and alterations proposed in this building to enable installation of testing and spinning equipments have also been completed. Action also has been initiated to install a plant for providing conditioned atmosphere (27°C temperature and 65% relative humidity) to the Testing and Spinning Section. There has been an inordinate delay in the procurement of this plant by CPWD though the amount was paid in 1983 itself.

As regards Trainees' Hostel, an estimate of Rs. 13,67,960 for a common building for the trainees of CTRL and NBSS & LUP (of which the share of CTRL was about Rs. 5.2 lakhs) was forwarded to ICAR for approval and the Council's approval was received. The first instalment of Rs. 1.30 lakhs has been paid to CPWD during 1983-84. However, the estimate has been revised by the CPWD recently to about Rs. 32 lakhs and therefore, this revised estimate is being sent to ICAR for approval.

As regards development of infra-structure such as water and power requirements for Ginning Training Centre, etc., four instalments totalling Rs. 10.5 lakhs have been paid to CPWD, Nagpur. The construction of roads and compound wall has been completed. A small structure has been constructed to house the electric sub-station.

(ii) *Equipments*

One 90-Saw Gin manufactured by M/s. Murray-Carver of Dallas (Texas), USA was installed and commissioned in Saw Gin Section. The ginning stand includes the saw gin, a super unit, pneumatic elevator, condenser, fans and piping. A 27" x 54" box size PUC press operated by a 25 HP hydraulic pump has also been installed.

In addition to the above imported machinery, some of the existing machinery comprising roller gins, precleaners and workshop machines initially

installed at CTRL, Bombay were transported to Nagpur and have been installed in the Ginning Training Centre. Of these, Double Cylinder Seed Cotton Opener (Platt Bros.), five cylinder I-type inclined cleaner, finishing extractor cleaner and CTRL extractor are installed in the pre-cleaning room. The double roller gin (Bajaj), CTRL Laboratory Model Gin and hand driven SR gin (Platt Bros.) are installed in Roller Gin Section. The workshop machinery includes two lathe machines, power saw and buffing machine.

The Centre is also equipped with a testing laboratory. The equipments provided in the testing laboratory include Uni-Spinner, Trash Analyser, Digital Fibrograph, Micronaire, Stelometer, Projection Microscope, Lea Testers, Wrap Block, etc. Orders have been placed with M/s. TAIRO, Baroda for a Miniature Card, Drawframe and Flyframe. Once these equipments are received, it would be possible to undertake miniature spinning trials on cotton samples.

The initial running of the Saw Gin and PUC press was carried out using AKH.4 cotton. The machinery was also demonstrated to Hon'ble Sardar Buta Singh, Minister for Agriculture, Government of India on the day of inauguration of the building.

(iii) *Staff*

The post of Scientist S-2 required for the Training Centre has been filled up and the incumbent joined duty in January, 1984. He has been supervising the erection of machinery as well as the construction work. One Scientist S-1 was also transferred from CTRL, Bombay to the Training Centre at Nagpur.

In so far as filling up of other posts is concerned, the Testing Unit has already been provided with some testing equipments and two technical assistants to carry out the tests. The equipments are now shifted to the testing section in the Ginning Training Centre. Out of the two assistants, one has since resigned. Proposals for additional technical staff were included in the Sixth Plan Proposals of CTRL and cleared by EFC but were not finally sanctioned due to ban on recruitment. Again, fresh proposals have been put forward in the EFC Memo of Seventh Plan and these are under process. Moreover, even the posts sanctioned earlier could not be filled due to the ban on filling up of vacant posts imposed by Government.

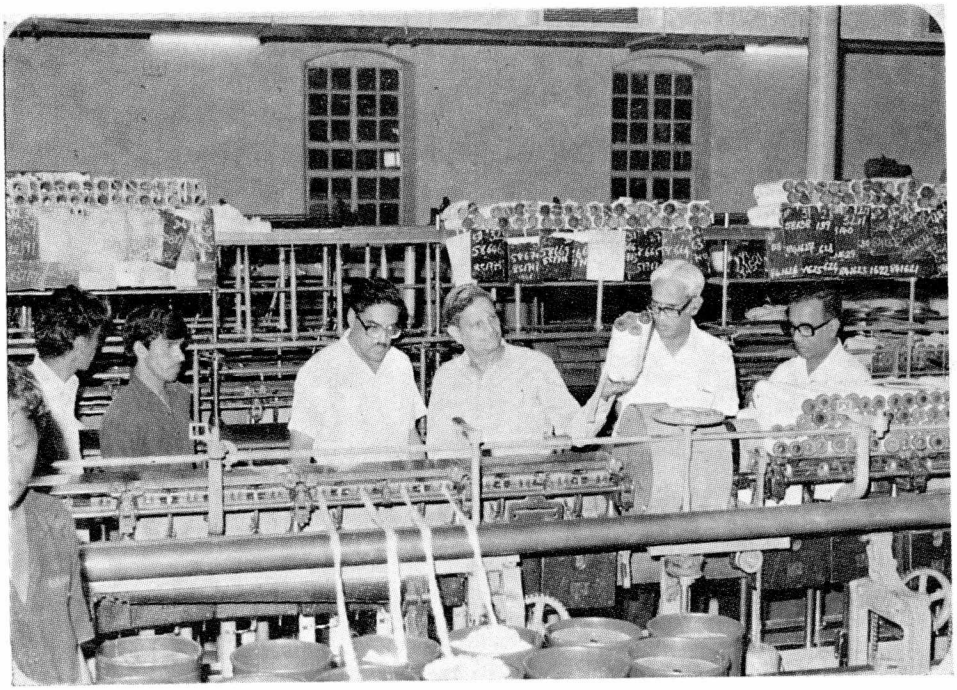
(iv) *Details of Training Courses Conducted*

As the scientist concerned was busy with erection of machinery, no training course was conducted during the year. However, ad-hoc advices were given to Ginning factories as and when requests were received. With the completion

PLATE I

SHRI P. N. RAU, SECRETARY, ICAR, VISITS CTRL

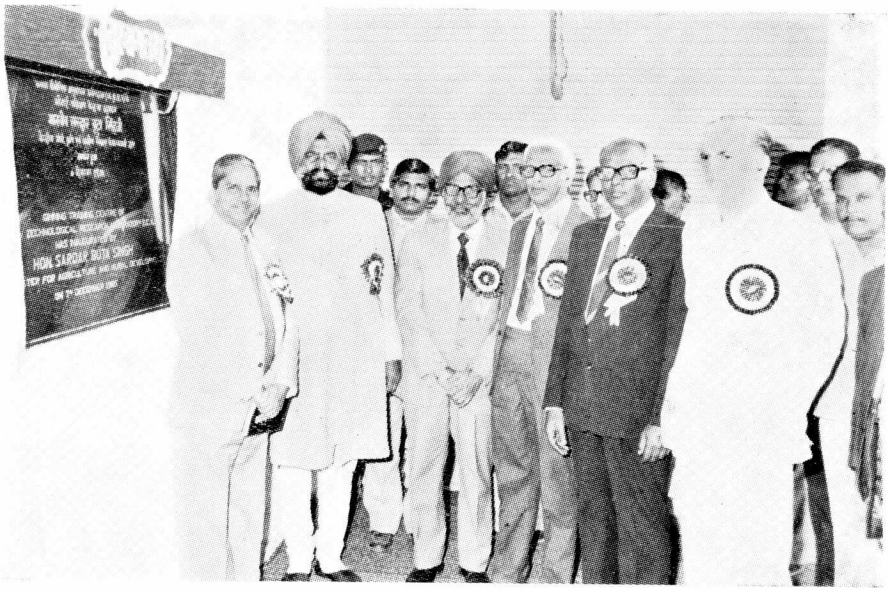
At the X-Ray Section



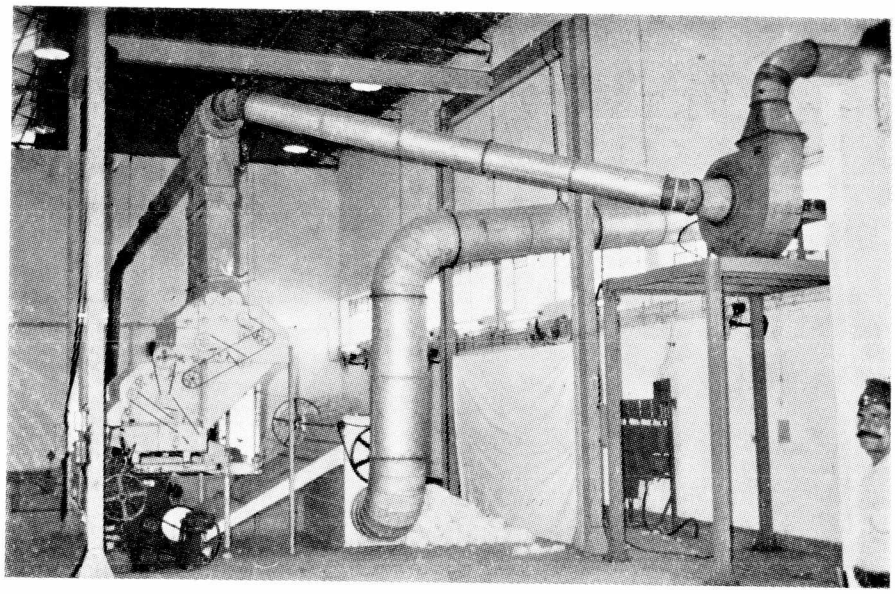
At the Mechanical Processing Division

PLATE II

INAUGURATION OF THE GINNING TRAINING CENTRE AT NAGPUR



Sardar Bhuta Singh, Hon'ble Minister for Agriculture and Rural Development with Dr. N. S. Randhawa, Director General, ICAR, Dr. M. V. Rao, Deputy Director General, ICAR, Dr. C. Kempanna, Assistant Director General, ICAR, Dr. N. S. Bhale, Director, Central Institute for Cotton Research, Nagpur, Dr. V. Sundaram, Director, CTRL and other dignitaries.



Saw Gin Installed at the Ginning Training Centre, Nagpur.

of the erection of saw gin, the Ginning Training Centre was formally inaugurated by Sardar Buta Singh, Hon'ble Minister for Agriculture and Rural Development in December, 1985. Plans are now being made to start the training programme in April/May, 1986. The period of training is tentatively fixed for two weeks and a course programme/syllabus drawn up.

Celebration of Hindi Day

Hindi day was celebrated on September 16, 1985 with the following programme:

Competitive tests on:

1. Pure Hindi Writing **(Shuddha Hindi Lekhan)**
2. General Knowledge **(Gyan Gammat)**
3. Quiz Programme on "What is the good word ?" **(Uchit Shabda Kya Hai ?)**
4. Hindi words writing (for Supporting Staff only)
5. Elocution Competition.

The final day function was presided over by Shri Ramvallabh Shastri, retired Assistant Editor, Nav Bharat Times. Prof. Ram Mhatre of Somaiya College, Vidyavihar and Shri Namvar Singh of Hansraj Morarji High School, Andheri, were the Chief Guests.

Cash prizes were awarded to successful participants in the Hindi competition.

Further, some enthusiastic members of CTRL took part in the open competitions arranged by the Town (Bombay City) Official Language Implementation Committee and many of the participants from CTRL secured prizes.

Hindi Teaching Scheme

During the year, one staff member had been nominated for undergoing training in Hindi stenography.

Post-Graduate Training

The recognition granted to CTRL by the University of Bombay as a Post-Graduate Institution was continued during the year for guiding students for M.Sc. and Ph.D. Degrees in Physics (Textiles), M.Sc. Degree in Physical

Chemistry and Organic Chemistry, M.Text. and Ph.D. Degrees in Textile Technology and Ph.D. Degree in Bio-Physics.

During 1985, twelve students were guided for M.Sc., of which two were for physical chemistry, two for organic chemistry and the remaining were for Physics (Textiles). One student was guided for M.Text. (Spinning), while guidance was given for Ph.D. to two students in Physics (Textiles) and two in Textile Technology.

Dr. V. Sundaram, Director, Dr. N. B. Patil, Senior Scientist (Physics), Shri M. S. Parthasarathy, Senior Scientist (Mechanical Processing), Dr. V. G. Munshi, Senior Scientist (Quality Evaluation), Dr. S. N. Pandey, Senior Scientist (Chemical Studies), Dr. K. R. Krishna Iyer, Senior Scientist (Physics), Dr. (Kum.) I. G. Bhatt, Senior Scientist (Chemical Studies) and Shri A. V. Ukidve, Scientist (Physics) continued as research guides for various degrees.

During the year, one student was awarded M.Sc. Degree in Physics (Textiles).

Membership on Other Organisations

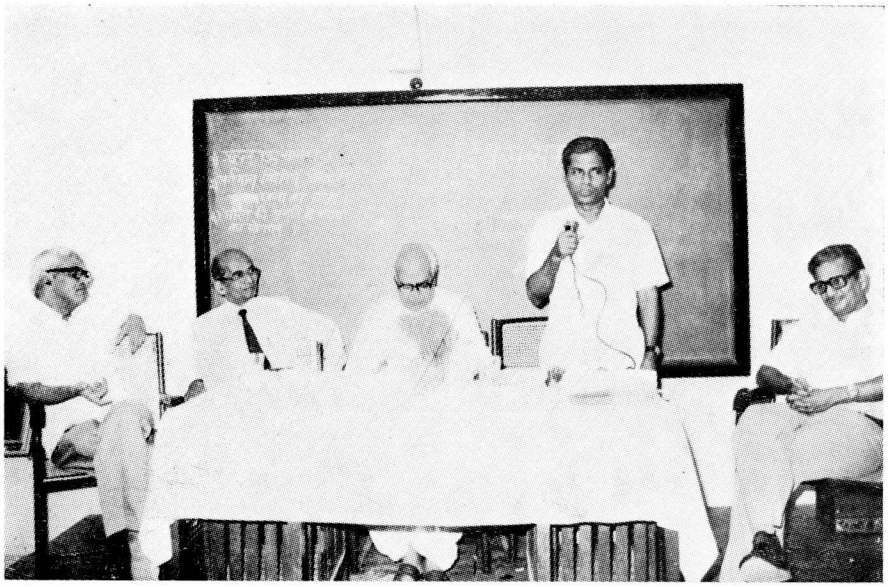
The Director and other scientists of CTRL continued to represent CTRL/ ICAR on various committees of the Indian Standards Institution, as in the past. Besides, the Director continued to be member in the following Committees/ Bodies during the year 1985:

1. Cotton Advisory Board of the Office of the Textile Commissioner, Government of India, Ministry of Commerce, Bombay.
2. Board of Directors of Cotton Corporation of India Ltd., Bombay.
3. Research Advisory Committee of South India Textile Research Association (SITRA), Coimbatore.
4. Governing Council of General Advisory Committee on Research and Liaison of Bombay Textile Research Association (BTRA), Bombay.
5. Cotton Research Advisory Sub-Committee of Indian Cotton Mills' Federation Cotton Development and Research Association, Bombay.
6. Board of Management of Victoria Jubilee Technical Institute (VJTI), Bombay.
7. Editorial Board of the Journal of Textile Association, Bombay.
8. Research Advisory Committee of ATIRA and Chairman of the Panel of Experts for 'Physics Oriented Studies of ATIRA', Ahmedabad.

PLATE III

HINDI DAY CELEBRATIONS

Shri Ramvallabh Shastri, Assistant Editor (Retd.), Navbharat Times with Prof. Ram Mhatre of Somaiya College, Vidyavihar and Dr. V. Sundaram, Director, CTRL at the Final-Day Function.



Shri Namvar Singh of Hansraj Morarji High School, Andheri recites a Hindi poem composed by himself at the function.

PLATE IV

The New Hydrometric Device Developed at CTRL for Indicating Ginning Percentage

ICAR Sports Meet

CTRL actively participated in the fifth ICAR Inter-Institutional Zonal Sports Meet (Zone IV) held at Bhopal and secured several prizes. The details are given in Chapter 7.

Finance

A statement showing sanctioned budget grant of CTRL and actual expenditure for the financial year 1984-85 has been furnished in Annexure IV. As could be seen from the statement the actual expenditure under non-plan was Rs. 68,25,525/- as against the sanctioned grant of Rs. 68,24,000/-. An expenditure of Rs. 43,28,878/- was incurred on the scheme for modernisation and strengthening of CTRL for intensive research on Cotton as against the sanctioned grant of Rs. 43,96,000/- (An expenditure of Rs. 1,81,730/- was incurred under Integrated Cotton Development Project).

Significant Findings

A total of 5721 germplasm stocks of **G. hirsutum** collected from CICR, Nagpur was evaluated for 2.5% span length, length uniformity, fineness, maturity and bundle strength and the test results were reported.

Studies on the changes of fibre characters during the development period of cotton bolls showed that contrary to general belief the lengthening phase of cotton fibre did not cease after 3 weeks or 21 days for all types of cotton. This has been revealed by the test results of SB 289 E cotton which belongs to **barbadense** species having a length of 32.0 mm and which recorded lower length of 19.5 mm at the initial stages of boll development.

A study on the dependence of various morphological and structural parameters on the fibre strength revealed that (i) the range in single fibre tenacity for different varieties are much wider as compared to that for fibre bundle tenacity at zero or 1/8" gauge length for the same varieties (ii) the bundle effect which lowers the tenacity when tested in the form of fibre bundles (at nominal zero gauge length), seems to have maximum influence in the case of **desi** varieties.

A study of inverse relaxation/stress recovery property of cotton and other textile fibres has shown that stress relaxation was more at 40% extension than at 30% extension. Also, the IR index falls from quite a high value to zero, almost abruptly.

Cotton fibres repeatedly treated with NaOH and $ZnCl_2$ solutions have been observed to layer by the layer expansion technique contrary to what was

reported by earlier workers. Further, it is generally observed that the inter-lamellar spaces in layered cross sections of all the repeatedly swollen fibres are more than in single swollen fibres.

X-ray diffraction studies on structural parameters of yarns showed that (i) the influence of twist on the yarn X-ray angle is similar for cotton yarns and viscose yarns obtained from multifilaments; however, the latter show better twist response for a given count, when the filament denier and fibre denier used for making the yarns were the same (ii) yarn X-ray angle has a higher correlation with yarn extension than with yarn tenacity.

A study on the moisture transfer characteristics of cotton fabrics varying in their thickness and construction details revealed that the parameter characterising the moisture transfer through a fabric, viz. the time taken to reach the mean RH, was strongly influenced by the fabric parameters such as thickness and weight per square metre.

Acrylonitrile grafted fabrics with a percent graft of 8 to 12 and methyl-methacrylate grafted fabrics with a percent graft of 2 to 3 improved the breaking strength. Styrene grafted fabrics had good water repellency.

Fabric samples which were given antibacterial finish were evaluated by modified Quinn test using **S-aureus** microorganism and it was observed that the experimental samples even after prolonged washings did not show any growth of bacterial colonies signifying the durability of the finish.

In the study of enhanced enzymolysis of never-dried cotton cellulose and other cellulosic materials, maximum reducing sugars were obtained when enzymolysis was carried out on wet substrates as compared to their dried counterparts. However, disordering of crystalline regions were observed only in the case of never-dried cotton fibres on enzymolysis as compared to dried fibres. Even alkali swollen fibres in wet condition on enzymolysis did not lower down the ordered regions.

The microcrystalline cellulose prepared by cellulase treatment from bagasse pulp has properties comparable to those of imported Avicel PH 101. Hence, bagasse pulp can be conveniently used as starting material for the preparation of microcrystalline cellulose in the place of wood pulp or cotton linters.

In connection with the study on analysis and grading of cotton linters, it was observed that the nature of trash greatly influences the properties of linter samples and that the different varieties of linters exhibited differential response to bleaching.

INTRODUCTION

Phenol formaldehyde is found to be a better binder for preparation of particle boards from cotton seed hulls and these boards could be made fire retardant by the addition of ammonium phosphates, borax and boric acid alone as well as in mixture.

Pulping experiments conducted to study the effect of addition of small quantity of anthraquinone during pulping of cotton stalk revealed that the addition of small amount of anthraquinone produced better quality pulp and the paper sheets prepared from the kraft anthraquinone pulp gave better breaking strength, burst factor and folding endurance as compared to the sheets prepared from conventional kraft pulp.

Trials undertaken at Apollo Mills, Bombay indicated that by employing dry fermentation technology of biogas preparation from willo-dust, as much as 250 m^3 biogas could be produced per tonne of willow-dust (Volatile Solids) in 60 days with a very constant supply of gas throughout the fermentation period.

2. PROGRESS OF RESEARCH

A brief project-wise account of the research work carried out at CTRL and at the Quality Evaluation units is given below:

Evaluation of the Quality of Cotton Samples received from Agricultural Trials

One of the main functions of CTRL is to participate actively in the various research programmes on cotton conducted in different cotton growing regions in the country by authoritative evaluation of the quality of new strains as well as strains from trials conducted for special purposes apart from fixing norms for adherence at various stages of developments of new cotton varieties. Accordingly, large number of cotton samples are received every year for technological evaluation mainly from trials relating to breeding and agronomy under the All-India Co-ordinated Cotton Improvement Project (AICCIP) as well as other Agricultural University/State schemes.

The number of such samples received for tests during the years 1983, 1984 and 1985 along with the average for the quinquennium 1976-1980 is given in Table 1(a). Total number of samples tested at the Regional Quality Evaluation Units during 1985 is summarised in Table 1(b).

The samples received from agricultural trials are tested in the order of their receipt and test reports are sent as soon as the tests are 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 circulars are compiled for the whole season and published as Technological Reports — one for Trade Varieties of Indian Cottons and the other for Standard Indian Cottons.

A few samples are received every year for miscellaneous tests such as determination of quality of ginning, oil content in cotton seed, etc. and reports on those tests are also issued immediately after the tests are over.

The results of samples subjected to different tests exclusively for research projects are not generally reported, as those results will form part of the relevant research publications.

Tables 2 gives the State-wise figures for the number of samples tested for fibre characteristics and spinning performance under two sub-heads: (i) AICCIP and (ii) Other State Schemes.

TABLE 1(a): NUMBER OF COTTON SAMPLES RECEIVED FROM AGRICULTURAL TRIALS FOR DIFFERENT TESTS AT CTRL

Type of Test	Average for the quinquennium 1976-1980	1983	1984	1985
Fibre and Full Spinning	175	183	187	217
Fibre and Microspinning	2093	1695	1362	2228
Microspinning alone	—	—	—	6
Fibre Test Alone	225	52	549	248*
Mill Test	14	13	4	8
Standard Cottons	24	18	22	23
Trade Varieties				
— Lint	27	27	14	8
— Kapas	50	64	45	35
Technological Research	96	323	45	20
Miscellaneous	22	97	—	3
TOTAL	2726	2472	2228	2796

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

Regional Quality Evaluation Unit	Quality Parameters				Micro-spinning
	Length	Fineness	Strength	Maturity	
Akola	2409	400	444	400	—
Coimbatore	4659	4654	1526	4674	731
Dharwad	1701	1701	1701	1701	—
Guntur	566	572	516	572	—
Hissar	470	491	244	445	—
Indore	631	631	634	631	—
Nagpur	697	717	737	667	—
Nanded	745	844	844	850	—
Rahuri	1093	1097	200	1097	—
Sriganganagar	975	975	975	975	—
Surat	12974†	9108	5202	9317	358

* Besides 1713 lint samples received and tested under "Germ Plasm" project.

† On Fibrograph, 4107 samples were evaluated on the basis of one pair of combs only

TABLE 2 : NUMBER OF SAMPLES AND REPORT SENT IN 1985

State	Fibre and full spinning	Fibre and Microspinning	Fibre Test alone	Total
(i) *All India Coordinated Cotton Improvement Project*				
Punjab	77(11)	51(8)	16(1)	144(20)
Haryana	—	39(7)	—	39(7)
Uttar Pradesh	12(2)	23(1)	—	35(3)
(New Delhi)				
Rajasthan	7(1)	51(7)	—	58(8)
Madhya Pradesh	—	75(6)	53(1)	128(7)
Gujarat	58(10)	25(2)	—	83(12)
Maharashtra	27(2)	80(13)	—	107(15)
Andhra Pradesh	5(2)	—	—	5(2)
Karnataka	—	232(14)	—	232(14)
Tamil Nadu	9(2)	38(4)	79(1)	126(7)
Total	195(30)	614(62)	148(3)	957(95)
(ii) *Other State Schemes*				
Punjab	—	2(2)	—	2(2)
Haryana	—	32(7)	—	32(7)
Uttar Pradesh	10(1)	40(1)	—	50(2)
(New Delhi)				
Rajasthan	—	—	—	—
Madhya Pradesh	—	—	—	—
Gujarat	3(1)	—	—	—
Maharashtra	6(2)	155(21)	6(1)	167(24)
Andhra Pradesh	—	8(2)	—	8(2)
Karnataka	—	26(3)	57(5)	83(8)
Tamil Nadu	2(1)	10(2)	—	12(3)
Total	18(4)	273(38)	63(6)	354(48)

ALL INDIA CO-ORDINATED COTTON IMPROVEMENT PROJECT

Taking recourse to the philosophy of collaboration of scientists of various disciplines for the improvement of cotton cultivation in the country, ICAR has launched the All India Co-ordinated Cotton Improvement Project (AICCIP) in April, 1967. The work on this project is carried out on an All India basis with active collaboration of the Central Institutes, Agricultural Universities and the State Departments of Agriculture. In this project, a number of progenies or crosses under test are screened through various trials, such as Initial Evaluation Trial, Preliminary Varietal Trial, Co-ordinated Varietal Trial, Pilot Project Demonstration Trial, etc. Yield is the prime factor in the Initial Evaluation Trial, while quality and yield are the criteria considered for further selections in subsequent trials.

As the cotton sowing and harvesting seasons differ widely from State to State, the breeding trials are conducted, zone-wise. Thus, three zones are identified according to agro-climatic conditions. The North Zone comprises the States of Punjab, Haryana, Rajasthan and Uttar Pradesh, the Central Zone includes States of Madhya Pradesh, Gujarat and Maharashtra and the South Zone encompasses the States of Andhra Pradesh, Karnataka and Tamil Nadu. The work done under this project is summarised below:

NORTH ZONE

This Zone is mainly known for its medium staple American **G.hirsutum** and short staple **G.arboreum** types of cottons. The main object of the trials is to identify strains superior to existing varieties. Emphasis is also given to evolve strains of early maturing or short duration type with a view to make the fields available for the second crop of food grains. Trials of the North Zone were also conducted at Padegaon which is in the Deccan Canal region of Maharashtra, where cotton is grown under irrigation and the crop is sown in April without waiting for the onset of monsoon.

G.hirsutum Trials

The Co-ordinated Varietal Trials (CVT) for Normal Plant Type, Compact Plant Type as well as for Early Maturing Type were conducted at Faridkot, Hissar, Ludhiana, Muktsar, Sirsa and Sriganganagar. Table 3 shows the ranges of 2.5% span length, fineness and bundle strength along with the assessment of maturity and spinning potential for the samples tried out in the above two trials.

TABLE 3 : SUMMARY OF THE TEST RESULTS OF STRAINS TRIED IN COORDINATED VARIETAL TRIAL (CVT) OF G.HIRSUTUM IN NORTH ZONE

Location	No. of samples	Range of 2.5% Span length (mm)	Range of Micronaire value (μ g/in)	Maturity	Range of Bundle strength (g/t)	Count	Spinning performance A	Spinning performance B	Control
1	2	3	4	5	6	7	8	9	10
			Normal Plant Type — Br 04(a)						
Faridkot	6F	22.6—26.1 (25.1)	3.3—4.3 (3.9)	60—88 (77)	47.2—50.9 (49.2)	40s	4	4	L.C.
Hissar	6M	23.1—25.5 (24.7)	3.8—4.4 (4.0)	72—81 (77)	43.4—48.2 (46.2)	40s	—	1	H.777
Ludhiana	6F	23.6—25.9 (24.7)	4.0—4.8 (4.4)	71—84 (76)	41.3—46.6 (44.7)	30s	6	1	F.286
Muktsar	5F	22.6—25.4 (23.8)	4.6—5.2 (4.9)	72—80 (74)	39.1—47.7 (43.1)	30s	5	—	F.286
Sirsa	6M	24.2—25.9 (24.9)	4.4—4.8 (4.6)	81—86 (83)	42.3—47.2 (44.9)	40s	—	4	H.777
Sriganganagar	7F	24.4—27.2 (25.0)	3.6—5.0 (4.4)	70—84 (76)	46.6—49.8 (48.2)	30s	5	3	B.N.

1	2	3	4	5	6	7	8	9	10
				Compact Plant Type — Br 04(b)					
Faridkot	6F	23.8—26.9 (25.4)	4.2—5.2 (4.6)	68—85 (78)	45.0—51.5 (49.0)	40s	5	4	—
Hissar	6M	22.6—24.8 (23.9)	4.2—5.0 (4.6)	73—78 (76)	42.3—45.0 (43.5)	40s	—	2	H.777
Ludhiana	6F	24.2—27.4 (26.0)	3.6—4.4 (3.8)	62—74 (69)	42.3—49.3 (45.2)	30s	6	—	F.286
Muktsar	6F	23.2—27.0 (25.5)	3.6—5.2 (4.4)	70—80 (74)	41.3—48.8 (44.8)	40s	2	3	F.286
Sirsa	6M	24.4—27.1 (25.5)	3.6—4.0 (3.8)	63—73 (71)	42.9—50.9 (46.8)	40s	3	3	B.N.
Sriganganagar	5M	24.4—26.4 (25.4)	3.7—4.6 (4.3)	70—76 (75)	46.4—50.4 (48.2)	30s	2	—	—
				Early Maturing Type — Br 04(c)					
Faridkot	6F	24.0—27.0 (25.5)	3.4—4.4 (3.9)	73—83 (80)	43.4—50.9 (47.0)	40s	2	3	L.C.

TABLE 3: SUMMARY OF THE TEST RESULTS OF STRAINS TRIED IN COORDINATED VARIETAL TRIAL (CVT) OF G.HIRSUTUM IN NORTH ZONE — *(Contd.)*

Location	No. of samples	Range of 2.5% Span length (mm)	Range of Micronaire value (μ g/in)	Maturity	Range of Bundle strength (g/t)	Count	Spinning performance A	Spinning performance B	Control
1	2	3	4	5	6	7	8	9	10
Hissar	5F	24.6—25.8 (25.0)	3.8—4.2 (4.0)	70—83 (77)	42.3—49.3 (47.2)	30s	4	3	L.C.
Ludhiana	6F	24.6—27.0 (24.9)	4.0—4.8 (4.4)	74—80 (77)	41.8—47.7 (44.8)	30s	5	1	F.286
Muktsar	6F	22.8—25.2 (23.8)	4.4—5.0 (4.6)	77—83 (80)	42.9—47.7 (45.5)	40s	2	2	F.286
Sirsa	7M	23.7—26.7 (24.8)	3.9—4.8 (4.3)	73—81 (77)	43.4—49.8 (47.8)	40s	—	—	H.777
Sriganganagar	6M	24.5—27.5 (25.0)	3.7—4.9 (4.4)	69—83 (77)	42.9—47.7 (46.2)	30s unt chosen	3	—	—

F — Full Spinning
M — Microspinning

A — No. of samples spinnable to the count chosen
B — No. of samples better than control.
Figures in bracket indicate averages

The strains which recorded encouraging spinning performance for 30s/40s counts at different locations under both the trials are given below:

Location	*Count*	*Strains*
Faridkot	40s	F.505, F.572, LH.751, HS.37, HS(CP).23, F.670, F.671, HS(CP).24, F.470, HS.45 and F.289
Hissar	30s	H.862, H.888, HS.45 and H.777
Ludhiana	30s	LH.911, LH.580, LH.886, F.572, BN, LH.900 HS(CP).23, Pusa.31, DH.31, Pusa.95, H.862, H.888, F.470, LH.722 and F.286
Muktsar	40s	Pusa.31, F.671, H.862 and HS.45
	30s	RS.610, LH.886, H.929, F.505 and F.286
Sirsa	40s	HS(CP).24, DH.66-4 and LH.900
Sriganganagar	30s	BN, RS.135, RS.610, F.505, G.Agethi, RS.654, LH.511, SH.181, RS.510 and H.862

Samples pertaining to Preliminary Varietal Trial were received from Faridkot, Hissar, Ludhiana, Muktsar and Sriganganagar.

The following strains fared well at the locations and counts indicated below:

Location	*Count*	*Strains*
Faridkot	30s	H.974, F.803 and H.286
Hissar	30s	H.777
Ludhiana	30s	H.926, H.83-1, H.974 and F.286
Muktsar	40s	H.974
Sriganganagar	30s	LH.1000, H.83-3 and H.926

The Initial Evaluation Trial was conducted at Faridkot and Hissar. The following strains recorded satisfactory yarn strength at the counts indicated below:

Location	*Count*	*Strains*
Faridkot	30s	F.755, F.756, LH.927, F.682, CAH.31 and F.286
Hissar	30s	F.699, F.753, F.755, H.994 and H.777

G.arboreum Trials

Samples pertaining to Co-ordinated Varietal Trials were received from Faridkot, Hissar, Ludhiana and Sriganganagar for fibre test only. The object of this trial is to identify coarser and shorter staple varieties in the place of existing varieties G.27 or HS.11. 2.5% span length of the strains tested under this trial ranged between 16.4 mm and 23.1 mm. The Micronaire value was higher than 7.0 for the following strains.

Location	*Count*	*Strains*
Faridkot		8262, 8260, HD 58, RG.8, RG. 10 and LD.230
Hissar		NA. 130, LD. 272, LD. 293, LD. 286, LD.306, G.27, HD. 37 and HD. 40
Ludhiana		LH. 230, LD. 323, RG. 8, RG. 9, LD. 58, LD. 84, LD. 86, LD. 206, LD. 262, LD. 299, LD.205 and G. 27
Sriganganagar		RG. 9, DS. 5, HD. 58 and RG. 8

Hybrid Trial

Hybrids involving **hirsutum** x **hirsutum** crosses were tried at Faridkot, Hissar, Ludhiana, Sirsa and Sriganganagar. The range of 2.5% span length was between 25.0 mm and 28.4 mm. Micronaire value ranged from 3.5 to 5.0. Maturity was average to good and bundle strength values were satisfactory. Following hybrids fared well at the counts indicated below:

Location	*Count*	*Promising hybrids*
Faridkot	30s	HH.334, CICR.Hy.1, RHH.195 and Akola, 82-132
Ludhiana	40s	HH.334, CICR.Hy.1 and RHH.195
Sirsa	40s	HH.334
Sriganganagar	30s	HH.334, CICR.Hy.1, CICR.Hy.3 and RHH.195

National Elite Varietal Trial

In this trial, some of the important strains which are recently released or likely to be released in the near future are grown at important Cotton Research Stations. During the period, such trial was conducted at Hissar, Ludhiana and Sriganganagar.

The following strains recorded good spinning performance:

Location	*Count*	*strains*
Hissar	20s	F.414, Supriya, LH.511, G.Cot.10, F.236, NA.247, Vikram, Khandwa 3, Suman, DS.59, MCU.10 and HS.45
Ludhiana	40s	LH.886, F.286, H.777, MEU.10, G.Cot.10, 081, LRA.5166 and Supriya
Sriganganagar	30s	Sharada, H.777, F.414, F.286, G.Cot.10, 081, LRA.5166, Suman and NA.247

Miscellaneous Trials

In the Miscellaneous Trial conducted at IARI, New Delhi, Pusa 31-4, Pusa 79/1-3, Pusa 109-10, Pusa 595 B-1, Pusa 595 B-4, Pusa 66-112-3-2, Pusa 734-14, Pusa 595 B-3, Pusa 2-17, Pusa 3-3, Pusa 7-56, Pusa 8-1, Pusa 8-7, Pusa 10-9, Pusa 11-6, Pusa 12-2, Pusa 31-93 and BN recorded good spinning performance at 40s count.

CENTRAL ZONE

Madhya Pradesh, Gujarat and Maharashtra comprise the Central Zone. This zone has the largest area under cotton cultivation. Although emphasis is given to improve the existing American types of cotton, sizeable percentage of cotton from **G.arboreum** species is also under cultivation as most of the area especially in Madhya Pradesh or Maharashtra is under rainfed cultivation. For over a decade, Hybrid 4 has been widely accepted in all the three states. However, attempts are being made to identify early maturing hybrids without sacrificing the yield. Trials are also conducted for the improvement in **G.herbaceum** species which is traditionally grown in some pockets in Gujarat State.

G.hirsutum Trials

In the Co-ordinated Varietal Trials (CVT) samples were received from Nanded, Surat and Talod under irrigated conditions and from Badnapur, Bharuch, Indore, Khandwa and Nanded under rainfed conditions. A set of samples pertaining to CVT of North Zone was received from Padegaon.

National Elite Varietal Trial

In this trial, some of the important strains which are recently released or likely to be released in the near future are grown at important Cotton Research Stations. During the period, such trial was conducted at Hissar, Ludhiana and Sriganganagar.

The following strains recorded good spinning performance:

Location	*Count*	*strains*
Hissar	20s	F.414, Supriya, LH.511, G.Cot.10, F.236, NA.247, Vikram, Khandwa 3, Suman, DS.59, MCU.10 and HS.45
Ludhiana	40s	LH.886, F.286, H.777, MEU.10, G.Cot.10, 081, LRA.5166 and Supriya
Sriganganagar	30s	Sharada, H.777, F.414, F.286, G.Cot.10, 081, LRA.5166, Suman and NA.247

Miscellaneous Trials

In the Miscellaneous Trial conducted at IARI, New Delhi, Pusa 31-4, Pusa 79/1-3, Pusa 109-10, Pusa 595 B-1, Pusa 595 B-4, Pusa 66-112-3-2, Pusa 734-14, Pusa 595 B-3, Pusa 2-17, Pusa 3-3, Pusa 7-56, Pusa 8-1, Pusa 8-7, Pusa 10-9, Pusa 11-6, Pusa 12-2, Pusa 31-93 and BN recorded good spinning performance at 40s count.

CENTRAL ZONE

Madhya Pradesh, Gujarat and Maharashtra comprise the Central Zone. This zone has the largest area under cotton cultivation. Although emphasis is given to improve the existing American types of cotton, sizeable percentage of cotton from **G.arboreum** species is also under cultivation as most of the area especially in Madhya Pradesh or Maharashtra is under rainfed cultivation. For over a decade, Hybrid 4 has been widely accepted in all the three states. However, attempts are being made to identify early maturing hybrids without sacrificing the yield. Trials are also conducted for the improvement in **G.herbaceum** species which is traditionally grown in some pockets in Gujarat State.

G.hirsutum Trials

In the Co-ordinated Varietal Trials (CVT) samples were received from Nanded, Surat and Talod under irrigated conditions and from Badnapur, Bharuch, Indore, Khandwa and Nanded under rainfed conditions. A set of samples pertaining to CVT of North Zone was received from Padegaon.

Summary of the test results has been given in Table 4. The following strains fared well at the location and count given below:

Location	*Count*	*Promising hybrids*
		Irrigated
Nanded	50s	G.3734, G.6763, G.4193 and NH.239
Surat	50s	G.2637, G.Cot.10, G.3549, CPD.8-1-LL and LRA.5166
Talod	50s	G.1-M, G.3734, G.3763, G.4193, G.2637, G.3837, CPD.8-1-LL, 71KH.82-1801, G.3000, G.2532, LRA.5166, DH.59, G.5159 and G.Cot.10
		Rainfed
Badnapur	40s	71BH-5/3 and G.Cot.10
Bharuch	40s	081, NH.210, PH.36, G.13426 and G.Cot.10
Indore	40s	79BH-5/3, ACH.2617, 68KH-33/1146, LRA.5166, G.Cot.10 and Vikram
Khandwa	40s	081, NH.210, G.13246, AC.938, 79BH-5/3, ACH.540, LRA.5161 and 66KH.33/1146
Nanded	50s	AC.938, LRA.5166 and G.Cot.10
Padegaon (North Zone entry)	30s	H.806-1, LH.640, LH.751, LH.846 and Laxmi

Samples pertaining to Preliminary Varietal Trial were received from Khandwa and Nanded under rainfed conditions. A set of samples pertaining to North Zone entries under irrigated conditions was received from Padegaon. Following strains fared well at the location and counts as indicated below:

Location	*Count*	*Promising strains*
Khandwa	40s	CPH.5545, KH.81/1911 and 68KH-33/1146, G.464, 79BH.5/2, G.4814 and NH.208
Padegaon (North Zone entry)	40s	H.912

A set of seven samples tried under the Initial Evaluation Trial was received from Talod. New strains such as CP.5249, CP.5635, G.1840, along with the control variety, G.Cot.10 recorded impressive performance at 60s count.

TABLE 4: SUMMARY OF THE TEST RESULTS OF THE STRAINS TRIED IN THE COORDINATED VARIETAL TRIAL (CVT) OF G.HIRSUTUM IN CENTRAL ZONE

Location	No. of samples	Range of 2.5% Span length (mm)	Range of Micronaire value (μ g/in)	Maturity	Range of Bundle strength (g/t)	Count	Spinning performance A	Spinning performance B	Control
1	2	3	4	5	6	7	8	9	10
				Irrigated — Br 04(a)					
Nanded	6M	27.4—30.3 (28.6)	3.4—4.1 (3.7)	61—80 (69)	41.8—46.1 (43.3)	50s	5	1	L.C.
Surat	7F	25.9—29.5 (27.7)	3.6—4.8 (4.1)	75—91 (83)	42.3—49.3 (45.5)	50s	6	3	G.Cot.10
Talod	18M	23.1—31.6 (28.0)	3.3—4.9 (4.1)	68—86 (77)	39.1—50.9 (45.9)	50s	15	4	L.C.
				Rainfed — Br 04(b)					
Badnapur	6M	24.2—27.3 (25.5)	3.5—3.9 (3.7)	66—71 (68)	40.7—46.1 (44.6)	40s	2	4	L.C.
Bharuch	7F	25.6—30.8 (28.0)	3.4—4.6 (4.1)	70—80 (75)	41.8—48.2 (44.5)	40s	6	0	L.C.

TABLE 4: SUMMARY OF THE TEST RESULTS OF THE STRAINS TRIED IN THE COORDINATED VARIETAL TRIAL (CVT) OF G.HIRSUTUM IN CENTRAL ZONE — (*Contd.*)

Location	No. of samples	Range of 2.5% Span length (mm)	Range of Micronaire value (μ g/in)	Maturity	Range of Bundle strength (g/t)	Count	Spinning performance A	Spinning performance B	Control
1	2	3	4	5	6	7	8	9	10
Indore	14M	23.0—30.2 (25.9)	2.9—4.0 (3.5)	58—81 (73)	38.1—50.4 (45.4)	40s	6	4	Vikram
Khandwa	14M	23.8—28.9 (26.2)	3.7—5.3 (4.1)	74—90 (80)	44.0—50.4 (46.4)	40s	9	2	68 KH-33-1146
Nanded	5M	25.3—29.6 (27.2)	3.2—4.5 (3.8)	50—78 (67)	42.3—46.6 (44.9)	50s	3	2	G.Cot.10
Padegaon (N.Z.)	6F	25.1—28.4 (26.8)	3.4—3.9 (3.8)	65—74 (71)	40.2—43.4 (41.7)	30s	4	—	Laxmi

F — Full Spinning
M — Microspinning

A — Spinnable to the count chosen
B — Better than control.
Figures in bracket indicate averages

G.herbaceum Trials

In the Co-ordinated Varietal Trial of **G.herbaceum** conducted at Surat under irrigated conditions and that at Viramgam under rainfed conditions, none of the strains fared well.

Hybrid Trials

The object of the trial is to identify hybrids superior in yield, quality and earlyness to replace the existing hybrids, such as Hybrid 4, Hybrid 6 and JKHy.1. Hybrids involving **hirsutum x hirsutum** crosses were received from Nanded, Surat, Badnapur and Bharuch of which promising ones are listed below:

Location	*Count*	*Promising hybrids*
		Irrigated
Nanded	60s	NHH.263, NHH.301, NHH.304, Godavari, G.Cot.Hybrid 6
Surat	50s	BCH.397, HH.334, BHH.2, G.Cot.6 and Hybrid 4
		Rainfed
Badnapur	40s	NHH.263, Hybrid 4 and Godavari
Bharuch	50s	AHH.82-117, GHH.334, CICR.HH.1, CICR.HH.2, CICR.HH.3 and Hybrid 4

Among the **hirsutum x hirsutum** crosses, DCH.32 and Varalaxmi at Nanded and Somanathpur under irrigated conditions recorded satisfactory yarn strength at 60s count.

Desi Hybrids

Efforts are being made to evolve **desi** hybrids, i.e. crosses between **arbereum x herbaceum.** During the year, **desi** hybrids were received from Surat, which were tried under irrigation. Special mention may be made of one hybrid, viz. GDH.149 having a mean length of 28.6 mm and 4.5 Micronaire value. This hybrid has given good spinning performance at 40s count. The other hybrids, viz. GDH.2, GDH.7 and AH.71 were suitable for coarser count of 20s.

National Elite Trial

Some of the newly released varieties have been tried at various main research stations, viz. Khandwa, Nagpur and Nanded. The following samples fared well for the locations and counts indicated :

Location	*Count*	*Promising varieties*
Khandwa	40s	Supriya, LRA.5166, Suman, 68KH.33/1146, H.777, Vikram and Khandwa 2
Nanded	50s	F.286, Vikram, G.Cot.10, Supriya, LRA.5166, and Khandwa 2
Nagpur	50s	LRA.5166, 081, NH.239, G.Cot.10

Evaluation of Dwarf Material

In order to identify dwarf type of plants, trials are conducted at Badnapur, Indore and Khandwa. Only one strain, viz. 0133 at Indore and as many as four strains, viz. Surat Dwarf, 081, 083 and 0133 recorded desired yarn strength at 40s count.

Miscellaneous Trials

During 1985, there has been incidence of a new wilt attack at the cotton growing tracts of Madhya Pradesh. A study was undertaken to examine the extent of adverse effect on fibre properties caused by the new wilt. Accordingly samples from the wilt affected and the unaffected areas were tested for mean length, fineness, maturity and bundle strength. It was observed that by and large, there was no difference in the staple length and bundle strength parametres; however, there were marked differences in the case of Micronaire value and maturity. Considering the differences between each pair of unaffected and affected plants, it was observed that the affected samples recorded lower values of Micronaire and maturity.

SOUTH ZONE

The South Zone which comprises Karnataka, Andhra Pradesh and Tamil Nadu has **G.hirsutum** species covering a large area. Cottons from other species, viz. **G.arboreum, G.herbaceum** and **G.barbadense** are also grown in some tracts of this zone. In addition, high yielding hybrids such as Hybrid 4, Hybrid 6, JKHy.1 (all **hirsutum x hirsutum** crosses) Varalaxmi, DCH.32 or Jayalaxmi (**hirsutum x barbadense** crosses) are also being cultivated on large scale in this zone.

G.hirsutum Trials

Co-ordinated Varietal Trial was conducted at Arabhavi and Siruguppa under irrigated conditions and from Raichur and Shimoga under rainfed conditions. The ranges of 2.5% span length, Micronaire value, maturity and bundle strength along with spinning potential are given in Table 5.

TABLE 5 : SUMMARY OF TEST RESULTS OF THE STRAINS TRIED IN THE COORDINATED VARIETAL TRIAL (CVT) OF G.HIRSUTUM IN SOUTH ZONE

Location	No. of samples	Range of 2.5% Span length (mm)	Range of Micronaire value (μ g/in)	Maturity	Range of Bundle strength (g/t)	Count	Spinning performance A	Spinning performance B	Control
1	2	3	4	5	6	7	8	9	10
				Irrigated — Br 04(a)					
Arabhavi	14M	25.4—34.2 (29.8)	3.2—4.3 (3.7)	70—82 (75)	35.9—45.0 (39.9)	50s	5	4	L.C.
Siruguppa	14M	24.6—33.8 (28.9)	2.8—4.4 (3.6)	61—84 (70)	36.4—44.5 (41.5)	50s	6	10	L.C.
				Rainfed — Br 04(b)					
Raichur	12M	20.9—26.5 (24.8)	3.1—4.5 (3.4)	55—81 (70)	42.3—47.2 (41.1)	40s	8	7	Laxmi
Shimoga	10M	24.9—30.9 (28.0)	3.1—4.7 (3.8)	54—72 (65)	39.7—46.1 (43.5)	50s	6	4	My.14

M — Microspinning
Figures in bracket indicate averages

A — Spinnable to the count chosen
B — Better than control

L.C. — Local Control

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

Location	*Count*	*Promising strains*
		Irrigated
Arabhavi	50s	LS.133-1, AV.3649, LRA.5166, MCU.5 and Local control
Siruguppa	50s	AHO.66-107-1/1, LRA.5166, AV.3649, LS.133-1, DIC.29 and MCU.5
		Rainfed
Raichur	40s	AN.920, LRA.5166, DRC.68, DP.445, JK.236-2, Sharada, DRC.6 and Laxmi
Shimoga	50s	DRC.6, JK.136-2, LRA.5166, DP.445, Laxmi and My.14

Preliminary Varietal Trials were conducted at Arabhavi and Siruguppa under irrigated conditions and at Shimoga at rainfed conditions.

The promising strains from the spinning point of view are listed below:

Location	*Count*	*Promising strains*
		Irrigated
Arabhavi	50s	ACP.71-51-9, LRA.5166, CPD.8-1-22 and MCU.5
Siruguppa	40s	CPD.8-1-22, MERS.24, LRA.5166, RAS.303, ACP-71-51-9, SRG.574, EMS.3, SRG.659, ACP.27-1/1, MCU.5, Sharada and Local Check
		Rainfed
Shimoga	50s	LRA.5166, Laxmi and My.14

Initial Evaluation Trial

This trial was conducted at Arabhavi and Siruguppa under irrigated conditions and at Shimoga under rainfed conditions. The promising strains may be listed as follows:

Location	*Count*	*Promising strains*
Arabhavi	50s	L.389-1, NA.606, LRA.5166, SRG.214, ACP.71-19-1/1, NSP.388, AH.107, MCU.5 and Local Check
Siruguppa	50s	SRG.258, ACP.71-12-5, NSP.841, L.2, RAS.311, NSP.388, LSP.36, LSP.35, NSP.842, JK.260, SRG.214, KG.11-28, NA.920, JK.258, NA.606, AS.104, L.389-1 and MCU.5
		Rainfed
Shimoga	50s	JK.349, L.3, JK.402, TKH.79, SRG.672, JK.404, JK.280, JK.406, JK.299, L.2, SRG.778, SRG.591, DRC.15, DRC.6, JK.403, SRG.804, JK.405, RAS.9, JK.279, SRG.811, L.1, SRG.139, TKH.66, LRA.5166, Laxmi and My.14

G.barbadense Trials

Co-ordinated Varietal Trial was conducted at Siruguppa under irrigated conditions. In addition to Suvin, only one strain, RRB.22-4 recorded encouraging spinning performance at 80s count.

G.herbaceum Trials

In the Co-ordinated Varietal Trial of **G.herbaceum** none out of the twelve strains recorded desired yarn strength at 20s count.

Hybrid Trials

Hybrid trials (either intra-hirsutum or interspecies) were conducted at Coimbatore and Siruguppa. Promising hybrids were as follows:

Location	*Count*	*Promising strains*
		Intra-hirsutum
Coimbatore	50s	T7XM12, T11XM12, T12XM12, T13XM12, T14XM12, T17XM12, T21XM12 and V22XM23
Siruguppa	40s	V1XT6, V22XM29 and JKHy.1
		Inter-species
Coimbatore		H.434 and Varalaxmi
	60s	H.424 and Varalaxmi
	80s	SCH.1, H.224, and H.194

In addition, the **desi** hybrid DDH.2 performed well at Raichur and was found suitable for 20s count.

National Elite Varietal Trial

Normally the strains which have shown consistantly satisfactory performance in yield and fibre properties are tested at various locations. During the period, this trial was conducted at CICR Regional Station, Coimbatore and Siruguppa under irrigated conditions and at Raichur under rainfed conditions. The promising strains are listed below:

Location	*Count*	*Strains/Varieties*
Coimbatore	40s	BC.761, LRA.5166, 081, Khandwa 3, H.777, F.414, F.286, MCU.5, Suman, SRT.1, Supriya and Vikram
Siruguppa	40s	Khandwa.3, Supriya and NRP.802
Raichur	50s	LRA.5166

Pilot Project Demonstration Trials

This trial was conducted at Arabhavi, Raichur and Siruguppa under irrigated conditions and at Raichur and Shimoga under rainfed conditions. This trial was also conducted at Shimoga with entries from **G.herbaceum** species.

Promising strains at the respective locations are indicated below:

Location	*Count*	*Promising strains*
		Irrigated
Arabhavi	50s	JK.119-24-54, MCU.5 and Local Check
Raichur	50s	Jayalaxmi (DCH.32)
Siruguppa	50s	LRA.5166 and MCU.5
		Rainfed
Raichur	40s	DS.44, CPD.111-2, Sharada and Laxmi
Shimoga	50s	LRA.5166 and My.14

Miscellaneous Trials

Many trials having different objectives have been conducted at Coimbatore, Guntur, Nandyal and Srivilliputtur.

PROGRESS OF RESEARCH

The new released variety, viz. LRA.5166 is being grown at different cotton growing tracts. Seven samples cultivated in the farmers' field at different locations were received for technological assessment. Their 2.5% span length ranged between 26.9 mm and 29.5 mm. The ranges of Micronaire value and bundle strength were 3.6 to 4.6 and 41.8 g/t to 55.2 g/t, respectively. Six out of seven samples recorded desired yarn strength at 50s count.

In another miscellaneous trial conducted at Coimbatore, a new culture, viz. HLS.1124 along with MCU.9 (control) recorded satisfactory spinning performance at 50s count.

Two strains, viz. JPKR and LPK. 516 along with MCU.7 were found suitable for 40s count in the rice fallows area of Tanjavur.

In glandless trial conducted at Coimbatore, two glandless cultivars (Kgl x JRKR)-8-6 and (Kgl x JRKR)-8-11 along with LRA.5166 and SRT.1 (both controls) recorded desired yarn strength at 40s count.

At Nandyal a trial was conducted to compare the performance of two new strains, viz. NA.920 and NA.896 with that of control NA.247. It was observed that NA.920 and NA.896 were inferior to NA.247 in respect of spinning performance at 40s count.

In another trial at Srivilliputtur, a comparison was made between SVPR.763 and MCU.7. Both the varieties had identical quality characteristics. However, MCU.7 had slightly better spinning performance at 40s count.

At Guntur, two new hybrids were raised viz. Lam Hybrid 1 along with two samples of Hybrid 6. In the first trial, both the samples recorded identical performance. However, in the second trial Hybrid 6 recorded slightly better performance at 50s count.

EXTRA-LONG STAPLE COTTONS (27 mm and above)

Test result of extra long staple cotton (27 mm and above) received as Trade Variety, Standard and Agricultural Cotton samples and tested during 1985 are given in Table 6.

MILL TEST

After careful consideration of the quality parameters of cotton strains in field trials and their subsequent assessments for technological properties at CTRL, the promising varieties of cotton are being subjected to mill test to

TABLE 6 : **RESULTS OF THE EXTRA-LONG STAPLE (27mm AND ABOVE) COTTON TESTED DURING 1985**

Variety	Place	Mean fibre length		Fineness			Bundle Strength		
		mm	in	Millitex	Micronaire value (μ g/in)	Mature fibres (%)	Tenacity (g/t) 0' gauge	Tenacity (g/t) $\frac{1}{8}$'' gauge	P.S.I. 0' gauge (lb/mg)
Supriya	Punjab	27.9	1.10	173	4.4	88	46.1	25.8	8.6
081	Gujarat	27.2	1.07	157	4.0	80	41.8	24.8	7.8
AHH.82-117	Bharuch	27.4	1.08	146	3.7	76	44.5	28.1	8.3
Hy.4	Bharuch	27.2	1.07	154	3.9	80	41.3	25.9	7.7
GDH.149	Surat	27.9	1.10	177	4.5	0.74*	51.5	—	9.6
Suman	Nagpur	27.0	1.06	157	4.0	0.70*	41.3	—	7.7
Supriya	Nagpur	27.0	1.06	181	4.6	0.73*	44.5	—	8.3

* Maturity Coefficient

TABLE 7 : COMPARATIVE SPINNING TEST RESULTS AT MILL AND CTRL FOR THE YEAR 1985

Sr. No.	Place	Hybrid Variety	MILL				CTRL			
			Waste (%)	Count	Lea Strength (lbs)	CSP	Waste (%)	Count	Lea Strength (lbs)	CSP
1.	Akola	081	5.5	40s	37.2	1486	5.3	40s	48.3	1932
		SRT.1*	5.5	40s	40.2	1612	8.3	40s	49.2	1968
2.	Surat	G.2637	—	40s	37.8	2072	3.0	40s	55.1	2204
		G.Cot.10*	—	40s	46.1	1844	4.0	40s	50.9	2036
3.	Rahuri	RHH.195	—	40s	50.4	2126	6.0	40s	55.5	2220
		Hybrid 4*	—	40s	48.4	1938	5.2	40s	44.4	1776
4.	Lam Guntur	Lam Hybrid 1	—	40s	49.3	1972	6.2	40s	56.0	2240
		Hybrid 6*	—	40s	50.6	2024	5.0	40s	58.2	2328

* Control

gauge their performance under mill conditions. The recommendations for large-scale propagation of these improved strains will be generally made only after their performance at mill conditions is confirmed. CTRL arranges mill test with the co-operation of a few textile mills in the country.

During the year, mill tests were arranged for samples received from Akola, Surat, Rahuri and Guntur and the test results are reported in Table 7.

It may be seen from Table 7 that in the case of the new strain, viz. 081 from Akola, the control variety SRT.1 has recorded slightly better spinning performance both at mill and at the laboratory. In the case of G.2637 from Surat it has recorded higher yarn strength both at the mill as well as at the Laboratory. A new intra-**hirsutum** hybrid RHH.195 from Rahuri also recorded higher CSP, both at the mill and at the Laboratory, while in the case of similar hybrid, viz. Lam Hybrid 1 from Guntur, the existing hybrid under cultivation (Hybrid 6) performed better than Lam Hybrid 1 both at the mill and at the Laboratory.

Evaluation of the Quality of the Major Trade Varieties of Cottons Grown in Different Parts of the Country.

Lint samples of fair average quality of the major varieties of Indian cottons are being obtained for each season through the East India Cotton Association (EICA) Ltd., Bombay and some regional cotton associations. Representative **kapas** samples of these varieties are also procured from State Departments of Agriculture for determination of ginning percentage. The fibre and spinning test results, ginning percentage, etc. on each variety of cotton are being published as Technological Circulars as early in the season as possible for information of cotton trade and industry. In all, 29 Circulars were issued during 1985. The test results of all the trade varieties of 1982-83 and 1983-84 were compiled and published as Technological Report on Trade Varieties of Indian Cottons 1982-83 and 1983-84 season.

Evaluation of the Quality of Standard Indian Cottons

To assess the seasonal fluctuations in the characteristics of Indian cottons and to gauge the comparative superiority or otherwise of the newly evolved strains, a number of selected varieties of Indian cottons called Standard Indian 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 as in the season as possible.

During 1985, 13 such circulars were issued. The results of samples of 1983-84 season were consolidated and published as Technological Report on Standard Indian Cottons 1983-84 Season.

Technological Evaluation of Germplasm Material

A total of 572 germplasm stocks of **G.hirsutum** were collected from CICR, Nagpur and evaluated for 2.5% span length, length uniformity, fibre fineness (micronaire value), maturity and bundle strength.

Under the BrO-1 trial, 175 samples were evaluated. Only one culture 1301.DD had mean fibre length below 20.5 mm. Stocks, EC.15737, EC.132021, HH.6, AR.27, EL.500, UPA.56 and K.3902 showed mean length between 28.0-30.0 mm. Acala 1572 had an extremely good uniformity ratio. Culture Tamcot-37 had very low Micronaire Value (2.4); but Acala 1572 and 1301 were coarse (5.0 Micronaire Value). Arkot 2-1 had low bundle strength of 37.0 g/t; but a few cultivers were identified for good bundle strength, viz. T.11, Tenas 61 (both 51.5 g/t), EL.114-3EE (50.9 g/t) Pee Dee 9223 (49.8 g/t), G244.10 (WIR.63), SL.341 B, UPA.56, A.58-1290, AC.719, B59-1679, Coker 413-6, 170 CO2-2-5-1-1 showed more than 9.0 lb/mg of bundle strength.

In **G.herbaceum,** out of 66 stocks, Goghari Itadi, 7182-1-1 (TP.82); HP.23-5 and 1-4-4-2 recorded Micronaire values above 6.0, while HK.86, Wagad 8, Sujay 3-3-3 and Kalagin had Micronaire values between 5.5 to 6.0.

Investigation of the Environmental Factors Affecting Fibre Quality — (I) Soil Factor

The lint material from the cotton crop grown under different soil profiles at Surat environment, as well as those from different environments from where the soils were brought had been tested for 2.5% span length, Micronaire fineness, bundle strength and percentage of mature fibres. The results were statistically analysed. It was observed that:

(i) Variation in 2.5% span length was significant between environments.

(ii) Micronaire fineness was comparatively less for Surat, Bharuch, Arnej and Junagadh soils.

(iii) The interaction between the varieties and environment was significant for the fineness characteristics.

(iv) The percentage of mature fibres was significant between environments and soils. The order of decrease in maturity for different soils was, more or less the same as the order of increase in fineness, which indicated that it was immaturity which has imparted low Micronaire values.

(v) The variation in bundle strength due to soil and environment were non-significant.

These observations need confirmation by continuing the trial for two more years.

Studies in the Changes of Fibre Characters during the Development Period of Bolls with Special Reference to Hybrid Cottons

During the period, quality parameters such as length, maturity and bundle strength of ten samples collected from Surat for the season 1984-85 have been evaluated.

Some of the important observations were as follows :

It is generally believed that the lengthening phase of cotton fibre ceases after 3 weeks or 21 days. Tests results on fibre length of 10 samples, from different stages of development however, indicated that this is not so for all types of cottons. In the case of cottons such as Gujarat 67, Hybrid 4, Hybrid 6, SB.289 E, Varalaxmi, etc. significant increase in length has been observed even after 21 days, while in the case of American Nectariless, Laxmi, G.27, DH.22, etc. there has been no increase in fibre length. The mean length of the hybrid cottons was between the mean length values of their parents. An interesting observation is made in the case of SB.289 E. a barbadense variety known for its longer length (32.0), that it recorded much lower length at the initial stage (19.5 mm) of boll development.

There has been progressive improvement in maturity with the development of the boll. The rate of improvement in maturity is not the same for all the cottons. In the case of 7 out of 10 cottons, no noticeable improvement in maturity was observed after 35 days post-anthesis.

In the case of bundle strength also the improvement was progressive during development of the boll. However, the rate of improvement was not consistant for all the varieties.

Effect of Irradiations and Chemical Treatments on Economical and Physical Characteristics of Cotton

The promising strain NA-39 (**G.arboreum,** diploid) gave good response and showed much morphological changes after Gamma-ray irradiation and EMS (chemical mutagenic) treatment. Plant-wise selection was done on the basis of the following observations:

1. High bearing
2. Boll size
3. Seed size
4. Non-fuzzy seeds
5. Short fibre content
6. Early bursting
7. Abnormal plants

82 single plant selections (SPS) were screened on the basis of extreme variations in the fibre properties.

TABLE 8 : FIBRE PROPERTIES OF SELECTED SAMPLES

Sample	Mean fibre length (in)	Micronaire value (μ g/in)	Maturity coefficient	PSI (lb/mg)	Ginning out-turn	Yield per plant (gms)
605 High bearing (15 Kr)	0.96	5.5	0.81	9.0	38.2	51.7
619 High bearing (30 Kr)	0.98	2.6	0.57	9.1	26.8	40.2
621 High bearing (30 Kr)	0.90	—	—	9.2	37.7	11.4
625 High yield (30 Kr)	0.96	3.9	0.73	8.7	37.8	88.2
634 High ginner (0.1% EMS)	0.91	5.4	0.81	8.7	41.1	24.4
637 High bearing (30 Kr)	1.01	2.9	0.59	8.5	35.0	45.9
641 Small seeds (0.1 EMS)	0.90	5.1	0.78	9.2	37.0	11.6
650 NA 39 (Control)	0.96	3.7	0.69	8.8	37.0	33.5

The seeds obtained from 82 SPS were sown in two replications of 20 dibbles on July 10, 1985 and promising SPS will be screened in the second week of January, 1986. Ginning of the screened SPS will be done shortly to study the fibre qualities.

Studies on the Inheritance of Strength and Structural Parameters in Cotton Fibres

The strength and crystallite orientation measurements of samples from three replications of each of the parents have been completed. The mean values of both the parents were observed to be the same as those obtained during earlier selections, confirming the purity of the strains. The strength tests on samples from one replication belonging to F_1 generation have been carried out and it has been found that, all the samples produced by various crossings (including the back crossings) have mean strength values below that of the average of the parental strains.

X-Ray Diffraction Studies on Structural Parameters of Yarns with a View to Utilising Them for Textile Yarn Characterization.

During the year, the relationship between the yarn x-ray angle ψy and counts was studied in more detail for various cottons. For a given cotton, the two parameters were inversely related, irrespective of the twist multiplier (TM) used.

The twist response behaviour of 16 cottons spun to their respective normal counts with appropriate TMs, was studied. Coarser yarns (usually spun from coarse cottons) exhibited higher response. Also when coarse and fine yarns spun from the same cotton were considered, coarser yarns gave higher response.

In addition, multifilament rayons were twisted on a ring frame using a set of different twist multipliers. The orientation profiles of the yarns of different counts (11s 30s, obtained by using multifilaments of different denier as well as different number of filaments) were obtained. It was found that the yarn x-ray angle was highly influenced by the twist per inch (TPI) used. Besides, the twist response was found to be higher for yarns of coarser counts. However, the twist response of the multifilament rayon yarns was higher than that of the cotton yarns spun to the same count, when the denier of the filament as well as that the cotton fibres used were the same.

The tenacity and breaking elongation values of SRT.1 cotton yarns (spun to 20s, 30s and 40s, each with a set of different TMs) were determined. The 50% x-ray angle (ψy) obtained from yarn orientation profiles, was found to be correlated well with yarn elongation ($r = + 0.85$). However, ψy had lesser dependence on yarn strength ψy ($r = + 0.68$). These observations are similar to those reported earlier for yarns spun from Suvin.

Study on the Orientation Behaviour of Cotton Fibres under Tensile Stress

Measurement of orientation from x-ray patterns obtained from fibre bundles maintained under different levels of stretch have been standardised. Preli-

minary analysis indicated that the response of orientation to external load could differ between cottons.

Cotton Fibre Strength and its Dependence on Various Morphological and Structural Parameters

Bundle tenacity at 0 "and 1/8" gauge lengths and the number of convolutions and structural reversals per unit length were determined for the 19 varieties selected from 4 species. For some of the varieties, results of single fibre breaking tenacity, extension and linear density were already available and the pooled data are incorporated in Table. 9

The tensile test results pertain to different gauge lengths as well as fibres taken in different modes and are not directly comparable. However, under the given conditions, the following observations could be made about the tensile parameters and behaviour of different varieties.

(i) Normally at a given gauge length, the bundle tenacity is expected to be lower as compared to single fibre tenacity and (ii) fibre tenacity (single or bundle) decreases with higher gauge length due to weak-link effect. In the present case when fibre bundle tenacity at 0" gauge length is compared with single fibre tenacity at 1 cm gauge length, it is observed that the former values are much more influenced by (ii). As expected, the influence is maximum for **desi** cottons (see column 9). The combined influence of both the factors (i) and (ii) mentioned above is clearly noticed when the bundle tenacity at 1/8" gauge length and single fibre tenacity are considered (see column 10).

In this case, factor (i) appears to influence most of the varieties belonging to **G.barbadense** and **G.hirsutum.** The varying influence of (ii) is also reflected in the range of tenacity values for different cottons. The range is least for fibre bundle tenacity at 0" gauge length and much wider for single fibre tenacity.

Compared to single fibre breaking extension values (which may be taken as near absolute values), bundle extension values are lower by about 25% for all the cottons except for AK.235 which shows a much higher decrease.

Study of Inverse Relaxation/Stress Recovery Property of Cotton and other Textile Fibres

A coarse Indian wool of the variety Rampur Bushier, was used to study inverse relaxation phenomenon in wool fibres. IR index was determined at

TABLE 9: SINGLE FIBRE AND FIBRE BUNDLE TENACITY RESULTS OF SOME VARIETIES

No.	Variety	Single fibre Tenacity (g/t)	Single fibre Ext. (%)	Fibre Bundle Tenacity 0" g.l. (g/t)	Fibre Bundle Tenacity $\frac{1}{8}$" g.l. (g/t)	Fibre Bundle Tenacity U.R. (%)	Fibre Bundle Tenacity Ext. (%)	% increase (+)/decrease (—) with reference to single fibre at 0" g.l. (+)	% increase (+)/decrease (—) with reference to tenacity at $\frac{1}{8}$" g.l. (—)	Decrease in fibre bundle extension (%)
1	2	3	4	5	6	7	8	9	10	11
1	Suvin	43.0	7.5	53.56	33.92	63.3	5.5	24.6	21.1	26.7
2	Sea Island	30.1	11.2	36.19	21.36	59.0	8.4	20.2	29.0	25.0
3	Badnawar	25.4	6.6	38.53	18.37	47.7	5.0	51.7	27.7	24.2
4	Varalaxmi	30.1	7.9	38.84	21.92	56.4	5.9	29.0	27.2	25.3
5	AK.235	29.7	7.9	43.14	22.71	52.6	5.0	45.2	23.5	36.7
6	Westerns	19.4	5.8	41.29	18.48	44.8	4.4	112.8	4.7	24.1
7	Jayadhar	22.8	5.6	42.94	20.48	47.7	4.2	88.3	10.2	25.0

various levels of retraction, corresponding to 40% and 30% extension levels. As observed for other fibres and yarns, the IR index increased from negative to positive values as the retraction level was increased at any extension level. The inverse relaxation passed through a transition zone. IR index was maximum at 12% retraction for 30% extension, while it occurred at 16% retraction for 40% extension. IR index falls to zero at 20% retraction for 30% extension and at 24% retraction for 40% extension levels. It is observed that the IR index falls from a fairly high value to almost zero abruptly.

Study of the Viscoelastic Behaviour of Textile Materials

Viscose continuous filament yarn (150 D/40 filaments) was tested for measurement of dynamic modulus at different strains during loading, unloading and reloading. It is observed that, at a given strain, the dynamic modulus of the 2nd cycle is always greater than that of the 1st cycle. However, unlike cotton and polyester yarns studied earlier, the difference between the 1st cycle and 2nd cycle dynamic modulus, at the same strain, has almost remained unchanged with respect to variation in strain.

A Comparative Study of Morphological and Structural Properties of Cotton Treated with Different Swelling Agents

Cotton fibres were repeatedly treated with NaOH, KOH, LiOH, ethylene diamine (EDA) as well as $ZnCl_2$ solution and changes in the morphology at the ultrastructural level have been studied. In all the cases, the fibres exhibited layering contrary to the observation made earlier by some workers. Samples repeatedly swollen by alkali metal hydroxides have revealed a characteristic honey comb structure and do not show a bilateral structure except in the case of 12% NaOH treated sample. However, the peripheral layers in most cases are seen to have lost the honey comb structure due to repeated treatment and the interlamellar separations are found to be more than those of the control. Among the three alkali metal hydroxides used, repeated swelling with 21% NaOH is found to have maximum effect on cotton. However, even after 10 cycles of 12% NaOH treatment the layered cross-sections of the fibres showed a bilateral structure due to the presence of cellulose I and II.

Morphology of layered cross sections of cotton fibres repeatedly treated with EDA is different from that of the alkali treated fibres. They are generally showing an open structure with some of the layers revealing a honey comb structure with fibrillar texture. Layer expansion of cotton fibres repeatedly treated with 65% $ZnCl_2$ shows well defined layers having a honey comb structure with fibrillar texture.

Generally, it is observed that the interlamellar spaces in layered cross sections of all the repeatedly swollen fibres are more than that of the control. Further, x-ray diffraction studies have shown that there is an increase in the disordered fraction in all the repeatedly swollen samples. This may result in weakening of many of the fibrils bridging the lamellae. In the layer expansion technique, rapid polymerization of methacrylate polymer in the fibre separates it into well defined layer. Therefore, in the repeatedly swollen samples, due to the weakening of the inter-lamellar bridges, the polymerization of the methacrylate inside the fibre will expand the layers to a greater extent than that of the control.

Preparation and Characterization of Microcrystalline Cellulose

The conditions for hydrolysis of cellulosic materials such as bagasse pulp (BP), wheat straw pulp (WSP) and cotton linters were changed with a view to obtaining microcrystalline cellulose of desired properties for making tablets. The new conditions of treatment are 2NHCl for 1/2 hr with material to liquor ratio 1 : 50. Using these conditions, about 100 gms of hydrolysed material of BP and cotton linters was prepared. Various properties such as percent crystallinity, particle length from DP values, bulk density and compressibility were determined and compared with those of imported microcrystalline cellulose (Avicel PH101). The Degree of Polymerization of hydrolysed BP, WSP and Avicel was determined. The enzymatic hydrolysis of BP and WSP was carried out for different time intervals ranging from 1 hr to 6 hr to get microcrystalline cellulose. The percent weight loss for 6 hr hydrolysis was very high (45%). Hence it is proposed to swell the samples with NaOH and then treat with enzyme for short duration. The conditions of enzymatic hydrolysis are being standardised.

Studies on Lakshmi-Rieter Drawing and Speed Frames

During the year, a medium staple cotton, Digvijay, having 2.5% span length of 24.1 mm, uniformity ratio of 46%, Micronaire value of 3.8, bundle strength at 3 mm gauge of 26.7 g/t, was taken up for the study.

The cotton was processed through blow room and card under optimum conditions. The card sliver was given two passages of draw frame using 1.3 break draft for both the passages with a setting of 32 mm at the front zone and 34 mm at the back zone on Lakshmi Rieter Draw frame. Rovings were prepared from the finished draw frame sliver on Lakshmi Rieter can-fed roving frame using three break drafts, viz. 1.21, 1.52 and 1.76, with two back zone settings of 36 mm and 41 mm. 30s yarn will be spun from all these combinations next year.

Influence of Fibre Length and Fibre Length Disrtibution Parameters on Yarn Quality

(i) *Categorization of Uniformity Ratio (UR) and Floating Fibre Index (FFI) at 12.5% span length (SL) for different ranges of staple length*

The UR and FFI values for short, medium, long and extra-long staple length groups of 30 cottons tested so far are given below:

Category (No. of samples)	Range of staple length (2.5% SL)	UR	FFI (50% SL) (%)	FFI (12.5% SL) (%)
Short (10)	Below 0.97	45-51	19.0-38.0	25.0-31.0
Medium (10)	0.98-1.10	46-51	14.0-29.0	25.0-31.0
Long & Extra Long (10)	1.11-1.37	38-49	15.0-53.0	25.0-39.0

(ii) *The Effect of FFI 12.5% SL on Hooked Fibres, U%, Imperfection and Hairiness*

Eighteen yarn samples were tested for yarn hairiness on Shirley Yarn Hairiness Tester. 30 more samples are proposed to be tested for determining the relationship between FFI (12.5% SL) and hairiness.

(ii) *Effect of FFI at 12.5% SL at Various Stages of Processing on Hooked Fibres*

Fourteen more trade variety samples were processed for hook study. The processed materials, viz. card and drawframe slivers, were tested for span length at 66.7, 50, 12.5 and 2.5 percent levels in forward and reverse directions. As reported earlier, the calculated values of UR and FFI were found to follow a definite trend. The mean value (forward and reverse) of UR increased from card to drawframe slivers, indicating improvement in parallelisation. The FFI values were found to decrease from card to second drawframe slivers indicating reduction in short fibre percentage.

In order to confirm UR and FFI values, a few samples are being tested on Baer Sorter for determining mean length and short fibre percentage at various stages of processing.

Blending of Cotton with Man-Made Fibres

The influence of denier and length in the formation of wrappers in OE spinning and their effect on yarn tenacity and elongation were studied in detail.

The fibres used in this study were as follows:

Polyester Fibre:

(i) 1.1 denier, 38 mm length

(ii) 1.2 denier, 38 mm length

(iii) 1.2 denier, 44 mm length

Viscose Fibre:

(i) 1.2 denier, 38 mm length

(ii) 1.5 denier, 51 mm length

Both polyester and viscose fibres were blended in the proportion 67 : 33, 48 : 52 and 15 : 85 polyester/viscose at blow room and processed through card and two draw frame passages. The finisher draw frame sliver was spun to 20s, 30s and 40s counts on open-end machine. The yarns spun were dyed with cold brand reactive dye so that the wrappers could be identified and classified. Yarns containing light and loose wrappers were located using a microscope and tested for yarn tenacity and elongation using Instron Tensile Tester. There appears to be no preponderance of wrappers when denier and length are kept constant. The length and denier of fibres per cross section of yarns were found to influence more on wrapper formation when the fibres of different denier, but the same lengths, were used. The influence of length of the constituents in the blend appears to dominate over the denier when both denier and length are changed. The light wrappers have a higher influence on tenacity and elongation when compared to loose wrappers.

Open-End Spinning of Indian Cottons and Cotton Wastes

The effect of blending of cottons of different lengths in different proportions on the properties of OE yarns was investigated and reported last year.

During the period under report, contribution of different fibre properties such as length, strength, fineness and maturity on various yarn quality characteristics as the yarn tenacity, elongation, U%, etc. were studied using factorial analysis. The study indicated that the single thread breaking tenacity and single thread breaking elongation have important bearing on yarn quality. Amongst the fibre properties, mean length of Indian cottons and their blends, fibre bundle strength and Micronaire value influenced yarn properties in that order.

Studies on Optimum Blending of Standard Varieties of Cotton Grown in Gujarat Region

The fibre orientation studies by the Fibrograph technique of the three blends, viz. G-7, G-8 and G-9 were completed. The fibre lengths in the major and minor hook directions of slivers obtained in the short and long processing systems were estimated. A comparison of the values obtained for the individual varieties as well as the blends has shown that:

(a) removal of hooks is achieved to a larger extent on the 50% span lengths than in 2.5% span lengths in both the directions;

(b) between the two, the increase is more in the minor hook direction;

(c) the overall length improvement, expressed as a percentage of the length of card sliver, is more after two passages of high speed drawing than three passages of conventional drawing; and

(d) the ratios between the figures for the 2.5% and 50% span lengths for both the sequences are about 1 : 3.25 in the major hook direction and 1 : 3.75 in the minor hook direction.

The spinning of the blends to 16s and 20s on the open-end system was completed. All the tests for yarn properties of the ring spun as well as open-end spun yarns were completed. The properties of the yarns spun from both the systems are given in Tables 10 and 11.

TABLE 10: PROPERTIES OF RING SPUN YARN OF 170 CO2, DIGVIJAY AND SANKAR 4

	Nominal counts	20s			30s		40s
Variety	170 CO2	Digvijay	S.4	170 CO2	Digvijay	S.4	S.4
F.Q.I	63.5	60.8	64.4	63.5	60.8	64.4	64.4
Corrected CSP	2198	2052	2396	1959	1887	2280	2072
Single Yarn Tenacity (g/t)	10.8	13.3	15.1	8.9	12.0	14.2	13.3
Breaking Elongation (%)	7.6	6.0	7.3	6.3	5.8	7.6	7.5
U%	13.5	15.1	14.3	16.7	17.3	16.6	17.4
Neps per 100M	79	31	90	106	46	96	120
Y.Q.I.	4.9	4.2	6.2	2.7	3.2	5.2	4.6

TABLE 11: PROPERTIES OF RING SPUN YARNS OF BLENDS OF 170 CO2, DIGVIJAY AND SANKAR 4

Nominal Counts	20s			30s		
Blend Code No.	G-7	G-8	G-9	G-7	G-8	G-9
F.Q.I.	56.5	57.8	54.0	56.5	57.8	54.0
Corrected CSP	2236	2198	2216	2031	1947	2013
Weighted CSP	2268	2194	2184	2105	2002	2019
Single Yarn Tenacity (g/t)	13.9	13.9	13.8	12.6	12.6	13.3
Breaking Elongation (%)	8.0	7.7	6.9	7.0	7.1	6.8
U%	15.8	15.4	15.4	18.0	18.0	17.7
Neps per 100M	60	62	52	80	94	59
Y.Q.I.	5.6	5.6	5.0	3.9	4.0	4.1

Blend Composition		S.4	170 CO2	Digvijay
	G-7	50	30	20
	G-8	20	50	30
	G-9	30	20	50

The FQI values of 3 blends are less than those of the individual cottons. This is probably due to the low uniformity ratios of the blends. All the same, the FQI values of the individual varieties and the blends do not vary much within the same group.

Ringspun Yarns

In Table 11 when the properties of 20s yarn are compared, there is good similarity among the three cottons in respect of CSP, single yarn tenacity U% and Yarn Quality Index. The breaking elongation (%) of G-9 is comparatively low. The difference between the corrected CSP and weighted CSP values is less than 1.5%. The individual deficiency in CSP exhibited by Digvijay for 20s (2052) has been amply made up when it is blended with the other two. The three blends are more or less equal in all respects when spun to 20s.

In the case of 30s the three blends are similar in all respects except for yarn tenacity and Neps. Their YQI values are almost equal. Here again, the low CSP values of Digvijay individually has been made up for in the blends.

Hence on the basis of these results, it can be suggested that 170 CO2, Digvijay and Sankar 4 mixed in different proportions can be spun optimally to 20s and 30s counts.

Open-End Spun Yarns

The properties of the yarns spun from the three blends on Open-end Spintrainer are given in Table 12.

TABLE 12: PROPERTIES OF ROTOR SPUN YARNS OF BLENDS OF 170 CO2, DIGVIJAY AND SANKAR 4

Nominal Counts	16s			20s		
Blend Code No.	G-7	G-8	G-9	G-7	G-8	G-9
F.Q.I.	56.5	57.8	54.0	56.5	57.8	54.0
Corrected CSP	1907	1901	1851	1871	1793	1782
Single Yarn Tenacity (g/t)	11.2	11.2	10.8	10.9	10.5	11.0
Breaking Elongation (%)	9.8	10.1	9.5	9.9	9.3	8.0
U%	12.4	12.0	12.1	12.6	12.2	12.7
Neps per 100M	38	30	42	45	42	45
ASTM Grade	B	B	B	C	C	B
Y.Q.I.	7.08	7.54	6.78	6.85	6.40	5.54
% Drop in CSP OE/Ring	—	—	—	16.3	18.5	19.6
% Gain in YQI OE/Ring	—	—	—	22.3	14.3	10.8

For 16s count the blend G-7 and G-8 are similar in respect of all properties followed by G-9. For 20s count, G-7 has the highest CSP and yarn elongation. The U% values are also similar. The percentage drop in CSP over that of the ring frame spun yarns ranged between 16.3 and 19.6. On the other hand the gain in YQI in comparison to the ring spun yarns lies between 10.8 and 22.3. On the basis of these data, blend G-7 has the lowest drop in CSP and the highest gain in YQI. Hence it can be preferred for being spun on the Open-End System (20s).

The experimental work on this project has been completed according to schedule.

Studies on Effect of Swelling Treatment on Yarn Irregularity with Special Reference to Uster Evenness Value (%)

Circularity and variation in circularity (CV%) was determined on fibres removed from yarn samples (20s and 30s) treated with NaOH and KOH along with non-treated samples (Control). It was observed that Uster value of both the yarns increased after treatment. It was also observed that although circularity (CV%) reduced to 15.2 and 13.2 for NaOH and 13.1 and 12.5 for KOH from 19.8 and 21.2 for 20s and 30s counts yarn, respectively. This indicated that the change in circularity and variation due to swelling treatment might not cause increase in Uster value (U%).

Further, this was confirmed by swelling spun viscose and filament rayon yarns and determining the Uster value. There was considerable increase in cross-sectional dimension without much changes in shape factor. The Uster value however increased in the case of spun yarn and decreased in the case of filament yarn.

It is proposed to study the changes in dielectric due to swelling treatment.

Performance Characteristics of Sewing Threads

It was reported earlier that 13 sewing thread samples were selected and tested for breaking strength, tenacity, elongation percentage (dry and wet), knot strength and abrasion resistance. During the period, these samples were tested for elastic recovery, stress-strain properties on Instron, yarn irregularity and hairiness. Further, these samples were given 30 hand washing treatment and then tested for breaking strength, elongation and abrasion resistance. It was observed that strength and elongation remained unchanged, whereas there was considerable reduction in abrasion resistance. To confirm the trend, three of the above samples were given repeated washing treatment. Strength, elongation and abrasion resistance were determined on these samples after 5, 15 and 25 washings, respectively. The results confirmed the above observations.

Pilling Behaviour of Textile Fabrics

Twelve samples of blended fabrics as shown in Table 13 were taken up for the comparison of pill formation, on Martindale Wear Tester and Tumble Pill Tester.

PROGRESS OF RESEARCH

The constructional parameters such as ends, picks, count, etc. were found out for the first three samples. The remaining nine samples were being tested for those properties. In the case of Martindale Wear Tester the test specimens were subjected to abrasion for 2000 and 3000 rubs in 40 and 60 min respectively, while Tumble Pill Tester was operated to complete 18000 revolutions in 5 hr. The specimens obtained on Martindale Wear Tester were graded in accordance with the Eureka standards by counting number of pills and ASTM standards. The specimens obtained on Tumble Pill Tester were graded according to ASTM Standards and the results are given in Table 14.

TABLE 13 : BLEND COMPOSITION

Sample No.	Blends	Composition (%)
1	Wool/Polyester	34.2/63.8
2	Wool/Polyester	47.2/52.8
3	Wool/Polyester/Nylon	89.8/2.0/8.2
4	Polyester/Cotton (Shirting)	80/20
5	Polyester/Cotton (Shirting)	45/55
6	Polyester/Cotton (Shirting)	90/10
7	Polyester/Cotton (Shirting)	69/31
8	Polyester/Cotton (Shirting)	48/52
9	Polyester/Cotton (Suiting)	48/52
10	Polyester/Cotton (Suiting)	67/33
11	Polyester/Cotton (Shirting)	67/33
12	Polyester/Cotton (Shirting)	64/36

TABLE 14 : ASSESSMENT OF PILLING AGAINST STANDARD PHOTOGRAPHS

Sample No.	Martindale Wear Tester		Tumble Pill Tester	
	Number of Pills after 3000 rubs	Eureka standard based on number of pills	ASTM Appearance grade	ASTM Appearance grade
1	33	3	4	4
2	20	4	4	4
3	23	3	4	4
4	9	4	4	4
5	0	5	5	5
6	9	4	4	4
7	5	4	4	4
8	24	3	3	4
9	28	3	3	3
10	14	4	4	4
11	33	3	3	3
12	33	3	3	4

ASTM pilling standard	Eureka standard
No. 5 No pilling (Excellent resistance)	0 to 4 pills
No. 4 Slight pilling (good resistance)	5 to 20 pills
No. 3 Moderate pilling (medium resistance)	21 to 39 pills
No. 2 Heavy pilling (poor resistance)	40 to 59 pills
No. 1 Very severe pilling (very poor resistance)	60 and above

It can be seen from Table 14 that the grades of Martindale Wear Tester and Tumble Pill Tester for the 12 fabrics were comparable. In sample No. 1, 3, 8 and 12, pill grading on Martindale specimens are found slightly higher than the specimens of Tumble Pill Tester. Eureka Standards which are based on counting number of pills could not be applied to specimens obtained on the Martindale Tester because it was difficult to count accurately the very large number of pills, observed on some of the samples.

A Study on the Comfort Properties of Textile Fabrics

During the course of investigation on the moisture transfer characteristics of cotton fabrics varying in their thickness and construction details, it was noticed that the relative humidity (RH) measurements carried out on the dry chamber, were influenced by the absorption and release of moisture by the acrylic sheets forming the chamber. This effect was found to be pronounced when the dry chamber was maintained at humidities below 55%. In order to overcome this difficulty, a chamber made of aluminium sheets was fabricated and used as the dry chamber. Using this new set-up, the time taken to reach mean RH was measured, keeping the dry chamber at different pre-determined humidities at the start of the experiment.

Analysis of the results obtained during measurement revealed that the time taken to reach mean RH, was strongly influenced by fabric parameters, viz. thickness ($r = +0.86$) and weight per sqare metre ($r = +0.89$).

Studies on Grafting of Vinyl Monomers on to Cotton Fabric

Freshly distilled styrene, methylmethacrylate and acrylonitrile monomers were grafted onto desized cotton fabric taken on the specially made frame using ceric ammonium nitrate as the initiator. The grafted fabrics were washed with soap solution, water and finally extracted with acetone in a soxhlet apparatus for 8 hours to remove any homopolymer. Grafting was uniform. Percent graft varied from 1 to 12 with acrylonitrile, 1 to 31 with methyl methacrylate and 2 to 13 with styrene. Since percent graft obtained with styrene was very low, a mixture of styrene and acrylonitrile (75 : 25) was used instead of styrene.

Styrene-acrylonitrile grafted fabrics showed a marginal fall in tensile breaking strength upto a percent graft of 4. At higher percent graft, the fall in strength was very steep. Acrylonitrile grafted fabric showed slight fall in strength at 2 percent graft and at 4 percent graft there was no change in breaking strength as compared to control. At percent graft level of 8 and 12, there was an increase of 12.4% and 9% in strength, respectively. On the other hand, in the case of methyl methacrylate grafted fabrics, there was an increase of 4%, 9%, 13.2% and 10.5% in breaking strength at percent grafts of 2, 5 12 and 31, respectively. Styrene grafted fabrics showed good water repellency.

Breaking strength of the grafted fabrics are shown in the Table given below:

Monomers used	Breaking strength of grafted fabrics (lbs)					
	Control	Percent graft				
		2	4	8	12-14	30-32
Styrene + Acrylonitrile (75 + 25)	55.0	52.7	51.2	46.0	28.8	—
Acrylonitrile	55.0	52.8	55.5	61.8	59.3	—
Methyl Methacrylate	55.0	57.1	59.3	—	62.7	60.8

Finishing of Cotton and Blended Fabrics with Resins and Metallic Monomers

The cotton fabric samples which were given a simultaneous crosslinking and polymerisation treatment earlier were evaluated for zinc content by atomic absorption method. The above mentioned samples alongwith DMDHEU controls and the untreated fabric samples were subjected to different number of washings in a laundrometer. These samples were evaluated for antibacterial performance by modified Quinn test method using **S-aureus** microorganism. It was observed that the experimental samples even after prolonged washings did not show any growth of **S-aureus** bacterial colonies; signifying the durability of the antibacterial finish. The DMDHEU control samples showed growth of various number of colonies, while the untreated fabric samples showed heavy growth **S-aureus** colonies.

Durable Flame Retardant (FR) Finishes for Textiles

As mentioned in the last report, a phosphorylation system has been developed using indigenously available cheap chemicals. A patent for the pro-

cess was filed jointly with Textiles Committee. Trials of this process were carried out in different textile mills. Various types of fabrics like poplin, cotton-viscose blend furnishing fabrics, drill, sheeting, canvas, furnishing fabrics, various types of printed curtain fabrics, corduroy, cambric, piled fabric, battice fabric, etc. were processed. All the treated samples retained good FR properties after drycleaning and detergent washing. The strength retention was also quite good ranging between 85%-100%.

In addition, at the request of Defence authorities, Pune, special type of fabric having initial high tear strength obtained from a mill was processed for FR finish in the presence of representatives of the Defence Department. The treated fabric is being analysed for various properties.

With a view to introduce water repellent (WR) property, two WR agents, wax emulsion and silicone emulsion with two catalysts were applied to FR fabrics under different conditions. Amongst these, wax emulsion could yield water repellency; however, FR property deteriorated. Silicone emulsion with zirconium sulphate yielded better results.

Studies on the Production of Amylase by Bacillus Subtilis-159 and Application of the Enzyme

In the earlier studies, work on production of amylase by **Bacillus subtilis-159** was carried out in shake flasks, using the low cost carbon and nitrogen sources, where the conditions like pH, temperature, etc. varied considerably. To obtain correct parameters for growth and amylase production, studies were carried out on a one litre Gallenkamp Modular Fermenter. **Bacillus subtilis-159** was grown under different conditions of aeration and agitation at 30°C. The aeration rate was varied from 300 cc/min. to 600 cc/min. while the broth was agitated at 360 rpm to 720 rpm. It was observed that the growth of the organism was rapid when aeration and agitation rates were 660 cc/min. and 480 rpm or 400 cc/min. and 720 rpm. respectively. Under these conditions maximum amylase was synthesized at 48 hr. Same amount of amylase was earlier obtained in shake flask within 96 hr.

B.subtilis-159 amylase was concentrated by different methods, viz. solvent precipitation, ammonium sulphate precipitation, dialysis against high molecular weight polymer and ultrafiltration methods. Drop in viscosity of three starches, viz. tapioca, maize and potato starch, was studied on the Brookfield Viscometer using **B.subtilis-159** amylase. Tapioca starch was found to be more susceptible to the enzyme attack and drop in viscosity was sharp.

Studies on the Biosynthesis of Cellulose by Microorganisms and Higher Plants

In the earlier studies, **in vitro** synthesis of cellulose in developing cotton bolls using C^{14} labelled uridine di-phospho glucose (UDP — C^{14}-glucose) was tried where two peaks of enzyme were obtained; one at 15 days post anthesis and another at 30-40 days post-anthesis. Presently another substrate, viz. C^{14}-Guanosine diphospho-glucose (GDP-C^{14}-glucose) was used to study the synthesis of Cellulose in developing cotton bolls. Cotton bolls were collected at different stages of development, starting from 10 days onwards and cellulose synthesizing enzyme (S) was isolated from the fibres by cutting, grinding and by the differential centrifugation. The enzyme was incubated with C^{14} labelled GDPG. The alkali-insoluble product was transferred into scientillation vials containing scintillation fluid for the measurement of activity.

Cellulose synthesizing enzyme (S) from 20 days and 35 days old fibres was also incubated with unlabelled UDPG and GDPG, separately and alkali-insoluble product formed was observed under microscope.

Studies on the Enhanced Enzymolysis of Never-Dried Cotton Cellulose and Other Cellulosic Materials

Cotton fibres from 40 days old DCH.32 variety were treated with 18% NoOH and subjected to enzymolysis both in wet and dry conditions. Similarly, cotton stalks were delignified and then subjected to enzymolysis before and after drying. Fresh cotton stalks, not allowed to dry was also included. Higher reducing sugars were obtained when cotton fibres were subjected to enzymolysis before drying. DP decreased progressively during the course of treatment. The amorphous content values of residues obtained from the wet material were lower than those of dried substrates at all times of enzymolysis. The reverse was true when dried substrates were used. Though sugar yields were maximum with cotton stalks in wet condition of enzymolysis, crystallinity values indicated an increase in order, irrespective of the treatment. Fresh and undried cotton stalks when subjected to enzymolysis gave about 85% conversion into reducing sugars in 6 hr. Maximum reducing sugars were obtained when enzymolysis was carried out on wet substrates as compared to their dried counterparts. However, the amorphous content values were lower only in the case of cotton fibres when transferred to enzyme system in wet condition whether with or without alkali treatment. The contrary was true with dried substrates.

Analysis and Grading of Indian Cotton Linters

Twentytwo commercial linter samples were analysed for trash content and invisible loss on Shirley Trash Analyser. In addition, percentage of chemical

cotton, ash content and cellulose yield were determined on raw linters, whereas cellulose content, ash content, ether soluble matter and whiteness index were determined on purified samples.

The results indicated a wide variation in short fibre content, cellulose yield, etc. This variation is likely to be caused by improper delinting of the samples.

It was noted that different samples of raw linters having same level of trash content, yielded on purification, different ash content values. This behaviour may be attributed to the nature of trash content.

Whiteness index of the commercial linter samples bleached under identical conditions showed wide variation. This may be either due to the differential response of varieties to bleaching or the nature of trash present in raw sample which is difficult to remove on purification.

Determination of Fibre Length Distribution:

Fibre length distribution in the case of about 15 linter samples was determined on Clark's Pulp Classifier at M/s. Mysore Acetate and Chemicals, Mandya. It was observed that the separation of different fibre length groups was not complete and Clark's Pulp Classifier was not suitable for this purpose.

Response of Linter Samples to Bleaching:

Six commercial linter samples were kiered and bleached with varying amounts of available chlorine ranging from 1 g/l to 2.5 g/l. All these purified samples were tested for viscosity.

The results indicated that as expected, with increase in available chlorine, viscosity values decrease; however, the rate of decrease varies with variety.

Utilisation of Cellulose Bearing Materials including Coarse Cotton, Cotton Plant Stalk and other Cellulose Bearing Materials for Manufacture of Viscose Pulp and Different Grades of Papers

During the period, an attempt was made to prepare viscose grade pulp. 100 g of cotton stalk chips were soaked in different concentrations of nitric acid solution (5%-20%) at ambient temperature for 72 hours. The material to liquor ratio was 1 : 10. The soaked material was boiled with water for half an hour and then extracted with 2% NaOH at 80°C for half an hour. Then the material was converted into pulp by mechanical disintegration and subsequently

washed with water to remove the excess chemicals. The pulps obtained were soft and very light in colour. The pulps were analysed for lignin and ash content. It was observed that the lignin and ash content decreased with increase in the concentration of the acid.

Preparation of Soda Pulps:

Soda pulps were prepared by digesting 500 g of cotton stalk chips with 18% and 22% NaOH on the oven dry (O.D.) weight of the raw material, in a rotary digester. The material to liquor ratio was kept at 1 : 6. The digestion was carried out at 160°C temperature and 6 kg/cm² pressure for 2 hr. and 45 minutes; which includes 45 min. required to raise the temperature of the contents from room temperature to 160°C. The cooked material was washed to remove the excess of chemicals. The material was then beaten in a valley beater to get the desired freeness.

Preparation of Soda-Anthraquinone Pulps:

Soda-anthraquinone pulps were prepared by digesting 500 g of cotton stalk chips with 18% NaOH + 0.05% anthraquinone and 22 % NaOH + 0.05% anthraquinone on the O.D. wt. of the raw material. The digestion was carried out in a rotary digester at 160°C temp. and 6 kg/cm² pressure for 2 hours. The material to liquor ratio was 1 : 6. The cooked material was washed to remove the black liquor and excess chemicals. It was then beaten in a valley beater to get the desired freeness.

Preparation of Kraft Pulp:

The kraft pulp was prepared by digesting 500 g of cotton stalk chips with 18% of chemicals (NaOH + Na_2S) at 20% sulphidity. The material to liquor ratio was 1 : 6. The cooking was carried out at 160° and 6 kg/cm² pressure in a rotary digester for 2 hr. The cooked material was washed to remove the excess chemicals and then disintegrated in a disintegrater and beaten in a valley beater to get the desired freeness.

Preparation of Kraft-Anthraquinone Pulp:

Kraft-anthraquinone pulp was prepared by employing the same experimental condition as that of the kraft pulp except addition of 0.05% of anthraquinone on the OD wt. of the raw material. The cooked material was washed till free from chemicals, then disintegrated and subsequently beaten in a valley beater to get the desired freeness of pulp.

Bleaching of Kraft-Anthraquinone Pulp:

A known quantity of the kraft-anthraquinone pulp was bleached with hypochlorite (7%) in a two step process at 50°C-60°C temp. for half an hour at 9-10 pH and 5% consistency.

Preparation of Paper Sheets and Testing:

Unbleached and bleached paper sheets of various gsm were prepared from the above pulps on a KVIC sheet making machine. The paper sheets were dried in air and then conditioned at 65% R.H. and 27°C temperature for 2 hr and then tested for various properties such as breaking length, burst factor, tear factor, number of double folds, etc.

Production of Biogas from Cellulosic Wastes from Textile Mills

The chloroform extract of the digested slurry on IR spectral analysis indicated that it contains indole-3-carboxyaldehyde. The biochemical pathway of this compound is to be ascertained with regard to its transformation to Indole Acetic Acid (IAA), the well known plant growth regulator.

It has also been observed that **Beijerineckia** sp., the free living nitrogen fixing bacterium, is specifically encouraged during the initial aerobic fermentation of willow-dust. Their role is yet to be established.

Trials undertaken on the pilot plant at Apollo Textile Mills indicated that as much as 500 m^3 of biogas was produced in 90 days from 2 tonnes of willow-dust when the solid to liquid ratio of 1 : 6 was maintained. When the same ratio was changed to 1 : 1.5, the quantity of biogas remained unaltered but it was distributed over 60 days with a constant supply like that of semi-continuous or plug flow fed digesters.

Trials undertaken at Apollo Textile Mills indicated that by employing dry fermentation technology, it is possible to produce as much as 250 m^3 of biogas per tonne of willow-dust in 60 days with a very constant supply of the gas throughout the fermentation period.

Utilisation of Cotton Plant and Cottonseed By-products with Special Reference to Cottonseed Hull

Hulls from local factories as well as commercial hull samples from Guntur was procured and boards were prepared for demonstration purpose using different concentrations of binder. Quite a number of fire retardant boards

were also prepared using hull, binder and different fire retardant chemicals such as ammonium dihydrogen orthophosphate, borax and boric acid, alone as well as in combination of different proportions and various flame retardant properties such as (i) duration of flaming, (ii) after-glow duration, (iii) charred length, (iv) charred areas and (v) loss in weight and physico-mechanical properties such as bending strength, water absorption and thickness swelling were studied.

The boards were prepared with three different FR agents, viz. (i) Ammonium phosphate, (ii) Borax and boric acid in proportion 70% + 30% respectively and (iii) Borax + boric acid + Ammonium phosphate in proportion of 60% + 25% + 15% respectively. The concentration of FR agents/mixture used for preparation of board was from 0% to 15%. All the FR treated boards showed increased water resistance, and deteriorated bending strength as compared to control with increase in concentration of FR.

With increase in concentration of FR from 0% to 15%, FR (i), (ii) and (iii), respectively, decreased (a) loss in weight from 68.2% to 4.5%, 5.2% and 6.8% and (b) bending strength (modulus of rupture) to 129 kg/cm², 97 kg/cm² and 66 kg/cm² from 172 kg/cm². Similar trend was observed for charred length and charred area.

The effect of FR on water resistance was more pronounced in the case of (i) than (ii) and (iii).

Particle boards prepared with cottonseed hull using different binders such as phenol formaldehyde were not only stronger in bending strength and tensile strength, but were very much water repellent also.

Boards prepared by using different water repellents like Silicorel, RSE-3000 and others, were studied, but the results were not encouraging.

Dehulled cotton seed samples of different species were ground to fine particles and were analysed for percent extractives, lignin, pentosan, cellulose, etc. It was observed that there was marked variation in pentosans and Hollocellulose content. Pentosans varied from 18.5% to 29.2% in the case of commercial hull and **G.arboreum,** respectively, whereas Hollocellulose varied from 64.7% for commercial hull to 69.6 for **G.barbadense.**

RESEARCH WORK DONE AT THE REGIONAL QUALITY EVALUATION UNITS

HISSAR

An investigation was undertaken to study the efficacy of various synthetic pyrethroids on the pink-boll worm incidence and their effect on the yield and

quality of H.777 cotton. Cypermethrin was found to be most effective in controlling the pink boll worm incidence and also recorded the highest **kapas** yield. 2.5% span length improved significantly by the treatment and other fibre quality characteristics were unaffected by the treatments.

INDORE

(i) A study on the effect of different levels of alkalinity on the fibre quality of five varieties, was being carried out for the last three years at Indore. The five different levels of alkalinity were created in normal soil by applying sodium carbonate in the pot. Amongst the five varieties Barwah selection was found to be very tolerant in salt affected soil and did very well in the normal soil also. The fibre bundle strength and maturity for this cotton were significantly higher and x-ray angle was significantly lower in sodic soil than that grown in normal soil.

(ii) Another investigation to study the impact of water logging on the quality of cotton grown in salt affected soil was carried out by pot experiments conducted at Indore. With the two varieties viz. Barwaha selection and Khandwa 2 grown in four soils of different alkalinity levels at the four stages of water-logging. It was observed that there was wide variation in fibre quality at different stages of water-logging but the trend was not consistent.

SURAT

To work out yield losses and quality degradation due to bacterial blight, an experiment was undertaken at Surat during 1982-85 seasons. The main treatments consisted of 3 levels of infection and sub-treatments on 6 varieties of cotton. The yield difference was non-significant due to different infection levels and their interactions. The infection did not influence the quality of cotton.

SRIGANGANAGAR

Effect of nitrogen fertilizers and different plant protection measures on the quality of American Cotton was studied. The treatments were four doses of nitrogen (0, 40, 80 and 120 kg) and three plant protection measures at 0, 50 and 100% levels. Statistical analysis of the data revealed that different N-levels did not show any effect on fibre quality. The plant protection measures showed significant improvement in length and fineness.

AKOLA

To improve fibre quality by single seed selection method. 14 varieties of cotton were chosen. During 1981-82 season first selection of single seeds of

these varieties was carried out. The hybrid varieties were dropped out as these varieties had shown segregation. However, the correlation of parental and varietal means with progency means for other varieties was studied. Second selection of single seed was carried out in 1982-83 season and fibre characters were studied. The genetic advance (GA) (percentage of successive generation mean over parental mean) in respect of G.P. length, maturity, fineness, strength was calculated. Some interesting conclusions were drawn as follows:

1. AKA.90, AKA.67 and AKH.4 gained GA in all major fibre properties.
2. PKV.083 gained GA in fibre properties except length and strength.
3. AK.235 appear to have become fixed at GP of 42%. Moreover it gained GA in all the major fibre properties.

3. PUBLICATIONS

A. Annual Report

Annual Report of the Cotton Technological Research Laboratory for the calendar year 1984.

B. Technological Report

No. 36 Technological Report on Standard Indian Cottons, 1983-84 season.

No. 33 & 35 Technological Report on Trade Varieties of Indian Cottons for 1982-83 and 1983-84 seasons.

C. Research Publications (CTRL Publication New Series)

No. 273 I. G. Bhatt, A. W. Shringarpure, V. Sundaram, S. N. Bailur and G. R. Phalgumani — Durable Flame Retardant (FR) Finish to Cellulosic Fabric by Phosphorylation (Reprinted from the Colourage Journal, Vol. XXXII, No. 6, p. 3, March 21, 1985).

No. 274 R. P. Nachane, K. R. Krishna Iyer and N. B. Patil — Bulk Resilience of Fibres (Reprinted from the Journal of Applied Polymer Science, Vol. 29, p. 4055, December, 1984).

No. 275 S. N. Pandey and C. R. Raje — A New Catalyst System for Improved Durable Press Properties of Cotton Fabric (Reprinted from the Textile Research Journal, Vol. 55, No. 2, p. 125, February, 1985).

No. 276 S. D. Pai, V. G. Munshi and A. V. Ukidve — SEM Studies on Changes in Tensile Properties and Abrasion Resistance of Sewing Threads During Chemical Processing Treatments (Reprinted from the Indian Journal of Textile Research, Vol. 10, No. 2, p. 56, June, 1985).

No. 277 R. H. Balasubramanya, S. P. Bhatawdekar and K. M. Paralikar — A New Method for Reducing the Stickiness of Cotton (Reprinted from the Textile Research Journal, Vol. 55, No. 4, p. 227, April, 1985).

No. 278 I. K. P. Iyer and V. G. Munshi — Study on Performance of Fineness/Maturity Tester and Fibrograph for the Measurement of Fineness: Part I (Reprinted from the Journal of Textile Association, Vol. 46, No. 1, p. 4, January, 1985).

No. 279 I. K. P. Iyer, V. G. Munshi — Study on Performance of IIC Fineness/Maturity Tester and Fibrograph for the Measurement of Maturity: Part II (Reprinted from the Journal of Textile Association, Vol. 46, No. 3, p. 75, May, 1985).

No. 280 S. D. Pai, V. G. Munshi and A. V. Ukidve — Influence of Physical Characteristics and Chemical Treatments on Lustre of Sewing Threads (Reprinted from the Textile Trends Journal, Vol. XXVIII, No. 3, p. 49, June, 1985).

No. 281 J. K. S. Warrier and V. G. Munshi — Tensile Testing Instruments for Single Cotton Fibre — A Brief Review (Reprinted from the Textile Trends Journal, Vol. XXVIII, No. 4, p. 41, July, 1985).

No. 282 S. N. Pandey and R. M. Gurjar — Production of Particle Boards from Cottonseed Hulls (Reprinted from the Agricultural Wastes Journal, Vol. 13, No. 4, p. 287, 1985).

No. 283 K. R. Krishna Iyer, R. P. Nachane and N. B. Patil — Bulk Resilience of Native and Chemically Treated Cottons (Reprinted from the Textile Research Journal, Vol. 55, No. 6, p. 383, June, 1985).

No. 284 S. N. Nagwekar, S. D. Pai, Vireshwar Singh and M. S. Kairon — Efficacy of Gramoxone Bolls Eye and Sodium Chlorate as Defoliants to Improve the Yield and Quality of Cotton H.777 (Reprinted from the Haryana Agricultural University Research Journal, Vol. XV, No. 3, p. 309, September, 1985).

No. 285 O. P. Govila, P. G. Oka, A. P. S. Verma and O. N. Avasthi — Development of Gossypium Barbadense for North India (Reprinted from the Indian Society for Cotton Improvement Journal, Vol. X, No. 1, p. 1, March, 1985).

No. 286 V. T. Srinivasan, B. B. Singh, P. K. Chidambareswaran and V. Sundaram — Cottonseed Oil Estimation by Pulsed Nuclear Magnetic Resonance Technique (Reprinted from the JAOCS, Vol. 62, No. 6, June, 1985).

No. 287 K. M. Paralikar — Scanning Electron Microscopy Study of Some Textile Materials (Reprinted from the Indian Society for Cotton Improvement Journal, Vol. VII, No. 2, p. 47, September, 1982).

No. 288 S. N. Nagwekar, A. P. Jayaswal, Lajpat Rai and R. K. Saini — Effect of New Insecticides Against Pink Bollworm and Its Effect on the Seed Cotton Yield and Fibre Quality of American Cottons (Reprinted from the Indian Society for Cotton Improvement Journal, Vol. VII, No. 2, p. 66, September, 1982).

No. 289 S. D. Pai, V. G. Munshi and A. V. Ukidve — Seam Quality of Cotton Threads (Reprinted from the Textile Asia Journal, Vol. XV, No. 6, p. 80, June, 1984).

No. 290 J. K. S. Warrier and V. G. Munshi — An Overview of the Relevance of Speed in Bundle Tenacity Determination of Cotton Fibres (Reprinted from the Indian Textile Journal, Vol. XCIV, No. 9, p. 91, June, 1984).

No. 291 Janaki K. Iyer — Estimation of Spinning Performance (Reprinted from the Indian Textile Journal, Vol. XCIV, No. 10, p. 81, July, 1984).

No. 292 S. D. Pai, V. G. Munshi and A. V. Ukidve — Cotton and Synthetic Threads — Part I (Reprinted from the Indian Textile Journal, Vol. XCIV, No. 11, p. 63, August, 1984).

No. 293 S. D. Pai, V. G. Munshi and A. V. Ukidve — Cotton and Synthetic Threads — Part II (Reprinted from the Indian Textile Journal, Vol. XCIV, No. 12, p. 71, September, 1984).

No. 294 S. N. Pandey — Future Prospects for Cottonseed Protein (Reprinted from the AICOSCA Newsletter, Vol. No. 10, p. 2, October, 1984).

No. 295 P. Bhaskar, A. V. Ukidve, B. Srinathan and K. R. Krishna Iyer — A Comparison of the Untwist-Retwist Method and Straightened Fibre Mehtod for Yarn Twist Determination (Reprinted from the Indian Textile Journal, Vol. XCV, No. 7, p. 89, April, 1985).

No. 296 P. V. Varadarajan, K. H. Sawakhande and I. G. Bhatt — Effect of the Presence of Different Trash Constituents on the

Ash Content of Linters (Reprinted from the Indian Pulp and Paper Journal, Vol. XXXIX, No. 6, p. 9, April-May, 1985).

No. 297 P. V. Varadarajan and I. G. Bhatt — Grading of Cotton Linters: An Easier Method of Determination of Cellulose Yield of Cotton Linters Through Mechanical Analysis. (Reprinted from the AICOSCA Newsletter, Vol. 7, p. 10, July, 1985).

No. 298 D. N. Makwana and V. G. Munshi — A Physical Method of Assessing Man-Made/Cotton Blend Composition (Reprinted from the Indian Textile Journal, Vol. XCVI, No. 1, p. 133, October, 1985).

No. 299 V. Sundaram, S. B. P. Rao and A. K. Basu — Cotton Improvement Research and Production Practices in India in Relation to Fibre Quality and End-Use Requirements — Part I and II (Reprinted from Indian Cotton Mills' Federation Journal, Vol. XXII, No. 1, p. 11, May, 1985).

No. 300 V. Sundaram, S. B. P. Rao and A.K. Basu — Cotton Improvement Research and Production Practices in India in Relation to Fibre Quality and End-Use Requirements — Part III: Achievement of Cotton Improvement Research (Reprinted from Indian Cotton Mills' Federation Journal, Vol. XXII, No. 2-3, p. 17. June-July, 1985).

No. 301 S. N. Pandey and C. R. Raje — Migration of Crosslinking Reagents in Cotton/Terene Blended Fabric During Resin Finishing (Reprinted from the Textile Research Journal, Vol. 55, No. 11, p. 694, November, 1985).

D. Other Publications

1. P. Bhama Iyer, K. R. Krishna Iyer and N. B. Patil — A Study of X-ray Orientation in Never-Dried Cotton Fibres (Published in the Journal of Applied Polymer Science, Vol. 30, No. 1, p. 435, January, 1985).

2. M. S. Parthasarathy — INDIA-ITME — Spinning — (Published in the J. Text. Assocn. 46, p. 49, March, 1985).

3. A. A. Gupte, B. Srinathan and A. K. Basu—Influence of Wrappers on Polyester/Viscose Blended Yarn Characteristics (Published in the

Proceedings of First National Convention of Textile Engineers, All India Seminar on Spinning Technology for Nineties, p. 15).

4. V. G. Khandeparkar, R. H. Balasubramanya, H. U. Gangar and V. Sundaram — Pilot Plant to Study the Production of Biogas and Biomanure from Willow-Dust — a Textile Mill Waste (Published in the Indian Society for Cotton Improvement Journal, Vol. X, No. 2, p. 140, September, 1985).

5. V. G. Munshi and V. Sundaram — Resume of Studies on Effect of Agricultural Practices on Cotton Fibre Quality (Published in the Indian Society for Cotton Improvement Journal, Vol. X, No. 2, p. 65, September, 1985).

6. A. V. Ukidve, P. G. Oka, P. Bhaskar, S. Chandrashekar and B. Srinathan — Comparison of Microspinning and Bulk Spinning Techniques (Published in the Indian Society for Cotton Improvement Journal, Vol. X, No. 2, p. 128, September, 1985).

E. Technological Circulars on Trade Varieties of Indian Cottons

T.C. No.	Variety	Place	T.C. No.	Variety	Place
2256	Nimbkar	Baramati	2271	G.Cot.12	Dharangdhra
2257	Sankar 4	Manvadar		(Kapatia)	
2258	Hybrid 4	Burhanpur	2272	Laxmi	Savanur
2259	T.34-S/G	Adampur	2273	J.34-R/G	Sriganganagar
2260	F.414	Kotkapur	2274	Suyodhar	Bijapur
2261	J.34-R/G	Jaitu	2275	G.Cot.12	Dhanduka
2262	Bengal Desi	Raman		(Kapatia)	
2263	B.1007	Burhanpur	2276	Y.1	Sendhwa
2264	Sanjay	Botad	2277	Laxmi	Bijapur
2265	Varalaxmi	Nargund	2278	J.34-S/G	Sriganganagar
2266	Western 1	Bellary	2279	AKH.4	Anjangaon
2267	Digvijay	Banaswara	2280	Maljari	Khargaon
2268	Digvijay	Dakor	2281	AKH.4	Akola
2269	Jayadhar	Ron	2282	JKHy.1	Guntur
2270	Suyodhar	Bagalkot	2283	Hybrid 4	Pusad
			2284	Varalaxmi	Badnawar

F. Technological Circulars on Standard Indian Cottons

S.C.No.	Variety	Place
260	Buri 1007	Achalpur
261	Deviraj	Junagadh
262	Badnawar 1	Badnawar
263	Digvijay	Bharuch
264	G.Cot.10 (SRT.1)	Bharuch
265	Laxmi	Rahuri
266	Hybrid 6	Surat
267	Suyodhar	Bagalkot
268	G.Cot.11	Bharuch
269	Hybrid 4	Surat
270	AKH.4	Akola
271	SRT.1	Akola
272	V.797	Viramgam

4. EXTENSION

CTRL does not have the facility of an agricultural farm attached to it and therefore, for field work associated with the cotton growing research, CTRL depends on Central Institutes and Agricultural Universities situated in various cotton growing tracts in the country. CTRL's direct extension services are confined to supply of reliable and accurate data on desired quality parameters of cotton, yarn, fabrics etc. received from cotton growers, traders and industry. In addition to conducting training courses in cotton technology mainly in the quality evaluation aspects of cotton fibres, yarns and fabrics and training to gin fitters in the finer details of quality ginning and in statistical methods connected with the quality parameters of fibres, yarns and fabrics, assistance is extended by way of development of useful new equipments for the field as well as for the industry, their fabrication and supply. Scientists at the twelve Quality Evaluation Units actively collaborate in the relevant research programmes of the Agricultural Universities or Government Agricultural Departments in the region, which ultimately benefit the farmer community.

Technical Queries

Several queries of technical nature on different aspects were received in addition to questionaires for seeking informations. These information dissemination work has been attended to regularly and promptly, apart from giving out information to those who sought it by personal visits. These queries include, research accomplishments of CTRL, technical know-how for commercial exploitation, statistical data of production, consumption acreage, etc. of cotton in India, technological aspects as moisture regain, trash content, quality ginning etc.

Testing

CTRL receives regularly a number of samples of fibre, yarn and fabrics for special tests from Government and Semi-Government Organisations as well as from Trade and Textile Industry on payment of the prescribed test fees. The number of samples received and tested during the year 1985 together with the corresponding figures for 1983 and 1984 and average for the quinquennium 1976-80 are given in the Table 15.

The total fees realised during the calendar year 1985 for carrying out paid test on samples received, was amounting to Rs. 43,139.50 as against Rs. 41,607/- during 1984.

TABLE 15 : NUMBER OF SAMPLES RECEIVED FOR PAID TESTS

Type of Tests	Average for the Quinquennium 1976-80	1983	1984	1985
Spinning	51	20	52	92
Fibre (EICA)*	158	78	100	37
Fibre (Others)	121	159	125	174
Yarn	48	227	187	198
Cloth	76	61	78	60
Moisture	—	48	21	7
Miscellaneous	17	55	40	23
	471	648	603	591

* These samples from East India Cotton Association (EICA) Ltd., Bombay are tested free of charge as EICA reciprocates by supplying, free of charge, a number of samples (6 kg. each) of the Trade Varieties and also the Grader's valuation reports on samples of improved cotton strains sent by them to this Laboratory.

It may be mentioned in this connection that the Test Fee Schedule was revised with effect from June, 1985, based on various costs involved as salary component of different categories of relevant staff, cost and power consumption of instrument, its depreciation, etc.

Besides the usual tests of routine nature, the following special tests were also carried out on some of the samples received as paid tests.

1. Two lots, consisting of six fabric samples each were received from a Bombay based Spinning and Manufacturing Co. for tests for Anti-bacterial Properties. The tests were carried out and results with comments were communicated to the party.

2. One sample of High Density Polyethylene (HDPE) sample was received from a Bombay firm for the evaluation of denier, tenacity and percentage elongation. The tests were carried out and the results forwarded to the party.

3. Nine Polyester film samples were received from a Plastic and Polyester Company in Bombay for carrying out Infrared Dichroism test. The Infrared scans pertaining to the samples were sent to the party.

Exhibition

As per instructions received from ICAR, CTRL participated in the Scientific and Industrial Exhibition organised in connection with Congress Centenary Celebration held between 28-12-1985 to 12-1-1986 along with Central Institute of Fisheries Education (CIFE), Bombay, Central Institute for Cotton Research (CICR), Nagpur, and National Bureau of Soil Survey and Land Use Planning (NBSS & LUP), Nagpur, by erecting a stall on the hired space of about 1000 sq. metres and displaying models and line display pieces of new technologies developed as well as coloured charts on various statistical data on cotton, charts and actual display specimens pertaining to waste material utilisation also formed part of the exhibition items.

Training

CTRL conducted two full time training courses in 1985 — One from July 15, 1985 to September 13, 1985 for persons deputed by cotton trading organisation and industry in Bombay and the other from September 23, 1985 to November 22, 1985 for personnel from moffusil centres. The training was mainly by lectures and practical work on methods of evaluation of quality of cotton fibre and yarn fabric and interpretation of test results based on statistical methods. The names and addresses of all the trainees are given below:

1. Shri P. Ramakrishnan,
   Cotton Corporation of India,
   Air India Building, 12th Floor,
   Nariman Point,
   Bombay-400 021.

2. Shri Mukesh L. Shah,
   P. L. Cotton Company,
   G/4, Lal Bungalow,
   Upashraya Lane,
   Bombay-400 077.

3. Shri Ramnath Hakla,
   Cotton Corporation of India,
   Air India Building, 12th Floor,
   Nariman Point,
   Bombay-400 021.

4. Shri Premlal Pranlal Damani,
   M/s. Pranlal Amarchand Damani,
   B-108, Cotton Exchange Building,
   Cotton Green,
   Bombay-400 033.

5. Shri A. W. Desai,
M/s. Orissa Textile Mills Ltd.,
P. O. Chowdwao,
Cuttack, Orissa-754025.

6. Shri C. R. Ramachary,
Sitalakshmi Ginning Factory,
Periakulam Road,
Theni, Tamil Nadu-626 531.

7. Shri H. V. Patil,
The Maharashtra State Co-operative Cotton Growers Marketing Federation Ltd.,
Khetan Bhavan,
J. T. Road, Churchgate,
Bombay-400 020.

8. Shri Michael John,
The Cotton Corporation of India Ltd.
Air India Building, 12th Floor,
Nariman Point, Bombay-400 021.

In addition, special training for about three months from May 24, 1985 to August 16, 1985 was given to the following two trainees from Burma in all the aspects of cotton quality evaluation and related subjects.

1. Daw Lai Win Khine,
Village Track Manager,
C/o. General Manager,
Project and Planning,
Agriculture Corporation,
Rangoon, Burma.

2. Daw Mya Khin,
Village Track Manager,
C/o. General Manager,
Project and Planning,
Agriculture Corporation,
Rangoon, Burma.

5. CONFERENCES AND SYMPOSIA

Director and scientists of the Laboratory participated in the following scientific and technological Conferences and Meetings connected with the work of the Laboratory.

Sr. No.	Meeting/Conference	Place	Date	Name(s) of the Officer(s) who attended the Meeting/ Conference
1	2	3	4	5
1.	26th Joint Technological Conference of ATIRA, BTRA, SITRA and NITRA	Ahmedabad	7-2-1985 and 8-2-1985	Shri B. Srinathan
2.	All India Seminar on Modern Weaving Technology	Bombay	30-4-1985	Shri M. S. Parthasarathy and Shri B. Srinathan
3.	National Seminar on Fertilizers	New Delhi	9-10-1985 and 10-10-1985	Dr. V. Sundaram
4.	26th Annual Conference of Association of Micro-biologists of India	Madras	10-10-1985 to 12-10-1985	Dr. V. G. Khandeparkar and Dr. R. H. Balasubramanya
5.	2nd Regional Workshop under the National Co-ordination of Testing and Calibration Facilities Programme	Bombay	25-10-1985	Dr. V. G. Munshi Dr. V. G. Khandeparkar Dr. (Kum.) I. G. Bhatt and Kum. I. K. P. Iyer
6.	National Symposium in Agricultural Education and Research in India	New Delhi	28-10-1985 to 30-10-1985	Dr. V. Sundaram
7.	Silver Jubilee Convention of Indian Society of Agricultural Engineering	Bhopal	29-10-1985 to 31-10-1985	Shri G. R. Anap

CONFERENCES AND SYMPOSIA

1	2	3	4	5
8.	Winter School on "Mechanics of Textile Structures"	A. C. College, Madras	2-12-1985 to 14-12-1985	Dr. K. R. Krishna Iyer
9.	Seminar on Electronics in the Textile Industry	Bombay	16-12-1985	Shri N. Ramesh Babu
10.	CAS Symposium on 'Developments in Fibres and their Processing'	Bombay	21-12-1985	Dr. V. Sundaram, Dr. N. B. Patil, Shri M. S. Parthasarathy, Dr. (Kum.) I. G. Bhatt, Dr. P. K. Chidambareswaran, Mrs. V. Iyer, Shri P. V. Varadarajan and Shri A. W. Shringarpure
11.	Dyeing of Polyester and its Blends	U.D.C.T., Bombay	25-1-1985	Dr. (Kum.) I. G. Bhatt and Shri A. W. Shringarpure
12.	Modern Atomic Spectroscopy	Bombay	5-12-1985	Shri P. V. Varadarajan Shri A. W. Shringarpure and Shri N. Thejappa

6. SUMMARY OF THE REPORT

This is the sixty second Annual Report of CTRL, which covers the calendar year 1985.

As in the past, CTRL had been functioning in collaboration with State Departments of Agriculture, Agricultural Universities and other sister research institutions for evolving better quality cottons and for increasing better utilisation of cotton lint as well as cotton plant by-products. CTRL continued to function as the co-ordinating centre for technology under AICCIP. 2796 cotton samples have been received at CTRL for various tests, while 1311 samples were tested under AICCIP and State Schemes. The total number of books in the Library remained at 3729 and of bound volumes of journals at 4716. The Library used to get regularly about 200 journals pertaining to cotton, textiles and related fields. CTRL received 96 books on textiles and related fields under ODA Book Presentation Programme. There were 31 on-going research projects during 1985 in addition to six common laboratory projects and two inter-institutional projects. The Ginning Training Centre at Nagpur established with World Bank assistance under the Integrated Cotton Development Project was formally inaugurated by the then Hon. Minister for Agriculture and Rural Development, Sardar Buta Singh in December, 1985. As usual, the Hindi Day was celebrated on September 16, 1985 with a variety of programmes. Mill tests were arranged on a total of 8 samples received from Akola, Surat, Rahuri and Guntur.

Research Activities

A total of 572 Germplasm stock of *G. hirsutum* received from CICR, Nagpur were evaluated for fibre properties.

Lint samples from cotton crop grown under different soil profiles at Surat were subjected to fibre test and several observations were reported.

Studies on the changes of fibre characters during the development period of bolls have shown that although the lengthening phase of fibres ceases at almost the end of third week, in the case of some of the cottons, the lengthening phase exceeds this period. The maturity and the bundle strength, however, show improvement progressively upto the eighth week from the post-anthesis.

SUMMARY OF THE REPORT

Eighty two single plant selections of the promising strain NA-39, grown from seeds irradiated with gamma-rays, were screened on the basis of extreme variations in fibre properties and the results indicated considerable morphological changes.

The relationship between the yarn x-ray angle and yarn count was studied in detail and it was found that (i) the two parameters were inversely related, irrespective of the twist multiplier used, (ii) the twist response was higher for coarser yarns, (iii) yarn x-ray angle was highly influenced by Twist per inch and the twist response was higher for coarser counts, when multifilament rayons were used for the study and (iv) the twist response of multifilament rayon yarns was higher than that of cotton yarns spun to the same count.

Measurement of orientation from x-ray patterns of fibre bundles under different stretch levels have been standardised as part of the study on the orientation behaviour of cotton fibres under tensile stress.

For the study of cotton fibre strength and its dependence on various morphological and stuctural parameters, single fibre as well as fibre bundle tenacities at nominal zero and 3.2 mm gauge lengths have been determined for the varieties selected. The number of convolutions and structural reversals per unit length have also been determined for 19 cottons. The trends of relationships observed in breaking tenacity under different conditions and the breaking extension were assessed.

A coarse Indian wool of the variety Rampur Bushier was used to study inverse relaxation (IR) phenomenon in wool fibres. IR index determination at various retraction levels corresponding to 40% and 30% extension levels showed that its behaviour is similar to that of other fibres, studied earlier.

Viscose filament yarn was tested for measurement of dynamic modulus at different strain levels during loading, unloading and reloading and it was observed that at a given strain, the dynamic modulus of the second cycle was always greater than that of the first cycle.

Cotton fibres repeatedly treated with LiOH, NaOH, KOH, Ethylene diamine and ZnCl solutions are found to layer, by the layer expansion technique, unlike reported earlier by some workers. Repeated swelling by alkali metal hydroxides reveals a characteristic honey comb structure throughout the cross section in all cases except in the case of 12% NaOH treatment where the layered cross section shows a bilateral structure. Layered cross section of cotton fibres repeatedly treated with ethylene diamine show profuse layering with some of the layers revealing a honey comb structure having a fibrillar

texture. Further, layer expansion of cotton fibres repeatedly treated with 65% $ZnCl_2$, showed well defined layers having a honey comb structure with fibrillar texture. In general, it was observed that the interlamellar spaces in layered cross sections of all the repeatedly swollen fibres were more than that of untreated and single swollen cotton.

In connection with the preparation and characterisation of microcrystalline cellulose, about 100 gm of hydrolysed cellulose material was prepared from cellulosic materials, like bagasse pulp, wheat straw pulp, cotton lint, etc. by treatment with ZN Hcl for $\frac{1}{2}$ hr. in the material to liquor ratio of 1:50. Various properties were determined of the material and compared with imported material. As the percent weight loss during enzymatic hydrolysis was very high, a pre-swelling with NaOH is proposed to be tried out.

Studies on Laxmi Rieter drawing and speed frames were undertaken with a medium staple cotton, Digvijay under certain standard conditions.

The study on influence of fibre length and fibre length distribution parameters on yarn quality was continued by testing 30 cottons for length uniformity ratio (UR) and floating fibre index (FFI) and eighteen yarn samples for yarn hairiness. Fourteen more samples were subjected to test for assesing the effect of FFI on carding and draw frame slivers at different span length levels in forward and reverse directions. It was observed that UR and FFI has a definite trend and the mean value of UR increased from card to draw frame slivers indicating improvement in parallelisation. The FFI values were found to decrease from card to second draw frame slivers indicating reduction in short fibre percentage.

The influence of denier and length in the formation of wrappers in OE spinning and their effect on yarn tenacity and elongation were studied in detail, using polyester fibre and viscose fibre, in connection with the blending studies of cotton with man-made fibres. The length and denier of fibres per cross section of yarns were found to influence more on wrapper formation when the fibres of different denier, but the same length, were used. The influence of length of the constituents in the blend appears to dominate over the denier, when both denier and length are changed. The tight wrappers have a higher influence on tenacity and elongation when compared to loose wrappers.

Study on Open-end Spinning (OE) of Indian cottons and cotton wastes was continued by investigating the contribution of different fibre properties on various yarn quality characteristics using factorial analysis. It was observed that the single thread breaking tenacity and single thread breaking elongation have considerable influence on yarn quality. Amongst fibre properties, mean

length of Indian cottons and their blends, fibre bundle strength and Micronaire value influenced yarn properties in that order.

In connection with the studies on blending of standard varieties of Gujarat cottons, fibre orientation aspect of three blends have been completed and fibre lengths in the major and minor hook directions of slivers obtained in the short and large processing systems were estimated. A comparison of the values obtained for individual varieties as well as blends has shown that (a) removal of hooks is achieved to a very large extent on the 50% span lengths than in 2.5% span lengths in both the directions and between the two the increase is more in the minor hook direction, (b) the overall length improvement is more after two passages of high speed drawing than three passages for the 2.5% and (c) the ratios between the figures for the 2.5% and 50% span lengths for both the sequences are about 1:3.25 in the major hook direction and 1:3.75 in the minor hook direction. The individual cottons as well as blend of 170 CO2, Digvijay, and S.4 were spun on ring spinning and open end spinning systems and the properties of yarn produced were compared and reported.

Circularity and variation in circularity were determined on fibres removed from yarn samples treated with two swelling agents, NaOH and KOH, along with control and it was observed that Uster value of treated yarns increased in the case of both the swelling agents and variation in circularity was correspondingly low. The same observation was confirmed using viscose and filament rayon yarns.

In connection with the study of the performance characteristics of sewing threads, thirteen sewing thread samples were tested for elastic recovery, stress-strain properties, yarn irregularity and hairiness, before and after hand washing treatments. It was observed that strength and elongation remain unchanged, whereas there was considerable reduction in abrasion resistance.

Twelve blended fabric samples were tested for pilling on Martindale Wear Tester and Tumble Pill Tester. Fabric specimens were also graded adopting Eureka standards by counting number of pills and ASTM standards by yarn appearance. The important observations made were reported.

In connection with the investigations on the comfort properties of textile fabrics, a chamber made up of aluminium sheets was fabricated and used as dry chamber. This became necessary in order to avoid the absorption and release of moisture by acrylic sheets, which formed the dry-chamber in the earlier experiments. Using this, the time taken to reach mean RH was measured, keeping its dry chamber at different pre-determined humidities at the

start of the experiment; analysis of results revealed that the time taken to reach mean RH was strongly influenced by thickness and weight per square metre.

Freshly distilled styrene, methyl methacrylate and acrylonitrile monomers were grafted on to cotton fabric by ceric ion initiation method. Percentage graft varied from 1 to 12 with acrylonitrile, 1 to 31 with methyl methacrylate and from 2 to 13 with a mixture of styrene and acrylonitrile (75: 25). Grafting was uniform and styrene grafted fabrics showed a marginal fall in strength upto a percent graft of 4 and there was a sharp fall in strength at higher percent grafts. Acrylonitrile grafted fabrics with a percent graft of 8 to 12 and methyl methacrylate grafted fabrics with a percent graft of 2 to 31 showed improvement in breaking strength. Styrene grafted fabrics showed good water repellency.

Fabric samples which were given a simultaneous crosslinking and polymerisation treatment were evaluated for zinc content by atomic absorption method. These samples were evaluated for antibacterial performance and it was observed that the treated samples even after prolonged washings did not show any growth of bacterial colonies.

Durable Flame Retardant (FR) Fabrics were made using indigenously available cheap chemicals at different textile mills and all the samples retained good FR properties with good strength retention (85% - 100%). As per request from Defence Authorities, Pune, special type fabric having initial high tear strength was given FR treatment. Of the two water repellent (WR) agents, wax emulsion and silicon emulsion tried out on FR treated fabrics, wax emulsion was comparatively better for WR while silicon emulsion with zirconium sulphate catalyst gave better results for both FR and WR.

The effect of aeration and agitation on amylase production by *Bacillus Subtilis*-159 is a one litre fermenter was studied. The amylase was concentrated by different methods. Drop in viscocity of three different starches, viz. tapioca, maize and potato starch using *B. Subtilis*-159 amylase was also studied. Tapioca starch was found to be more suceptible to enzyme attack and drop in viscocity was sharp.

In vitro synthesis of cellulose in developing cotton fibres was studied using C-14-labelled Guanosine diphospho-glucose. The cellulose synthesising enzyme from 20 days and 35 days old fibres was incubated with unlabelled UDPG and GDPG separately and alkali — insoluble product formed was observed under microscope.

SUMMARY OF THE REPORT

In connection with the study on the enhanced enzymolysis of never-dried cotton cellulose and other cellulosic materials, maximum reducing sugars were obtained when cotton fibres were subjected to enzymolysis in wet condition resulting in a decrease in DP and a lowering of crystalline order. The reverse was true with dried substrates. Though sugar yields were high with cotton stalks when enzymolysis was carried out in wet condition, the crystallinity showed an increase.

Twenty two commercial linter samples were subjected to test for trash content and invisible loss on Shirley Analyser apart from percentage of chemical cotton, ash content, cellulose yield, α cellulose content, ash content, ether soluble matter and whiteness index. It was observed that short fibre yield, cellulose yield, etc. varied considerably among different samples and the ash content values and differed even at the same level of trash content. There was wide variation in whiteness index also of different samples bleached under identical conditions.

As part of the study of utilisation of cotton plant stalk for the preparation of pulp and paper, experiments were conducted to assess the effect of addition of small quantity of anthraquinone during pulping process of cotton plant stalk. For this purpose, two soda pulps one with 18% NaOH and the other 22% NaOH and two soda-anthraquinone pulps, one 18% NaOH $\pm$ 0.5% anthraquinone and the other 22% NaOH+0.05% anthraquinone, were prepared. Similarly, kraft pulp with and without anthroquinone was also prepared. A small quantity of kraft anthraquinone pulp was bleached. Paper sheets were prepared from all the above mentioned pulps and tested by Tappi Standard method. The results showed that, in general, the addition of small quantities of anthraquinone enhances the quality of pulp. The paper sheets prepared from the kraft anthraquinone pulp gave better srength and folding endurance as compared to all other pulps prepared.

Trials undertaken at the biogas pilot plant at Apollo Textile Mills indicated that a very constant supply of biogas could be obtained using willow-dust by the dry fermentation technique, the rate being 250m^3 of biogas per tonne of willow dust (V.S.) in 60 days.

Particle boards using cotton seed hull as raw material and phenol formaldehyde as binder, were found to have better strength and water repellent properties. These boards were made fire retardant by the addition of ammonium phosphate, borax and boric acid alone as well as in mixture. Hull samples of seeds of different species were analysed for various constituents and it was observed that hulls from seeds of *G. arboreum* species were a better source of pentosans, while those from *G. barbadense* for hollocellulose.

Research work being done at the Regional Quality Evaluation Units included :

(i) Investigation to study the efficacy of various synthetic pyrothroids on the pink boll worm incidence and their effect on the yield and quality of H.777 cotton.

(ii) Study on the effect of different levels of alkalinity on the fibre quality of five cotton varieties.

(iii) Study on the impact of water logging on the quality of cotton grown in salt affected soil.

(iv) Study on yield losses and quality degradation due to bacterial blight.

(v) Study on the effect of nitrogen fertilisers and different plant protection measures on the quality of American cottons.

(vi) Improvement of quality of cottons by single seed selection method.

7. PERSONNEL

Major activities in 1985 under personnel function at CTRL are given below:

A. Appointments

Scientific Staff

Shri S. K. Chattopadhyay (w.e.f. 1-4-1985) to the post of Scientist S-1.

Administrative Staff

Kum. Anna Marie D. Fernandes (w.e.f. 11-11-1985) to the post of Junior Clerk (Compassionate grounds).

Supporting Staff

Shri B. H. Umredkar (w.e.f. 14-1-1985) to the post of Supporting Staff Grade I (Watchman).

B. Assessment

Scientific Staff

The Five Yearly assessment of eligible scientific personnel of CTRL was held and promotions/advance increments granted as detailed below:

Promotions

Sr. No.	Name	Grade to which promoted	Effective date of promotion
1.	Shri B. Srinathan	Scientist S-3 (Rs. 1500-2000)	1-7-1984
2.	Smt. S. P. Bhatawdekar	Scientist S-2 (Rs. 1100-1600)	1-1-1984
3.	Kum. C. R. Raje	Scientist S-2 (Rs. 1100-1600)	1-1-1984

Advance increments

Sr. No.	Name	Grade	No. of advance increments	Effective date of increments
1.	Smt. Prema Nair	Scientist S-1 (Rs. 700-1300)	Three	1-1-1984
2.	Shri A. J. Shaikh	Scientist S-1 (Rs. 700-1300)	Three	1-1-1984
3.	Smt. G. Revathi	Scientist S-1 (Rs. 700-1300)	One	1-1-1984
4.	Shri P. V. Varadarajan	Scientist S-1 (Rs. 700-1300)	Three	1-1-1984
5.	Shri M. Ahmad	Scientist S-1 (Rs. 700-1300)	Two	1-7-1984

Technical Staff

The Five Yearly assessment of eligible technical personnel was held and promotions/advance increments were granted as detailed below:

Promotions

Sr. No.	Name	Grate to which promoted	Effective date of promotion
1.	Shri M. S. Sitaram	Technical Officer Gr. T-7 (Rs. 1100-1600)	1-7-1984
2.	Smt. R. P. Bhatt	Jr. Quality Evaluation Officer Gr. T-5 (Rs. 650-1200)	1-1-1985
3.	Shri G. Viswanathan	Jr. Quality Evaluation Officer Gr. T-5 (Rs. 650-1200)	1-1-1985

Advance increments

Sr. No.	Name	Grade	No. of advance increments	Effective date of increments
1.	Shri R. Dwarkanath	Jr. Quality Evaluation Officer Gr. T-5 (Rs. 650-1200)	One	1-1-1985
2.	Shri V. B. Suryanarayanan	Senior Technical Assistant Gr. T-4 (Rs. 550-900)	Three	1-1-1985
3.	Smt. S. V. Sukhi	Senior Technical Assistant Gr. T-4 (Rs. 550-900)	Three	1-1-1985
4.	Shri R. M. Modi	Senior Technical Assistant Gr. T-4 (Rs. 550-900)	Three	1-1-1985
5.	Shri R. K. Landge	Technical Asst. Gr. T-1-3 (Rs. 425-700)	One	1-1-1985
6.	Shri B. B. Gaykar	Driver Gr. T-1 (Rs. 260-430)	One	1-7-1985
7.	Shri S. B. Kamble	Laboratory Technician Gr. T-1 (Rs. 260-430	One	1-7-1985

C. Promotions

Administrative Staff

1. Shri K. S. Deshpande to the post of Superintendent w.e.f. 25-5-1985.
2. Shri K. W. Khamkar to the post of Assistant w.e.f. 1-7-1985.
3. Shri S. N. Salve to the post of Assistant w.e.f. 1-7-1985.
4. Smt. V. V. Desai to the post of Senior Clerk w.e.f. 1-7-1985.
5. Smt. S. D. Ambre to the post of Senior Clerk w.e.f. 1-7-1985.
6. Shri B. D. Sawant to the post of Assistant w.e.f. 8-7-1985.
7. Shri N. V. Kambli to the post of Jr. Clerk w.e.f. 1-10-1985 (by Departmental Competative Examination)

Supporting Staff

1. Shri Vijendra Singh to the post of S.S. Gr. IV w.e.f. 8-10-1985.
2. Shri L. R. Indurkar to the post of S.S. Gr. III w.e.f. 8-10-1985.
3. Shri R. B. Jadhav and Shri. S. M. Sawant to the post of S.S. Gr. II w.e.f. 8-10-1985.

D. Transfers

Scientific Staff

Dr. S. N. Pandey, Scientist S-3 to Jute Technological Research Laboratories, Calcutta as Director w.e.f. 15-10-1985.

Smt. Vatsala Iyer, Scientist S-2 from I.A.R.I., New Delhi to C.T.R.L., Bombay w.e.f. 25-4-1985.

Technical Staff

Shri H. Sengupta, Technical Assistant Gr. T-II-3 to Jute Technological Research Laboratories, Calcutta w.e.f. 26-3-1985.

Administrative Staff

Shri M. Sarkar, Junior Clerk to Jute Technological Research Laboratories, Calcutta w.e.f. 26-3-1985.

E. Deputation/Foreign Assignments

Dr. N. B. Patil, Scientist S-4 was deputed to Holland for participating in the familiarisation and acquaintance programme on X-ray APD System from 21-10-1985 to 1-11-1985.

F. Resignation/Termination of Service

(1) Shri L. K. Suri, Scientist S-1, resigned from service w.e.f. 8-7-1985.

(2) Shri V. B. Bengal, S.S. Gr. I (Watchman) terminated from service w.e.f. 31-10-1985.

G. Retirement

Shri G. S. Rajaraman, Scientist S-3 retired from service w.e.f. 31-10-1985.

H. Obituary

Shri F. C. Fernandes, Superintendent, expired on 18-5-1985.

I. ICAR Inter-Institutional Zonal Sports Meet

CTRL contingent consisting of 31 members participated in the ICAR Inter-Institutional Zonal Sports Meet held at BHEL Sports Complex at Bhopal from November 5 to 8, 1985 and CTRL won in the following sports events:

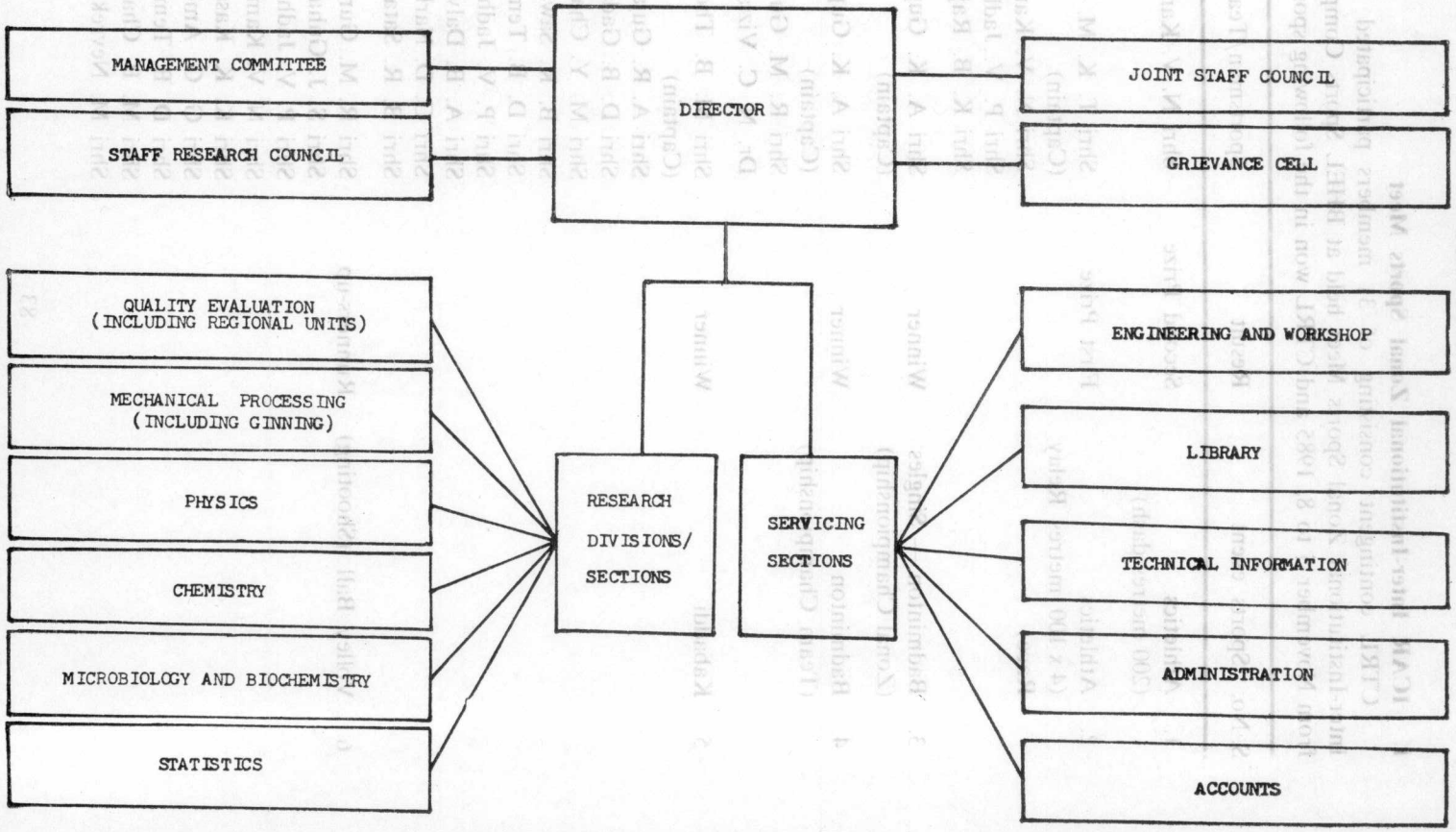
S. No.	Sports event	Result	Sportsman/Team
1.	**Athletics** (200 metres dash)	Second Prize	Shri N. V. Kambli
2.	Athletics (4 x 100 metres Relay Race)	First Prize	Shri T. K. M. Das (Captain) Shri N. V. Kambli Shri P. V. Jadhav Shri K. B. Rajagopal
3.	Badminton — Singles (Zonal Championship)	Winner	Shri A. K. Gupta (Captain)
4.	Badminton (Team Championship)	Winner	Shri A. K. Gupta (Captain) Shri R. M. Gurjar Dr. N. C. Vizia
5.	Kabaddi	Winner	Shri M. B. Thokrul (Captain) Shri A. R. Gujar Shri D. B. Gadankush Shri M. Y. Chandanshive Shri B. K. Sawant Shri D. B. Temgire Shri P. V. Jadhav Shri A. B. Dalvi Shri G. D. Narkar Shri B. R. Satam
6.	Volley Ball (Shooting)	Runners-up	Shri R. M. Gurjar (Captain) Shri S. J. Guhagarkar Shri P. V. Jadhav Shri N. V. Kambli Shri K. K. Kasar Shri G. G. Ambare Shri D. B. Temgire Shri M. B. Chandanshive Shri M. Nevrekar

8. ANNEXURES

ANNEXURE—I

COTTON TECHNOLOGICAL RESEARCH LABORATORY

ORGANISATION CHART



ANNEXURE - II

NEW EQUIPMENTS PURCHASED DURING 1985

1. Cotton Colorimeter — Model 830
2. Fibrosampler — Model 192
3. Oscilloscope — Model 3337
4. Spectronic 21 UVD Spectrophotometer
5. TAIRO Miniature Card — Model MC-10
6. Trash Analyser
7. Water Chiller Machine
8. Luminar Flow Ultraclean Air Equipment
9. Automatic Micro Processor Digital IC Tester
10. Single Board Computer 16 Bit
11. Launderometer
12. Isolene Aplab Ultra Isolation Transformer
13. 80 Column Dot Matrix
14. Autoclave

ANNEXURE - III

DISTINGUISHED VISITORS

1. Dr. R. M. Chakraborti,
   Director,
   Nehru Science Centre,
   Worli,
   Bombay.

2. Dr. K. V. Raman,
   Director,
   National Academy of Agricultural Research Management,
   Rajendranagar, Hyderabad.

3. Mr. Boujbel Mohxn,
   Director of Agricultural Planning,
   Tunisia.

4. Mr. Khemaies Jhinaou,
   First Secretary,
   Embassy of Tunisia,
   New Delhi.

5. Dr. P. N. Rau,
   Secretary, ICAR, and
   Joint Secretary, DARE,
   New Delhi.

6. Mr. Glyn Russ,
   British Council,
   London.

7. Dr. C. Nanjundayya,
   Ex-Director, CTRL,
   Bangalore.

8. Shri B. S. Gupta,
Professor & Graduate Administrator,
School of Textiles,
N.C. State University, Raleigh,
N.C. 27695.
U.S.A.

9. Mr. Wang Ruohai,
The Chinese Academy of Agriculture Science,
China.

10. Mr. Xiang Xianlin,
The Chinese Academy of Agriculture Science,
China.

11. Mr. Xing Yihua,
The Chinese Academy of Agriculture Science,
China.

12. Mr. Cai Shuda,
The Chinese Academy of Agriculture Science,
China.

13. Mr. Roy Stogdon,
International Institute for Cotton,
Brazil.

14. Mr. Yvette Menezes,
International Institute for Cotton,
Brazil.

15. H.E. Mr. Nguyen Nvoc Triu,
Minister of Agriculture,
Vietnam.

16. Dr. J. S. P. Yadav,
Chairman,
Agricultural Scientists Recruitment Board,
New Delhi.

17. Dr. L. R. Hirekerur,
Director,
National Bureau of Soil Survey & Land Use Planning,
Nagpur.

18. Mr. Umar K. Balolh,
Pakistan Agricultural Research Council,
Islamabad,
Pakistan.

ANNEXURE IV

FINANCIAL STATEMENT

EXPENDITURE AND RECEIPTS OF LABORATORY DURING 1984-85

	Sanctioned Grant (Rs.)	Actual Expenditure (Rs.)	Saving (—) Deficit (+) (Rs.)
A. EXPENDITURE			
I. Cotton Technological Research Laboratory including Quality Evaluation Units of CTRL at Regional Stations (Non-Plan)			
(a) Capital expenditure including expansion of Laboratory	5,85,000.00	5,85,873.00	(+) 873.00
(b) Working expenditure	62,39,000.00	62,39,652 00	(+) 652.00
	68,24,000.00	68,25,525.00	(+) 1,525.00
II. Scheme for modernisation & strengthening of CTRL for intensive research on cotton (Plan)	43,96,000.00	43,28,878.00	(—) 67,121.00
III. Integrated Cotton Development Project	—	1,81,730.00	(+)1,81,730.00

B. RECEIPTS	Rs.
Sale proceeds of fruits, vegetables, plants, etc.	430.00
Sale proceeds of vehicles, machines, tools, plants, and other non-consumable stores	18,023.00
Analytical and Testing fees	22,203.00
Rent	1,22,697.00
Fees for training, application fees, etc.	7,780.00
Sale of publications	4,211.00
Interest on loans & advances granted to Council's employee.	2,116.00
Miscellaneous receipts (including sale of mixed cotton waste)	1,53,236.00
	3,30,696.00

9. APPENDICES

APPENDIX — I

STAFF WORKING AT THE COTTON TECHNOLOGICAL RESEARCH LABORATORY AS ON DECEMBER 31, 1985

(*List does not include vacant posts*)

List of Staff in the Headquarters

SCIENTIFIC PERSONNEL

Director

Dr. V. Sundaram, M.Sc., Ph.D. F.T.I.

Scientist S-4

1. Dr. N. B. Patil, M.Sc., Ph.D.
2. Shri M. S. Parthasarathy, M.Text. (Bom.), M.Sc. Tech (Manch.), A.M.C.S.T., Rashtrabhasha Ratna
3. Dr. V. G. Munshi, M.Sc., Ph.D., F.T.A.

Scientist S-3

1. Dr. (Kum.) I. G. Bhatt, M.Sc., Ph.D.
2. Dr. P. K. Chidambareswaran, M.Sc., Ph.D.
3. Dr. K. R. Krishna Iyer, M.Sc., Ph.D., F.T.A.
4. Dr. V. G. Khandeparkar, M.Sc., Ph.D.
5. Shri P. G. Oka, M.Sc.
6. Shri T. N. Ramamurthy Rao, B.Sc., B.Sc. (Tech.)
7. Shri B. Srinathan, B.Sc. (Text.), M.Sc. (Text.)

Scientist S-2

1. Dr. S. Aravindanath, M.Sc., Ph.D.
2. Shri N. Ramesh Babu, B.E., M.Tech.
3. Dr. R. H. Balasubramanya, M.Sc., Ph.D.
4. Smt. S. P. Bhatawdekar, M.Sc.
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. R. P. Nachane, M.Sc.
10. Dr. K. M. Paralikar, M.Sc., Ph.D., F.R.M.S.
11. Shri B. M. Petkar, M.Sc.
12. Kum. C. R. Raje, M.Sc.
13. Dr. S. Sreenivasan, M.Sc., Ph.D.
14. Shri A. V. Ukidve, M.Sc.

APPENDICES

Scientist S-1

1. Shri Muntazir Ahmed, B.Sc., B.Sc. (Text.)
2. Shri P. Bhaskar, M.Sc.
3. Shri S. K. Chattopadhyay, M.Tech.
4. Smt. K. L. Datar, M.Sc.
5. Kum. A. S. Dighe, M.Sc.
6. Shri S. G. Gayal, M.Sc.
7. Shri R. M. Gurjar, M.Sc.
8. Shri A. K. Gupta, M.Sc., LL.B., W.P.M.M.T.
9. Shri D. N. Makwana, M.Sc.
10. Shri D. V. Mhadgut, M.Sc.
11. Shri G. S. Patel, M.Sc.
12. Smt. Prema Nair, M.Sc.
13. Smt. G. Revathi, M.Sc.
14. Shri A. J. Shaikh, M.Sc.
15. Shri P. V. Varadarajan, M.Sc.
16. Dr. N. C. Vizia, M.Sc., Ph.D.
17. Smt. J. K. S. Warrier, M.Sc.

Scientist S

1. Shri K. H. Sawakhande, M.Sc.
2. Shri N. Thejappa, M.Sc.

TECHNICAL PERSONNEL

Technical Officer T-7

Quality Evaluation

1. Shri M. S. Sitaram, B.Sc.

Technical Officer T-6

Electrical Engineering

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

Technical Officer T-5

Quality Evaluation

1. Shri K. V. Ananthakrishnan, B.Sc., D.B.M.
2. Smt. R. P. Bhat, B.Sc.
3. Shri K. S. Byrappa, L.T.M., A.T.A.
4. Shri K. Chandran, B.A.
5. Shri S. Chandrasekhar, L.T.M., A.T.A.
6. Shri B. S. Ganvir, B.Sc.
7. Shri S. R. Ganatra, M.Sc.
8. Kum. I. K. P. Iyer, B.Sc.
9. Shri C. R. Sthanu Subramony Iyer B.Sc.
10. Shri H. R. Laxmivenkatesh, D.T.T., A.T.A.
11. Shri S. N. Nagwekar, B.Sc.
12. Smt. S. D. Pai. M.Sc.
13. Shri A. W. Shringarpure, B.Sc.
14. Shri G. Viswanathan 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.

Senior Technical Assistant T-4

1. Smt. P. A. Dabholkar, B.Sc.
2. Shri S. J. Guhagarkar, B.Sc.
3. Shri I. H. Hunsaikatti, B.Sc.
4. Smt. A. A. Kathe, B.Sc.
5. Shri R. M. Modi, S.S.C., Cert. Photography
6. Smt. N. D. Nachane, B.Sc.
7. Shri E. A. Pachpinde, B.Sc.
8. Shri R. S. Pathare, B.Sc.
9. Shri K. B. Rajagopal, B.Sc.
10. Shri D. Radhakrishnamurthy, M.Sc.
11. Shri S. Sekar, B.Sc.
12. Smt. R. K. Shahani, B.Sc., B.Lib.
13. Smt. S. V. Sukhi, B.Sc.
14. Shri V. B. Suryanarayanan, B.Sc.
15. Shri S. Vancheswaran, B.Sc.

Technical Assistant T-II-3

1. Shri S. G Dalvi, S.S.C., Cert. Wireman, Cert. Ref. & A.C., Govt. Elec. Sup. 1
2. Shri S. M. Gogate, B.Sc.
3. Smt. S. R. Kamath, B.Sc.
4. Shri P. K. Mandhyan, B.Sc.
5. Shri M. M. Shaikh
6. Shri S. Venkatakrishnan, B.Sc.

Technical Assistant T-I-3

1. Shri N. O. Anthony
2. Shri P. B. Gurjar
3. Shri R. K. Landge
4. Shri R. B. Pawar

Technical Assistant T-1

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

Auxiliary Personnel

Senior Operator (Refrigeration)

Shri V. V. Kshirsagar, S.S.C., I.T.C., Cert. Ele. Supr., Cert. F&S

Hindi Translator

Smt. K. R. Joshi, M.A.

APPENDICES

Senior Fitter (Mechanical Processing)

1. Shri P. K. Gopalan
2. Shri Purushottam Vira

Operator (Workshop Machinery)

Shri D. L. Upadhye, S.S.C. (Technical), NCTVT (I.T.I. and C.T.I.)

Senior Operative (Mechanical Processing)

1. Shri P. J. Ahire
2. Shri R. A. Dalvi
3. Shri D. B. Gadankush
4. Shri Bechan Nokai
5. Shri K. D. Mohite
6. Shri H. K. Pawar
7. Shri M. M. Rupawate
8. Shri S. G. Shinde

Plumber

Shri H. B. Tambe

Carpenter

Shri G. D. Narkar

Driver

1. Shri B. B. Gaykar
2. Shri S. S. Patekar

Administrative Personnel

Administrative Officer

Shri P. Ramamurthy, B.A.

Asstt. Administrative Officer

D. L. Kalsekar

Accounts Officer

Shri D. S. Ranganathan

Superintendent

1. Shri G. Sasidharan, B.A., LL.B.
2. Shri P. D. Sonawane, B.A.
3. Shri K. S. Deshpande

Assistant

1. Shri D. P. Naidu
2. Shri K. Sudhakaran
3. Shri D. J. Raut
4. Shri G. Moosad, B.Com.
5. Shri V. V. Gore, B.A.
6. Smt. S. S. Dongare, B.A.
7. Smt. K. Jayagouri Shivaramakrishnan
8. Shri M. Z. Bhagat
9. Shri V. M. Kasabe
10. Smt. M. V. Kamerkar, B.A.
11. Smt. Veena Kotwani, B.A.
12. Shri B. S. Bhenwal
13. Shri K. W. Khamkar, B.A
14. Shri S. N. Salve
15. Shri B. D. Sawant

Stenographer

Shri Venu Thanikal

Junior Stenographer

1. Smt. Chellamma Damodaran
2. Kum. V. T. Bhuvad, M.A.
3. Kum. T. A. Rodrigues

Senior Clerk

1. Shri A. B. Dalvi
2. Shri D. G. Kulkarni
3. Smt. S. S. Shanbhag
4. Smt. V. V Desai
5. Smt. S. D. Ambre

Junior Clerk

1. Shri K. N. Iyer
2. Smt. S. M. Desai
3. Smt. J. J. Karanjavkar
4. Shri A. P. Natu
5. Kum. S. G. Nayar
6. Shri U. A. Gupte, B.Com.
7. Shri K. Parleshwar
8. Smt. S. R. Shirsat, B.A.
9. Shri N. V. Kambli
10. Kum. A. M. D. Fernandes

Telephone Operator

Smt. K. K. Kale

Supporting Staff Grade IV

1. Shri R.G. Chiplunkar
2. Shri K. K. Kasar

APPENDICES

Supporting Staff Grade III

1. Shri T. R. Kadam
2. Shri Obilal Parsuram
3. Shri Chatrapal Mhatri
4. Shri R. R. Khurdekar
5. Shri Babu Aba Babar

Supporting Staff Grade II

1. Shri S. V. Patil
2. Shri A. B. Sawant
3. Shri V. Y. Unhalekar
4. Shri G. G. Ambare
5. Shri M. R. Nevrekar
6. Shri T. B. Thapa
7. Shri A. R. Bane
8. Shri T. S. Mhaske
9. Shri G. S. Deorukhkar
10. Shri S. L. Gawde
11. Shri M. B. Thokrul
12. Shri Shamji Waghela
13. Shri B. K. Sawant
14. Shri Butnislal Balmiki
15. Shri N. J. Kharat
16. Shri M. Y. Chandanshive
17. Shri R. B. Jadhav
18. Shri S. M. Sawant

Supporting Staff Grade I

1. Shri B. R. Jadhav
2. Shri M. B. Gurve
3. Shri N. R. Kamble
4. Shri A. R. Gujar
5. Shri M. B. Chandanshive
6. Shri O. T. Thapa
7. Shri B. R. Satam
8. ~~Smt.~~ Shri D. M. Chaugule
9. Smt. T. V. Bhowar
10. Shri S. D. Gurav
11. Shri M. K. Ghadge
12. Shri M. Z. Rathi
13. Shri Narayan Singh
14. Shri C. S. Salvi
15. Shri D. M. Raje
16. Shri P. V. Jadhav
17. Shri D. M. Temgire
18. Smt. Birmo R. Taleram
19. Shri C. P. Solanki
20. Shri M. J. Sumra
21. Shri K. T. Mahida
22. Shri R. R. Gosai

List of Staff at the Quality Evaluation Units

1. AKOLA :

Technical Assistant T-II-3

Kum. V. S. Ayyar, B.Sc.

2. COIMBATORE :

Technical Officer T-5
(Quality Evaluation)
1. Shri A. K. Antony, B.Sc.
2. Smt. Santa V. Nayar, B.Sc.
3. Shri C. P. Venugopalan, B.Sc.

Auxiliary Staff (Sr. Operative)
Shri K. V. Nair

Supporting Staff Grade III
Shri N. Arumugham

Supporting Staff Grade II
Shri V. M. Subramanyan

3. DHARWAD :

Technical Officer T-5
(Quality Evaluation)
Shri E. S. Abraham, B.Sc.

Technical Assistant T-II-3
Shri M. T. Danolli, B.Sc.

Supporting Staff Grade II
Shri Y. R. Sone

Supporting Staff Grade I
Shri C. J. Bagalkoti

4. GUNTUR :

Technical Officer T-5
(Quality Evaluation)

Shri R. Dwarkanath, B.Sc.

Technical Assistant T-II-3
Shri S. Mukundan, B.Sc.

Supporting Staff Grade III
Shri Ch. Thimmanna

Supporting Staff Grade I
Shri V. Y. M. Survarchala Rao

5. HISSAR	:	*Technical Assistant Grade T-II-3* Shri V. K. Madan, M.Sc. *Supporting Staff Grade IV* Shri Gian Singh
6. INDORE	:	*Scientist S-1* Shri S. B. Jadhav, M.Sc. *Supporting Staff Grade III* 1. Shri John Robert 2. Shri H.S. Bhabar
7. LUDHIANA	:	*Supporting Staff Grade III* Shri Kamikkar Singh
8. NAGPUR	:	*Scientist S-2* Shri G. R. Anap, B. Tech., M.Tech. *Scientist S-1* Shri U. N. Borkar, B.Sc. (Agri.) B.Sc. (Agri. Engg.), M. Tech. (Agri. Engg.) *Technical Assistant Grade T-II-3* Shri V. M. Kulmethe, B.Sc. *Supporting Staff Grade I* 1. Shri Satyanarayan Gope 2. Shri Mohsin Ahmed 3. Shri M. P. Tohakar 4. Shri B. H. Umredkar
9. NANDED	:	*Scientist S-1* Shri L. D Deshmukh, M.Sc. *Technical Assistant T-II-3* Shri N. V. Bansode, B.Sc. *Supporting Staff Grade II* Shri L. R. Indurkar *Supporting Staff Grade I* Shri R. K. Pallewad

10. **RAHURI** :

Senior Technical Assistant T-4
Shri R. S. Darade, B.Sc.

11. **SRIGANGANAGAR** :

Technical Officer T-6
(Quality Evaluation)
Shri Ram Parkash, B.Sc., LL.B.

Technical Assistant T-II-3
Shri D N. Moon, B.Sc.

Supporting Staff Grade III
Shri Vijendra Singh

Supporting Staff Grade II
Shri Sanwarmal Saini

12. **SURAT** :

Scientist S-1
Shri Y. Subramanyam, M.Sc.

Technical Officer T-5
(Quality Evaluation)
Shri M. C. Bhalod, B.Sc.

Technical Assistant T-II-3
Shri G. G. Mistry, B.Sc.

Junior Clerk
Shri E. T. Gurav

Supporting Staff Grade IV
Shri J. B. Dhodia

Supporting Staff Grade II
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 December 31, 1985

Group/Class	Permanent / Temporary	Total number of employees	Scheduled Castes	Percentage to total employees	Scheduled Tribes	Percentage to total employees	Remarks
Gr. A (Cl. I) Permanent							
(i) Other than lowest rung of Cl. I		20	—	6.3%	—	—	—
(ii) Lowest rung of Cl. I		28	3				
Total		48	3				
Temporary							
(i) Other than lowest rung of Cl I		5	1	20%	—	—	—
(ii) Lowest rung of Cl. I		—	—				
Gr. B. (Cl. II)	Permanent	13	1	23.4%	—	—	—
	Temporary	30	4				
Gr. C. (Cl. III)	Permanent	28	2	13.6%	—	1.3%	—
	Temporary	45	8		1		
Gr. D. (Cl. IV) Excluding Sweepers	Permanent	47	13	22.9%	3	8.2%	—
	Temporary	14	1		2		
Gr. D. (Cl. IV) Sweepers	Permanent	2	2	100%	—	—	—
	Temporary	5	5				

Note: (1) This statement relates to persons and not to posts. Posts vacant etc. should not, therefore, be taken into account.

(2) A person on deputation should be included in the establishment of the borrowing Ministry/Department/Office and not in the parent office.

(3) Persons permanent in one grade but officiating or holding temporary appointment in the higher grades should be shown in the figures relating to the class of service in which the higher grade concerned is included.

APPENDIX—III

Statement showing the number of Reserved Vacancies filled by Members of Scheduled Castes and Scheduled Tribes during the Year 1985

Class of post	Total number of vacancies		Number of vacancies reserved		Scheduled Castes				Scheduled Tribe						Remarks
	Notified	Filled	Out of Col. 2	Out of Col. 3	Number of SC candidates appointed	Number of SC vacancies carried forward from the previous year	Number of ST candidates appointed against vacancies reserved for SCs in the 3rd year of carry forward	Number of reservation lapsed after carrying forward for three years	Number of vacancies reserved		Number of ST candidates appointed	Number of ST vacancies carried forward from the previous year	Number of SC candidates appointed against vacancies reserved for STs in the 3rd year of carry forward	Number of reservation lapsed after carrying forward for three years	
									Out of Col. 2	Out of Col 3					
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
I. *Post filled by direct recruitment*															
Other than lowest rung of Class II	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Lowest rung of Class I	—	—	—	—	—	—	—	—	—	—	—	—	—		Necessary advertisement was issued. Action on the applications received will be taken, on lifting of the ban on recruitment. Because of the ban on recruitment posts are vacant.
Class II	2	—	1	—	—	—	—	—	—	—	—	—	—		
Class III	20	—	6	—	—	—	—	—	—	—	—	—	—		
Class IV (Excluding Sweepers)	14	—	1	—	—	—	—	—	2	—	—	—	—		
Class IV (Sweepers)	—	—	—	—	—	—	—	—	—	—	—	—	—		

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
						II. *Posts filled by promotion*									
Other than lowest rung of Class I	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Lowest rung of Class I	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Class II	1	1	—	—	—	—	—	—	—	—	—	—	—	—	—
Class III	5	5	1	1	1	—	—	—	—	—	—	—	—	—	—
Class IV (Excluding Sweepers)	4	4	—	—	—	—	—	—	—	—	—	—	—	—	—
Class IV (Sweepers)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

NOTE : (1) Consolidated figure should be given under Group (Class)

(2) In Columns 4, 5 and 9, 10 the number of vacancies actually reserved out of Column 2-3 whether against brought forward reservations or against normal reservations during the year should be given.

(3) In the case of promotion by selection from Group C to Group B within Group B and from Group B to the lowest rung of Group A. Class III, to Class II, within Class II and from Class II to the lowest rung of Class I). The words "in the third year of carry-forward" in the heading of Col. 7 and 12 and the words "after carrying forward for three years" in the heading of Col. 8 and 13 will not be applicable and these cols. may be filled accordingly. (C.F. Department of Personnel and A.R. Office Memorandum No. 10/41/73—Estt (SCT), dated the 20th July, 1974. 10/37/74—Estt. (SCT) dated 3rd February, 1975 and 1/9/74—Estt (SCT), dated the 29th April, 1975).

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Other than lowest rung of Class I	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Lowest rung of Class I	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Class II	1	1	—	—	—	—	—	—	—	—	—	—	—	—	—
Class III	5	5	1	1	1	—	—	—	—	—	—	—	—	—	—
Class IV (Excluding Sweepers)	4	4	—	—	—	—	—	—	—	—	—	—	—	—	—
Class IV (Sweepers)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

NOTE : (1) Consolidated figure should be given under Group Class.

(2) In Columns 4, 5 and 9, 10 the number of vacancies actually reserved out of Column 2/3 whether against brought forward reservations or against normal reservations during the year should be given.

(3) In the case of promotion by selection from Group C to Group B within Group B and from Group B to the lowest rung of Group A, Class III, to Class II, within Class II and from Class II to the lowest rung of Class I). The words "in the third year of carry-forward" in the heading of Col. 7 and 12 and the words "after carrying forward for three years" in the heading of Col. 8 and 13 will not be applicable and these cols. may be filled accordingly. (C.F. Department of Personnel and A.R. Office Memorandum No. 10/41/73—Estt (SCT), dated the 20th July, 1974 10/17/74—Estt (SCT) dated 3rd February, 1975 and 1/9/74—Estt (SCT), dated the 29th April, 1975)