CIRCOT

Annual Report 1995-96

Central Institute for Research on Cotton Technolog
Mumbai

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ANNUAL REPORT

1995-96

Central Institute for Research on Cotton Technology

Indian Council of Agricultural Research

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Executive Summary

This is the Seventy-second Annual report of CIRCOT covering the period April 1, 1995 to March 31, 1996.

Introduction : CIRCOT was established in the year 1924 under the name Technological Laboratory of the Indian Central Cotton Committee (ICCC). ICAR took over the administrative control of CIRCOT, when all the commodity committees including ICCC were abolished in 1966 and the name of the laboratory changed as Cotton Technological Research Laboratory. New mandates were formulated for intensifying research and re-orienting the Institute activities in consonance with the research priorities of ICAR. It was renamed as Central Institute for Research on Cotton Technology on April 1, 1991.

At the head-quarters, about 3,000 cotton samples from various breeding trials were evaluated while at the Regional Units more than 12,000 samples from initial stages of trials were screened. Continuing as the co-ordinating centre for technology under the AICCIP, the Institute screened as many as 2,000 samples of cotton for fibre properties and spinning potential.

The total number of books in the library stands at 4924 and of bound volumes of journals at 6308. The recognition granted to CIRCOT by the Bombay University as a post graduate Institution has been continued during this year as well. More than 45 sponsored personnel from cotton trade and industry were trained in cotton testing methods and evaluation.

Highlights of Research Results : Significant variations were noticed in fibre length and ginning percentage among plants, bolls, locules and seeds of the same variety in a study on variations of fibre length and G.P. among seeds, locules, bolls and plants. The seeds at the base of the locule contained shorter fibres and smaller bolls possessed shorter fibres with lower G.P.

The studies on splicing of cotton and blended yarns were continued during the year. The effect of yarn count in conjunction with yarn twist and tail index, blending polyester with cotton in various proportions and spinning systems (ring, rotor and air-jet spinning systems) on the retained strength of the splice-joint was studied. Mill trials with optimised settings and lower air pressure were conducted. Trials on breaks during rewinding of yarn containing splice-joints prepared using the above settings were also carried out.

In a study on improvement in processing techniques for microspinning of small lots of lint, the selected samples were spun with two modifications, *viz.* apron drafting and roller drafting. It was observed from the single thread strength data of both full spun and micro spun yarns of fifteen samples that microspinning with apron drafting is comparable with full spinning.

The objective of the project on seed coat-fragments in ginned cotton was widened to include germplasm lines of *hirsutum* varieties as per the advice of the Research Advisory Committee. Accordingly the breeders have been approached to supply seed cotton samples from *hirsutum* cottons.

Spliced joints of 40s count yarn with different Retained Splice Strength (RSS) and Retained Splice Elongation (RSE) were prepared for a study on splicing of cotton and blended yarns. The spliced yarn segments were tested for tensile properties. Scanning electron micrographs of each spliced zone were recorded at regular intervals so as to obtain the complete picture of the splice joint. The results are being analysed.

For a survey of cottonseed milling industries in India proposed for the north zone comprising Punjab, Haryana and Rajasthan, a list of cottonseed crushing units has been prepared. A questionnaire is being despatched to the factories for collecting information.

Properties of cottonseed like moisture content, dimensions, shape, density, weight and frictional characteristics of over 60 varieties were determined for a study on the engineering properties of cottonseed. The variety VCH.1 is found to have the longest seed while AKA.5 and Suvin have the largest bulk density. Sphericity of seeds remained in a narrow range (0.58 - 0.74) while angle of repose ranged from 43° - 46°. Wide variation was observed between static coefficient of friction and coefficient of external friction against different surfaces like wood, iron, steel and glass. The data will serve as design parameters for fabricating seed processing machinery.

In a study of blended fabric properties and their inter-relationships, it was observed that polyester-wool fabrics are thicker than polyester-cotton and pure cotton fabrics of equal weight. The polyester-wool fabrics also possess higher bending rigidity. The bending recovery values of polyester-wool fabrics are comparable to those obtained for polyester-cotton and cotton fabrics. However, 100% wool fabrics of comparable weight display directly higher bending recovery.

In a study of morphological deformities present in cotton fibres and their relation with space constraint in the developing boll, the work relating to enumeration of deformities present in fibres of field opened bolls of sixteen varieties has been completed. The deformities other than structural reversals in the fibres collected from field opened bolls were nearly half in number as compared to the fibres from unopened bolls, while the structural reversals per cm were same in both fibres.

Aqueous swelling accompanied by stretch brings about significant changes in the morphological and structural features of cotton fibres. The treatment leads to drastic reduction in convolution frequency and convolution angle, appreciable decrease in reversal frequency, significant improvement in circularity and orientation without any change in the crystallinity of the fibre.

The study of inverse creep / reverse creep property of cotton and other textile materials showed that nylon exhibits the phenomenon of inverse creep. The quantum of inverse creep depends on the initial load as well as the subsequent reduced loads.

Parameters related to fabric compression measured on 48 different fabrics with compression tester of Kawabata Evaluation System and Instron tensile tester showed no agreement. This suggests that Kawabata Evaluation System alone can be used for precise measurements of low stress mechanical properties.

To study the effect of yarn structure on the dyeing behaviour fabrics, air-jet and ring spun yarns made from polyester/cotton blends were used in knitted fabrics. These fabrics were dyed with disperse and reactive dyes. The polyester portion was first dyed with disperse dyes using the carrier method. The cotton portion was subsequently dyed with reactive dyes using salt for exhaustion and alkali for fixation. Colour strength and colour difference of the samples are being evaluated. Methods for determination of dye uptake are being standardised.

In another dyeing study involving the use of natural dyes, it was found that cotton can be given a violet shade with lac dye after pad-dry-cure treatment with chitosan. The dyed fabric shows medium lightfastness, good perspiration as well as rubbing fastness but poor washfastness. Treatments like crosslinking and mordanting with alum or ferrous sulphate are found to improve washfastness. Mordanting gives different colours as well. A pretreatment with tannic acid followed by tartar, emetic or alum has been found suitable for dyeing cotton to a bright yellow shade with berberin. A temperature of 60° C was found to be optimum for dyeing. Dyeing of cotton with the bark of *babul* and onion skins has shown encouraging results.

In a study on antibacterial finishing of cotton employing electron beam curing, preliminary antibacterial finishing treatments employing gamma radiation were given to cotton fabric to identify suitable chemical formulation and to get maximum add-on. The chemically treated and irradiated samples were tested for physical properties, zinc %, peroxide % and antibacterial performance. The results are being analysed. Suitable fabric holders for electron beam irradiation were designed and fabricated.

To study the effect of chemical processing on dyeing of knitted fabrics physical properties of two types of grey knitted fabrics and the corresponding pretreated fabrics were determined.

Ten cotton fibre samples belonging to differnt varieties were kiered, bleached and dyed with different reactive dyes to various colours to study the varietal affects of dyeing. The samples were evaluated for fibre tenacity and elongation before and after dyeing. The colour parameters of the dyed fibre samples were analysed by using a computerised colour matching system.

For a study on continuous fermentation of cellulase by *Penicillium funiculosum*, bleached fabric samples were treated with this enzyme as well as a commercially available cellulase to improve the quality of the fabrics. The weight loss was less in the case of fabric samples treated with *P.funiculosum* cellulase and percent reflectance was comparable with that of fabrics treated with commercial cellulase. The residue after treating fabrics with cellulase for biopolishing showed about 5% cotton activity and 44% carboxymethyl cellulase (CMCase) activity.

Corrugated boxes of various dimensions were prepared as per specifications for a study on the production and utilization of kraft paper from cotton plant stalks. These boxes were evaluated for various properties at the Indian Institute of Packaging, Mumbai. The boxes along with test reports were sent to Konkan Krishi Vidyapeeth, Dapoli, CIHNP, Lucknow and

NRCC, Nagpur for field trials on mango and orange fruits. The trials are completed and the test report is awaited.

Eleven cottonseed meals prepared from different varieties of cotton were subjected to enzymolysis with proteolytic enzymes in a study on preparation and characterisation of protein hydrolysates (peptones) from cottonseed meal. The percentage recovery of peptones was better in *desi* varieties than hirsutums and hybrids.

In a study on production of biogas from solid cellulosic wastes by dry fermentation it was found that gas production from press-mud is technologically feasible and economically viable. The data generated through one tonne trials have been compiled and a feasibility report is being prepared.

A number of non ionic surfactants were prepared from cottonseed oil by reacting with polyethylene glycols in a study on textile processing aids from cottonseed oil. These surfactants/softeners are quite stable in alkaline and neutral media and ranged from pale yellow liquid to light brown paste.

To study the preparation of pure fatty acids from cottonseed oil, raw, refined and hydrogenated cottonseed oil were split into the component fatty acids by enzymatic and modified Twitchell methods. Higher percentage of fat splitting was achieved by latter process, while the former method, though much slower, was clean and energy saving one.

Preliminary trials for preparation of pulp and paper from crop residues after processing through anaerobic digestion have indicated that good quality paper can be prepared from rice straw and wheat straw. The requirement of initial open boiling prior to anaerobic digestion standardised for cotton plant stalks has been replaced with simple overnight soaking for both the straws. About 75 kg of rice straw was processed through anaerobic digestion and handed over to Hand Made paper Institute, Pune for paper making trials on cylinder mould machine. The results of paper trials are awaited.

News paper waste and catalogue paper were subjected to cellulase treatment for a study on utilisation of cellulase for deinking of waste paper pulp. Paper samples prepared from the enzymatically deinked pulp are found to have good appearance.

To study the presence of toxic inorganic elements and associated agents in respiratory organs of workers exposed to cotton dust, qualitative examination of BAL samples were completed and the data are being put to use for quantitative analysis. Efforts are continuing to achieve reproducible results from biopsy tissues.

Extension activities : The Director and Scientists of CIRCOT are members of various committees of BIS for cotton and textile testing and of advisory panels of ATIRA, BTRA, SITRA,VJTI, UDCT, etc. Key extension activities of CIRCOT during the reporting period has been supply of accurate and reliable data on the quality aspects of cotton fibres, yarns and fabrics, consultancy services and publication of research results for the benefit of appropriate user groups. Further, quite a large number of samples received for paid tests at the Testing House were tested and reports issued soon after the tests. Over Rs. 3.5 lakhs was received during the reporting period. Training courses were conducted in twelve batches on cotton testing and evaluation at the headquarters of CIRCOT and 65 sponsored personnel attended the courses.

CONTENTS

1

Introduction

This seventy-second Annual Report of the Central Institute for Research on Cotton Technology (CIRCOT), covers the period April 1, 1995 to March 31, 1996.

CIRCOT was established by the Indian Central Cotton Committee (ICCC) in the year 1924 under the name of Technological Laboratory of ICCC. The objectives then were to undertake spinning tests on various cotton strains received from agricultural departments in the country and to test their spinning values. To carry out these activities, the Institute had established co-ordination with the Departments of Agriculture and Agricultural Universities located in major cotton producing tracts in the country. After the abolition of commodity committees including the ICCC, and the administrative control passed on to the Indian Council of Agricultural Research (ICAR) its name was changed to Cotton Technological Research Laboratory (CTRL). Since then the research activities were reoriented and geared up towards meeting the technological challenges aimed at increasing the production and quality of cottons in the country. Research on the better utilisation of cotton and cotton agro-wastes was accorded priority recently in order to make cotton cultivation more remunerative, apart from opening up self employment opportunities to rural people.

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

The important functions of CIRCOT are as follows :

1. To undertake basic and applied research for developing strategies for improvement of quality of cotton fibre and yarn through post-harvest technology and processing, and developing technology for better utilisation of crop residues and cotton wastes.

2. To co-ordinate network of research and assess quality of cotton fibres for their suitability under the All India Co-ordinated Cotton Improvement Project.

3. To act as a centre for training in cotton technology and other areas of the Institute.

4. To act as a repository of information on post-harvest technology of cotton and by-products as well as crop residues.

5. To collaborate with relevant national and international agencies in achieving the above objectives.

6. To provide consultancy.

Organisation : As could be seen from the organisational chart in Annexure I,

Director heads the Institute assisted by a team of Senior Scientists and Technical Officers. An Administrative Officer provides him support in the general administration, while the Finance and Accounts Officer looks after matters concerned with accounts and audit of this Institution.

Library : To keep pace with the advancements in the field of cotton research, latest available books on cotton, cotton technology, waste utilisation and general books of research interest are periodically added to the library. During 1995-96, **63** books were added to the library and the total number of books by the end of March 1996 was 4924. With the current addition of 90 bound volumes of journals, the total number of bound volumes stands at 6308. One hundred journals were obtained through subscription. Many journals were also received by way as complimentary or on exchange basis. During the period Rs.6,11,495/- was incurred for the purchase of books as well for subscribing to journals. Besides the staff of this Institute, the library facilities were availed of by the students and researchers from various colleges affiliated to Bombay university, sister institutions and personnel from the textile industry. Inter-library loan facilities were also maintained with other libraries in Bombay.

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

Distinguished visitors : Hon. Shri Tara Singh, Member of Parliament and Convenor of the Parliamentary Standing Committee on Agriculture with members, Dr. Ranbir Singh, Shri Birbal and Shri R.N. Goswami visited the Institute. They were accompanied by Shri P.D.T. Achary, Director, Shri U.C. Bhardwaj and Shri Krishan Lal, Liaison Officers, Lok Sabha Secretariat, and Shri S.D. Rai and Shri Gyan Chand Principal Scientists from DARE.

Shri G. Balakrishnan, Secretary to Govt.of India, Ministry of Agriculture, Dept.of Agriculture and Co-operation, New Delhi, also visited the Institute on official work apart from Prof. G. Singh and Dr. R.P. Kachru, DDG and ADG, respectively from ICAR who visited the Institute on various occasions.

Management Committee : Forty-second meeting of the Management Committee was held on January 30,1996. Apart from regular items such as, confirmation of the minutes of the previous meeting, action taken on the recommendations of the committee, progress of expenditure, progress of works, action taken on the recommendations of the Institute Joint Council and Grievance Committee, discussions on on-going research projects and research highlights, etc. Restructuring of Divisions as per the suggestions from ICAR to restrict the number of Divisions to a minimum and making them multi-disciplinary in nature figured as one of the important items in the agenda. Accordingly, four Divisions *viz.* Quality Evaluation and Improvement, Mechanical Processing, Chemical and Bio-chemical Procesing and Technology Transfer were suggested for the Institute.

Other important agenda items discussed were that of Guest House Rules and Tariffs for CIRCOT Test House and allotment rules for staff quarters.

Staff Research Council : The ninety-fifth meeting of the Staff Research Council (SRC)

PLATE - I
RAC MEETING

Dr. R.P. Kachru, Assistant Director General, Indian Council of Agricultural Research, being welcomed by the Director

Dr. V.B. Gupta, Chairman, RAC, Dr.R.P. Kachru, Assistant Director General, ICAR and Dr. K.R.K. Iyer, Director, CIRCOT engaged in discussion during RAC Meeting. Seated on the extreme left is Dr.N.Balasubramanian, (Member, RAC) and on the extreme right is Dr.V. Sundaram (Member, RAC)

Talk by Prof. V.B. Gupta, Chairman, RAC on "An Appraisal of Some of the Structural Models for Melt Spun Fibres"

A section of the audience

was held on May 23 and 24, 1995. Progress of research work during April 1,1994 to March 31,1995 and new project proposals for 1995-96 were discussed and a new programme of work for 1995-96 was finalised. This was further discussed in the Management Committee Meeting held on January 30, 1996.

Research Advisory Committee : The first meeting of the Research Advisory Committee for CIRCOT constituted by ICAR to suggest research programmes based on National and global context of research in the various thrust areas, to review the research achievements and to see that these are consistent with the mandate of the Institute, was held on November 21-22,1995.

Prof.(Dr.)V.B. Gupta, Head, Department of Textile Technology, I.I.T., New Delhi was the chairman. Other members in the Committee are as follows :

1. Dr.V. Sundaram, Emeritus Scientist & Retd. Director, CIRCOT.
2. Dr.N. Balasubramanian, Retd. Sr. Deputy Director and Head, Mechanical Processing Division, BTRA, Mumbai.
3. Dr. A.K. Basu, Retd. Director, CICR and Advisor (Cotton), CCI, Mumbai.
4. Shri V. Ramachandran, General Manager (Spinning), Century Textiles and Industries, Worli, Mumbai.
5. Dr. R.P. Kachru, ADG., ICAR, New Delhi.
6. Shri S.R. Lathar, Member, Management Committee of CIRCOT, and
7. Dr. K.R. Krishna Iyer, Director, CIRCOT.

Dr. V. G.Khandeparkar, Principal Scientist and Head, Microbiology & Biochemistry Divn., CIRCOT was the Member-Secretary.

In addition to discussion on the on-going research projects and new project proposals, the draft of the Perspective Plan document of the Institute was also considered by the RAC. There was a Seminar by Dr.V.B. Gupta, Chairman, RAC on **An Appraisal of Some of the Structural Models for Melt Spun Fibres.**

Research Projects : In all, there were 38 on-going research projects grouped under the following six Thrust Areas :

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

Post-Graduate Training : The recognition granted to CIRCOT by the University of Bombay as a Post-Graduate Institution was continued during the period. Eight students were being guided for M.Sc. and six for Ph.D. Eleven scientists of the Institute remained as recognised guides for M.Sc. and Ph.D. in various disciplines such as, Physical chemistry, Organic chemistry, Bio-Physics, Microbiology, Spinning and Textile Physics and Textile Bio-Physics.

Shri C.R.S. Moni, Technical Officer was awarded M.Sc. in Physical Chemistry under the guidance of Dr. V. Sundaram, Retd. Director, CIRCOT. Shri G. Viswanathan, Technical Officer and Shri R.D. Nagarkar, Sr. Technical Asistant have registered for their Ph.D. under the guidance of Dr. A.V. Ukidve and Dr. R.P. Nachane, respectively.

Smt. Jyoti Pradhan from Bombay University has registered for Ph.D. in Textile Physics under Dr. P.K. Chidambareswaran and Kum. Sarika Sawant from Bombay University registered for M.Sc. under Dr. R.H. Balasubramanya.

Institute Joint Council (IJC) : Two meetings were conducted on February 9 and September 15, 1995 to discuss various matters of general interest to the staff. The meeting held in September was the first regular meeting of the newly constituted IJC.

Finance : A statement showing sanctioned budget grant of CIRCOT and the actual expenditure for the financial year 1995-96 has been furnished in Annexure III. As could be seen therefrom, the actual expenditure under the Non-Plan was Rs.245.42 lakhs as against the actual sanctioned grant of Rs.246.85 lakhs. Further, an expenditure of Rs.81.24 lakhs was incurred under the Plan budget as against a sanctioned grant of Rs. 90 lakhs.

Visit of Members of Parliamentary Standing Committee on Agriculture to CIRCOT

The Parliamentary Standing Committee on Agriculture (Study Group 1) consisting of the following four Hon'ble Members of Parliament visited the CIRCOT, on October 10,1995 :

Shri Tara Singh (Convenor),
Dr. Ranbir Singh,
Shri Birbal, and
Shri R.N. Goswami

Five officials from the Lok Sabha Secretariat and DARE also accompanied them. An informal meeting of scientists and Honourable MPs was held and Shri Tara Singh, Hon'ble MP, chaired the session. Dr.V.G. Khandeparkar, Principal Scientist of CIRCOT, welcomed the MPs. Afterwards, Dr.K.R.K. Iyer, Director of the Institute gave a presentation on the research activities and achievements of the institute with the help of audio-visual aids. This was followed by discussions in which the visiting dignitaries and scientists of CIRCOT participated with great enthusiasm and interest. After the discussions, the visitors were taken to an exhibition of products based on processes and research results of CIRCOT. The visitors evinced keen interest in all the articles laid out for demonstration. There were detailed discussions on many of the research products and processes which were then demonstrated. A visit to the Morarji Textile Mills, Mumbai was also arranged for the Standing Committee members.

PLATE - II

VISIT OF PARLIAMENTARY STANDING COMMITTEE ON AGRICULTURE

Honourable Members of the Parliamentary Standing Committee on Agriculture with Director and ICAR Officials

Members in discussion with Dr.K.R.K. Iyer, Director, CIRCOT

Talk by Dr.K.R.K. Iyer, Director on the different facets of CIRCOT activities

***Honourable Members** of the Parliamentary Standing Committee on Agriculture at an exhibition of CIRCOT Technologies*

National Seminar on Future Trends in Textiles : A two day National Seminar on Future Trends in Textiles was organised by CIRCOT in collaboration with the Indian Fibre Society on July 19-20,1995 at the Hotel Leela Kempinski in Mumbai. The Conference was inaugurated by Prof. R.S. Paroda, Secretary. Department of Agricultural Research and Education, Govt. of India and Director General, ICAR. There were Six Technical Sessions as given below, apart from the inaugural session, which was chaired by Mr. S.P. Sapra, Sr. Vice President, Reliance Industries and the concluding session was chaired by Prof. Gajendra Singh, DDG (Engg.), ICAR.

Session I	:	Fibre Production
Session II	:	Marketing of Textiles
Session III	:	General
Session IV	:	Mechanical Processing
Session V	:	Chemical Processing
Session VI	:	Industrial Textiles

In all eighteen papers were presented in the above technical sessions touching upon the contemporary issues being faced by the trade and the textile industry. These sessions witnessed brilliant expositions on a wide range of topics such as fibre production, marketing, total quality management, mechanical and chemical processing of textile fibres, by stalwarts in the respective fields. **CIRCOT — Seventy Years of Service to the Nation** which is a brochure containing activities of the Institute and a Book of Papers encompassing full length papers presented in all the sessions, were released on this occasion.

Seminar on Recent Advances in Mechanical Processing : A half-day seminar on Recent Advances in Mechanical Processing was held on April 26,1995. Shri M.B. Lal, Chairman-cum- Managing Director, CCI, Mumbai presided over the function. His key note address was followed by a Technical Session under the Chairmanship of Dr. T.V.K. Srivastava, Additional Textile Commissioner, Govt. of India in which the following four papers were presented.

1. Present status of Ginning in India and Steps for Modernisation - by Shri M.S. Parthasarathy, Principal Scientist and Head, M.P. Division, CIRCOT.

2. Imperfections in Yarns in the Light of Modern Development in Spinning Machinery- by Shri V. Ramachandran, Spinning Manager, Century Textiles & Industries Ltd.

3. Modern Developments in Weaving- by Prof.N.K. Talukdar, Retd. Prof. & Head, Textile Manufacturing, VJTI.

4. Quality Aspects in Knit-wear- by Shri S. Neelakantan, Manager, Technical Services, The Dawn Mills Company, Ltd.

A booklet entitled **Resumé of Research in Mechanical Processing** was also released.

This seminar was attended by personnel from cotton trade and industry apart from scientific and technical personnel of CIRCOT and other textile research institutes.

Group Discussion on Future requirements of Cotton : A group discussion on the Future Requirements of Cotton to serve as a feed back to Cotton Improvement Research was held on December 12,1995 under the chairmanship of Shri Sudhir Sanghi, Chairman, Indian Cotton Development Council (ICDC). Thirty-six personnel from Cotton Trade and Industry participated in this discussion. Dr.K. Venugopal, Project Co-ordinator, Coimbatore presented a paper on Present Scenario of Breeding Research and Dr.K.R. Krishna Iyer, Director, CIRCOT presented a paper on **Current Thoughts on Cotton Quality**. Dr.V. Sundaram, Emeritus Scientist, Retd. Director, CIRCOT was the moderator for the group discussion. Dr.K.C. Mandloi, Zonal Co-ordinator (Central) from JNKVV, Regional Research Station gave the vote of thanks.

Internal Seminar : A seminar on Scientific & Technical Paper Writing for Effective Communication was given by Dr.(Smt.) P. Bhama Iyer, Sr. Scientist, Physics Division on December 13, 1995 which was attended by scientific and technical personnel from CIRCOT.

Computer Awareness Training : A computer training programme to expose the staff of CIRCOT on the fundamental aspects of computers was organised. Brief lectures and practical demonstrations on DOS, WordStar and Lotus 1-2-3 were conducted by a team comprising Dr. P.K.Chidambareswaran, Shri V.B. Suryanarayanan, Shri D. Radhakrishnamurthy and Shri M.V. Vivekanandan. There were three batches in which 45 personnel from Scientific, Technical and Administrative categories participated.

NICNET Connectivity : As part of the Council's effort to link all the Institutes of the ICAR through a computer network for faster communication, CIRCOT established NICNET connectivity with effect from July 1995. This facility is expected to transmit communications faster through e-mail.

Visit of Marathi Vigyan Parishad Members : The thirtieth All India Marathi Vigyan Sammelan was held on 24-25 December,1995 at Mumbai. One of their Seminars was held at CIRCOT on Monday December 25,1995. In all, 11 delegates of the Sammelan and 26 staff members of CIRCOT attended the Seminar. Papers were read by various staff members of CIRCOT on various aspects of cotton and its by-products. The delegates also visited various laboratories of the Institute to acquaint themselves with the type of research work being undertaken here.

Significant Findings : Studies on variations of fibre length and G.P. among seeds, locules, bolls and plants showed variations in all the varieties. Significant reduction in fibre length was noticed for smaller bolls in all varieties except Deviraj and G.Cot.15. In general, G.P. was found to be lower for smaller bolls. Ginning Percentage gradually increased for the seeds from top to base of the locule. Lint content was minimum for the seeds at the tip of locule. There is scope for varietal improvement by selecting seeds attached to the locule in large bolls.

Through Statistical prediction of yarn strength from fibre properties, a method to determine short fibre percentage from the fibrograms generated by HVI was developed.

PLATE - III

SEMINAR ON FUTURE TREND IN TEXTILES

Dr.R.S. Paroda, Director General, Indian Council of Agricultural Research, lighting the Inaugural Lamp

Inaugural Address by Dr.R.S. Paroda, Director General, ICAR

A section of the illustrious audience

Another section of the audience

PLATE - IV

SEMINAR ON RECENT ADVANCES IN MECHANICAL PROCESSING OF COTTON

Shri M.B. Lal in conversation with Dr.S.N. Pandey, Director, CIRCOT

A section of the audience

PLATE - V

GROUP DISCUSSION ON FUTURE REQUIREMENTS OF COTTON

Talk by Dr. V. Sundaram, Former Director of CIRCOT.
Others: Shri Sudhir Sanghi, Chairman, ICDC and Dr. K.R.K. Iyer, Director, CIRCOT

Dignitaries at the Group Discussion

Splice joints prepared from polyester/ cotton blends in the ratio of 50:50 had higher retained strength in comparison with the joints prepared from yarns of other blends as well as from pure polyester and cotton. The retained splice strength is also the highest for ring-spun blended yarns as compared to rotor and air-jet spun yarns. For the latter two yarns, strength of splice joints are barely above half the parent yarn strengths. The study also indicated that the mill trials on the optimised settings at low supply of air-pressure proved successful. No breaks of the splice joints during rewinding of yarn were noticed.

Polyester-wool fabrics are thicker than polyester-cotton and pure cotton fabrics of equal weight. They also possess higher bending rigidity. The bending recovery values of polyester-wool fabrics are comparable to those obtained for polyester-cotton or cotton fabrics. However, 100% wool fabrics of comparable weight had higher bending recovery.

Aqueous swelling accompanied by stretch drying of cotton fabrics brings about significant changes in the morphological and structural characteristics of cotton fibres. The treatment results in drastic reduction in convolution frequency and convolution angle, appreciable decrease in reversal orientation without affecting crystalline nature of the fibre.

Lac dye which is being used to dye wool and silk was successfully used to dye cotton after a simple pre-treatment with chitosan. Crosslinking and use of mordants could be used to increase the washfastness for this natural dye. Different colours could also be obtained with the use of mordants.

Good quality protein hydrolysates (Peptones) has been prepared from cottonseed meal. Peptones obtained from the meal of *desi* varieties were superior to hirsutums and hybrids. Non-ionic surfactants obtained by reacting cottonseed oil/cottonseed oil fatty acids are found to be stable in alkaline and neutral mediums.

Eighty and Eighty-five percent fat splitting can be achieved by enzymatic method and modified Twitch method, respectively while preparing pure fatty acids from cottonseed oil.

An attempt has been made at CIRCOT to correlate Tightness Factor (TF) with other physical properties of knitted fabrics made out of yarns from two cottons, 170 CO2 and Hybrid 4, spun to 32s, 38s and 44s counts on conventional ring spinning and 32s count on rotor spinning system.

Three species of oyster mushrooms, *viz., Pleurotus sajor-caju, P.flabellatus and P. florida* were grown on cotton plant stalks with and without nutrient supplementation on diferent sized substrata. One kg of the substratum was found to be better during both ideal and slighltly adverse conditions in Bombay with regard to the yield of the sporophores whereas 5 kg substratum was found to be better under only ideal conditions. *P. sajor-caju* yielded about 500 g of fleshy fruiting bodies per kg of the material and it was about 800 g when the stalks were supplemented with Bengal gram flour @ 3%. The results on the other two species were also the same on 1 kg substratum without nutrient supplementation.

The efficiency of converting nitrogen from cotton plant stalks to mushroom protein by three species of *Plerotus. viz.*

P.sajor-caju, *P.florida* and *P.flabellatus* has been investigated. The sporophores of *P.flabellatus* were found to contain maximum protein of 30% followed by *P.sajor-caju* and *P.florida*. It was found that the protein concentration in the caps was more than that in the stems in all the cases. It was as high as 36% in the caps of *P.sajor-caju*. The caps were richer in protein by 50% than the stems. The spent cotton stalks were found to contain around 55% holocellulose and around 1.2% nitrogen.

The willow dust based biogas technology has been extended to process *koji* material for the production of biogas by solid state fermentation. The trials using a 25 kg. level plant indicated that it is possible to obtain 400 ml of biogas per kg of the material in 45 days. This technology is being explored to utilise spent *Koji* for the production of biogas.

A method was developed at CIRCOT for anaerobic digestion of cellulosic materials for a week at room temperature to kill the saprophytic fungi to a very significant extent apart from softening the lignocellulosic materials for easy proliferation of mushroom fungus during spawn run. This method thus eliminates the usage of fungicides used for killing saphrophytic micro-oraganisms which would otherwise pose residual problems in sporophores.

Trials undertaken with cotton stalks and rice straw for growing edible mushrooms indicated that hot water treatment can be totally dispensed with, thus there is energy saving when they are subjected to anaerobic digestion for seven days. This low cost technology can be adopted even by the farmers to save energy and develop crop, easily.

Dr. Vithal, Director, Directorate of Cotton Development Clarifies a Point during Group Discussion

A section of the Participants at the Group Discussion

PLATE - VI

VISIT BY DELEGATES OF MARATHI VIGYAN SAMMELAN PARISHAD

Delegates with Director and Staff of CIRCOT

Delegates keenly observe specimens of particle board and paper prepared from cotton stalk using CIRCOT Technology

2

Progress of Research

A brief account of the progress of research work during 1995-96 at CIRCOT and its regional units including the Ginning Training Centre at Nagpur, is given below :

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

This thrust area encompasses three distinct facets of technological research :

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

(b) Tests on Standard and Trade varieties of Indian Cottons, and Research work done on specific agricultural and technological aspects relevant to cotton improvement.

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

(a) Evaluation of the Quality of Cotton Samples Received from Agricultural Trials and the All India Co-ordinated Cotton Improvement Project (AICCIP)

A large number of cotton samples are being received every year for technological evaluation from trials conducted by the AICCIP, Agricultural Universities and State Agricultural Departments. The number of samples received during 1995-96 for different tests from agricultural trials at the Headquarters has been given in Table 1 (a). The number of samples tested at each of the Regional Quality Evaluation Units of CIRCOT is presented in Table 1(b). The number of cotton samples received and tested at CIRCOT for various quality parameters from different states and reports sent under AICCIP is given under Table 2.

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

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

ALL INDIA CO-ORDINATED COTTON IMPROVEMENT PROJECT (AICCIP)

The ICAR launched the AICCIP, in April 1967 with a view to achieving closer collaboration between the scientists of various disciplines as well as bringing together Agricultural Universities, Central Institutes and State Departments of

TABLE 1(a) : NUMBER OF COTTON SAMPLES RECEIVED AT THE HEAD QUARTERS OF CIRCOT DURING 1995-96

Type of test	Average for the quinquennium 1986-90	1993-94	1994-95	1995-96
Fibre and full spinning	239	147	195	102
Fibre and Microspinning	1898	1815	1676	1182
Microspinning alone	56	-	-	-
Fibre test alone	392	311	903	365
Mill test	11	3	4	-
Standard cottons	19	17	21	19
Trade varieties :				
— Lint	43	-	17	14
— Kapas	24	-	17	
Technological Research	15	5	9	-
Miscellaneous	7	-	9	-
Total	2704	2298	2851	1682

TABLE 1 (b) : NUMBER OF SAMPLES TESTED AT THE REGIONAL QUALITY EVALUATION UNITS DURING 1995-96

Regional Quality Evaluation Units of CIRCOT	Quality Parameters				
	Fibre length (2.5% SL)	Fibre fineness	Fibre maturity	Fibre strength	Micropinning test
Akola	1205	440	440	572	-
Coimbatore	1191	1185	1185	1191	124
Dharwad	619	619	619	619	-
Guntur	961	906	906	874	-
Hisar	894	894	894	894	-
Indore	536	530	536	530 + 260 1/8"	-
Ludhiana	3850	1399	1199	1409 + 708	-
Nagpur	907	803	777	781	-
Nanded	675	672	675	672	-
Rahuri	943	854	860	854	-
Sirsa	627	494	317	363	-
Sriganganagar	1226	1054	1054	927	-
Surat	11785	5615	4019 + (1185) Pressley	5670	13

TABLE 2: NUMBER OF COTTON SAMPLES TESTED AT CIRCOT HEADQUARTERS DURING 1995-96 UNDER AICCIP

State	Fibre and full spinning	Fibre and Micro spinning	Fibre tests alone	Total
Punjab	45 (8)	88 (14)	-	133 (22)
Haryana	4 (2)	114 (19)	-	118 (21)
Rajasthan	4 (1)	79 (9)	-	83 (10)
New Delhi	-	41 (4)	264 (4)	305 (8)
Uttar Pradesh	12 (2)	18 (3)	-	30 (5)
Maharashtra	14 (3)	406 (33)	-	420 (36)
Madhya Pradesh	9 (2)	347 (22)	16 (1)	372 (25)
Karnataka	6 (2)	79 (26)	-	85 (28)
Tamil Nadu	8 (2)	10 (2)	85 (3)	103 (7)
Total	102(22)	1182 (132)	365 (8)	1649 (162)

Note : The numbers in brackets relate to reports issued.

Agriculture in cotton improvement research. The main objective of this Project has been to look into the problems of production, productivity and quality of cotton with a multi-disciplinary approach.

The breeding material available with the cotton breeders of various states is systematically screened every year and only the promising material are considered for further trials. Maintenance of 'Germplasm' as well as Initial Evaluation Trials and Preliminary Varietal Trial form the preliminary stages of screening while Co-ordinated Varietal Trial and Full Spinning Trial, etc. constitute the advanced trial under this project. Yield would be the main criterion in the Initial Evaluation Trials while both yield and the quality are the criteria for further selections as well as subsequent trials. This is the twenty-ninth year of the AICCIP.

As the cotton growing 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, Uttar Pradesh and New Delhi, the Central Zone includes the States of Madhya Pradesh, Maharashtra and Gujarat, and South Zone covers the states of Andhra Pradesh, Karnataka and Tamil Nadu.

As many as 1649 cotton samples were screened for fibre properties and spinning potential during 1995-96 season. The test data on various breeding trials were presented at the Panel Meetings held at Sriganganagar for North Zone and at Raichur for combined Central and South Zones, respectively. The work done under various breeding trials is summarised briefly as follows:

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 the existing varieties. Emphasis is also given to evolve strains of early maturing or short duration type with a view to making the field available for the second crop of food grains.

G. hirsutum Trial :

The Co-ordinated Varietal Trials (CVT) for Normal Plant Type as well as early maturing Compact Plant Type were conducted at Bhatinda, Muktsar, Ludhiana, Faridkot, Hisar, Mathura, Kheri and Sriganganagar. Table 3 shows the ranges of 2.5% span length, Micronaire value and bundle tenacity at both '0' and 3.2 mm gauge lengths along with spinning potential for the samples belonging to the above two trials. The strains that had recorded encouraging spinning performance at 20s, 30s, 40s and 50s counts at different locations under both these trials are listed below :

Location	*Count*	*Promising Strains*
Bhatinda	30s	LH.1537, F.1084, F.1378, LH.1470, LH.1318, F.846, Pusa 19-17, LH.1363, F.1054
	40s	F.1084,LH.1470, LH.1318, Pusa 45-3-6, LH.1818, Pusa 19-17, LH.1363, LH.1556, LH.1054
	50s	Pusa 45-3-6, LH.1818, LH.1556
Muktsar	20s	F.1255, F.846
	30s	F.1084, F.1378, LH.1318, F.1394, LH.1556
	40s	LH.1318, LH.1556
Ludhiana	20s	F.1255
	30s	LH.1537, F.1378, LH.1470, LH.1343, F.846, LH.1753, F.1852, F.1488, LH.1363, F.1054
	40s	F.1378, LH.1470, LH.1343, Pusa 45-3-6, F.4488, LH.1363, LH.1556, F.1054
	50s	Pusa 45-3-6, LH.1556
Faridkot	20s	F.1394, RS.903; F.1084, F.1378, F.1255
	30s	F.846, F.1084, F.1488, F.1054
	40s	—
Hisar	30s	RS.903, F.1378, HS.215, B.N., H.1156, LH.900, RS.921, F.1408, Pusa 19-17
Mathura	20s	NZH.43
	30s	NZH.46, NZH.48, NZH.47, NZH.415, Vikas, HZC.454, HZC.468, HZC.458
	40s	NZH.46, NZH.48, NZH.415, HZC.456, HZC.467
	50s	HZC.456

Location	*Count*	*Promising Strains*
Kheri	20s	H.1156
	30s	LH.1818, F.1488, F.1408, LH.1556, F.1054
	40s	LH.1818, F.1488, LH.1556
Sriganganagar	20s	LH.1366, RS.810, F.1378, LH.1470, F.1255, RST.9, RS.638

Samples pertaining to the Preliminary Varietal Trials (PVT), Br.O3, were received from Muktsar, Ludhiana, Faridkot, Hisar, Mathura and Sriganganagar. The promising strains under this trial that fared well in spinning performance at the selected count are listed below along with locations:

Location	*Count*	*Promising Strains*
Muktsar	30s	LH.1640, LH.1587,F.1506, F.1470, F.1395
Ludhiana	40s	LH.1587, NZH.317, F.1395
Faridkot	20s	F.1506, F.1470, F.1395
Hisar	30s	B.N., LH.1696
Mathura	40s	F.1470
Sriganganagar	40s	—

The Initial Evaluation Trial, (IET), Br.O2 was conducted at Ludhiana, Hisar, Muktsar. The following strains recorded satisfactory spinning performance at selected counts and locations mentioned below :

Location	*Count*	*Promising Strains*
Ludhiana	40s	F.1537, LH.1639, LH.1769
Hisar	30s	B.N., HS.230, H.1123, H.1177, F.1528
Muktsar	30s	LH.1771, F.1523, F.1414, F.1515, LH.1644

G.arboreum Trial :

The Co-ordinated Varietal Trial (CVT) Br.24 was conducted at Ludhiana, Hisar, Sirsa, Mathura and Sriganganagar. The object of this trial was to identify coarse short staple and high ginning out-turn varieties suitable for blending purpose in the place of the existing variety. The 2.5% span length of the strains tested under this trial ranged between 15.7 mm to 26.7 mm. The promising strains with Micronaire values 7.0 and above are listed below :

Location	*Promising strains having Micronaire values 7.0 and above*
Ludhiana	LD.491, LD.327, LD.560, RG.35, RG.24, RG.34, LD.620
Hisar	NZA.245, NZA.2412
Sirsa	NZH.244, NZH.245, NZH.2410, NZH.2411, NZH.2416, DS.5
Mathura	NZH.245, NZA.2411, NZA.244, NZA.241
Sriganganagar/Ajmer	NZA.244, NZA.246, RG.8, RG.45, RG.52, RG.22, RG.68, LD.491, HD.259, LD.327, LD.560, RG.35, RG.45, RG.35, LD.572, HD.324, RG.18, RG.8

Samples Pertaining to Preliminary Varietal Trial (PVT), Br.23 were received from Hisar, Ludhiana, Mathura and Sirsa. The following strains recorded Micronaire value 7.0 and above at the location stated below :

Location	*Promising strains having Micronaire values 7.0 and above*
Hisar	NZA.231
Ludhiana	HD.317, LD.679, RG.77, LD.327, RG.83
Mathura	NZH.2310, NZA.2318, Lohit
Sirsa	NZA.231, NZA.234, NZA.2310, NZA.2317, NZA.2318, DS.5

Hybrid Trial :

The object of this trial was to identify hybrids superior to the local check varieties in yield and technological characteristics.. The samples belonging to Intra-hirsutum Hybrid Trial involving G.hirsutum x G.hirsutum crosses were received from Faridkot, Ludhiana, Bhatinda, Hisar, Sirsa and Sriganganagar. The promising hybrids showing better spinning performance at selected counts are listed below along with locations:

Location	*Count*	*Promising Hybrids*
		Br.05 (a) - 1 Conventional Type
Ludhiana	40s	HHH.166, LHH.144, LHH.207, Fateh
Bhatinda	40s	LHH.144, LHH.107

Location	*Count*	*Promising Hybrids*
Faridkot	30s	FHH.7, Fateh, LHH.107
Hisar	40s	HHH.29
Sirsa	40s	HHH.166, HHH.29, LHH.107, LHH.120, CSHH.33
Sriganganagar	20s	Raj.HH.77, CSHH.29, ACHH.651, LHH.120, RST.9
		Br.05 (a) - 2 Male Sterile Base
Ludhiana	40s	Fateh, LHH.280, LHH.152, LHH.606
Bhatinda	40s	CAHH.2, LHH.152, LHH.606
Hisar	40s	LHH.152, HHH.81, LHH.121
Sirsa	40s	SHH.7, HHH.81, LHH.606, Raj. HH.24
Sriganganagar	40s	—
Faridkot	30s	LHH.121, FHH.58

A few entries from Central & South Zone were tried in the north at Sirsa under Intra-hirsutum Hybrid Trial, Br.O5 (b) under Rainfed conditions. The 2.5% span length varied from 23.0 mm to 27.7 mm, Micronaire ranged between 3.7 and 5.0, mature fibre percentage varied from 72 to 81 and bundle tenacity varied from 42.9 g/t to 47.7 g/t for zero gauge length and from 19.2 g/t to 22.1 g/t for 3.2 mm gauge length. The strains GK.151, CSHH.2 and CSHH.3 showed good spinning performance at 40s count.

Miscellaneous Trials :

A good number of trials having different objectives were conducted at New Delhi, Hisar and Sirsa. The details of these trials along with the results are given below:

A Pusa-HB varietal trial was conducted at IARI, New Delhi and 30 strains were tested for fibre properties. Most of the strains were found to be extra-long, fine and had very good strength.

Four established varieties, viz. RG.8, G.A., B.N. and RST.9 were grown at Sriganganagar for obtaining fibre properties for comparison as local check. RG.8 variety was very coarse, G.A. was spinnable to 20s count, B.N. was spinnable to 30s & 40s counts whereas, RST.9 was spinnable to 20s count.

A miscellaneous trial of IET of G.arboreum was conducted at Hisar under

TABLE 3 : SUMMARY OF TEST RESULTS ON COTTON STRAINS UNDER CO-ORDINATED VARIETAL TRIALS (Br.O4) IN THE NORTH ZONE

Location	No.of samples	Range of					Spinning Performance			Control Variety
		2.5% span length (mm)	Micronaire value	Maturity	Bundle Tenacity (g/t) 0' gauge	3.2 mm gauge	Count	A	B	
1	2	3	4	5	6	7	8	9	10	11
					Normal Plant Type (Br.04) (a)					
Bhatinda	6F	25.4 - 26.2	4.0 - 4.9	73 - 82	42.9 - 47.7	17.6 - 22.1	30s	5	5	F.846
							40s	3	3	
Muktsar	7F	24.1 - 26.9	3.5 - 4.8	65 - 85	47.7 - 51.5	19.1 - 21.5	20s	2		F.846
							30s	5	5	
							40s	2		
Ludhiana	6F	25.1 - 26.3	3.8 - 4.4	66 - 81	47.2 - 48.8	17.2 - 21.9	20s	1	1	F.846
							30s	5	4	
							40s	3	3	
Faridkot	5F	23.5 - 25.1	4.1 - 4.9	70 - 79	45.0-49.3	16.2 - 19.2	20s	4	4	F.846
							30s	2	2	
							40s			
Hisar	5M	23.0 - 26.2	3.7 - 4.3	64 - 82	42.3 - 49.8	18.8 - 21.2	30s	4	4	H.1117
Mathura	6F	25.5 - 27.9	4.4 - 4.8	72 - 83	44.5 - 48.2	19.6 - 21.0	20s	1		Vikas
							30s	5	4	
							40s	3		
Sriganganagar	6M	23.8 - 28.0	4.4 - 5.4	73 - 83	44.0 - 47.2	18.8 - 22.1	20s	6	3	RST-9

TABLE 3 : (CONTD.)

1	2	3	4	5	6	7	8	9	10	11
					Compact Plant Type (Br.04) (b)					
Bhatinda	7F	24.9 - 31.8	3.9 - 5.1	73 - 83	45.6 - 48.6	19.6 - 25.1	30s	4	3	F.1054
							40s	7	5	
							50s	5		
Ludhiana	7F	25.3 - 27.4	3.8 - 4.5	71 - 85	43.4 - 47.2	19.4 - 23.6	30s	5	4	F.1054
							40s	5	4	
							50s	1		
Faridkot	6M	25.0 - 27.0	4.0 - 4.9	73 - 85	36.4 - 45.6	19.4 - 22.6	30s	2		F.1054
Kheri	6F	22.6 - 29.5	3.6 - 4.7	68 - 88	44.5 - 48.2	18.2 - 23.0	20s	1		F.1054
							30s	5	3	
Hissar	5M	24.0 - 27.9	3.2 - 3.7	55 - 73	46.6 - 48.2	20.4 - 24.5	30s	5	5	LH.900
Mathura	6F	24.9 - 31.8	3.9 - 5.1	73 - 83	45.6 - 48.8	19.6 - 25.1	30s	4	1	Vikas
							40s	4	3	
							50s	1		
Sriganganagar	6M	24.4 - 28.1	4.2 - 5.5	71 - 88	44.5 - 48.8	17.9 - 22.3	20s	1	5	RST.9

F - Full Spinning
M - Microspinning
A - No. of samples spinnable to selected count
B - No. of samples having spinning performance better than or on par with control

irrigated conditions. The strains were short staple, very coarse and of good strength. Out of ten varieties, two were spinnable to 20s count.

Miscellaneous G.hirsutum trial was conducted at Hisar. All the ten strains were giving good spinning performance at 20s count. The strains were medium staple, average in fineness, good in maturity and strength.

G.arboreum trial was conducted at Hisar. The strains were short staple, coarse, highly mature and of good strength. None of the strains was spinnable to 20s count.

Another G.hirsutum trial was conducted at Hisar under irrigated conditions. The strains were medium staple, average in fineness, good in maturity and strength. Most of the strains give good spinning performance at 20s count.

Two G.hirsutum varieties viz. H.1098 and H.974 were tried at Hisar. The strains were medium staple, average in fineness, good maturity, strength and were spinnable to 30s count.

Two varieties LRK.516 and H.777 were tried at Sirsa for a comparative study. LRK.516 was medium staple, average in fineness and satisfactory in spinning performance at 50s and 60s counts whereas, H.777 was short staple and spinnable only to 30s count.

Under a miscellaneous trial at IARI, New Delhi, 105 samples were tested. All were medium staple, fine and had good tenacity values. In another trial at IARI, New Delhi, 84 samples were tested on HVI. The 2.5% span length varied from 23.0 mm to 28.1 mm, micronaire value ranged between 2.9 and 5.4 and tenacity at 3.2 mm gauge length varied from 17.1 g/t to 28.8g/t.

Interspecific hybrid trial was conducted at IARI, New Delhi. All the 18 strains were extra long and were spinnable to 80s count. In another trial at IARI, 45 samples were tested. All were medium staple, average in fineness and had good strength.

Central Zone :

This zone has the largest area under cotton cultivation. Although emphasis is given to improve the existing American type G.hirsutum cottons, sizeable percentage of cottons from *G.arboreum* species is also under cultivation in this zone. For many years, hybrids, such as H.4, H.6, JKHy.1, etc. were being commercially cultivated in this zone. Attempts are being made to identify early maturing hybrids without sacrificing the yield. Considering the increasing demand for the medium and superior medium categories of cotton, attempts are on to evolve desi hybrids. Trials are also conducted for the improvement of cottons in *G.herbaceum* species which are traditionally grown in some pockets of Gujarat state.

G.hirsutum Trial :

The Co-ordinated Varietal Trial, Br.04 was conducted at Padegaon under irrigated conditions and at Nanded, Khandwa, Jalgaon, Badnawar and Indore under rainfed conditions. The range of 2.5% span length, Micronaire value, maturity and bundle tenacity at both '0' and 3.2 mm gauge lengths along with assessment of their spinning potential have been compiled in Table 4.

TABLE 4 : SUMMARY OF TEST RESULTS ON COTTON STRAINS UNDER CO-ORDINATED VARIETAL TRIALS (Br.O4) IN THE CENTRAL ZONE

Location	No.of samples	Range of					Spinning Performance			Control Variety
		2.5% span length (mm)	Micronaire value	Maturity	Bundle Tenacity (g/t) 0' gauge	3.2 mm gauge	Count	A	B	
				Br.04 (a) - Irrigated						
Padegaon	7M	27.3 - 32.7	3.7 - 4.2			19.5 - 23.6	40s	5	1	LRA.5166
				Br.04 - (b) Rainfed						
Nanded	12M	25.6 - 28.0	3.3 - 4.4	61 - 84	28.6 - 45.0	18.1 - 20.7	40s	3	1	LRA.5166
Jalgaon	6M	24.5 - 27.7	3.2 - 4.6	60 - 74	47.2 - 48.8	17.7 - 20.8	40s 30s	-	-	JLH.168
Badnawar	12M	23.4 - 26.4	2.9 - 5.5	57 - 72	40.2 - 46.6	17.8 - 22.6	30s	8	3	LRA.5166
Indore	12M	23.8 - 26.5	2.0 - 3.7	54 - 80	41.3 - 48.8	16.8 - 19.9	40s	2	9	LRA.5166
Khandwa	12M	24.8 - 27.4	3.2 - 4.3	61 - 80	41.8 - 47.2	18.7 - 20.7	30s	12	4	LRA.5166

M - Microspinning

A - No. of samples spinnable to selected count

B - No. of samples having spinning performance better than or on par with control

The promising strains having good spinning potential are listed below along with location and selected count :

Location	*Count*	*Promising Strains*
		Br. O4 (a)
Padegaon	40s	G(T).2714, LRA.5166, G(T).1426, G.(T)14, G(B).20
		Br. O4 (b)
Nanded	40s	NH.547, PH.93, LRA.5166, NH.450
Khandwa	30s	NH.450, JLH.168, KH.2160, NH.452, LRA.5166, H.101, KH.2237, AKH.8362, AKH.8828, NH.439, GJHS.52
Jalgaon	40s	—
	30s	JLH.168, AKH.8828
Badnawar	30s	NH.450, JLH.168, LRA.5166, KH.101, AKH.8362, AKH.8828, GJH.552
Indore	40s	GJHS.52

Samples pertaining to Preliminary Varietal Trial Br.03, were received from Khandwa and Jalgaon under rainfed conditions. The following strains were found promising in respect of spinning performance at the selected count and location.

Location	*Count*	*Promising Strains*
Khandwa	30s	JLH.1492, JLH.1191, G(T).1080, G.2709, LRA.5166, JLH.1991
Jalgaon	40s	—

The Initial Evaluation Trial, Br.O2 was conducted at Khandwa and Jalgaon under rainfed conditions. The strains at Jalgaon were medium staple, fine and recorded good strength but were not spinnable to 40s count. All the strains at Khandwa gave good spinning performance at 30s count.

G.arboreum Trial :

The Co-ordinated Varietal Trial, Br.24 was conducted at Nanded and Jalgaon. The strains AKA.5, PA.262, and KWA.7 from

Jalgaon have recorded good spinning performance at 20s count, whereas PA.141 and AKA.8713 from Nanded gave good spinning performance at 30s count. Under long staple *desi* Trial, JLA.1693, AKA.8922, AKA.8401, AKA.8816, AKA.9143 and PA.255 varieties from Jalgaon fared well in spinning at 20s count while none of the strains from Nanded was found spinnable to 30s count.

Hybrid Trial :

The object of this trial was to identify early maturing hybrids superior in yield and quality and compare it with the existing local hybrids such as H.6, JKHy.1, etc. in Madhya Pradesh, Maharashtra and Gujarat. Considering the increasing demand for medium and superior staple categories of cotton, attempts were also made to identify *desi* hybrids.

Intra-hirsutum Hybrid Trial : Conventional Type

Samples pertaining to this trial were received from Jalna and Nanded under irrigated conditions and from Aurangabad, Jalgaon and Khandwa under rainfed conditions. The promising hybrids which fared well in spinning performance at the locations indicated are mentioned below :

Location	*Count*	*Promising Strains*
Indore	40s	CMSGH.6, CNHH.108, MECH.184, NBHH.2332
Aurangabad	40s	—

Inter-specific Hybrid Trial : Br.15 & Br.25

Hybrids involving *G.hirsustm* x *G.barbadense* crosses (Br.15) were tried at Jalna, Badnawar and Padegaon while *desi* hybrids involving *G.arboreum* x *G.herbaceum* crosses (Br.25) were tried at Jalgaon. The promising hybrids from the spinning point of view which fared well in spinning performance at selected counts and locations are listed below :

Location	*Count*	*Promising Hybrids*
		Br.15
Jalna	60s	NGHB.109, GHB.583, NBHB.11, MECHB.122, DHB.595, DHB.685, WHB.1876, BCHB.150,VCHB.4, GHB.582, DHB.680, MECH.118, NFHB.11, DCH.32
Badnawar	60s	NFHB.111, NFHB.109, VCHB.4
Padegaon	80s	—
		Br.25
Jalgaon	20s	GBDH.1, CNDH.1, Pha.121

Evaluation of Short Duration and Compact Type Material (Br.52-2)

Dwarf and compact type of plants of *G.hirsutum* have certain advantages in respect of yield over the normal plant type. In order to study the yield and the technological characters of such plant types, a trial was undertaken at Khandwa and Padegaon. It was observed that the strains from Khandwa were medium staple, fine and of good strength. The strains RB.423, NH.011, AKH.8929 and CNNPT.3 gave good spinning performance at 30s count. However, the strains at Padegaon were found to be of medium staple, average in fineness and strength. One variety *viz.*, CNHPT.12 was spinnable to 30s count.

Miscellaneous Trial :

A few miscellaneous trials having different objectives were conducted at Khandwa, Nanded, Akola and Padegaon, the details of which are as given below :

Four established varieties were grown at Khandwa as local check. Maljari, KWA.3 and KH.2160 were satisfactorily spinnable to 20s count, while Khandwa 3 was spinnable to 30s and 40s counts. All the varieties were short staple having very good strength.

Three varieties were tried at Akola under Br.05 (b)-2 miscellaneous trial. Variety CAHH.8 was long staple, average in fineness and had very good strength. It was satisfactorily spinnable to 50s count. The variety CAHH.468 was short staple, coarse and was spinnable to 40s count. Hybrid 6 was spinnable to 50s count.

Under multi-location hybrid trial at Padegaon, six strains were tried. Only one strain, *viz.* RHH.1287, was comparable to control H.6 giving satisfactory spinning performance at 40s count.

A *desi* cotton trial was conducted at Nanded. Out of the four strains, AN.473 was spinnable to 30s count. This strain was medium staple and average in fineness and strength.

Five strains were tried at Nanded under *G.arboreum* trial. The strains were medium staple, coarse and had very good strength. The variety PA.262 was spinnable to 30s count.

A miscellaneous trial was conducted at Khandwa, where 15 samples were tested for fibre properties. The 2.5% span length varied from 21.1 mm to 26.9 mm. Micronaire value varied from 2.6 to 3.8 and bundle tenacity at 3.2 mm gauge length varied from 15.9 g/t to 19.0 g/t.

G.arboreum trial Br.2B was tried at Nanded. The strains were medium staple, coarse and had good bundle strength. The varieties NA.377 and PA.141 were giving satisfactory spinning performance at 30s count.

Another *G.arboreum* trial Br.2C was held at Nanded. All the strains were medium staple coarse and had good bundle strength. Only one variety, *viz* .NA.467 gave satisfactory spinning performance at 30s count.

South Zone

This zone comprises the states of Andhra Pradesh, Karnataka and Tamil Nadu and is known for long staple cottons. Although, cottons belonging to *G.hirsutum* species

TABLE 5 : SUMMARY OF TEST RESULTS ON COTTON STRAINS UNDER CO-ORDINATED VARIETAL TRIALS (Br.O4) IN THE SOUTH ZONE

Location	No.of samples	Range of					Spinning Performance			Control Variety
		2.5% span length (mm)	Micronaire value	Maturity	Bundle Tenacity (g/t) 0' gauge	3.2 mm gauge	Count	A	B	
					Br.04 (a) Irrigated					
Siruguppa	8M	24.0 - 34.3	3.1 - 4.5	67 - 72	41.3 - 49.3	16.6 - 23.6	50s	1	4	JK.119
Raichur	5M	22.6 - 27.5	2.9 - 4.2	47 - 72	42.9 - 46.6	16.6 - 22.1	30s	3	4	MCU.11
Arabhavi	14M	23.8 - 32.0	2.6 - 3.4	52 - 72	38.1 - 52.0	17.6 - 23.5	40s	7	7	AH.107
					Br.04 (b) Rainfed					
Raichur	7M	22.9 - 25.3	3.1 - 4.1	59 88	41.3 - 45.6	16.7 - 19.4	30s	1	3	LRA.5166
					Br.04 (d) Compact Type					
Siruguppa	7M	24.3 - 30.4	3.4 - 4.0	62 - 76	42.3 - 47.2	18.4 - 20.9	50s		-	LRA.5166
Raichur	6M	23.5 - 28.9	3.4 - 4.1	58 - 69	40.7 - 45.6	17.2 - 22.9	30s	4	2	NA.325
Arabhavi	16M	25.0 - 30.0	2.8 - 3.5	47 - 70	42.0 - 50.4	17.2 - 22.1	40s	8	6	LRA.5166

M - Microspinning

A - No. of samples spinnable to selected count

B - No. of samples having spinning performance better than or on par with control

cover large area under cultivation, those belonging to the other three species are also grown in this zone in some area in both irrigated as well as rainfed tracts. In addition, *Intra-hirsutum* and inter-specific hybrid cottons are also cultivated on large scale in this zone.

G.hirsutum Trial :

Co-ordinated Varietal Trial (Br.04), was conducted at Siruguppa, Raichur and Arabhavi under irrigated conditions and at Raichur under rainfed conditions. Also a separate trial of compact type Br.04(d) was conducted at Siruguppa, Raichur and Arabhavi. The ranges of 2.5% span length, Micronaire value, maturity and bundle tenacity at both '0' and 3.2 mm gauge lengths along with their spinning performance are presented in Table 5.

The following strains were found to be promising in spinning performance at the counts and locations mentioned below :

Location	*Count*	*Promising Strains*
		Br. 04 (a)
Siruguppa	50s	LRA.5166
	60s	—
Raichur	30s	VRS.27, L.604, JK.276-8-2
Arabhavi	40s	VRS.7, MCU.5, ICMF.31, ICMF.20, JK.276-2, LRA.5166, RAC.21
		Br. 04 (b)
Raichur	30s	TKH.189
		Br. 04 (d)
Siruguppa	30s	—
Raichur	30s	CDG.1, NA.325, 70E, AND.123
Arabhavi	40s	CDG.1, Anjali, 70E, RHCC.13, ICMF.20, CDE.1, AND.133, LH.1134

Preliminary Varietal Trial (Br.03) was conducted at Arabhavi, Raichur and Siruguppa under irrigated conditions and at Raichur alone under rainfed conditions. The following strains recorded encouraging spinning performance at selected counts and locations stated below :

Location	*Count*	*Promising Strains*
		Br. 03 (a)
Arabhavi	40s	VRS.19, TSH.188
Raichur	30s	LRA5166, VRS.19, CHH.120
Siruguppa	50s	LRA.5166
	60s	VRS.19, MCU.5
		Br. 03 (b)
Raichur	30s	TKH.891

Initial Evaluation Trial (Br.02), was conducted at Siruguppa, Arabhavi and Raichur under irrigated conditions and at Raichur under rainfed conditions. The following strains fared well in spinning performance at selected counts and locations mentioned below :

Location	*Count*	*Promising Strains*
		Br. 02 (a)
Siruguppa	50s	—
	60s	VRS.16
Arabhavi	40s	DT.213, L.714, LPS.2
Raichur	30s	RAC.116, TCH.1025, TECH.1028, TCH.976, CWROK.165
		Br. 02 (b)
Raichur	30s	—

Intra-hirsutum Hybrid Trial :

The hybrid trial involving *G.hirsutum* x *G.hirsutum* crosses, Br.05 (a)-1, for conventional type was conducted at Arabhavi, Raichur, Siruguppa and Attur under irrigated conditions, while Male sterile Base type Br.05 (a)-2 was conducted at Siruguppa alone under irrigated conditions. The following hybrids recorded satisfactory spinning performance at selected counts and locations stated below :

Location	*Count*	*Promising Hybrids*
		Br. 05 (a)-1
Arabhavi	50s	RCH.20
Raichur	30s	SCHH.2, HCHH.16, RCH.20
Siruguppa	40s	RCH.20, Savitha, RAHH.2
Attur	40s	RCH.2, RAHH.2, RCHH.18, TMB.45
		Br. 03 (B)-2
Siruguppa	40s	AHH.131, LH.861

Inter-specific Hybrid Trial (Br.15):

The hybrids involving *G.hirsutum* x *G.barbadense* crosses (Br.15), were tried at Raichur under irrigated conditions. The 2.5% span length varied from 29.0 mm to 33.5 mm, fineness (Micronaire value) varied from 2.6. to 3.4, bundle tenacity varied from 44.5 g/t to 53.1 g/t for zero gauge and from 19.0 g/t to 24.2 g/t for 3.2 mm gauge length. All the five hybrids, *viz.* RCHB.21, HB.8914, RAHB.51, CHB.595 and DHB.105 fared well in spinning performance at 60s count and showed superiority over the controls.

Miscellaneous Trial :

A few trials having different objectives have been conducted at Kovilpatti, Srivilliputhur, Mudhol, Raichur and Coimbatore. The details of the test results are given below :

A miscellaneous trial of *G.hirsutum* cotton culture TKH for release purpose was conducted at Kovilpatti. All the four strains of TKH were short staple, fine, average in maturity and possessed good strength. However, the variety TKH.590 gave satisfactory spinning performance at 30s count while the variety TKH.789 gave good spinning performance only at 20s count.

A new culture of cotton TSH for release was taken up for trial at Srivilliputhur. The variety TSH.288 was short staple, fine, good in strength and maturity and spinnable to 30s count. The variety TSH.289 was short staple, fine, average in maturity, good strength and spinnable to 20s count. Two varieties, SUPR.1 and LRA.5166, were medium staple, fine, good in strength, maturity and were spinnable to 40s count.

An *Intra-hirsutum* hybrid trial was conducted at Dharwad. The hybrids DHH.11 and NHH.44 were short staple, fine and had good maturity and strength. Both were spinnable to 20s count.

Four samples were tested at Mudhol, of which two varieties 1867 & 1875 were medium staple, coarse, having good strength and showed high maturity. Both

were spinnable to 20s count. Other varieties 1874 and Saraswathi were medium staple, average in fineness, good in maturity and strength and were spinnable to 30s count.

Under a miscellaneous trial conducted at Raichur established varieties were tried. The variety LRA.5166 gave satisfactory spinning performance at 40s count under Br.02 (a), Br.03 (a), Br.04 (a) and Br.02 (b) trials. The MCU.5 variety showed satisfactory spinning performance at 40s count under Br.02(a), Br.03 (a) and Br.04 (a) trials. Under interspecific hybrid trial, Br.15, and DCH hybrid gave good spinning performance at 60s count. The variety NHH.44 and Savitha gave satisfactory spinning performance at 40s count.

A miscellaneous trial of HLS.72 series was conducted at CICR Coimbatore. Twenty-one strains were tested for fibre properties on HVI. In general, the strains were found to be long staple, fine and possessing good strength.

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

(i) *Standard Indian Cottons* : To assess seasonal fluctuations in the characteristics of Indian cottons and to gauge the comparative superiority of the newly evolved strains, a number of established varieties of Indian cottons called Standard Cottons are tested every year. These varieties are grown in Government farms and cotton research stations under the supervision of senior cotton scientists of agricultural universities, under identical conditions. Extensive fibre and spinning tests are regularly being done on such samples and the test results are published as Technological Circulars for information of cotton breeders and other research workers as early in the season as possible. During 1995-96, 10 such circulars were issued.

(ii) *Trade Varieties of Indian Cottons* : Lint samples of fair average quality of the major Trade Varieties of Indian cottons are being obtained for each season through various organisations. Representative *Kapas* samples of these varieties are also procured from the State Departments of Agriculture for determination of ginning percentage. The fibre and the spinning test results, ginning percentage and other test results on each variety of cotton are being published as Technological Circulars for information of cotton trade and industry. Information on such circulars issued during 1995-96 on 12 Indian Cottons is given in Chapter 3.

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

Variations of Fibre Length and G.P. among, Seeds, Locules, Bolls and Plants

Six varieties, G.Cot. Hyb.6, Hyb.10, G.Cot.15, G.824, G.Cot.DH.7, and G.Cot.DH.9 were studied for mean halo length and ginning percentage. In each variety, three large and three small bolls were collected from each of the three random plants in the field. From each locule, the seeds were analysed for three positions, *viz.* tip, middle and base of the locule. The mean values are given in the Tables 6, 7 and 8.

Variations were observed among the plants, bolls, locules and seeds in all the varieties. Significant reduction in halo length was noticed for smaller bolls in all varieties except G.Cot 15. In general, the G.P. was also found to be lower for smaller

TABLE 6 : MEAN HALO LENGTH FOR BOLLS OF DIFFERENT SIZES

Variety/Plant		Large Bolls			Mean	Small Bolls			Mean
		B1	B2	B3		B4	B5	B6	
G.Cot.Hyb.10	P1	24.0	22.8	23.2	23.3	15.3	22.3	23.0	20.2
	P2	23.0	22.3	22.0	22.4	21.1	20.6	20.8	20.8
	P3	22.5	23.6	23.8	23.3	20.8	22.1	20.9	21.3
G.Cot.15	P1	20.5	19.7	19.6	19.9	18.7	19.7	17.9	18.8
	P2	17.3	16.7	17.4	17.1	17.5	17.7	18.8	18.0
	P3	18.7	18.6	18.2	18.5	20.3	19.2	18.1	19.2
G.824	P1	12.4	21.6	21.3	21.4	19.9	20.9	19.3	20.0
	P2	26.0	24.8	23.8	24.9	21.7	22.9	22.1	22.2
	P3	22.2	24.6	25.9	24.2	21.2	22.5	23.8	22.5
G.Cot.DH.7	P1	19.0	19.3	20.0	19.4	17.0	16.9	17.0	17.0
	P2	17.1	18.5	18.5	18.0	18.0	15.1	18.2	17.1
	P3	17.3	17.9	18.6	17.9	17.5	17.9	17.8	17.7
G.Cot.DH.9	P1	25.4	23.6	24.9	24.6	24.5	25.9	24.0	24.8
	P2	23.8	24.5	22.8	23.7	22.2	23.3	21.7	22.4
	P3	24.2	24.2	23.8	24.1	22.7	22.1	22.4	22.4

P = Plant B = Boll

TABLE 7 : G. P. VALUES FOR BOLLS OF DIFFERENT SIZES

Variety/Plant		Large Bolls			Mean	Small Bolls			Mean
		B1	B2	B3		B4	B5	B6	
G.Cot.Hyb.10	P1	33.5	32.4	34.1	33.3	30.0	21.6	24.8	25.5
	P2	32.0	33.0	30.6	31.9	30.6	30.7	30.6	30.6
	P3	31.6	29.0	29.3	30.0	33.8	32.1	32.2	32.7
G.Cot.15	P1	25.3	29.8	31.4	28.4	33.1	31.4	32.2	32.2
	P2	36.3	37.4	36.0	36.6	35.0	34.7	34.7	34.8
	P3	33.2	34.0	33.5	33.6	29.5	32.8	36.1	32.8
G.824	P1	37.0	38.2	32.0	35.7	33.4	35.6	33.2	34.1
	P2	31.7	34.9	35.5	34.0	32.6	28.9	25.5	29.0
	P3	30.5	28.6	28.0	29.0	25.4	28.0	30.6	28.0
G.Cot.DH.7	P1	34.8	42.1	38.9	38.6	33.3	29.3	36.1	32.9
	P2	35.0	35.0	33.1	33.9	31.7	30.1	32.2	31.3
	P3	38.7	37.2	36.0	37.3	33.9	35.0	33.2	34.0
G.Cot.DH.9	P1	30.6	33.3	32.0	32.0	29.6	29.7	32.3	30.5
	P2	28.9	24.2	24.4	25.8	24.8	25.5	27.3	25.9
	P3	26.9	27.1	25.8	26.6	24.0	23.7	23.8	23.8

P = Plant B = Boll

TABLE 8: G.P. VALUES FOR DIFFERENT POSITIONS OF SEEDS IN THE LOCULES

Variety	Tip of Locule	Middle Locule	Base of Locule
G. Cot Hyb.10	29.3	30.3	31.4
G. Cot.15	31.9	32.8	34.4
G. 824	29.1	31.9	34.9
G. Cot DH.7	33.4	34.0	36.5
G. Cot DH.9	25.2	27.1	29.7

bolls. The seeds near the tip of locule recorded low G.P. It gradually increased for the seeds from tip to base of locule. Lint content was also minimum for the seed at the tip of locule. There is scope for varietial improvement by selecting seeds attached to base of locule in large bolls.

Statistical Prediction of Yarn Strength from Fibre Properties

Forty-nine samples of Trade Variety and Standard Indian Cottons tested for full spinning during the seasons 1993-94 and 1994-95, were collected. The fibre properties like 2.5% SL, Micronaire value, bundle tenacity at 3.2 mm gauge length, elongation % and colour, were determined using HVI. Normalised fibrogram given by HVI for fifteen samples were analysed for different length parameters. A method for determining the short fibre percentage from the fibrogram is under way. Effective length (EL) and short fibre % (SF%) determined from these fibrograms were compared with those calculated from comb sorter diagrams. High correlations (r=0.95 for EL and r=0.85 for SF%) were found between the measurements made by these two methods.

THRUST AREA II : POST-HARVEST TECHNOLOGY OF COTTON

Studies on Splicing of Cotton and Blended Yarns

During the period, the following aspects were studied :

(a) Effect of yarn linear density on the retained strength of splice joints : Additional spinning of 30s and 50s count yarns using three different levels of twist from the same LRA-5166 cotton was carried out. A second order rotatable experimental design involving three variables, Yarn count (X_1), Yarn twist (X_2) and Tail index (X_3), with three specified levels of each for the variables was chosen. On the splicer, optimum settings for various machine variables as reported earlier, were used. In all, 15 experiments were conducted. For each of the experiments, 25 splice samples were prepared and tested on the Uster Tensorapid for tensile properties.

(b) Effect of blending polyester with cotton on strength retention of splice joints : A 1.5 d and 38 mm polyester was blended with a combed stock of MCU.5 cotton at the draw frame in three different proportions (25:75, 50:50 and 75:25) before being routed for ring spinning into 40s yarns. Besides, yarns were spun from pure cotton as well as polyester fibres. For each yarn, 25 splice specimens were prepared using the settings on the splicing machine. All the parent yarns as well as the splice samples were tested on the Tensorapid equipment. The experiment was replicated using pure as well as 50:50 blended yarns spun from entirely different lots of polyester and cotton.

(c) Effect of different spinning systems on the retained splice strength (RSS) of cotton and blended yarns : For this study, 30s count polyester-cotton blended yarns spun from ring, rotor and air-jet spinning systems were used. A blended sliver with a polyester composition of 67% by weight was used for spinning yarns in all the systems. The parent yarns as well as their respective splice samples were tested for tensile properties on the Tensorapid equipment.

(d) Mill trials on optimised settings in conjunction with lower air-pressure determined at the laboratory : One of the splicing machines available in a textile mill was set as per the optimum settings. Splice samples were prepared from 42s count mill-spun yarn with a lower supplied air-pressure of 4.3 kg/cm^2 for about 2 hours. Besides, in one kg. of 60s yarn, 52 splice-joints were systematically put, marked with colour and studied for breaks during rewinding.

Improvement in Processing Techniques of Micro-Spinning for small lint samples

Ten samples belonging to the 1994-95 season were spun using micro-spinning technique incorporating two modifications, *viz.* with apron drafting and with roller drafting. After regular carding 4 doublings have been used. The spun samples are being tested for single thread strength parameters on Uster Dynamometer and also for lea strength.

During this period testing for single thread strength parameters on the 15 samples already microspun during the season 1994-95 has been completed.

Also from the 1995-96 season, 15 samples of Trade varieties and Standard cottons have been collected. The full spinning of these samples and the test for single thread strength parameters and lea strength have been completed.

From the available data on 15 samples and comparison of single thread strength of yarns from micro-spinning with those of full-spinning, it is observed that the micro-spinning with apron drafting is comparable with full-spinning. More trials are being conducted for definite confirmation.

Seed Coat Fragments in Germplasm

In an earlier report, data on seed coat fragments shed by cultivated varieties covering a wide range of seed size and fuzziness were discussed. As per the advice of the Research Advisory Committee, the objective of the project was changed to include germplasm lines particularly of *hirsutum* varieties. Accordingly breeders have been approached for pure germplasm lines especially belonging to *hirsutum*.

Scanning Electron Microscopy on Splicing of Cotton and Blended Yarns

Spliced joints of 40s count cotton yarn were prepared using various settings on the splicing machine so as to produce joints with different Retained Splice Strength (RSS) and Retained Splice Elongation (RSE). Twenty-five specimens of each splice sample were tested on the Uster Tensorapid for tensile properties. The parent yarn was also tested on the same machine. The scanning electron microscopy of spliced region of these three yarns was carried out and micrographs of each spliced zone were recorded at regular

intervals so as to visualise the entire spliced zone. The results are being interpreted.

Determination of Relationship between Imperfections and Classimat Faults in Cotton Yarns

During the period under report, the yarn samples of counts ranging from 20s to 100s were tested for U% and imperfections *viz.* thick and thin places and neps at 4 sensitivity levels, *viz.* - 50, 3, 3; 50, 2, 2; 40, 3, 3; and 40, 2, 2.

Even though it was suggested that the fibre properties of the yarns tested be studied, no fibre tests were carried out, as the yarns selected for the study were commercial samples of which the history was not known. This is because, a large length of yarn was required for Classimat study and such a large length of yarn could not be spun at CIRCOT from cottons with known fibre properties.

It is proposed to take up about 30 samples for final analysis and conclusions. Therefore, during the next year additional 14 yarn samples would be tested for hairiness and imperfections for which Uster Classimat data are available.

Survey of Cottonseed Milling Industries in India - North Zone (Punjab, Haryana, Rajasthan)

During the reporting period, a list of cotton seed milling industries in Punjab, Haryana and Rajasthan has been prepared. The state-wise break-up of the number of factories is as follows :

Punjab	-	26
Haryana	-	52
Rajasthan	-	34

The addresses of all cottonseed milling industries have also been collected. A Questionnaire already prepared for the survey is to be printed before despatch to the factories in the above three states.

Studies on Engineering Properties of Cottonseed

Several engineering properties of cotton seed belonging to over 60 varieties were determined. The properties included moisture, dimensions, shape, density, weight and frictional characteristics. The longest seeds belonged to the variety VCH.1 (10.3 mm) while the largest bulk density was found in AKA.5 and Suvin (0.42 g/ml). Sphericity of seeds remained in a narrow range (0.58 to 0.74). The angle of repose was found to be within 43^{0} - 46^{0}. The static coefficient of friction and coefficient of external friction against different surfaces like wood, iron, steel and glass showed wide variations. The data thus serve as design parameters for fabricating seed processing machinery.

Mechanical Processing of Coloured Cottons

Three samples of naturally coloured cottons received from Khandwa and Akola were evaluated for their spinning and weaving performance to develop various woven and knitted products. All samples were short to medium stapled and comparatively weak in fibre strength. The highest spinning count of the best sample was 28s carded at CIRCOT level. These samples were successfully spun on conventional ring spinning system into 6s, 20s and 28s carded counts. One sample was also spun to 6s on rotor spinning machine with the idea to develop naturally coloured denim OE yarns. A denim fabric (66 x 34

count) was woven on a sample loom. The fabric count can be increased by weaving on a powerloom which was not possible on the sample hand loom. 20s yarn was successfully knitted on a 18 gauge interlock circular knitting machine and the fabric was found to be suitable for modern T-shirts. 20s carded yarn was also woven into shawl and shirting. 28s singles were woven on a handloom into plain fabrics having counts of 66 x 46 and 58 x 54. One shirt and kurta were stitched from these plain fabrics. Like spinning, weaving was also carried out successfully though with some difficulties during sizing due to high wax content in naturally coloured cottons.

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

Mechanical Properties and Wear Comfort of Apparel Fabrics and their Relationships

The work carried out during the current year comprised measurement of bending hysteresis on polyester-wool fabrics of graded properties procured/prepared for the current project. The hysteresis diagram obtained in this measurement was characterised by the coercive couple (CC), bending rigidity (BR) and bending recovery (R).

In the case of polyester-wool fabrics, for a given weight, the coercive couple and the bending rigidity values were 2-4 times higher than those obtained for cotton and cotton-polyester blends. The increased rigidity to bending for polyester wool fabrics arises from its higher thickness for a given weight as compared to corresponding cotton and polyester fabrics. In the case of polyester-wool fabrics, the coercive couple and bending rigidity were found to be well correlated with thickness of the fabric ($r_{t.CC}$ = 0.61 and $r_{t.BR}$=0.60). It is interesting to note that polyester- wool fabrics showed lower values of shear stiffness when compared with cotton or polyester fabrics of given weight, although they possess higher bending rigidity. The bending rigidity values for polyester-wool fabrics were also highly correlated with drape coefficient, with r value of + 0.94.

The bending recovery values of polyester-wool fabrics are comparable to those of polyester-cotton and pure cotton fabrics of corresponding weight. However, 100% wool fabrics had significantly high bending recovery as compared to cotton and polyester-cotton fabrics of corresponding weight.

A Study of Morphological Deformities in Cotton Fibres in relation to Space Constraint

Using Scanning Electron Microscope, enumeration of different kinds of morphological deformities in fibres collected from field opened bolls of sixteen varieties selected for the study has been completed. Fifty fibres from each variety were scanned in SEM and average number of each type of deformity per cm. along the length of the fibre was determined. Comparison of data on fibres from unopened and field opened bolls of the sixteen varieties shows that the number of deformities other than the structural reversals in field opened fibres is much less (ranging from 12-21 per cm) than in comparison to those observed (22-44 per cm) in fibres of unopened bolls. The number of structural reversals per cm. in different varieties as expected, remained unchanged

on boll opening. Experimental work under the project has been completed and results are being analysed to examine the inter-relationships between the number of deformities on the one hand and space constraint, boll volume, boll weight, etc. on the other.

A Study of Structural Weak links in Cotton

Of the twenty cottons investigated for rheological behaviour after aqueous swelling-stretching-drying treatment, ten cottons, were chosen for the assessment of the morphological and structural features. The cross-sectional area, perimeter, ribbon width, convolution frequency, convolution angle and reversal density were estimated, by adopting the techniques standardised at CIRCOT. The following conclusions have emerged.

i. Aqueous treatment accompanied by stretch brings about 4% to 12% reduction in the cross sectional area of the cotton fibre.

ii. Perimeter of the treated fibres gets reduced, the range of decrease varying between 5% and 11%.

iii. The circularity of the fibre cross-section improves by about 10%. By and large the structure appears to become more compact as a result of the treatment.

iv. On an average, about 50% reduction in number of convolutions per cm. is observed after the aqueous treatment. The reduction in convolution angle is 60%-65%.

v. The treatment should not be expected to affect the structural reversals in the fibre, but their number shows a 16% decrease which could be ascribed to the elongation of the fibre during the treatment.

vi. The refractive index parallel to the fibre axis ($n_{||}$) increases while the index perpendicular to the fibre axis ($n_{\perp}$) shows a decrease. As a result the birefringence ($n_{||} - n_{\perp}$) assumes a higher value after the treatment indicating that fibrillar orientation with respect to the fibre axis improves on account of stretch imparted during treatment. The above result is confirmed by the fact that the x-ray angles of treated fibres are considerably lower than those of corresponding control fibres.

vii. The crystallinity indices of both raw and the corresponding treated fibres are more or less the same implying that the treatment does not bring about any change in the crystalline nature of the cotton fibre.

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

In this study a nylon single filament of 17.5 tex was loaded to 250 gm. The immediate extension and creep over a period of 200 seconds were measured. Then the load was partially reduced. Immediate decrease in extension and inverse creep after 500 seconds were determined.

Table 9 gives the results, in which columns 2 and 3 give the values of immediate extension and creep after 200 seconds under the influence of 250 gms load. Column 4 gives

TABLE 9: INVERSE CREEP / REVERSE CREEP OF NYLON FILMENT

Initial Load (g)	Immediate Extension (%)	Creep (%)	Reduced Load (g)	Immediate decrease in extension (%)	Inverse Creep (%)
250	8.226	1.288	10	0.033	— 0.083
250	9.221	1.924	20	0.099	— 0.149
250	9.200	1.827	30	0.216	— 0.066
250	9.331	1.759	40	0.314	— 0.047
250	8.995	1.601	50	0.400	0.000

the reduction in load. Corresponding immediate crease applied in and inverse creep value after 500 seconds are shown in the columns 5 and 6. The negative sign indicates that there was creep taking place in the specimen. But it decreases gradually to zero at the reduction level of 50 gm. load.

Objective analysis of fabric hand and wear comfort

Procedure for tensile, shear and compression measurements with KES-FB 1 (Kawabata Evaluation System for Fabric-1) and KES-FB 3 has been standardised. Forty-eight different fabric samples comprising cotton, polyester and their blends have been selected for a complete evaluation of low-stress mechanical properties with the KES-FB 3 system. The samples have been so chosen that it is possible to study the influence of fibre, yarn and fabric parameters on these properties.

Compression measurements (fabric thickness, compressional resilience, compressional energy, and compressional linearity) have been completed on the above fabrics. It may be noted that compression data for these fabrics had been obtained earlier by using Instron Tensile Tester by a method designed for this purpose. A comparison of data for the various parameters obtained from Instron and KES-FB 3, showed very little agreement. However, thickness values measured at any given load for the different fabrics revealed good correlation (r^2=0.91). But, Instron values were always found to be lower than that obtained from KES-FB3. Correlation between all the other sets of parameters measured by the two different instruments were found to be non-significant. Probable reasons for this disparity are being examined.

THRUST AREA IV : CHEMICAL PROCESSING AND FINISHING TREATMENTS

Effect of Yarn Structure on the Dyeing Behaviour of Cotton/Polyester Blended Yarns/Fabrics

Preparation of Sample : An air jet spun yarn of 45s count with a blend composition of 65% polyester and 35% cotton was obtained from an upcountry spinning mill. Ring yarn of 45s count was spun from the same blended sliver at the pilot plant of CIRCOT. Both the yarn samples were identically knitted into single jersey fabrics on a 10 cm diameter, 12 gauge Bently-Komet

Hose Knitting Machine with two feeders and 6 needles per cm.

Dyeing : The samples for dyeing were scoured, bleached and cut to the required size before dyeing. The ring spun (RS) and air-jet (MJS) yarns were dyed separately as well as together in one dye bath with disperse and reactive dyes to dye the polyester and cotton portions, respectively. First the polyester portion was dyed with disperse dye. This was followed by dyeing with reactive dye. A portion of the dyed material was reserved for determining dye uptake of polyester.

Dyeing of Polyester : The polyester portion was dyed in a laboratory scale High Temperature-High Pressure Dyeing Machine using the carrier method of dyeing. A standard dyeing procedure was followed. The material was maintained at 60°C for 15 minutes after which the temperature was raised to 100 °C at the rate of 1°C /min and dyed at that temperature for 60 min. The material was dyed to 2% shade using a material to liquor ratio of 1:30. After dyeing, the samples were rinsed, boiled in a non-ionic detergent solution to remove the carrier, reduction cleared and washed. They were then treated with dilute acetic acid, washed and dried.

Dyeing of Cotton : The RS and MJS samples which were dyed together with disperse dyes as given above were further dyed with HE reactive dyes. Along with these, fresh samples of the blend were also dyed to study the dye uptake of cotton portion. The samples were dyed to 2% shade at 85°C in the same dyeing machine using an M:L of 1:30. Standard dyeing procedures were followed using salt for exhaustion and alkali for fixation. After dyeing for a fixed period of time, the material was soaped with a non-ionic detergent solution, washed and dried.

The dyed material is being evaluated for colour strength and colour difference. Methods for determining dye uptake values are being standardised.

Dyeing of Cotton with Natural Dyes

Collection of natural dyes : Lac, Berberin and Mangisth dyes in powder form were obtained from National Handloom Development Corporation (NHDC), Lucknow. Extracts from four plants were also obtained from Regional Research Laboratory (RRL) Jammu for use as dyes. Besides, babul, tamarind and pipal bark and onion skins were also collected to examine the possibility of using their extracts for dyeing cotton.

Dyeing experiments : Commercially scoured and bleached cotton fabric procured from a mill was used for all the dyeing experiments.

(a) Lac dye : Efforts were mainly concentrated on the lac dye as it is a by-product of lac-processing industry and approximately 80 tons of this dye can be easily obtained annually at the current level of stick lac production.

Lac is an acid dye and it can dye wool and silk but it has no affinity for cotton. Therefore cotton has to be modified to facilitate dyeing with lac. After carrying out various trials, a pad-dry-cure treatment with chitosan was found suitable.

Cotton fabric was padded with a 0.3% chitosan solution (prepared by diluting a

1% stock solution in 1% acetic acid) to 80% wet pick up. It was dried at 100°C for 7 minutes and cured at 160°C for 3 minutes. It was washed with distilled water at 40°C for 20 minutes and air-dried.

The lac dye was used as such without any further purification. Its dye content was approx. 45%. A solution was prepared by pasting the dye with Turkey Red Oil (TRO) and dissolving it in hot water after adding borax (one part of borax for one part of dye) and filtering, pH was adjusted to 4.5, just before dyeing.

Dyeing was started at room temperature; the bath temperature was then raised to boiling point and dyeing continued at this temperature for an hour. Material to liquor ratio was 1:30. Five per cent and 10% shades were used. Cotton was dyed to violet shade. Dyed samples were soaped with a non-ionic detergent at 70°C, washed with water, air-dried and evaluated for various properties.

The dyed samples are found to possess good rubbing and perspiration fastness, medium light fastness, but very poor fastness to washing. To improve the wash fastness, a crosslinking treatment with DMDHEU was given to the dyed fabric. In another experiment, a crosslinking agent was incorporated in the chitosan pre-treatment bath itself prior to dyeing. These samples were also evaluated and it has been ascertained that washfastness improved considerably with cross-linking treatments.

Different colours can be obtained from the same dye with the help of mordants. Only alum and ferrous sulphate mordants, which are environmentally acceptable, were used. Fabrics were given a pre-treatment with tannic acid 5% (o.w.f.) before giving the mordanting treatment. Both pre- and post-mordanting techniques were tried. Five per cent and 10% concentrations of the mordant (o.w.f.) were employed. With alum, pre-mordanting gave bright pink colour whereas post-mordanting gave dull pink shade. Mordanting with iron gave black colour. In a pre-mordanting trial with alum, tannic acid was replaced by myrabolan (Harda) powder (20% o.w.f.) which gave a brown colour on subsequent dyeing. All these samples were also tested for colour durability parameters. The results have shown that in addition to providing different colours, mordanting considerably improves the wash fastness of the dyed fabrics. Other fastness properties remain almost the same as the reference plain dyed fabric, with the exception of perspiration fastness which is little lower in the case of iron mordanted fabrics.

(b) Berberin : Berberin is a yellow natural dye obtained from *Berberis vulgaris*. Dye solution was prepared by pasting the dye with cold water and then dissolving it in hot water. This dye also has no affinity to cotton. A pre-treatment with tannic acid followed by tartar emetic or alum was found suitable for dyeing with berberin (1% shade was used). Dye bath was well exhausted and the cotton fabric was dyed to a yellow colour. Different dyeing temperatures were tried and a temperature of 60°C was found to be optimum for dyeing. Dyed fabric was soaped with non-ionic detergent at 60°C, washed thoroughly with water and air dried.

(c) Local Plant Material Dye : Dyeing of cotton with the extract of **babul** bark and onion skins has shown encouraging results.

A Study on Antibacterial Finishing of Cotton Employing Electron Beam Curing

During the period under report, preliminary antibacterial finishing treatments employing gamma ray radiation were given to cotton fabric to ascertain *optimum* chemical formulation and to get maximum add-on. After standardisation, chemical treatments were given to cotton fabric with different concentrations of zinc acetate (10%, 12% and 14%). The samples chemically treated in the presence of H_2O_2 and in the absence of H_2O_2 were subjected to Gamma ray irradiation in different dosages (one and two mega rads).

The chemically treated and irradiated samples were evaluated for various physical properties like percentage add-on, strength retention and elongation, and were also analysed for zinc %, peroxide % and anti-bacterial performance. The results are being analysed. Suitable fabric holders were got fabricated for carrying out electron beam irradiation and the conditions for the irradiation were standardised at BARC.

Effect of Chemical Processing on Dyeing of Knitted Fabrics

Two different types of double jersey knitted fabrics were procured. Grey fabrics were scoured and bleached with hypochlorite. The fabrics were assessed for their physical properties.

Impact of Dyeing on Strength and Colour of Fibres from Different Varieties of Cotton

In the first phase, 10 different varieties of cotton were selected for the experiment. The fibres were freed of trash particles employing Shirley trash analyser and were further purified through alkaline kiering and hypo-bleaching under standard conditions. The bleached samples were evaluated for fibre tenacity and elongation on HVI. In order to study the dyeing characteristics of the fibres, four reactive dyes of cold brand type and one vat dye were chosen. The samples were dyed to 2% shade with the above dyes under standard conditions followed by soap water and cold water washing and drying at room temperature. The dyed fibre samples were hand-opened and tested for fibre tenacity and elongation, and for various colour parameters in a computerised colour matching system.

THRUST AREA V : UTILISATION OF BY-PRODUCTS OF COTTON AND PROCESSING WASTES

Studies on Continuous Fermentation of Cellulase by Penicillium funiculosum

Studies were carried out earlier to improve the fabric qualities like gloss/lustre, softness, etc. of unbleached fabric using cellulase. In the present studies, bleached fabric was subjected to cellulase treatment for 30 min. to 60 min. Both *Pencillium funiculosum* cellulase and a commercial cellulase (**Cellusoft**) were used at a pH of 4.8 and 50 ^{0}C keeping the fabric-to-liquor ratio at 1:15. The enzyme treated fabric showed gradual weight loss with time. However, considerable loss of weight was noticed in the case of **Cellusoft** treated samples. There was an increase in percent reflectance of the treated fabric, but no increasing trend with time was evident. Though weight loss was less with *Penicillium funiculosum* cellulase, change in percent reflectance in fabric samples

treated with both the enzymes was comparable.

Residual cellulase activity after the fabric treatment was determined to find out (a) which component of cellulase was most important for bio-polishing and (b) whether the liquor could be re-used. The results showed that the liquor after fabric treatment has 5.46% cotton activity and 56.5% carboxymethyl cellulase activity, indicating that the cellulase component which acts against crystalline cellulosic material is very important, as it utilised 95% while 44% of other component remained unutilised. It may be possible to reuse the liquor after supplementing it with component which is active against crystalline cellulase.

Kraft Paper from Cotton Plant Stalks for Use in Production of Corrugated Fibre Boxes for Packaging of Fruits

Corrugated boxes of various dimensions as specified by various collaborating institutes were got prepared in a local factory. The boxes were evaluated for various properties like compression strength, bursting strength and cobb test at Indian Institute of Packaging, Mumbai and the results are given below :

Sl. No.	Property	RSC (7-ply)	Telescopic (5-ply)
1.	Compression Strength (kgf)	224.0	432.0
2.	Bursting strength (kg/cm^2)	9.50	16.50
3.	Cobb Test (g/m^2) 30 mm.	82.01	82.01

These boxes along with the test reports were sent to Konkan Krishi Vidhyapeeth, Dapoli and CIHNP, Lucknow for undertaking packaging and transportation trials on mango and to National Research Centre for citrus, Nagpur for conducting trials on oranges. The trials are completed and the test report is awaited.

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

A process for the preparation of peptone from commercial cottonseed meal which has been standardised earlier showed that good quality peptone can be prepared from both bench scale trials and pilot scale trials. Since commercial cottonseed meal is derived from different varieties, the influence of individual varieties, on the quality of product (peptone) could not be ascertained. Hence the study was extended to preparation of protein hydrolysates from different cottonseed varieties.

Eleven varieties from four species of cultivated cottons including a couple of hybrids were selected for the preparation of protein hydrolysates (peptones). The varieties under study were AK.235, and Sanjay (CJ.73) from *G. arboreum*, G.Cot.13, Gujarat 11 and Jayadhar from *G. herbaceum*, Deviraj, Gujarat 12 and SRT.1 from *G. hirsutum*, a single variety Suvin from *G. barbadense*, and DCH.32 and Hybrid 6 from inter-specific hybrids.

The de-fatted meals of these varieties were subjected to enzymolysis in the same manner as standardised in the bench scale trials on commercial cottonseed meal. The protein hydrolysates prepared from cottonseed meals were analysed for various biochemical constituents. The results indicated that there exists varietal response

for the recovery percentage of protein hydrolysates. The recovery was better with *desi* varieties than the *hirsutums* and the hybrids. However, the quality of peptones can be best judged from their performance in the culture media for growing various micro-organisms, *viz.* bacteria, fungi, actinomycetes, yeast and from the production of cellulase and amylase enzymes by growing *Pencillium funiculosum* F_4 and *Bacillus subtilis -159*. Preliminary work on these lines has given encouraging results; hence systematic study is being taken up separately by proposing a replacement project.

Production of Biogas from Solid Cellulosic Wastes by Dry Fermentation

Production of biogas from press-mud has been found to be technologically feasible and economically viable. The data generated on one tonne trials have been compiled and a feasibility report on the technology is being prepared.

Textile Processing Aids from Cottonseed Oil

A number of non-ionic surfactants were prepared through reaction of cottonseed oil and cottonseed oil fatty acids with polyethylene glycols under different conditions. The products ranged from pale yellow liquid to light brown paste. These are quite stable in alkaline, neutral and slightly acidic medium. The properties of these surfactants/softeners are being evaluated.

Preparation of Pure Fatty Acids from Cottonseed Oil

Cottonseed oil was washed with 1% sulphuric acid and boiled with an equal amount of water for eight hours; removing the water and replacing with fresh water every two hours. About 85% splitting of the oil was obtained by this modified Twitchell process. Cottonseed oil was also split into component fatty acids using castor seed enzyme. In this case 80% splitting was achieved. This is an eco-friendly, energy saving and clean method. Fatty acids were separated by fractional distillation under vacuum. Splitting of hydrogenated cottonseed oil was also carried out. In this, the yield of stearic acid was much higher.

Preparation of Pulp and Paper from Crop Residues after Processing through Anaerobic Digestion

Preliminary trials have indicated that good quality paper can be prepared from rice straw and wheat straw. The requirement of initial open boiling prior to anaerobic digestion standardised for cotton plant stalks has been replaced with simple overnight soaking for both the straws. About 75 kg of rice straw was processed through anaerobic digestion and handed over to Hand Made Paper Institute, Pune, for paper making trials on cylinder mould machine. Results on paper trials are awaited.

Utilisation of Cellulase for De-inking of Waste Paper Pulp for Paper

Earlier, preliminary work had shown that cellulase could hydrolyse news paper waste and release the printing ink. This enzyme could thus find use in the recycling of printed paper. During the period under report news paper waste, catalogue papers, etc. were treated with commercial cellulase at 50° C, and at pH 4.8 for 2 to 4 hours. The pulp was washed with water several times to remove the liberated ink and

then paper samples were prepared from it. These specimens appeared to be brighter than the control. Further work is in progress.

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

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

The qualitative scans of 6 additional Broncheo Alveolar Lavage (BAL) samples confirmed that the elements of importance are Cl, Ca, K, S, Ti, Al, Mg, Na, Si, Cd and Mo. Thus, the informa-tion needed for preparing standards for quantitative determination can be considered to have been collected. Preparation of standards and calibration are in progress.

Reproducibility of data from biopsy tissue samples has been unsatisfactory. Since matrix effects appear to be one of the possible reasons, efforts are under way to check out this aspect using pre-concentration techniques as well as more number of samples.

3

Publications

A. Annual Report

Annual Report of the Central Institute for Research on Cotton Technology for the Year 1994-95.

B. Technological Circulars

Technological Circulars on Trade and Standard Varieties of Indian Cottons for the Seasons 1992-93 and 1993-94.

C. Research Publications (CIRCOT Publications — New Series)

520 N.C. Vizia, S.B. Jadhav and K.R. Krishna Iyer — *Seed Coat Fragments in Cotton Lint* (Reprinted from the Journal of the Textile Association, Vol.56, No.1, P.17-21, May 1995)

521 R.P. Nachane and V. Sundaram — *Analysis of Relaxation Phenomena in Textile Fibres Part I : Stress Relaxation* (Reprinted from the Journal of Textile Institute, Vol. 86, No. 1, P.10-19, 1995)

522 R.P. Nachane and V. Sundaram — *Analysis of Relaxation Phenomena in Textile Fibres, Part II : Inverse Relaxation* (Reprinted from the Journal of Textile Institute, Vol. 86, No.1, P.20-32, 1995)

523 Sheela Raj, G.B. Hadge, P. Bhama Iyer and K.R. Krishna Iyer —*A Quantitative Evaluation of NaOH Swelling and its Effect on Maturity of Cotton Fibres* (Reprinted from the Journal of Applied Polymer Science, Vol. 55, No.13, P.1861, 1995)

524 I.K.P. Iyer, K.B. Rajagopal, S. Sekar and S.J. Guhagarkar — *Comparative Study on Visual and Instrumental Grading of Cotton* (Reprinted from the Proceedings of the SITRA Conference held at Coimbatore during May 28-29, P.68-72, 1995)

525 A.V. Ukidve, V.G. Munshi, P.K. Mandhyan and G. Viswanathan —*A Method for Analysis of Yarn Unevenness by Spectrum Analyser Instrument* (Reprinted from the Proceedings of the SITRA Conference held at Coimbatore during May 28-29, P.232-233, 1995)

526 S.J. Guhagarkar, I.G. Bhatt and R.D. Nagarkar — *Use of Z^{++} Cations in Hydrolysis of Cotton Plant Stalk to Optimise Yield of Glucose* (Reprinted from the Journal of the Textile Association, Vol. 56, No.2, P.69, July 1995)

527 N. Thejappa and V.V.R. Subrahmanyam — *Glyceride composition of Oils from Different Varieties of Cotton*

Seeds (Reprinted from the Journal of Oil Technologists' Association of India, Vol. 26, No.4, P.99-102, October-December 1994)

528 N. Thejappa and V.V.R. Subrahmanyam — *Changes in Stability of Cotton Seed and Coconut Oil Blend due to Inter-esterification* (Reprinted from the Journal of Oil Technologists' Association of India, Vol. 27, No.1, P.133-136, January - March 1995)

529 S.J. Guhagarkar, I.G. Bhatt and R.D. Nagarkar — *Irradiation of Cotton Stalk* (Reprinted from the Indian Textile Journal, Vol. 105, No.11, P.28-30, August 1995)

530 A.V. Ukidve, V.G. Munshi, P.K. Mandhyan and G. Viswanathan — *Studies on Spectrum Density Analysis of Yarn Hairiness Variations* (Reprinted from the Indian Journal of Fibre & Textile Research,Vol. 20,No.2, P.92-96, June 1995)

531 Sheela Raj, M.V. Vivekanandan, S. Sreenivasan, K.R.Krishna Iyer and N.B. Patil — *Measurement of Bending Hysteresis* (Reprinted from the Asian Textile Journal, Vol. 3, No.8, P.55-61, June 1995)

532 C.R. Raje — *Improved Anti-soiling Finish* (Reprinted from the Indian Textile Journal, Vol. 105, No.10, P.18-20, July 1995)

533 V. Iyer, J.K. Iyer and V.A. Shenai — *Kinetics of Dyeing of Rotor and Ring Spun Cotton Yarns* (Reprinted from the Indian Journal of Fibre & Textile Research, Vol. 20, No.3, P.161-164, September 1995)

534 V.G. Munshi, A.V. Ukidve, C.R. Raje, P. Bhaskar and S.D. Pai — *Effect of Washing Temperature on Fabric Properties* (Reprinted from the Indian Textile Journal, Vol. 106, No.2, P.28-31, November 1995)

535 A.A. Gupte, B.L. Bhattak and S.K. Chattopadhyay — *Influence of Preparatory Processes on Blend Irregularities of Rotor Spun Blended Yarns* (Reprinted from the Journal of Fibre & Textile Research, Vol. 20, P.79-82, June 1995)

536 S.K. Chattopadhyay and M. Ahmed — *Contribution of Spinning and Knitting through R&D of CIRCOT.* (Reprinted from the Textile Industry and Trade Journal, Vol. 33, No.7-8, P.71-80, July-August 1995)

537 S. Sreenivasan, P. Bhama Iyer and K.R. Krishna Iyer — *Influence of Delignification and Alkali Treatment on the Fine Structure of Coir Fibres,* ***(Cocos nucifera)*** (Reprinted from the Journal of Material Science, Vol. 31, P.721-726, 1996)

538 S. Sreenivasan, P. Bhama Iyer and G.S. Patel — *Studies on Swelling of Cotton Fibers in Alkali Metal Hydroxides. IV : Influence of Initial Fibre Properties and Variations in Fine Structure on Tensile Behaviour* (Reprinted from the Journal of Applied Polymer Science, Vol. 58, P. 2405-2413, June 1995)

539 G.R. Anap, G. Vijayan Iyer and K.R. Krishna Iyer — *A Resume' of the Investigations carried out on the Pre-cleaning and Ginning of Indian*

Cottons (Reprinted from the Textile Industry and Trade Journal, Vol. 33, No.11-12, P.101-104 November-December 1995)

540 Y. Subrahmanyam, Janaki K. Iyer and V.G. Munshi — *Effect of Exposure to Weather Conditions on the Quality of Cotton* (Reprinted from the Journal of Indian Society for Cotton Improvement, Vol. 20, No.2, P.168, September 1995)

541 D.V. Mhadgut, Muntazir Ahmed, P.K. Mandhyan and H.R. Laxmivenkatesh — *Spinnability of Cottons From Single Thread Strength of Microspun Yarns* (Reprinted from the Journal of Indian Society for Cotton Improvement, Vol. 20, No.2, P.179, September 1995)

542 S.G. Vinzanekar, A.G. Jogdeo, P.R. Joshi and V. Sundaram, M.S. Parthasarathy and B. Srinathan — *A Study of the Influence of Fibre Properties on the Characteristics of Rotor Spun Yarns by Factor Analysis* (Reprinted from the Journal of Textile Institute, Vol. 87, Part I, No.1, P.68-77, 1996)

D. Other Publications

1. Brochure of the Institute - CIRCOT - — *Seventy years of Service to the Nation 1924 to 1994.*

2. Schedule of Test Fees

3. V.K. Madan, A.D. Khurana and S.N. Nagwekar — *Efficacy of Synthetic Pyrethroids and Conventional Insecticides against Pink Bollworms and their Effect on Yield and Quality of* ***G.hirsutum*** *Cottons* (Published in the Journal of Indian Society for Cotton Improvement, Vol. 20, No. 2., P.173-178, September 1995

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

1. S.N. Pandey — *Eco-friendly Parameters for Cotton* (Presented at the Seminar on Eco-friendly Textiles - Challenges to the Textile Industry held on April 1, 1995 at Ahmedabad)

2. G.R. Anap and P.G. Patel — *Design of Foot Operated Ginning Machine* (Presented at the 30th Annual Convention of Indian Society of Agricultural Engineers held during April 17-19, 1995 at Coimbatore)

3. I.K.P. Iyer, K.B. Rajagopal, S. Sekar and S.J. Guhagarkar — *Comparative Study of Visual and Instrumental Grading of Cotton* (Presented at the Joint Technological Conference held during May 28-29, 1995 at SITRA, Coimbatore)

4. A.V. Ukidve, V.G. Munshi, P.K. Mandhyan and G. Viswanathan — *A Method for Analysis of Yarn Unevenness by Spectrum Analyser* (Presented at the Joint Technological Conference held during May 28-29, 1995 at SITRA, Coimbatore)

5. S.N. Pandey — *Future Trends in Textile Testing* (Presented at the National Seminar on Future Trends in Textiles held during July 19-20, 1995 at Mumbai)

6. M.S. Parthasarthy and G.R. Anap — *Status of Ginning in India and Steps*

for Modernisation (Presented at the National Seminar on 'Future Trends in Textiles, held during July 19-20, 1995 at Mumbai)

7. S.N. Pandey — *Non-Woven Geo Textiles for Diverse Applications* (Presented at the National Seminar on Future Trends in Textiles, held during July 19-20, 1995 at Mumbai)

8. R.H. Balasubramanya, A.J. Shaikh and V.G. Khandeparkar — *Preparation of Pulp and Paper from Rice and Wheat Straw after Processing through Anaerobic Digestion* (Presented at the 36th Annual Conference of Association of Microbiologists of India held during November 8-10, 1995 at Hisar)

9. S.G. Gayal, Vatsala Iyer, N.D. Nachane and V.G. Khandeparkar — *Production of Cellulase by* ***Penicillium funiculosum*** *and Application of the Enzyme in Textile* (Presented at the 36th Annual Conference of Association of Microbiologists of India held during November 8-10, 1995 at Hisar)

10. R.H. Balasubramanya and V.G Khandeparkar — *Production of Biogas from Spent Koji by Solid State Fermentation* (Presented at the National Symposium on Frontiers in Applied Environmental Microbiology held during December 11-13, 1995 at Cochin)

11. Muntazir Ahmed — *Weft Knitted Jacquard Design* (Presented at the ISTE Workshop on 'Development in Knitting' held during January 22-27, 1996 at Mumbai)

12. R.H. Balasubramanya and V.G. Khandeparkar — *Production of Biogas from Solid Cellulosic Waste at Low Temperature* (Presented at the National Symposium on Recent Trends in Biological Treatments of Industrial Wastes held during February 21-23, 1996 at Pune)

13. R.P. Nachane, G.F.S. Hussain and K.R. Krishna Iyer — *Inverse Relaxation and Inverse Creep in Polymers* (Presented at the Seminar on Recent Advances in Physico-chemical Aspects of Fibres and Polymers held during February 28-29, 1996 at Mumbai)

14. D.N. Makwana and A.V. Ukidve — *Electrical Resistance of Textile Materials* (Presented at the Seminar on Recent Advances in Physico-chemical Aspects of Fibres and Polymers held during February 28-29, 1996 at Mumbai)

F. Technological Circulars on Trade Varieties of Indian Cottons

T.C. No.	Variety	Place
2568	Hybrid 6	Kapadwanj
2569	RG.8	Sriganganagar
2570	Ganganagar Ageti	Sriganganagar
2571	G.Cot.13	Dhandhuka
2572	SRT.1	Bodeli
2573	Deviraj	Surendranagar
2574	Gujarat 1	Surendranagar
2575	V.797	Mehsana
2576	NHH.44 (Auto gin & P)	Kundi
2577	NHH.44 (DR gin)	Sailu
2578	Digvijay	Bharuch
2579	JKHy.1	Khargone

G. Technological Circulars on Standard Cottons

S.C. No.	Variety	Place
461	Deviraj	Junagadh
462	LH.900	Abohar
463	LH.327	Abohar
464	G.Cot.10	Surat
465	G.Cot.12	Surat
466	V.797	Chharodi
467	G.Cot.13	Chharodi
468	G.Cot.10	Bharuch
469	Digvijay	Bharuch
470	G.Cot.11	Surat

4

Extension

CIRCOT has no agricultural farm attached to it at the headquarters but all the Regional Quality Evaluation units located within the agricultural university premises or in the major cotton growing tracts in the country, serve as extension units for the Institute. The staff at these units collaborate with the scientists in these agricultural universities or state departments of agriculture through collaborative research projects. These research projects are aimed at solving the problems faced by the farming community in the country. Assistance is also rendered by way of development of useful equipments required by them, by giving suggestions, by discussions, etc. on the technological aspects of cotton at different stages of crop development, post-harvest technology operations and gainful utilisation of cotton crop by-products and agro-wastes.

The Director and Scientists of CIRCOT are members of various committees constituted by the Bureau of Indian Standards for cotton and textile testing and they participate in various seminars, symposia, conferences, etc. in the country so that the knowledge and their expertise in various fields are passed on to the user groups. Director and many scientists are members in various advisory panels of institutions like ATIRA, BTRA, SITRA, VJTI and UDCT.

Being experts in the field of cotton technology and allied areas, some of the scientists are invited from time to time to give lectures and to participate in various discussions in other organisations. They also publish their research findings, apart from participating in exhibitions displaying technologies developed, improvement in processes, by-products and waste utilisation, etc.

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

Having gauged the futuristic trends in the cotton textile sector, the Institute conducts regular training courses both at the headquarters and at the Ginning Training Centre (GTC), Nagpur. At the headquarters, Integrated Training Course on Cotton Testing Methods and Evaluation with elementary statistical methods applicable to textile testing were conducted for the sponsored personnel from the cotton trade and industry while, at the GTC, theoretical and practical training was imparted on the different aspects of ginning, maintenance and operation of different ginning machines and precleaners. This course is basically meant for the sponsored gin fitters, supervisors and officers working at the ginning industries. GTC has been equipped with different types of roller gins, saw gins and pre-cleaners. A hostel that can accommodate about 20 trainees has also been provided at GTC.

Supply of reliable and accurate data on the quality aspects of cotton fibre, yarn, fabrics, consultancy services and publication of research results for the benefit of appropriate user groups have been the key extension activity of CIRCOT.

Technical Queries: Many queries from private organisations, semi government, state and central government departments, regarding various technologies and devices developed by CIRCOT, instrument fabrication, various methods evolved for testing of cotton fabric, fibre and yarn samples, quality parameters of different cotton varieties, by-products and agro-waste utilistion, etc. were replied to.

Paid Tests : The Institute has been receiving large number of samples of cotton fibre, yarn, and fabric for paid test from various textile mills, Government and semi government organisations as well as from cotton trade and industry on payment. During the year fabric samples were also received from the controller of stores, BMC, Mantralaya, Handloom and Powerloom sectors, and MSTC.

Testing on High Volume Instrument had considerably increased over the years apart from tests for mildew resistance, fluorescence for optical whiteness, colour fastness and microspinning. The clientele includes, Cotton Corporation of India, cotton co-operative marketing institutions, many textile mills besides various private organisations.

The number of samples received for paid tests during the period 1995-96, together with samples tested for the year 1994-95 and for the quinquennium 1986-90 are given in the following table.

TYPES OF PAID TESTS AND THE NUMBER OF SAMPLES TESTED DURING 1995-96

Sl. No.	Type of test	Average for the quin quennium 1986-90	1994-95	1995-96
1.	Fibre	1481	551	997
2.	Spinning	95	245	221
3.	Yarn	159	172	207
4.	Fabric	106	187	235
5.	Ginning	-	103	205
6.	Moisture	14	-	-
7.	Miscellaneous	20	51	78
8.	Trash content	-	-	232
Total		1875	1309	2175

The total test fee received during the year was Rs. 3,61,058.

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

1. Three cotton samples *viz.* S-4, MCU.5 and MECH.1 received from Kothari Industrial Corporation, Coimbatore were analysed to find the cause for the presence of fluorescent fibres in UV light, variation in the length and strength, maturity and fineness, and disappearance of fluorescence after wash in water. Analysis showed that fluorescence in cotton does not give any shade variation in yarn and fabrics after printing/dyeing.

2. One sample of absorbent cotton wool received from Gorakh International, Mumbai was tested for water

absorbency and fluorescence for optical whiteness.

3. One fabric sample received from J.K. Corporation Ltd., Mumbai was subjected to cross sectional examination for light and dark fibres.

4. Eight PE monofilament samples received from Ministry of Defence, Research and Development establishment, Gwalior were tested for sonic modulus by PPM -5.

5. Five samples of polymer chips received from Terence Fibres India Ltd., Thane were tested for cross sectional view on light microscope and photographs on these were supplied.

6. Two samples of polymer chips received from Reliance Industries, Raigad (M.S.) were tested for the cross sectional view at magnification 833 x and supplied the cross sectional photographs.

7. Two cotton samples received from Spentex Industries Ltd., Mumbai were tested for honey dew.

8. Six cotton samples received from Coats India Ltd., Madurai were tested for determination of honey dew.

9. One PSF sample received from S.P. Surgical Pvt. Ltd., Mumbai was tested for the determination of denier, length by BISFA, strength and elongation percentage on Instron.

10. Four yarn samples received from Vrajlal & Bros., Mumbai were tested to know whether the samples were dressed or not in terms of textile industry.

11. Five canvas samples were received from Madura Industrial Textiles, Madurai for testing the resistance to microbial attack by mixed culture method.

12. One velvet fabric received from Mamaji's Company, Mumbai to determine the blend composition for velvet and basic fabric separately.

13. Three fabric samples received from Sandoz India Ltd., Mumbai were tested for antibacterial effect.

14. Eighteen cotton samples were received from Bhaidas Cursondas & Co., Mumbai for the determination of seed coat content.

Training :

Integrated Training Course on Cotton Testing Methods and Evaluation :

In eight batches of two weeks duration 45 sponsored personnel from cotton trade and industry were trained. They were from Cotton Corporation of India, Maharashtra State Co-op. Cotton Growers' Marketing Federation, EICA and from private mills.

There were four batches of four weeks' duration, in which 20 sponsored personnel underwent training during this period. Apart from this, one sponsored candidate was imparted special training for a month. An amount of Rs. 98,000/- was generated from the training programmes during the period under report.

Ginning Training :

At the GTC, Nagpur training was given to four sponsored personnel from ginning factories. An amount of Rs.800/-was collected from training.

Nomination & Awards :

Dr. (Smt.) P. Bhama Iyer completed Laboratory Assessor Training Course organised by National Accreditation Board for Testing & Calibration Laboratories (NABL) and was awarded certificate.

She has been nominated in the Glossary Committee on Meteorological Terms.

Dr. K.M. Paralikar has been nominated as Member in the Ad-hoc Board of Studies in Bio-physics at the Bombay University.He has also been nominated as Member in the M.Sc. Bio-physics Syllabus Committee of Bombay University.

5

Conference and Symposia

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

Sl. No.	Meetings/Conferences/ Seminars/Symposia, etc.	Place	Date	Name(s) of the Scientist(s) and Technical Personnel who attended the Conference/Meeting, etc.
1.	Seminar on Eco-friendly Textiles : Challenges to the Textile Industry.	Ahmedabad	01-04-1995	Dr. S. N. Pandey
2.	XXX Annual Convention of Indian Society of Agricultural Engineers.	Coimbatore	17-04-1995 to 19-04-1995	Dr. G. R. Anap
3.	Two day Jt. Technological Conference.	SITRA, Coimbatore	28-05-1995 and 29-05-1995	Dr. A. V. Ukidve Shri S. J. Guhagarkar Shri P. K. Mandhyan
4.	National Seminar on Future Trends in Textiles.	Mumbai	19-07-1995 and 20-07-1995	Scientific and Technical Personnel of CIRCOT
5.	36th Annual Conference of Association of Microbiologists of India.	Hissar	08-11-1995 to 10-11-1995	Dr. R. H. Balasubramanya Dr. S. G. Gayal
6.	International Conference on Advances in Chemical Processing of Textiles with special reference to Eco-textiles	BTRA, Mumbai	10-11-1995 and 11-11-1995	Dr. (Smt.) V. Iyer Dr. P. V. Varadarajan
7.	Paperx '95 : An International Trade Fair and Conference on Pulp and Paper Technology.	New Delhi	08-12-1995 to 12-12-1995	Shri A. J. Shaikh Dr. P. V. Varadarajan
8.	National Symposium on Frontiers in Applied Environmental Microbiology.	Cochin	11-12-1995 to 13-12-1995	Dr. R. H. Balasubramanya

Sl. No.	Meetings/Conferences/ Seminars/Symposia, etc.	Place	Date	Name(s) of the Scientist(s) and Technical Personnel who attended the Conference/Meeting, etc.
9.	OTAI International Seminar on Challenges facing Fats, Oleochemicals and Surfactants in the 21st Century & Expo.	Mumbai	19-12-1995 to 22-12-1995	Dr. N. Thejappa
10.	ISTE Workshop on Developments in Knitting.	Mumbai	22-01-1996 to 27-01-1996	Shri Muntazir Ahmed
11.	Thirty-seventh Joint Technological Conference.	BTRA, Mumbai	14-02-1996 and 15-02-1996	Dr. K. R. Krishna Iyer, Dr. P.K. Chidambareswaran, Dr. A. V. Ukidve, Dr. G. R. Anap. Dr. (Smt.) Vatsala Iyer and Shri Muntazir Ahmed
12.	National Symposium on Recent Trends in Biological Treatment of Industrial Wastes.	Pune	21-02-1996 to 23-02-1996	Dr. V. G. Khandeparkar, Dr. R. H. Balasubramanya and Shri H. U. Gangar
13.	Seminar on Recent Advances in Physico-Chemical Aspects of Fibres and Polymers.	Mumbai	28-02-1996 and 29-02-1996	Dr. A. V. Ukidve, Dr. (Smt.) P. Bhama Iyer, Dr. K. M. Paralikar, Dr. R. P. Nachane, Shri G. F. S. Hussain and Dr. D. N. Makwana
14.	Workshop on Eco-Friendly Paper — Its Relevance in the Indian Context.	Bangalore	01-03-1996 to 03-03-1996	Shri A. J. Shaikh

6

Personnel

Major events during 1995-96 concerning personnel at CIRCOT are given below :

A. APPOINTMENT

Sl. No.	Name	Designation	Effective date of appointment
		1. Scientific Staff	
	Dr. K. R. Krishna Iyer	Director	05-01-1996
		2. Technical Staff	
1.	Shri R. S. Pathare	Technical Officer T- 6	31-07-1995
2.	Dr. (Smt.) Sudha Tiwari	Technical Officer T- 6	05-09-1995
3.	Shri S.V. Kokne	Technical Asstt. T-II-3	07-08-1995
4.	Shri R.R. Mahangade	Technical Asstt. T-II-3	17-08-1995
5.	Kum. P.L. Indurkar	Technical Asstt. T-II-3	20-11-1995
6.	N.P. Ghuge	Technical Asstt. T-II-3	05-12-1995
7.	Shri M. G. Ambare	Technical Asstt. T-I	01-08-1995
8.	Shri N. D. Kambli	Technical Asstt. T-I	28-12-1995
		3. Administrative Staff	
1.	Shri S. K. Dohatare	Administrative Officer	11-09-1995
2.	Smt. T. P. Pawar	Jr. Stenographer	05-08-1995
3.	Kum. V. S. Nayak	Jr. Stenographer	16-08-1995
4.	Shri T. D. Dhamange	Jr. Clerk	05-12-1995

Sl. No.	Name	Designation	Effective date of appointment
		4. Supporting Staff	
1.	Shri M. G. Bhandkkar	Supporting Staff Gr. I	13-07-1995
2.	Shri K. D. Varak	Supporting Staff Gr. I	18-12-1995

B. ASSESSMENT

Technical Staff

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

Promotion

Sl. No.	Name	Grade to which promoted	Effective date of promotion
1.	Shri H. U. Gangar	Technical Officer T-7	01-07-1992
2.	Shri K. S. Bhyrappa	Technical Officer T-7	01-01-1994
3.	Shri T. K. M. Das	Technical Officer T-7	01-01-1994
4.	Shri S. M. Gogate	Technical Officer T-5	01-07-1995
5.	Smt. S. R. Kamath	Technical Officer T-5	01-01-1996
6.	Shri G. G. Mistry	Technical Officer T-5	01-01-1995
7.	Shri S. L. Bhanuse	Sr. Technical Asstt. T-4	01-01-1995
8.	Shri G. B. Hadge	Sr. Technical Asstt. T-4	01-01-1995
9.	Shri R. K. Jadhav	Sr. Technical Asstt. T-4	01-01-1996
10.	Shri Jal Singh	Sr. Technical Asstt. T-4	01-01-1996
11.	Shri C. M. More	Sr. Technical Asstt. T-4	01-07-1995
12.	Shri K. Narayanan	Sr. Technical Asstt. T-4	01-07-1995
13.	Shri M. B. Patel	Sr. Technical Asstt. T-4	01-07-1995
14.	Shri B. R. Pawar	Sr. Technical Asstt. T-4	01-01-1996
15.	Shri R. S. Prabhudesai	Sr. Technical Asstt. T-4	01-01-1995
16.	Shri V. L. Rangari	Sr. Technical Asstt. T-4	01-01-1995
17.	Shri P. N. Sahane	Sr. Technical Asstt. T-4	01-07-1995
18.	Shri K. Thiagarajan	Sr. Technical Asstt. T-4	01-07-1995
19.	Shri D. V. Kambli	Technical Assiatant T-2	01-01-1996

Advance Increment

Sl. No.	Name	Grade	No. of advance increment(s)	Effective date of increment
1.	Shri R. S. Darade	T-5	Two advance increments	01-01-1995
2.	Shri R. S. Darade	T-5	One more advance increment (Total 3)	01-01-1996
3.	Shri S. J. Guhagarkar	T-5	Three advance increments	01-01-1995
4.	Shri I. H. Hunsikatti	T-5	One advance increment	01-07-1995
5.	Smt. A. A. Kathe	T-5	Two advance increments	01-01-1995
6.	Smt. A. A. Kathe	T-5	One more advance increment (Total 3)	01-01-1996
7.	Shri V. V. Kshirsagar	T-5	One more advance increment (Total 3)	01-01-1995
8.	Shri D. Radhakrishnamurthy	T-5	Three advance increments	01-01-1995
9.	Shri K. B. Rajagopal	T-5	Three advance increments	01-01-1995
10.	Shri S. Sekar	T-5	Two advance increments	01-01-1995
11.	Shri S. Sekar	T-5	One more advance increment (Total 3)	01-01-1996
12.	Smt. R. K. Shahani	T-5	Three advance increments	01-01-1995
13.	Shri S. Vancheswaran	T-5	Three advance increments	01-01-1996
14.	Shri S. M. Gogate	T-4	One more advance increment	01-01-1995
15.	Shri K. Narayanan	T-4	One more advance increment	01-01-1995
16.	Shri G. Vijayan Iyer	T-4	Three advance increments	01-01-1995
17.	Shri M. Bhaskar	T-II-3	One advance increment	01-01-1996
18.	Shri U. D. Devikar	T-II-3	Two advance increments	01-01-1995
19.	Shri U. D. Devikar	T-II-3	One more advance increment (Total 3)	01-01-1996
20.	Shri R. G. Dhakate	T-II-3	One advance increment	01-01-1995
21.	Shri R. G. Dhakate	T-II-3	Two more advance increments (Total 3)	01-01-1996
22.	Shri R. K. Jadhav	T-II-3	Two more advance increments (Total 3)	01-01-1995
23.	Shri H. S. Koli	T-II-3	Two advance increments	01-01-1995

Sl. No.	Name	Grade	No. of advance increment(s)	Effective date of increment
24.	Shri H. S. Koli	T-II-3	One more advance increment (Total 3)	01-01-1996
25.	Shri C. M. More	T-II-3	One more advance increment	01-01-1995
26.	Shri K. Venkanna	T-II-3	Two advance increments	01-07-1995
27.	Shri K. V. Nair	T-I-3	Two advance increments	01-01-1995
28.	Shri K. V. Nair	T-I-3	One more advance increments (Total 3)	01-01-1996
29.	Shri H. K. Pawar	T-I-3	Two advance increments	01-01-1995
30	Shri H. K. Pawar	T-I-3	One more advance increment (Total 3)	01-01-1996
31.	Shri D. V. Kamble	T-2	One more advance increment (Total 3)	01-01-1995
32.	Shri P. N. Raut	T-1	One more advance increment (Total 3)	01-01-1996

C. PROMOTION

Scientific Staff

1. Shri A.K. Gupta to the post of Scientist (SG) w.e.f. 01-01-1986.
2. Dr. (Smt.) Sujatha Saxena to the post of Scientist (Sr.Scale) w.e.f. 15-12-1992.

Technical Staff

The following personnel have been promoted through Departmental Promotion Committee (DPC).

1. Shri S.S. Patekar to the post of Driver T-II-3 w.e.f. 27-04-1995.
2. Shri P.N. Sahane to the post of Sr. Technical Assistant w.e.f. 01-07-1995.
3. Shri B.B. Gaykar to the post of Driver T-II-3 w.e.f. 31-07-1995.
4. Shri D.V. Kambli to the post of Technical Assistant T-I-3 w.e.f. 01-01-1996.
5. Shri B.K. Sawant to the post of Technician T-1 w.e.f. 16-12-1995.

Administrative Staff

1. Shri G. Sasidharan, Assistant Administrative Officer was relieved w.e.f. 04-12-1995 to report for duty at CIBA, Madras as Administrative Officer.
2. Shri A.R. Gujar to the post of Jr. Clerk w.e.f. 26-07-1995.

3. Shri K. Sudhakaran to the post of A.A.O. w.e.f. 30-12-1995.

4. Smt. S.S. Dongare to the post of Superintendent w.e.f. 24-01-1996.

5. Shri A.P. Natu to the post of Assistant w.e.f. 24-01-1996.

6. Smt. S.D. Dudam to the post of Sr. Stenographer (Officiating) w.e.f. 19-04-1995.

7. Smt. G.G. Palorkar to the post of Sr. Clerk w.e.f. 31-01-1996.

8. Smt.U.N.Bhandari to the post of Stenographer (Officiating) w.e.f. 19-04-1995.

Supporting Staff

1. Shri D.G. Kamble to the post of S.S. Gr. II w.e.f. 17-06-1995.

2. Shri M.B. Gurve to the post of S.S. Gr. III w.e.f. 18-12-1995.

3. Shri K.T. Mahida to the post of S.S. Gr. II w.e.f. 21-12-1995.

4. Shri P.G. Ghogale to the post of S.S. Gr. II w.e.f. 30-12-1995.

D. TRANSFER

Scientific staff

Dr. G. R. Anap, Sr. Scientist from Ginning Training Centre, Nagpur to CIRCOT, Mumbai w.e.f. 28-07-1995.

Technical staff

1. Shri E.A. Pachpinde, Technical Officer T-6 from CIRCOT Q.E. Unit, Sirsa to CIRCOT, Mumbai w.e.f. 06-04-1995.

2. Shri V.L. Rangari, Technical Assistant T-II-3, CIRCOT Q.E. Unit, Surat to G.T.C., Nagpur w.e.f. 16-08-1995.

3. Shri R.K. Jadhav, Technical Assistant T-II-3, CIRCOT Q.E. Unit, Nanded to CIRCOT, Mumbai w.e.f. 04-09-1995.

4. Shri P.N. Raut, Technician T-1, CIRCOT Q.E. Unit, Coimbatore to G.T.C., Nagpur w.e.f. 14-08-1995.

5. Kum. Binu Prasad Surendran, Technical Assistant T-II-3, CIRCOT Q.E. Unit, Sirsa to CIRCOT, Mumbai w.e.f. 29-09-1995.

6. Shri Hamid Hasan, Sr. Technical Assistant T-4, CIRCOT Q.E. Unit, Ludhiana to CIRCOT Q.E. Unit Sirsa w.e.f. 09-11-1995.

7. Shri Udai Vir Singh, Sr. Technical Assistant T-4, CIRCOT Q.E. Unit, Sriganganagar to CIRCOT Q.E. Unit, Sirsa w.e.f. 01-01-1996.

8. Kum. P. Indurkar,Technical Assistant T-II-3, CIRCOT, Mumbai to CIRCOT Q.E. Unit, Nanded w.e.f. 15-01-1996.

9. Smt. C.D. Prabha, Sr.Technical Assistant from CPCRI, Kasargod to CIRCOT, Mumbai w.e.f. 27-01-1996 (FN).

10. Shri R.G. Dhakate, CIRCOT Q.E. Unit, Nanded to CIRCOT Q.E. Unit , Akola w.e.f. 30-01-1996.

11. Shri N.P. Ghuge, Technical Assistant T-II-3 from CIRCOT, Mumbai to CIRCOT Q.E. Unit, Sirsa w.e.f. 12-02-1996.

12. Smt. Nirupama Panda, Technical Assistant T-II-3 transfered to ICAR, H.Q., New Delhi w.e.f. 10-06-1996.

Administrative staff

Shri M.K. Jain, Administrative Officer, CIRCOT, Mumbai to ICAR, New Delhi w.e.f. 18-02-1995.

E. RETIREMENT

1. Shri M.S. Parthasarathy, Principal Scientist retired from service w.e.f. 31-04-1995.

2. Shri B.M. Petkar, Scientist (Sel. Grade) retired from service w.e.f. 30-06-1995.

3. Dr. S.N. Pandey, Director retired from service w.e.f. 01-08-1995 (F.N.).

4. Shri N.R. Kamble, SS.Gr.II retired from service on invalid pension w.e.f. 05-01-1996.

5. Smt. P.A. Dabholkar, Technical Officer T-5 voluntarily retired from service w.e.f. 01-03-1996 (F.N.).

F. RESIGNATION / TERMINATION

Smt. K.R. Joshi, Hindi Translator resigned from service w.e.f. 06-07-1995.

G. DEPUTATION

1. Smt. V.V. Janaskar, Jr. Clerk on deputation for another one year at Seamen's Employment Office, Mumbai.

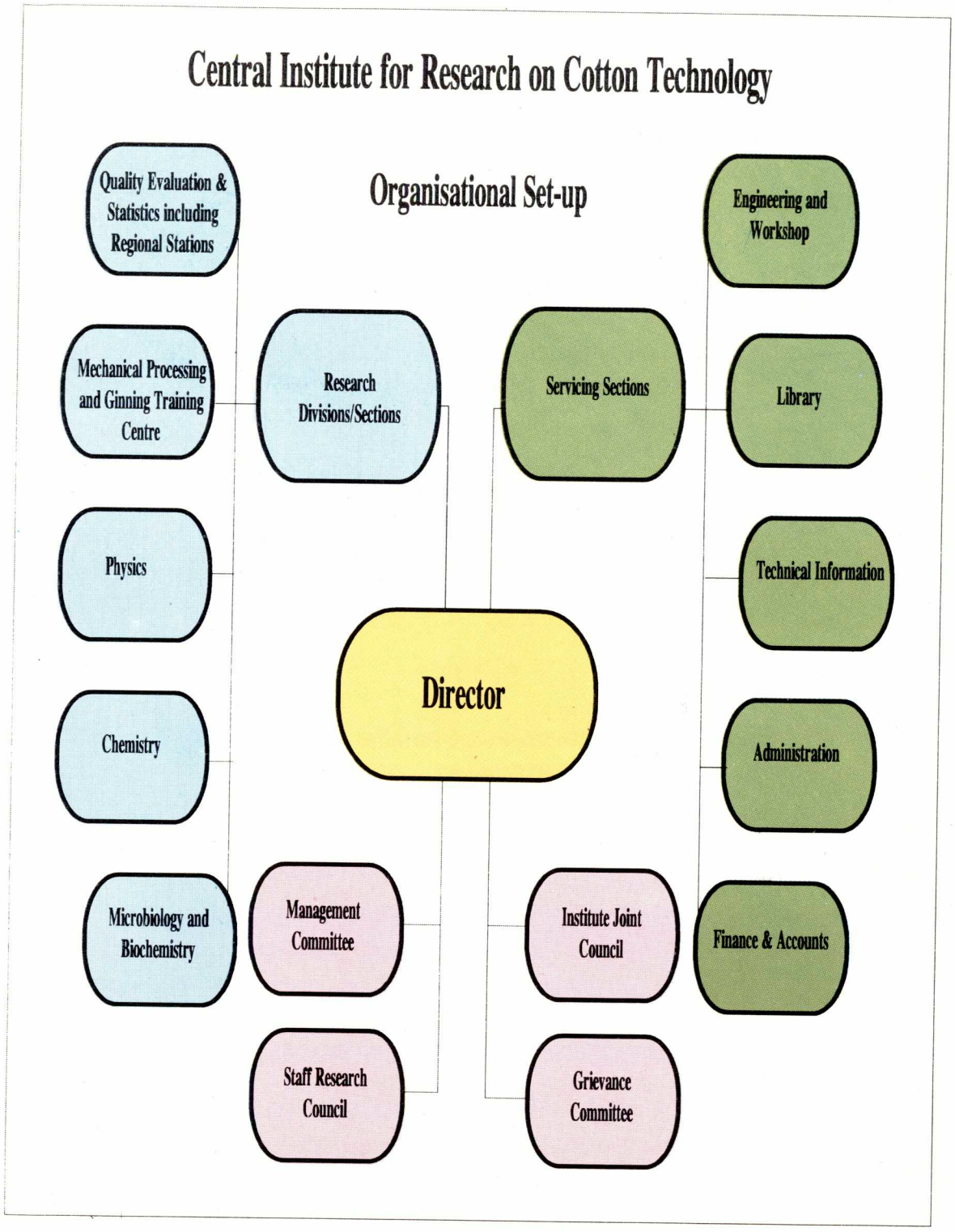
2. Shri Venu Thanikal, Sr. Stenographer on deputation for one year at Ministry of Surface Transport, Directorate General of Shipping from 19-04-1995.

H. OBITUARY

Shri T.B. Thapa, S.S. Gr. II expired on 21-04-1995 while in service.

7. Annexures

ANNEXURE – I



ANNEXURE - II

LIST OF EQUIPMENTS PROCURED

1. Computerised Colour Matching System
2. Mini Quartz Distillation Apparatus
3. PC/AT Computer - 2 Nos.
4. Crockmeter
5. Open-Bath Beaker Dyeing Machine
6. GC/Mass Spectrometrer
7. TGA/DSC Thermal Analyser
8. Infra-red Oven
9. Digital pH meter
10. Laboratory Jigger
11. Column Oven for HPLC
12. Perspirometer
13. Single Pan Chemical Balance
14 Fibrograph 630 Model

ANNEXURE — III

FINANCIAL STATEMENT
EXPENDITURE AND RECEIPTS OF THE INSTITUTE DURING 1995-96

	Sanctioned Grant Rs.	Actual Expenditure Rs.	Savings(—) Deficit(+) Rs.
A. EXPENDITURE			
CIRCOT including Q.E. Units ;			
I. Non-Plan			
(a) Capital expenditure including expansion of the Institute	46,09,000	46,04,000	(—)1,43,000
(b) Working expenditure	2,00,76,000	1,99,38,000	
II. Plan			
(a) Capital expenditure including expansion of the Institute	72,00,000	71,99,000	(—) 76,000
(b) Working expenditure	18,00,000	17,25,000	
B. RECEIPTS			
Sale proceeds of farm produce			42,420
Sale proceeds of vehicles, machines, tools and plant and other non-consumable materials			—
Analytical and testing fees			3,51,589
Rent			1,44,022
Application fees from candidates in connection with recruitment and training			1,01,512
Sale of publications			780
Interest on loans and advances granted to council's employees			1,05,790
Leave salary, pension contributions, etc.			1,000
Miscellaneous receipts			38,077
Summer Institute			—
Receipts for services rendered by the Institute			39,700
Interest on TDR & STD			2,64,958
		Total	10,89,848

8

Appendices

APPENDIX - I

STAFF WORKING AT THE CENTRAL INSTITUTE FOR RESEARCH ON COTTON TECHNOLOGY AS ON 31-03-1996

(List does not include vacant posts)

LIST OF STAFF AT THE HEADQUARTERS

Scientific Personnel

Director

1. Dr. S.N. Pandey, M.Sc., Ph.D. *(upto 31-07-1995)*
2. Dr. K.R. Krishna Iyer, M.Sc., Ph.D., F.T.A. (05-01-1996 *onwards)*

Principal Scientist

1. Dr. P.K. Chidambareswaran, M.Sc., Ph.D.
2. Dr. V. G. Khandeparkar, M.Sc., Ph.D..
3. Dr. A. V. Ukidve, M.Sc., Ph.D., F.T.A.

Senior Scientist

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

Scientist (Selection Grade)

1. Shri M.Ahmed, B.Sc., B.Text (Text.Tech)
2. Smt. S.P. Bhatawdekar, M.Sc.
3. Shri G.F.S. Hussain, M.Sc.
4. Smt. J.K.Iyer, M.Sc.
5. Shri A.K. Gupta, M.Sc., L.L.B., W.P.M.M.T.
6. Smt. Prema Nair, M.Sc.(Agri.)
7. Kum. C.R. Raje, M.Sc.
8. Shri A.J. Shaikh, M.Sc.
9. Dr. P.V. Varadarajan, M.Sc., Ph.D.

Scientist (Sr. scale)

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

Technical Personnel

Technical Officer T-7

1. Shri K.S. Bhyrappa, L.T.T., A.T.A.
2. Shri T.K.M. Das, B.Sc., D.B.M., D.E.I.M., Dip.J., D.P.R., Cert.I.A.R.S.
3. Shri H.U. Gangar, B.E.(Electrical), Grade I.E.T.E.

Technical Officer T-6

1. Shri S. Chandrasekhar, L.T.M., A.T.A., Cert.S.Q.C.
2. Shri B.S. Ganvir, B.Sc.
3. Shri S.N. Nagwekar, B.Sc.
4. Shri E.A. Pachpinde, M.Sc.
5. Shri R.S. Pathare, B.Sc.
6. Dr. (Smt.) Sudha Tiwari, B.Sc., Ph.D.

Technical Officer T-5

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

Senior Technical Assistant T-4

1. Shri P.B. Gurjar
2. Shri G.B. Hadge, B.Sc.
3. Shri R.K. Jadhav, B.Sc.
4. Shri M.Mohan, M.Sc., Dip.J.
5. Shri V.V. Murudkar, L.T.M.
6. Shri R.D. Nagarkar, M.Sc.
7. Shri R.S. Prabhudesai, B.Sc., D.C.M.
8. Smt. C.D. Prabha, M.Sc.
9. Smt. Sheela Devi Raj, M.Sc.
10. Smt. S.D. Shetye, B.Sc., M.Lib.
11. Shri S. Kumar Subramanian, B.Sc.
12. Shri D.N. Moon, B.Sc.
13. Shri G. Vijayan Iyer, Dip. Mech.Engg., Post. Dip. Prod. Mfg., A.M.I.E.(Mech.)
14. Shri M.V. Vivekanandan, B.Sc.

Technical Assistant T-II-3

1. Shri V.N. Bhorkar, B.Sc.
2. Smt. Bindu Venugopal, B.Sc.
3. Smt. Binu Sunil, B.Sc.
4. Shri R.R. Chhagani, B.Sc.
5. Shri U.D. Devikar, B.Sc.
6. Shri S.N. Hedau, B.Sc.
7. Shri V.D. Kalsekar, B.Sc.
8. Shri D.U. Kamble, B.Sc.
9. Shri S.V. Kokane, B.A.
10. Shri H.S.Koli, B.Sc.
11. Shri R.R. Mahangade, M.Sc.
12. Kum. S.S. Nagwekar, M.Sc.
13. Shri B.R. Pawar, B.Sc.
14. Shri P.N. Sahane, D.I.F.T.
15. Smt. P.B. Subasri Subramanian, B.Sc.
16. Smt.N.A. Sonkusle, B.Sc.
17. Shri R.M. Sonke, B.Sc.

Category T-II-3

Driver

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

Category T-I-3

1. Shri P.J. Ahire
2. Shri D.B. Gadankush
3. Smt.K.K. Kale, B.A.
4. Shri S.B. Kamble
5. Shri G.D. Narkar (Carpenter)
6. Shri H.K. Pawar
7. Shri S.G. Shinde
8. Shri H.B. Tambe

Category T-2

1. Shri D.V. Kambli (Wireman)
2. Shri P.G. Kadam (Wireman)

Category T-1

1. Shri G.G. Ambare
2. Shri M.G. Ambare
3. Shri A.R. Bane
4. Shri M.B. Chandanshive, Cert.Cot.Spin. (Machinist/Fitter)
5. Shri R.G. Chiplunkar
6. Shri D.M. Correia, S.S.C., I.T.I., N.C.T.V.T.(Mechanic)
7. Shri G.S. Deorukhkar
8. Shri B.R. Jadhav
9. Shri T.R. Kadam
10. Shri N.D. Kambli
11. Shri K.K. Kasar
12. Shri R.R. Khurdekar
13. Shri T.S. Mhaske
14. Shri K.D. Mohite
15. Shri M.R. Nevrekar
16. Shri S.V. Patil
17. Shri A.B. Sawant
18. Shri B.K. Sawant
19. Shri C.V. Shivgan, H.S.C., Cert.Wireman,Cert. Electrician, N.C.T.V.T.., Cert.Elec.Supr.(PWD)., Cert. M. & A.W.(Technician)
20. Shri M.B. Thokrul
21. Shri V.Y. Unhalekar
22. Shri S.A. Waghela

Driver

Shri A.D. Salaskar

Auxiliary Personnel

Canteen staff

Smt. K.R. Khaire (Tea Maker & Dish Cleaner)

Administrative Personnel

Administrative Officer

Shri S.K. Dohatare

Assistant Administrative Officer

1. Shri P.D. Sonawane, B.A., L.L.B.
2. Shri K. Sudhakaran

Superintendent

1. Shri M.Z. Bhagat
2. Shri G.Moosad, B.Com.
3. Smt. S.S. Dongare, B.A.

Assistant

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

Senior Stenographer

Smt. S.D. Dudam, M.A.

Stenographer

1. Smt. T.T. Souz
2. Smt. U.N. Bhandari

Junior Stenographer

1. Smt. R.R. Tawde
2. Shri R.D. Shambharkar
3. Smt. T.P. Pawar
4. Kum. V.S. Nayak

Senior Clerk

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

Junior Clerk

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

Sr. Gesteter Operator

Shri A.B. Sawant

Supporting Staff Gr.III

1. Shri C. Mhatri
2. Shri N.J. Kharat
3. Shri M.Y. Chandanshive
4. Shri R.B. Jadhav
5. Shri S.M. Sawant
6. Shri M.B. Gurve

Supporting Staff Gr.II

1. Shri O.T. Thapa
2. Shri B.R. Satam
3. Shri D.M. Chougule
4. Smt. T.V. Bhowar
5. Shri N.R. Kamble
6. Shri S.D. Gurav
7. Shri M.K. Ghadge
8. Shri M.Z. Rathi
9. Shri N. Singh
10. Shri D.B. Temgire
11. Shri D.M. Raje
12. Smt. B.R. Balmiki
13. Shri C.S. Salvi
14. Shri R.S. Rane
15. Shri T.B. Khan
16. Shri K.T. Mahida
17. Shri P.G. Ghogale

Supporting Staff Gr. I

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

LIST OF STAFF AT THE QUALITY EVALUATION UNITS

AKOLA

Technical Officer T-5	: Shri N.V. Bansode, B.Sc.
Technical Assistant T-II-3	: Shri R.G. Dhakate, B.Sc.
Supporting Staff Grade I	: Shri S.R. Patode

COIMBATORE

Technical Officer T-5	: Smt. Santa V. Nayar, B.Sc.
	: Shri S. Venkatakrishnan, MSc., A.T.A
Sr. Technical Assistant T-4	: Shri K. Thiagarajan, M.Sc.
Operator T-2	: Shri K.V. Nair
Supporting Staff Grade IV	: Shri N. Arumugham
Supporting Staff Grade III	: Shri V.M. Subramanian

DHARWAD

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

GUNTUR

Technical Officer T-5	: Shri S. Mukundan, B.Sc.
Technical Assistant T-II-3	: Shri K. Venkanna, M.Sc., B.Ed.
Supporting Staff Gr.IV	: Shri Ch. Thimmanna
Supporting Staff Gr.II	: Shri V.Y.M. Suvarchala Rao

HISAR

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

INDORE

Senior Technical Assistant T-4	: Shri S. Banerjee, B.Sc.
Technical Assistant T-II-3	: Shri P.S. Anil Kumar, B.Sc.
Supporting Staff Gr.IV	: Shri John Robert
Supporting Staff Gr.III	: Shri H.S. Bhabar

APPENDICES

LUDHIANA

Technical Officer T-8	:	Shri Ram Parkash, B.Sc., L.L.B.
Technical Assistant T-II-3	:	Shri Nehrulal Meena
Supporting Staff Gr.I	:	Shri Satyanarayan Gope
	:	Shri Sarup Singh

NAGPUR

Scientist	:	Shri P.G. Patil, M.Tech. (Post-Harvest Engg.)
Technical Officer T-6	:	Shri V.M. Kulmethe, B.Sc.
Sr. Technical Assistant T-4	:	Shri S.L. Bhanuse, B.Sc.
	:	Shri M. Bhaskar, Dip. Ref. & Air-Cond.
	:	Shri V.L. Rangari, B.Sc.
	:	Shri R.C. Yadhav, Dip. Mech.Engg
Technical Assistant T-1	:	Shri P.N. Raut, S.S.C. (Tech), H.S.C., Dip.Elect.Eng., N.T.C., N.A.C., N.C.T.V.T.
Operator (Auxiliary)	:	Shri B.V. Shirsath, B.A., I.T.I.
Senior Clerk	:	Shri B.D. Dhengale
	:	Shri G.G. Palorkar, B.A.
Junior Clerk	:	Shri S.A. Telpande, M.Com.
Driver	:	Shri R.A. Suddawar
Machine Operator	:	Shri B.H. Umredkar
Supporting Staff Gr.I	:	Shri A.R. Chutale
	:	Shri J.P. Patel
	:	Shri C.L. Mundale
	:	Shri R.B. Kautkar
	:	Shri P.S. Panchbudhe, M.A.
	:	Shri M.P. Tohokar
	:	Shri R.G. Matel
	:	Shri R.C. Rokde
	:	Shri M.G. Bhandkkar

NANDED

Scientist (Sr. Scale)	:	Shri L.D. Deshmukh, M.Sc.
Technical Assistant T-II-3	:	Kum. P.L. Indurkar
Supporting Staff Gr.III	:	Shri L.R. Indurkar
Supporting Staff Gr.I	:	Shri S.N. Umare

RAHURI

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

SIRSA

Senior Technical Assistant T-4	:	Shri Hamid Hasan, M.Sc.
	:	Shri Udai Vir Singh, B.Sc., B.Ed
Technical Assistant T-II-3	:	Shri N.P. Ghuge, B.Sc.
Supporting Staff Gr.I	:	Shri Mahabir Singh

SRIGANGANAGAR

Senior Technical Assistant T-4	:	Shri Matish Chandra, M.Sc.
Supporting Staff Gr.IV	:	Shri Vijendra Singh
Supporting Staff Gr.III	:	Shri Sanwarmal Saini

SURAT

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

APPENDIX - II

Statement showing the total number of Government servants and number of Scheduled Castes & Scheduled Tribes amongst them as on March 31, 1996

Group	Total No.of employees 31-3-1996	Total No.of Scheduled Castes 31-3-1996	Total No.of Scheduled Tribes 31-3-1996
Group A Permanent			
(i) Other than Lowest Rung of Group A	38	3	Nil
(ii) Lowest Rung of Group A	2	1	Nil
Temporary			
(i) Other than Lowest Rung of Group A	6	1	Nil
(ii) Lowest Rung of Group A	4	2	Nil
Group B			
Permanent	51	7	Nil
Temporary	3	1	Nil
Group C			
Permanent	104	24	8
Temporary	20	5	3
Group D (excluding Sweepers)			
Permanent	53	12	5
Temporary	12	3	1
Group D (Sweepers)			
Permanent	9	9	Nil
Temporary	2	2	Nil
Total	304	70	19

APPENDIX - III

Statement showing the number of reserved vacancies filled by members of Scheduled Castes and Scheduled Tribes during the year 1995-96 (as on 31-3-1996)

Part I : Posts filled by direct recruitment
SCHEDULED CASTES

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

SCHEDULED TRIBES

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

APPENDIX - III

Statement showing the number of reserved vacancies filled by members of Scheduled Castes and Scheduled Tribes during the year 1995-96 (as on 31-3-1996)

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

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

SCHEDULED TRIBES

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