Cotton Technological Research Laboratory

Indian Council of Agricultural Research

Annual Report
1973

BOMBAY

Contents

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I. Introduction

The Cotton Technological Research Laboratory has entered its Golden Jubilee Year and this is the 50th Annual Report of the Laboratory covering the calendar year 1973.

This Laboratory was founded by the Indian Central Cotton Committee (ICCC) in 1924 and through the last five decades, its main function has been to collaborate actively with the Departments of Agriculture in producing better quality cotton through research. The Laboratory started with a Spinning Division and various Research Sections, viz., Physical Testing, Fibre Physics, Chemistry, Microscopy, and Statistics. In the year 1937, a Test House was organised to render service to the trade and industry, for testing cotton fibre, yarn, and fabrics by standard methods and give authoritative reports. In the year 1941, a Ginning Section was set up to carry out systematic research in pre-cleaning and ginning of Indian cottons. Later, through the years, various testing and research sections were strengthened from time to time by acquiring sophisticated equipments.

The Laboratory came under the administrative control of the Indian Council of Agricultural Research (ICAR) from the 1st April, 1966, on the abolition of the ICCC. During the last one decade, especially after the CTRL came under the ICAR, the research activities of the Laboratory have been intensified and research facilities have been further modernised. For instance, new Sections like Microbiology, Biochemistry and Instrumentation have been organised during the Fourth Five-Year Plan and the Laboratory has now excellent facilities for carrying out basic studies in fibre structure, using sophisticated equipments like x-ray diffraction, infra-red spectrophotometer, and electron microscope. Research efforts of the Scientists at the CTRL will be continued as in the past towards improving the economy of India by helping the cotton grower in producing better quality cottons and enhancing utilisation of cotton and cotton plant by-products.

The chief functions of this Laboratory are :

(*i*) to actively participate in the programmes for improvement in production and quality of cotton in India, by helping the agricultural departments in evaluating the quality of new strains evolved,

(*ii*) to carry out research on the physical, structural, and chemical properties of cotton in relation to quality and spinning performance,

(*iii*) to carry out research investigations on the ginning problems of cotton,

(*iv*) to investigate the greater and better utilisation of cotton, cotton waste, linters, cotton seed, etc.,

(*v*) to help the trade and the industry by furnishing true valuation of different trade varieties cultivated,

(*vi*) to issue authoritative reports on the samples received for tests from the government departments, the trade and other sources, and

(*vii*) to disseminate technical information.

This Laboratory maintains a good up-to-date Library of books on cotton technology. At the end of 1973, there were 2,849 books, 128 of which were added during the year. The number of bound volumes was 2,689. The Library received regularly about 164 journals dealing with textiles and allied subjects, 71 of which were subscribed for and the others received on exchange or complimentary basis.

New Equipments Purchased

During the year, the following equipments were acquired for the Laboratory :

1. "Keisokki" Micronaire.
2. "Kartik Model 200" Air Compressor.
3. "Zeiss" Rapid Photometer GIII.
4. Omni-Mixer Homogenizer.
5. "KMI" Tearing Tester.
6. Travelling Microscope.
7. "MOSCAL 1400" Desk Calculator.
8. Zoom Microscope.
9. Research Microscope.
10. "Systronics" Type 1011 A.F. Generator and Type 1101 Standard Signal Generator.
11. Deioniser "Mark 6".
12. Multimeter Model 260-6 m with probs.
13. R.72 Pocket size Digital Instrument (Calculator).
14. Torsion Balance LB 403/1.
15. Dehumidifying Unit "Y-1".
16. "R. 40" Water Cooler.

Distinguished Visitors

Dr. M. S. Swaminathan, Director General, ICAR, Dr. E. Khan, Sr. Scientist of ICAR, Dr. V. Santhanam, Project Co-ordinator and Head,

IARI, Coimbatore, Dr. H. S. Mann, Director, Central Arid Zone Research Institute, Jodhpur, and Dr. S. B. Bandyopadhyay, Director JTRL, Calcutta, visited this Laboratory in connection with official work.

Among the other distinguished persons who visited this Laboratory during the year under review, mention may be made of the following :

1.	Dr. A. Gaertner, Institute for Meersforching, Bremenhaven, West Germany.	
2.	Shri Ravji K. Ganatra, Mayor of Bombay, Bombay.	
3.	Mr. Frank Lowenstein, Chief of Mission, World Bank, Washington, U.S.A.	World Bank Team
4.	Dr. H. Manning, Cotton Production Specialist.	
5.	Mr. G. von Wallenberg, Financial Specialist.	
6.	Mr. Roy U. Baker, Ginning Specialist.	
7.	Mr. Allen Smith, Cotton Seed Crushing Specialist.	
8.	Mr. Max Preysch, Spinlab, Zurich, Switzerland.	
9.	Prof. I. D. Shapiro, Head, Laboratory of Plant Resistance to Pests, All Union Research Institute of Plant Protection, Leningrad, U.S.S.R.	Soviet Delegation of Agricultural Scientists
10.	Dr. M. P. Lesovoy, Head, Laboratory of Plant Resistance, Kiev, U.S.S.R.	
11.	Dr. I. V. Panarin, Sr. Scientist, Plant Protection Department, Krasnodor Agricultural Research Institute, Karsnodor, U.S.S.R.	
12.	Mrs. V. M. Sedova, Interpreter, Ministry of Agriculture of the U.S.S.R., Moscow, U.S.S.R.	
13.	Mr. U. Khim Maung, General Manager (Res.), Agriculture Corporation, Ministry of Forest & Agriculture, Rangoon, Burma.	

14. Mr. Ibrahim Moneim Mansour,
Minister for Finance & National Economy,
Khartoum, Sudan.
15. Mr. Sayed Mohd. Abdel Magid Ahmed,
Commissioner General for Development.
16. Mr. Sayed Farouk Ibrahim El Magboul,
Dy. Under Secretary,
Ministry of Finance & National Economy.
17. Mr. A. W. Tamim,
Asstt. Secretary, Ministry of Finance &
National Economy.
18. Mr. Sayed Maurice Loga,
Manager, General Bank of Sudan.
19. Mr. Sayed Abu Baker El Sadeeq Ibrahim,
General Manager,
National Cotton and Trade Corporation.
20. Mr. Sayed Yusuf Mohd. Abdali,
Sudan Consul General, Bombay.

} Sudanese Delegation

21. Prof. A. N. Kothare,
Director of Correspondence Courses,
University of Bombay, Bombay.
22. Prof. K. S. Korgaonkar,
Cancer Research Institute,
Bombay.

} University Enquiry Committee

23. Dr. J. T. Wenham,
Dy. General Secretary,
The Textile Institute, Manchester, U.K.
24. Mr. Frank H. Burkitt,
International Institute for Cotton,
Manchester, U.K.
25. Mr. Hassan Saeed Singabi,
Chief Cotton Sampler,
Sudan Gezira Board, Sudan.
26. Dr. R. W. Must,
Commercial Executive,
International Plant Breeders,
Rotwell, England.
27. Dr. J. T. Walker,
Head of Genetics,
International Plant Breeders,
Rotwell, England.
28. Dr. I. P. S. Dias,
Dy. General Manager,
River Valley Development Board, Ceylon.

29. Dr. K. R. Anthon,
General Cotton Adviser,
Cotton Research Corporation,
London, U.K.
30. Dr. G. W. Uhlenbroek,
UNDP/FAO Cotton Agronomist,
Box 107, Kathmandu.
31. Dr. Winston Currie Boteler,
Associate Prof., School of Textile Engineering,
Georgia Institute of Technology,
Atlanta, Georgia, U.S.A.
32. Mr. A. Z. Tishin,
Scientific Institute of Cotton Breeding,
Tashkent, U.S.S.R.

Visit of the World Bank Team

The World Bank Team that visited the Laboratory in 1973 were highly impressed with the facilities and research activities of the Laboratory. Mr. Roy Baker, Ginning Specialist, visited several ginning factories in India and some of them with the Ginning Engineer of our Laboratory. Also, Mr. Allen Smith, expert in cotton seed crushing, visited various cotton seed crushing factories in India along with the Senior Scientist of our Laboratory. In their Pre-appraisal Report on Integrated Cotton Development Project, the World Bank Team has strongly recommended the setting up of a Training and Advisory Service attached to the CTRL in Bombay, for improving the ginning industry in India, both by conducting training courses and imparting technical guidance to the ginning industry.

Achievement Audit of the Laboratory

The Achievement Audit Committee constituted in 1971 by the ICAR to evaluate the work of the Laboratory submitted the final report in March, 1973. The Committee was generally appreciative of the work carried out so far and has made various recommendations to increase the research facilities so that the CTRL can become a National Centre for Cotton Research for the whole country. The Report is being examined by the Council. However, action has been taken to include some of the suggestions in the Fifth Plan Proposals of the Laboratory.

Staff Research Council

During the year, three meetings of the Staff Research Council were held. The first meeting was held on the 21st March, 1973, to consider and approve

the programme of research work for 1973. The second meeting was held on the 21st June, 1973, to consider the suggestions of the Achievement Audit Committee for improving the research work as well as the proposals for celebrating the Golden Jubilee of the Laboratory in 1974. The third meeting was held on the 24th December, 1973, for considering the progress of the work connected with the various research projects.

Inter-Institutional Projects

The following two collaborative research projects have been sanctioned by the ICAR to be undertaken at this Laboratory in close collaboration with the Jute Technological Research Laboratory (JTRL) and Central Sheep and Wool Research Institute (CSWRI):

1. Studies on spinning from blends of cotton with wool, jute and ramie on cotton system.
2. Studies on de-burring of raw wool using mechanical devices.

Although the first project was sanctioned by the Council in April, 1972, it has not been possible to start work on this project for want of staff which could not be appointed due to a ban imposed on recruitment to scientific and technical posts under the ICAR. This ban has since been removed and steps are already under way to appoint the requisite staff to start the project work.

The second project was sanctioned by the Council in May, 1973, when the ban on recruitment to scientific and technical posts was in force. However, with the lifting of this ban, steps are now being taken to appoint the staff provided for the project so as to take up the work.

In addition to the above two projects, another scheme entitled "Optimal blending of standard varieties of Indian cottons" has since been sanctioned by the Council in October, 1973. Work on this project will be taken up as soon as the necessary staff is appointed and requisite machinery purchased.

Membership on Other Organisations

The Director continued as an *ex-officio* member of the following bodies during the year :

1. Executive Council Member, Mahatma Phule Krishi Vidyapeeth, Rahuri.
2. Cotton Research Advisory Sub-Committee of the ICMF Cotton Development Research Association.
3. Governing Council, Bombay Textile Research Association.
4. Study Team on Cotton set up by the National Commission on Agriculture.

5. Indian Standards Institution, TDC 2 : 7 (Convenor of the Sub-Committee for Grading of Raw Cotton).
6. Member, Board of Management of the Victoria Jubilee Technical Institute (VJTI).

In addition, the Director was also appointed as a member of the following bodies during the year :

1. Indian Cotton Development Council, Directorate of Cotton Development.
2. Research Advisory Committee of the SITRA, Coimbatore.
3. Working Group for the finalisation of the project for the development of short duration cotton varieties of less than 5 to 7 months' duration at Amaravati (Maharashtra) and Hissar.

The Director and other scientific officers of the Laboratory continued to be members of the various committees, etc., and represented the ICAR on the various institutions as in the past.

Post-Graduate Training

In addition to the recognition granted to this Laboratory as a Post-Graduate Institution for guiding students for M.Sc. and Ph.D. degrees in Textile Physics and M.Sc. degree in Physical Chemistry, the University of Bombay has extended the recognition for guiding students for M. Text. degree in Spinning Technology and Ph.D. degrees in Bio-physics also. Dr. V. Sundaram (Director) and Dr. R. L. N. Iyengar (Retired Scientist) continued to be teachers for guiding students for Ph.D. and M.Sc. degrees in Textile Physics (by research). Dr. V. Sundaram (Director) and Dr. S. N. Pandey (Junior Scientific Officer) continued to be teachers for guiding students for M.Sc. degree in Physical Chemistry (by research). Further, Dr. N. B. Patil (Senior Physicist) and Dr. V. G. Munshi (Senior Scientific Officer) have been recognised by the University of Bombay as teachers for guiding students for M.Sc. degree in Textile Physics (by research) in 1973. Shri M. S. Parthasarathy (Senior Spinning Technologist) has also been recognised by the University of Bombay as a teacher for guiding students for M. Text. degree in Spinning Technology (by research) during the year.

During the year, eight members of the research staff were being guided for M.Sc. and two for Ph.D. degrees in Textile Physics, and two for M.Sc. degree in Physical Chemistry.

Two post-graduate students of this Laboratory were awarded M.Sc. degree in Textile Physics by the University of Bombay for their theses, during the year.

In-Service Training

Shri Joe D'Souza, Senior Research Assistant (Microbiology), was permitted to participate in the Summer Institute in Quality Control in Pesticides and Fertilizers at Indian Agricultural Research Institute (IARI), New Delhi, for a period of one month from the 24th April.

Shri V. G. Khandeparkar, Junior Microbiologist, was permitted to participate in the advanced Winter School in Biochemical Engineering held from the 5th to the 22nd December, 1973, at the Indian Institute of Technology, Delhi.

Deputation Abroad

Dr. V. Sundaram, Director, was deputed by the Government of India (ICAR) for a period of one month as a Consultant on Cotton Technology with the Asian Development Bank, Manila, to Sri Lanka, to advise : (*i*) in the establishment and initial operation of Laboratory facilities for Cotton Technology relevant to the improvement of cotton varieties according to standard requirements of the markets and textile industries, and (*ii*) drawing up a training programme for local counterpart, technical personnel in assessment and determination of fibre quality and in the operation and maintenance of the relevant equipment. Shri L. R. Jambunathan, Senior Research Assistant, was also deputed to Sri Lanka, for the same purpose for a period of eleven months with effect from the 5th July, 1973.

Dr. V. Sundaram was also deputed to USSR under Indo-USSR Agreement in Agriculture and Animal Sciences for a period of five weeks from the 26th August to study the developments made in that country in the field of Cotton Technology.

Expansion an Modernisation

The development programme planned for the expansion and modernisation of the Laboratory has been progressing steadily. The first phase of the electrical power wiring work in the Spinning Division, intended for the new blow-room machinery was completed. The sanction for the requisite additional electric load was obtained from the Government of Maharashtra. The newly installed blow-room machinery has been commissioned and trials are being taken to standardise the blow-room process. The electrical work in the second phase covering the light and power wiring in the rest of the Spinning Division has been awarded for execution by the Electrical Division of the Central Public Works Department.

With regard to the new controlled humidity and temperature plant to be procured and installed in the Spinning Division, the tender offered by

M/s. Voltas Ltd., Bombay, has been accepted by the Director General of Supplies and Disposals, New Delhi, for execution of the work. The foreign exchange required for controls to be imported from the USA for this plant has not yet been released by the Government of India and the matter is under correspondence.

The Workshop machinery shifted to the hall on the ground floor of the New Research Laboratory Building has been installed and put into operation.

The work connected with the construction of the 2nd floor of the New Research Laboratory Building has been awarded for execution by the CPWD. The construction work is well in progress. The research sections proposed to be accommodated in the 2nd floor will require power wiring for operating the testing instruments of their respective sections. This work also has been awarded for execution by the Electrical Division of the CPWD.

Staff Amenities

The construction work relating to the 16 Nos. Type I quarters is nearing completion and the quarters are likely to be handed over for occupation soon.

The Council has conveyed its administrative approval and financial sanction to the construction of 8 Nos. Type IV quarters at a cost of Rs. 4,10,729 for providing housing accommodation to the senior members of the staff. The work was, accordingly, assigned to the CPWD for execution. However, owing to the subsequent ban imposed by the Government of India on the construction of non-functional buildings in view of the acute financial stringency, the work has been kept in abeyance for the present and will be taken up for execution as soon as the ban is lifted.

Finance

A statement showing the sanctioned budget grant of the Laboratory and the actual expenditure for the financial year 1972-73 is furnished in Appendix I. It will be noticed that the actual expenditure was Rs. 16.44 lakhs as against the sanctioned grant of Rs. 18.23 lakhs, for Technological Research. An expenditure of Rs. 9.68 lakhs was incurred under the Fourth Plan Scheme for modernisation and strengthening of CTRL for intensive research on cotton against the sanctioned grant of Rs. 11.46 lakhs leaving an amount of Rs. 1.78 lakhs unutilised. Apart from this, an expenditure of Rs. 2.14 lakhs was incurred on the All India Co-ordinated Cotton Improvement Project (AICCIP) and Rs. 6,000 on the ICAR Schemes from the Agricultural Produces Cess Fund, against the sanctioned grant of Rs. 2.60 lakhs and Rs. 10,000, respectively. The savings in these schemes to the tune of Rs. 46,000 and Rs. 4,000, respectively, were mainly due to non-materialisation of purchase of certain equipment and also due to non-filling up of the posts under the respective schemes on account of the ban on recruitment.

Highlights of Research Work Carried Out

1. Under the All India Co-ordinated Cotton Improvement Project the following improved varieties were recommended for release in the respective areas indicated against each :

Jyothi — Khandesh tract comprising of Jalgaon and Dhulia districts and parts of Nasik district.

MCU. 8 — Summer Cambodia tract of Tamil Nadu.

2. While screening existing Indian varieties of cotton suitable for easy-care treatments, Sanjay, Digvijay and MCU.1 were found promising.

3. A method for the production of highly active thermostable cellulose enzyme by *Penicillium funiculosum*, utilising waste material, such as saw dust, rice husk, jute stick, etc., has been developed. This is proposed to be patented.

4. Work on the isolation and identification of thermophilic bacteria producing desizing amylase is in progress. This enzyme has high potential use in the textile industry.

5. Studies on blends of polyester with selected Indian cottons have shown that blends of certain Indian cottons with high proportions of polyester were quite good and comparable in quality to blends with imported cottons.

6. An apparatus for measuring the bulk-resilience of cotton is being fabricated.

7. An instrument for measuring the lateral compressibility of cottons is also being designed.

8. Studies have been initiated on the effect of different systems of processing on the spinning performance of superior cottons so as to enable their better utilisation.

9. The survey of cotton ginning factories initiated last year in collaboration with the ATIRA, BTRA and SITRA is making steady progress. Besides collecting information by mailed questionnaire, specially trained investigators were deputed to many centres for making on-the-spot assessment.

10. It was observed that the Cycocel (CCC) spraying increased the yield of cottons Jayadhar at Dharwar and Hampi at Siruguppa. Similarly, pretreatment of cotton seed with Succinic acid gave higher yield at the Dharwar research station. In all the above cases, there was no adverse effect on fibre quality.

II. Progress of Research

During the year under review, considerable progress has been made in the various research investigations undertaken at this Laboratory. A few papers based on the research work completed were published in suitable scientific and technical journals. In the case of a few more investigations, the experimental work has been completed and the results are being analysed.

With regard to the project on the evaluation of quality of new strains of cotton, it may be pointed out that 1,588 samples were received from various trials under the All India Co-ordinated Cotton Improvement Project. In many cases, the tests had to be carried out urgently so as to have the results for discussion at the Panel Meetings in respective zones. Consequently, there was a heavy pressure of testing work in the earlier part of the year. Due to installation of new spinning machinery, rewiring, etc., there was dislocation in the spinning of samples for regular testing work as well as for research investigations. This has caused some setback in the progress during this year.

The progress made in each research project is indicated briefly in the following pages :

Evaluation of the Quality of Cotton Samples Received from the State Agricultural Departments

A large number of samples are received at the Laboratory for various tests from the State Departments of Agriculture. Some samples are obtained in connection with various research investigations at the Laboratory. The number of samples received during the years 1971, 1972 and 1973 together with the corresponding average figures for the quinquennium 1966-70 are given in Table 1 (*a*). The number of samples tested at various regional stations during 1973 is given in Table 1 (*b*).

The samples received from the State Departments of Agriculture are generally tested in the order of their receipt and the test results are sent to the officers concerned as quickly as possible. The results of tests on each of the Trade Variety and Standard Indian Cotton samples are reported in the form of a Technological Circular immediately after tests are completed. Later, the test results are consolidated for the whole season and published as two Technological Reports, one on the Trade Varieties and another on the Standard Indian Cottons. The technological research samples are utilized for the

TABLE 1 (*a*) : NUMBER OF COTTON SAMPLES RECEIVED FROM THE STATE DEPARTMENTS OF AGRICULTURE AND TESTED AT THE LABORATORY

Types of test	Average for the quinquennium 1966-70	1971	1972	1973
Fibre and full spinning	597	467	600	418
Fibre and microspinning	2,250	2,811	1,869	2,080
Microspinning alone			1,033	816
Fibre tests alone	143	139	112	80
Mill tests	14	20	18	8
Standard cottons	23	21	12	22
Trade varieties—lint	27	22	12	37
Trade varieties—*kapas*	42	59	51	49
Technological Research	272	138	48	63
Miscellaneous	100	—	—	—
Total	3,468	3,677	3,755	3,573

TABLE 1 (*b*) : NUMBER OF COTTON SAMPLES TESTED AT THE REGIONAL STATIONS

Station	Length	Fineness	Maturity	Strength
Coimbatore	829	829	829	829
Dharwar	900	900	358	900
Hissar	207	418	207	207
Indore	581	581	581	645
Ludhiana	439	439	439	369
Nanded	1,065	1,065	1,065	1,051
Nandyal	270	476	26	477
Sriganganagar	249	249	18	249
Surat	3,133†	3,936	3,963††	3,158
Total	7,673	8,895	7,486	7,885

† 3,121 samples were tested on Digital Fibrograph and 12 on Balls Sorter.
†† 3,936 samples were tested by Micronaire Spacer Technique and 27 by Caustic Soda Method.

TABLE 2 : NUMBER OF SAMPLES TESTED AND REPORTED FOR THE STATE DEPARTMENTS OF AGRICULTURE

A. *Co-ordinated Project*

State	Fibre and full spinning	Fibre and micro-spinning	Micro-spinning	Fibre tests	Total
Maharashtra	7 (2)	340 (24)	—	—	347 (26)
Gujarat	112 (12)	104 (8)	—	—	216 (20)
Mysore	59 (5)	146 (10)	—	—	205 (15)
Andhra Pradesh	5 (1)	32 (4)	—	—	37 (5)
Tamil Nadu	17 (2)	146 (13)	—	—	163 (15)
Madhya Pradesh	25 (3)	92 (7)	—	—	117 (10)
Rajasthan	—	85 (3)	—	—	85 (3)
Punjab	5 (1)	143 (8)	—	30 (2)	178 (11)
Haryana	12 (1)	160 (8)	—	—	172 (9)
Others	4 (1)	64 (4)	—	—	68 (5)
Total	246 (28)	1,312 (89)	—	30 (2)	1,588 (119)

B. *Other State Schemes*

State	Fibre and full spinning	Fibre and micro-spinning	Micro-spinning	Fibre tests	Total
Maharashtra	50 (21)	—	6 (1)	156 (14)	212 (36)
Gujarat	45 (17)	22 (2)	98 (9)	—	165 (28)
Mysore	62 (24)	18 (1)	43 (4)	—	123 (29)
Andhra Pradesh	9 (2)	25 (2)	24 (3)	80 (1)	138 (8)
Tamil Nadu	29 (12)	2 (1)	44 (3)	—	75 (16)
Madhya Pradesh	18 (13)	—	—	—	18 (13)
Rajasthan	4 (1)	—	—	—	4 (1)
Punjab	4 (2)	—	20 (2)	—	24 (4)
Haryana	—	—	—	—	—
Others	9 (4)	—	112 (1)	17 (1)	138 (6)
Total	230 (96)	67 (6)	347 (23)	253 (16)	897 (141)

Note : Figures in brackets indicate the numbers of reports issued.

Laboratory's research work; no test reports are usually issued on such samples as the results are included in the relevant research papers published by the Laboratory. A few of the small samples received for tests are in the form of *kapas* and they are first ginned in the Ginning Section before they are tested for various properties. During 1973 about 165 samples had been received as *kapas* and were ginned. Further, 44 samples of *kapas* of Trade Varieties were ginned for determining their ginning outturn.

The state-wise break up of the number of samples received from the State Departments of Agriculture and tested for different properties, on which reports were issued to the concerned officers during the year, are given in Table 2 (page 13).

ALL INDIA CO-ORDINATED COTTON IMPROVEMENT PROJECT

This is the sixth year of the Project. Reports on the various samples grown under advanced trials such as Co-ordinated Varietal Trial, Preliminary Varietal Trial, Pilot Project Trial, etc., were presented as preliminary reports at the Panel Meetings of Breeding and Technology disciplines held at Ludhiana, Pune and Coimbatore during the months of April and May, 1973, as there were no regular Workshop meetings. These reports were useful to Cotton Breeders for considering the promising strains for further trials. The total number of samples tested during the period under report was 1,588, included in 125 reports.

The Project covered seven locations in North Zone comprising the States of Haryana, Punjab, Uttar Pradesh, Rajasthan and IARI Research Stations, 17 locations in the Central Zone comprising the States of Madhya Pradesh, Gujarat and Maharashtra, and 10 locations in South Zone comprising the States of Andhra Pradesh, Karnataka and Tamil Nadu. A few samples from the rice fallows tract of West Bengal were also tested for fibre properties. A brief summary of the important test results on the samples received under various trials conducted at different locations in the three zones is given below :

NORTH ZONE

G. hirsutum Trials

In the Co-ordinated Varietal Trial of *G. hirsutum*, samples under Normal Plant Type Trial were received from Faridkot, Hissar, Jullundur and IARI (Sirsa), and samples under New Plant Type Trial from Faridkot, Hissar and IARI (New Delhi and Sirsa).

It may be seen from the test results summarised in Table 3, that the strains have shown wide variation in mean fibre length ranging from 21.8 mm to 29.7 mm, the lowest value of mean fibre length being recorded by the

TABLE 3 : SUMMARY OF THE TEST RESULTS OF THE STRAINS TRIED IN CO-ORDINATED VARIETAL TRIAL OF *G. hirsutum* (IRRIGATED) Br.04 RAISED AT DIFFERENT LOCATIONS IN NORTH ZONE

Location	No. of samples	Mean fibre length, mm	Micronaire value	Maturity	Bundle strength (zero gauge), g/t	Count spun SKF	Spinning performance		Control
							No. of samples spinnable to the count selected	No. of samples better or on par with control	
Normal Plant Type									
Faridkot	11	22.1 to 27.2 (25.8)	3.5 to 5.6 (4.1)	Low to average	42.9 to 47.7 (45.0)	40s@	nil	3	320F
Hissar	12	22.6 to 27.9 (25.5)	3.6 to 4.6 (3.9)	Average	43.4 to 49.3 (46.4)	50s full	nil	11	H.14
Jullundur	10	21.8 to 29.7 (26.6)	3.6 to 5.0 (4.3)	Average	41.3 to 49.3 (45.3)	50s (micro)	3	5	320F
IARI, Sirsa ..	11	22.6 to 27.9 (25.2)	2.4 to 4.2 (3.4)	Low to average	43.4 to 47.7 (45.3)	50s (micro)	1	9	320F
New Plant Type									
Faridkot	19	22.1 to 28.7 (25.2)	3.2 to 4.8 (4.1)	Low to average	37.5 to 46.6 (42.6)	50s (micro)	nil	14	320F
Hissar	16	22.9 to 27.9 (25.0)	4.0 to 4.8 (4.3)	Average	41.8 to 51.5 (45.8)	40s	nil	7	H.14
IARI, New Delhi .. (early sown)	14	23.4 to 27.4 (25.8)	3.4 to 4.9 (4.2)	Low to average	40.2 to 48.8 (44.9)	40s	6	2	H.14
IARI, New Delhi .. (late sown)	14	24.4 to 27.2 (26.0)	2.8 to 4.6 (3.7)	Low to average	42.9 to 52.0 (46.3)	40s	6	4	H.14
IARI, Sirsa ..	13	22.9 to 27.2 (25.4)	3.6 to 4.8 (4.0)	Low to average	41.3 to 48.8 (45.0)	50s	3	12	320F

N.B. Values in brackets indicate averages.

@ 5 Full spinning + 6 Microspinning. Maturity coefficient : Low — Below 0.70, Average — 0.70 to 0.80, Good — above 0.80

strain Jai at all the locations. The fineness for most of the strains was satisfactory and the Micronaire value ranged from 2.4 to 5.6. As regards maturity, a few samples at Faridkot, Sirsa and New Delhi recorded low maturity. The bundle strength was satisfactory ranging between 37.5 g/t and 52.0 g/t. All the samples were spun on SKF high drafting system. However, none of the samples raised at Faridkot and Hissar responded well at 50s count. The following samples fared well at the locations indicated below :

Jullundur — RS.89, J.207, SH.369 and SH.269 for 50s count
Sirsa — SH.469, SS.167, D.33 and D.40 „ 50s „
New Delhi — SS.167, SS.265, 10-1, D.33 and H.14 „ 40s „

It may also be seen from the table that many strains at Hissar and Sirsa (in Normal Plant Type Trial), and Faridkot, Sirsa and Hissar (in New Plant Type Trial) recorded better spinning performance than their respective controls. It appears that the strains under New Plant Type trial have given comparatively better technological performance than those under Normal Plant Type. No significant difference was observed in the technological performance of the samples from trial on different sowing dates at the IARI, New Delhi.

Samples pertaining to Preliminary Varietal Trial were received from Faridkot, Hissar, Jullundur, New Delhi and Sirsa. The test results indicated that their mean fibre length ranged between 21.3 mm and 29.7 mm. The Micronaire value ranged between 2.5 and 4.9. The maturity was rather low in the case of a few samples from Faridkot, Hissar, New Delhi and Sirsa. However, the bundle strength values were satisfactory ranging between 30.1 and 52.5 g/t. The samples were spun on SKF high drafting system for 50s count. As many as eight samples from Jullundur and four samples from Sirsa recorded spinning potential of 50s count and above. It was noted that most of the samples recorded better spinning performance than their corresponding controls.

In the Initial Evaluation Trial, samples were received only from Hissar. Most of them had mean fibre length below 25.4 mm (1.00″), low maturity and average bundle strength. None of the 18 samples fared well even at 40s count when spun on SKF.

Miscellaneous Trials

In order to evolve a long staple *G. hirsutum* cotton suitable for Mewar tract of Rajasthan, 27 samples were raised at Ajmer. Many samples had good mean fibre length (over 26 mm) and satisfactory bundle strength, but low maturity. Only two strains, viz. RS.221 and RS.331, recorded promising performance at 50s count (micro) when spun on SKF.

In a similar trial conducted at Sriganganagar, the strain RH.12 and a cross of C.116 with Wilds 5-90 fared well at 50s count (micro). In the Miscellaneous Trial at Hissar, 14 samples with a control (H.14) were received for microspinning test. The samples which fared well at 40s count (micro) are : H.559, H.534, H.549 and H.547.

In the Miscellaneous Trials conducted at Jullundur, the following samples were found promising at 40s count SKF (micro) :

Micro Varietal Trial—J.244, J.261, J.258, J.260, J.250, J.259 and J.254.
Main Varietal Trial—J.236, J.127, J.176, J.238, J.207, J.219, J.225, J.205 and J.204.
Semi-Varietal Trial—J.262, J.267, J.265, J.263, J.256 and J.204.

In the Mutation Breeding Trial conducted at New Delhi, the two mutants of MCU.5 namely, MCU.5-37 and MCU.5-21, recorded promising yarn strength at 50s count by full spinning technique. The mutant designated as 4-1 was also found to be promising.

CENTRAL ZONE

G. hirsutum Trials

In the Co-ordinated Varietal Trial of *G. hirsutum*, samples were received from Junagadh, Surat, Talod and Badnawar for full spinning tests, and from Rahuri, Achalpur, Jalgaon, Nanded and Parbhani for microspinning tests. In addition, samples pertaining to this trial with Northern Zone entries were received from Indore, Kopargaon, Rahuri and Morena for microspinning tests.

Table 4 gives the general summary of the test results of the trials in the Central Zone. It is seen from this table that the mean fibre length for the strains ranged from 22.1 mm to 30.7 mm. The Micronaire value ranged from 2.4 to 5.4. The maturity was unsatisfactory for all the samples at Nanded. It was observed that a few samples at Surat, Badnawar, Rahuri, Achalpur, Jalgaon and Parbhani also did not record satisfactory maturity values. The bundle strength values ranged from 39.7 g/t to 52.5 g/t. Regarding spinning, the samples were spun on SKF high drafting system. The samples from Rahuri, Parbhani and Achalpur did not fare well at 50s count. Many samples raised at Nanded, Surat, Junagadh and Badnawar were found suitable for 50s count. Further, it may be pointed out that many strains raised at Nanded, Junagadh, Rahuri, Achalpur and Surat recorded better spinning performance than their respective controls. This indicates that there is considerable scope for selecting better strains for replacing the existing varieties, based on further trials.

TABLE 4 : SUMMARY OF THE TEST RESULTS OF THE STRAINS TRIED IN CO-ORDINATED VARIETAL TRIAL OF *G. hirsutum* (IRRIGATED) Br.04 (CENTRAL ZONE ENTRIES) RAISED AT DIFFERENT LOCATIONS IN CENTRAL ZONE

Location	No. of samples	Mean fibre length, mm	Micronaire value	Maturity	Bundle strength (zero gauge), g/t	Count spun SKF	Spinning performance		Control
							No. of samples spinnable to the count selected	No. of samples better or on par with control	
Normal Plant Ttype									
Junagadh (I) ..	16	24.4 to 30.0 (27.0)	2.9 to 4.8 (4.0)	Average	42.3 to 52.0 (47.1)	50s full	11	12	Deviraj
Surat (I)	16	24.6 to 30.7 (27.7)	3.5 to 4.9 (4.4)	Average to good	41.3 to 52.0 (47.0)	50s full	14	10	Deviraj
Talod (I)	12	24.1 to 30.2 (26.5)	2.4 to 4.2 (3.2)	Low to average	42.3 to 52.0 (47.1)	50s full	7	5	Deviraj
Badnawar (R) ..	14	24.1 to 30.0 (26.3)	3.0 to 4.6 (3.8)	Low to average	42.2 to 49.3 (45.4)	50s full	11	3	Badnawar 1
Rahuri (I) ..	18	22.9 to 26.9 (25.4)	2.5 to 3.6 (3.3)	Low to average	39.7 to 47.7 (43.3)	50s micro	nil	11	B.147
Achalpur	18	23.1 to 27.7 (24.9)	3.1 to 4.5 (3.7)	Low to average	42.9 to 50.4 (46.5)	50s micro	3	11	B.1007
Jalgaon	14	23.1 to 30.0 (26.8)	3.8 to 5.4 (4.6)	Low to average	41.3 to 48.2 (44.9)	50s micro	8	9	B.147
Nanded	18	22.4 to 30.5 (26.4)	2.4 to 3.3 (2.7)	Low	41.8 to 52.5 (45.3)	50s micro	16	15	L.147
Parbhani	13	22.1 to 28.2 (24.6)	3.2 to 4.5 (3.9)	Low to average	42.9 to 52.0 (46.6)	50s micro	1	7	B.147

(I) = Irrigated (R) = Rainfed.

In the irrigated tracts of Madhya Pradesh and Maharashtra, Co-ordinated Varietal Trials (Normal Plant Type and New Plant Type) were conducted with varieties from North Zone trials. The test results of both Normal and New Plant Types are summarised in Table 5 (page 20). It may be seen from this table that their mean fibre length ranged from 21.6 mm to 30.7 mm. The Micronaire value ranged between 3.0 and 4.9. The maturity was low to average at most of the locations. Bundle strength values were rather low in the case of a few samples raised at Kopargaon and Rahuri. The spinning performance, in general, was not encouraging as many of the samples did not fare well at 50s count. However, it can be seen that 9 out of 12 samples at at Indore and 7 out of 11 samples at Morena showed better performance than the local control, C.59-228.

Samples pertaining to Preliminary Varietal Trial (Normal Plant Type) were received from Achalpur, Amreli, Jalgaon, Parbhani and Rahuri and to Preliminary Varietal Trial (New Plant Type) from Achalpur, Jalgaon and Parbhani. The promising strains at 50s count at each location are indicated below :

Location	*No. of samples*	*Promising Strains at 50s SKF*
Normal Plant Type		
Achalpur	21 (micro)	KH.8-932, B.68-2647 and IAN.5991
Amreli	14 (micro)	B.68-2647, 68BH.25-33, KH.8-931, KH.2-12, MCU.5, ND.54 and 69BH.27-81
Jalgaon	21 (micro)	KH.8-931, B.68-2647, IAN, 6058, IAN.5991 and SRT.4757
Parbhani	26 (micro)	Nil
Rahuri	20 (micro)	B.68-2647
New Plant Type		
Achalpur	8 (micro)	KW.68-2970 and IAN.579-188
Jalgaon	8 (micro)	IAN.579-188 and KW.68-2970
Parbhani	4 (micro)	Nil
Northern Zone Entries		
Kopargaon	30 (micro)	SH.469 and SH.169
Morena	12 (micro)	70IH.321 and 70IH.446

In the case of Initial Evaluation Trial, samples were received from Achalpur, Badnawar, Jalgaon, Junagadh, Parbhani and Rahuri for Micro-spinning tests. Out of these, six samples from Achalpur, viz. IAN.579-188, IAN.4889, MCU.5, 68KH.9-96, 5056 and 5981, responded well at 50s count. The strain 68KH.9-69 fared well at Jalgaon also at 50s count.

TABLE 5 : SUMMARY OF THE TEST RESULTS OF THE STRAINS TRIED IN THE CO-ORDINATED VARIETAL TRIAL OF *G. hirsutum* BR.04 (NORTH ZONE ENTRIES) RAISED AT DIFFERENT LOCATIONS IN CENTRAL ZONE

Location	No. of samples	Mean fibre length, mm	Micronaire value	Maturity	Bundle strength (zero gauge), g/t	Count spun SKF	Spinning performance		Control
							No. of samples spinnable to the count selected	No. of samples better or on par with control	
Normal Plant Type									
Indore	12	21.6 to 27.9 (25.2)	3.3 to 4.6 (3.8)	Low to average	42.9 to 50.4 (47.2)	50s micro	2	9	C.59-228
Kopargaon ..	12	22.6 to 27.9 (24.6)	3.1 to 4.4 (3.9)	Low to average	38.1 to 45.6 (41.8)	50s micro	nil	2	Laxmi
Rahuri	12	22.4 to 30.7 (26.6)	3.0 to 4.5 (3.8)	Low to average	38.1 to 45.0 (42.3)	50s micro	1	2	Laxmi
New Plant Type									
Kopargaon ..	11	23.4 to 26.9 (25.1)	3.3 to 4.2 (3.7)	Low to average	33.8 to 42.9 (38.8)	50s micro	nil	(No control)	
Morena .. .. (Normal sown)	10	22.6 to 25.9 (24.3)	3.6 to 4.9 (4.3)	Average	44.0 to 50.4 (47.8)	50s micro	1	3	C.59-228
Morena .. .. (Late sown)	11	21.8 to 26.9 (24.2)	3.5 to 4.9 (4.2)	Average	44.0 to 50.4 (47.2)	50s micro	2	7	C.59-228
Rahuri	12	22.1 to 25.7 (23.6)	3.0 to 3.6 (3.3)	Low	35.9 to 45.0 (42.6)	50s micro	nil	3	Laxmi

G. barbadense Trials

Samples pertaining to the Co-ordinated Varietal Trial were received from Surat for full spinning test and from Rahuri for microspinning test.

The mean fibre length of the 16 samples raised at Surat ranged from 30.0 mm for Tadla 2 to 36.5 mm for Suvin 62-6. The maturity was satisfactory for all the samples. The bundle strength values were also promising, ranging between 41.8 g/t for Tadla 2, and 52.0 g/t for CBE.25 and Sujata. The two samples of Suvin recorded encouraging yarn strength at 120s count. The other strains namely, IBSI.57, N.27, Giza 7, CBE.34, Sujata, IBSI.53 and CBE.148 had good yarn strength at 100s count.

As regards the 11 samples from Rahuri, the mean fibre length ranged between 27.7 mm for N.27 and 30.2 mm for Andrews and ERB.4492. The maturity was low in the case of some samples. The bundle strength values were average to good ranging from 40.7 g/t for ERB.4488 to 50.4 g/t for IBSI.57 The best spinning performance at 80s count was shown by the strain IBSI.57 with Sujata, IBSI.53 and Giza 7 being the next best.

The samples raised at Surat were found to be comparatively superior to those raised at Rahuri in technological performance.

G. arboreum Trials

Samples belonging to this trial were received from Akola, Amreli, Jalgaon, Nanded and Parbhani for microspinning tests. A few *G. hirsutum* strains were raised along with the *G. arboreum* strains. None of the *G. arboreum* strains showed promising performance even at 30s count. As expected, the *G. hirsutum* strains gave better spinning performance than *G. arboreum* strains.

G. herbaceum Trials

In the Co-ordinated Varietal Trial of *G. herbaceum*, 12 samples (9 *G. herbaceum* + 3 *G. hirsutum*) under irrigated conditions and 11 samples (8 *G. herbaceum* + 3 *G. hirsutum*) under rainfed conditions were raised at Surat and Broach, respectively. Most of the strains, viz., 2623 (HSC:32s), Sujay (HSC:30s), 6057 (HSC:29s), Digvijay (HSC:29s), 504 (HSC:28s), 2624-3148 (HSC:28s) and 6117 (HSC:27s) recorded identical performance at Surat and Broach. The strains Digvijay (HSC:38s), Sujay (HSC:35s), 6117 (HSC:35s) and 3245 (HSC:32s) at Broach recorded better spinning performance than at Surat.

The three *G. hirsutum* strains gave better technological performance than the *herbaceums*.

In the Preliminary Varietal Trial conducted at Surat, 9 out of 12 strains gave impressive performance at 40s count. Similarly in the case of 32 samples under Initial Evaluation Trial, none of the samples gave encouraging performance at 40s count.

Miscellaneous Trials

In the Pilot Project Demonstration Trial conducted at Badnawar and Indore (both under rainfed conditions), the following strains recorded impressive yarn strength at 60s count by full Spinning Technique :

Badnawar : IAN.579-188 and 66BH.5-91
Indore : ERB.4488, ERB.4492 and IAN.579-188

The strains 66BH.5-91 along with local control, Badnawar 1, fared well at 50s count in the District Varietal Trial conducted under rainfed conditions at Badnawar.

In the Long Staple Short Duration Trial under irrigated conditions at Badnapur, the strain MCU.5 showed spinning potential of 70s. Hybrid 4 included in this trial also recorded impressive yarn strength at 50s count.

Out of five *G. hirsutums* raised at Hansot under rainfed conditions, the strain IAN.579-188 and IAN.937 fared well at 60s count.

In the Compact Plant Type Trial conducted at Morena, the strain 70IH.481-1 showed spinning potential of 50s while in the trial of different dates of sowing the strain 70IH.446 sown in May was found to be suitabe for the same count.

In the *G. hirsutum-barbadense* Hybrid Trials conducted at Surat under irrigated conditions, the cross of Gujarat 67 with SB.289E was found to be superior to the crosses of Gujarat 67 with USSR.76, Marrad and ERB.4530 at 80s count.

In the Hybrid Trial conducted at Rahuri, the hybrid Varalaxmi (at both pickings) recorded the best spinning performance at 50s count followed by the crosses of Thanekar with Bonde and B.1007. The samples of Vishnu (IAN.579-188) at first and second pickings also recorded good yarn strength at 50s count.

In the *G. barbadense* Trial conducted at Kopargaon under irrigated conditions, the strain N.28 recorded best spinning performance at 80s count followed by Pima S.3 and Pima S.4.

In the Agronomy Trial conducted at Rahuri under irrigated conditions, the strain MCU.5 recorded very good performance in respect of mean fibre length, bundle strength and spinning at 50s count.

SOUTH ZONE

G. hirsutum Trials

Two sets of varieties were tested under Co-ordinated Varietal Trial. Samples of Set I were received from Siruguppa for full spinning and from Arabhavi, Dharwar and Kovilpatti for microspinning. Samples of Set II were received from Siruguppa for full spinning and from Coimbatore for microspinning. In addition, this trial was also conducted in the rice fallows of Tenali and these samples were tested for microspinning. The test results are summarised in Table 6.

TABLE 6 : SUMMARY OF THE TEST RESULTS OF THE STRAINS TRIED IN THE CO-ORDINATED VARIETAL TRIAL OF *G. hirsutum*, BR.04 RAISED AT DIFFERENT LOCATIONS IN SOUTH ZONE

Location	No. of samples	Mean fibre length, mm	Micronaire value	Maturity	Bundle strength (zero gauge), g/t	Count spun SKF	Spinning performance		Control
							No. of samples spinnable to the count selected	No. of samples better or on par with control	
Set I									
Siruguppa ..	18	24.1 to 30.5 (26.8)	3.4 to 5.0 (4.0)	Low to average	36.4 to 45.0 (40.0)	50s (full)	7	14	Hampi
Arabhavi ..	18	23.4 to 32.0 (28.4)	3.5 to 4.6 (3.9)	Low to average	39.1 to 48.2 (41.9)	50s (micro)	5	7	Vijaya
Dharwar ..	18	23.1 to 29.5 (26.8)	3.3 to 4.5 (3.7)	Low to average	38.6 to 44.5 (41.6)	50s (micro)	nil	15	GS.23
Kovilpatti ..	17	21.6 to 28.7 (25.8)	3.2 to 4.0 (3.5)	Low to average	40.7 to 47.2 (44.0)	50s (micro)	1	15	Bharathi
Set II									
Siruguppa ..	18	23.4 to 30.0 (26.2)	3.4 to 5.2 (4.3)	Low to average	38.1 to 49.3 (42.0)	50s (full)	9	17	Hampi
Coimbatore ..	21	22.1 to 29.5 (25.9)	2.9 to 5.0 (3.4)	Low to average	36.4 to 45.6 (41.9)	50s (micro)	12	9	MCU.5
Rice Fallows									
Tenali	8	23.9 to 29.0 (25.6)	3.8 to 4.8 (4.3)	Average	41.8 to 53.1 (47.1)	50s (micro)	3	2	Krishna

It may be seen from this table that the mean fibre length of the samples in Set I ranged from 21.6 mm to 32.0 mm and their fineness from 3.2 and 5.0. Some of the samples had low maturity at all places. The bundle strength values ranged between 36.4 g/t and 48.2 g/t. Regarding spinning, samples grown at Siruguppa and Arabhavi responded well at 50s count. As many as 14 samples from Siruguppa, and 15 each from Dharwar and Kovilpatti gave better spinning performance than local controls, Hampi, GS.23 and Bharathi, respectively.

As regards Set II, the mean fibre length ranged from 22.1 mm to 30.0 mm, the fineness from 2.9 to 5.2 and bundle strength from 36.4 g/t to 49.3 g/t. As many as 9 samples at Siruguppa and 12 samples at Coimbatore gave satisfactory performance at 50s count. Many samples in this set also gave better spinning performance than the local controls, Hampi and MCU.5, respectively.

In the case of samples from rice fallows at Tenali, it was noted that their mean fibre length ranged from 23.9 mm to 29.0 mm with satisfactory fineness and bundle strength. Three out of eight samples were found suitable for 50s count and out of these only two fared better than the local control Krishna.

In the case of Preliminary Varietal Trial, 16 samples from Arabhavi under irrigated conditions and 10 samples from Dharwar under rainfed conditions were tested for fibre properties and spinning performance by microspinning technique. As many as 8 out of 18 samples from Arabhavi recorded mean fibre length over 28.0 mm (1.10″). However, only three strains namely, MCU.5, 46-1 and ELS.177, responded well at 50s count.

In the case of samples from Dharwar, the mean fibre length was above 25.4 mm (1.0″) for most of the samples. Only three samples, viz., IAN.579-188, KW.68-2970 and 69BH.29-6-1 gave promising spinning performance at 50s count.

Samples pertaining to Initial Evaluation Trial were received from Arabhavi and Siruguppa under irrigated conditions and from Dharwar under rainfed conditions for microspinning tests. The strains promising at 50s count are indicated below :

Location	*No. of samples*	*Promising strains*
Arabhavi	16	ELS.391, GS.23-1009 and ELS.365
Siruguppa	15	MCU.5
Dharwar	16	GS.23-1009 and MCU.5

G. barbadense Trials

In the case of Co-ordinated Varietal Trial of *G. barbadense*, 17 samples (4 full spinning and 13 microspinning) raised under irrigated conditions at Coimbatore were received. In addition, a set of 13 samples raised under rainfed condition was also received from Arsikere for microspinning tests. As

regards the samples from Coimbatore, the best spinning performance at 80s count was given by the strain Suvin 62-6 followed by Suvin 62-17. The other promising strains were CBS.156, IBSI.57, N.27, Giza 7 and Sujata.

In the case of samples from Arsikere, only three samples, viz., CBS.148, IBSI.53 and Sujata fared well at 80s count.

G. arboreum Trials

Samples pertaining to the Co-ordinated Varietal Trial of *G. arboreum* were received from Coimbatore and Kovilpatti. Only one sample, 1512, raised at Coimbatore was found to be suitable for 30s count. The technological performance of the *hirsutums* raised under this trial was much superior to that of the *arboreums*.

G. herbaceum Trials

As regards the Co-ordinated Varietal Trial of the *herbaceums*, samples were received from Dharwar and Raichur under rainfed conditions for microspinning tests only. Of these, 6111 and 6062 fared well at 40s count (micro). The spinning performance of the samples from Raichur was very poor even for 30s count (micro).

The *hirsutum* strains in this trial gave better spinning performance than the *herbaceums*.

Miscellaneous Trials

Many miscellaneous trials were conducted at various locations. The important strains in the respective trials are indicated as follows :

Location	*Trial*	*Counts*	*Name of strain*
Raichur	Pilot Project Demonstration	50s (full)	Laxmi
Tenali	Miscellaneous	50s (micro)	A.218, IC.1058, Krishna, C.6-62 and V.14
Tenali	Preliminary Yield	50s (micro)	3440 and 338
Guntur	Miscellaneous	50s (full)	Imp.-A.179
Coimbatore	Breeding New Strains of Cambodia	50s (micro)	CRH.026, CRH.014 and CRH.041
IARI, Coimbatore	High Yielding Early Cultures	50s (full)	CP.15-20
Coimbatore	Main Strain Trial	60s (full)	MCU.5, ELS.271A, IS-MCU.5-2, ELS.334 and 46-1

Miscellaneous Trials of *G. barbadense* strains were also conducted at IARI, Coimbatore. Of these, the crosses of Suvin and Pima designated as SPH.IV/13-5, PSH.III/19-6 and PSH-I/16-12 realised very high strength at 100s count. The progeny, Suvin 62-1 (BK.9), also gave good performance at this count.

In the reselection programme of some of the exotic *G. barbadense* selections, one culture with experimental number EB.7-2-II/3-5 (reselected from Giza 69) raised at the IARI, Coimbatore, appears to have promising yield (on par with Sujata) and higher ginning percentage. This sample was spun to 100s count (micro). It gave almost the same yarn strength as that of Sujata.

Samples from West Bengal

In order to examine the adaptability in the rice fallows of West Bengal, trials were conducted at Moyna Development Block, Midnapur. The cotton selected for this was Krishna and two samples of this variety were tested for fibre properties and ginning percentage. The ginning percentage for both the samples was around 33.8. The mean fibre length was 25.7 mm for both the samples, with satisfactory maturity and bundle strength. These values are comparable to those of Krishna grown at Tenali.

Incidentally, the seeds were also critically examined and it was found that most of them were healthy.

EXTRA-LONG STAPLE (27 MM AND ABOVE) COTTONS

The results of the detailed tests carried out on extra-long staple cotton samples received and tested at the Laboratory during 1973 are shown in Table 7. This supplements the prominent strains described under the All India Co-ordinated Cotton Improvement Project.

MILL TESTS

Selected improved varieties of cotton which possess promising characteristics and are considered superior to the current ones on the basis of the Laboratory tests, are subjected to actual mill tests for their performance at the mills. Only after the superiority of the new varieties is confirmed by the mill tests, at least for two seasons, the varieties are recommended for large scale propagation. Necessary arrangements for carrying out mill tests are made by this Laboratory. A few mills have been co-operative enough to undertake such tests on the samples sent to them.

During the year, mill tests were carried out on eight samples. The comparative test results at the mill and the Laboratory are given in Table 8.

TABLE 7 : RESULTS OF EXTRA-LONG STAPLE (27 MM AND ABOVE) COTTONS TESTED IN 1973

Variety	Place	Mean fibre length		Fineness		Maturity coefficient	Bundle strength	
		mm	in.	Millitex	Micronaire value		Tenacity (zero gauge) g/t	PSI (zero gauge) lb/mg
Andhra Pradesh								
A.179	Guntur	30.5	1.20	126	3.2	0.65	**43.4**	8.1
IC.1715	,,	27.0	1.06	150	3.8	0.70	**40.2**	7.5
MCU.5	,,	27.0	1.06	138	3.5	0.67	**41.8**	7.8
A.218	Tenali	27.0	1.06	150	3.8	0.70	**52.5**	9.8
Giza 7	Yemmiganur	31.9	1.26	157	4.0	0.72	**45.6**	8.5
Sea Island	,,	32.8	1.29	157	4.0	0.71	**44.5**	8.3
Gujarat								
IAN.579-188	Achhalia	28.4	1.12	138	3.5	0.69	46.6	8.7
Hybrid 4	Amod (Broach dist.)	28.2	1.11	161	4.1	0.74	**48.8**	9.1
KH.2-12	Amreli	27.4	1.08	126	3.2	0.73	50.9	9.5
MCU.5	Amreli	27.9	1.10	110	2.8	0.68	**48.8**	9.1
Gujarat 67	Anjar	29.2	1.15	126	3.2	0.67	39.7	7.4
Hybrid 4	Dakor (Kaira dist.)	28.3	1.11	150	3.8	0.71	41.3	7.7
IAN.579-188	Hansot	29.7	1.17	150	3.8	0.69	50.9	9.5
IAN.937	,,	29.0	1.14	142	3.6	0.68	**46.1**	8.6
Hybrid 4	Himatnagar	28.3	1.11	161	4.1	0.73	**47.7**	8.9
66BH.5-91	Junagadh	28.2	1.11	165	4.2	0.84	52.0	9.7
70IH.446	,,	27.2	1.07	154	3.9	0.83	50.4	9.4
70IH.452	,,	27.4	1.08	130	3.3	0.85	46.6	8.7
CP.25-1	,,	28.4	1.12	142	3.6	0.78	48.8	9.1
CP.1998F	,,	27.9	1.10	157	4.8	0.83	45.6	8.5
Deviraj	,,	27.7	1.09	161	4.1	0.87	45.6	8.5
IAN.579-188	,,	27.9	1.10	142	3.6	0.76	45.0	8.4
IAN.4757	,,	28.7	1.13	142	3.6	0.72	45.0	8.4
Kampala	,,	27.0	1.06	146	3.7	0.75	42.3	7.9
MCU.5	,,	30.0	1.18	114	2.9	0.81	47.2	8.8
66BH.5-91	Surat	29.2	1.15	177	4.5	0.85	49.3	9.2
70IH.446	,,	27.7	1.09	157	4.0	0.83	52.0	9.7
70IH.452	,,	29.2	1.15	189	4.8	0.90	48.8	9.1
Andrews	,,	32.8	1.29	157	4.0	0.85	47.2	8.8
CBE.25	,,	33.3	1.31	157	4.0	0.81	52.0	9.7
CBE.34	,,	32.8	1.29	165	4.2	0.85	50.4	9.4
CBE.148	,,	30.7	1.21	169	4.3	0.87	49.8	9.3

TABLE 7 : RESULTS OF EXTRA-LONG STAPLE (27 MM AND ABOVE) COTTONS TESTED IN 1973—(*Contd.*)

Variety	Place	Mean fibre length		Fineness		Maturity coefficient	Bundle strength	
		mm	in.	Millitex	Micronaire value		Tenacity (zero gauge) g/t	PSI (zero gauge) lb/mg
Gujarat—(Contd.)								
CP.15-2	Surat	27.2	1.07	181	4.6	0.83	46.6	8.7
CP.25-1	,,	27.9	1.10	165	4.2	0.86	49.3	9.2
CP.1998F	,,	27.9	1.10	193	4.9	0.85	47.7	8.9
Deviraj	,,	27.4	1.08	161	4.1	0.81	43.4	8.1
ERB.4488	,,	32.0	1.26	165	4.2	0.86	45.0	8.4
ERB.4492	,,	31.2	1.23	165	4.2	0.86	46.6	8.7
ERB.4530	,,	31.2	1.23	169	4.3	0.74	47.7	8.9
ERB.4530 × Guj. 67 ..	,,	32.8	1.29	118	3.0	0.67	44.0	8.2
Exotic 3 + (G. 67 × Moco)F_1 II year	,,	30.7	1.21	118	3.0	0.63	47.7	8.9
Exotic 3 + (G. 67 × Moco)F_1 III year	,,	31.2	1.23	110	2.8	0.59	45.6	8.5
Exotic 3 + (G. 67 × Moco)F_1 IV year	,,	31.5	1.24	110	2.8	0.59	46.6	8.7
Giza 7	,,	32.3	1.27	154	3.9	0.86	47.2	8.8
Gujarat 67 × Marrad ..	,,	33.8	1.33	118	3.0	0.67	40.7	7.6
(Gujarat 67 × Moco) F_1 ..	,,	32.3	1.27	114	2.9	0.61	44.5	8.3
Guj. 67 × SB.289E	,,	34.8	1.37	114	2.9	0.70	48.2	9.0
Gujarat 67 × USSR.76 ..	,,	33.8	1.33	118	3.0	0.70	43.4	8.1
Hybrid 4 (first flush) ..	,,	29.0	1.14	181	4.6	0.74	44.0	8.2
IAN.579-188	,,	29.7	1.17	142	3.6	0.69	51.5	9.6
IAN.4757	,,	29.5	1.16	169	4.3	0.83	48.2	9.0
IBSI.53	,,	32.8	1.29	157	4.0	0.88	49.3	9.2
IBSI.57	,,	31.0	1.22	169	4.3	0.87	49.3	9.2
Kampala	,,	27.9	1.10	157	4.0	0.80	41.3	7.7
LL.60	,,	27.4	1.08	177	4.5	0.90	42.3	7.9
Marrad	,,	32.0	1.26	154	3.9	0.85	48.8	9.1
MCU.5	,,	30.7	1.21	138	3.5	0.82	48.8	9.1
N.27	,,	31.5	1.24	154	3.9	0.85	51.5	9.6
Sujata	,,	32.0	1.26	157	4.0	0.87	52.0	9.7
Suvin 62-6	,,	36.5	1.43	134	3.4	0.82	50.4	9.4
Suvin 62-17	,,	35.1	1.38	122	3.1	0.82	48.2	9.0
Tadla 2	,,	30.0	1.18	193	4.9	0.88	41.8	7.8

TABLE 7 : RESULTS OF EXTRA-LONG STAPLE (27 MM AND ABOVE) COTTONS TESTED IN 1973—(*Contd.*)

Variety	Place	Mean fibre length		Fineness		Maturity coefficient	Bundle strength	
		mm	in.	Millitex	Micronaire value		Tenacity (zero gauge) g/t	PSI (zero gauge) lb/mg
Gujarat—(Contd.)								
Ys+(G. 67 × Moco) F_1 I year..	Surat	31.2	1.23	118	3.0	0.64	46.1	8.6
Ys+(G. 67 × Moco) F_1 I year.. Rainfed	,,	31.5	1.24	110	2.8	0.59	47.2	8.8
70IH.446	Talod	27.0	1.06	110	2.8	0.69	51.5	9.6
70IH.452	,,	27.9	1.10	122	3.1	0.70	48.2	9.0
Deviraj	,,	27.2	1.07	122	3.1	0.70	43.4	8.1
IAN.80	,,	27.0	1.06	165	4.2	0.73	42.0	7.5
IAN.4757	,,	30.2	1.19	118	3.0	0.71	46.6	8.7
Haryana								
H.297	Hissar	27.9	1.10	146	3.7	0.77	48.2	9.0
SH.269	,,	27.0	1.06	157	4.0	0.76	46.6	8.7
SH.369	,,	27.7	1.09	157	4.0	0.80	48.8	9.1
IARI								
CP.15-20	Coimbatore	27.4	1.08	146	3.7	0.69	43.4	8.1
CP.1998F	,,	27.0	1.06	154	3.9	0.68	39.1	7.3
4-1	New Delhi	27.2	1.07	173	4.4	0.73	42.9	8.0
MCU.5-21	,,	29.2	1.15	154	3.9	0.71	41.3	7.7
MCU.5-37	,,	30.0	1.18	157	4.0	0.70	41.3	7.7
Karnataka								
Varalaxmi	Gajendragad (Dharwar dist.)	27.9	1.10	118	3.0	0.64	40.7	7.6
S.I. Andrews	Mysore	30.8	1.21	154	3.9	0.72	41.8	7.8
66BH.5-91	Siruguppa	27.7	1.09	169	4.3	0.84	45.0	8.4
70IH.452	,,	27.0	1.06	197	5.0	0.88	39.7	7.4
AS.31	,,	29.0	1.14	150	3.8	0.79	40.2	7.5
CP.25-1	,,	29.2	1.15	134	3.4	0.75	41.8	7.8
ELS.0162	,,	28.4	1.12	142	3.6	0.79	38.6	7.2
ELS.117	,,	27.0	1.06	150	3.8	0.79	40.7	7.6
ELS.139	,,	27.4	1.08	169	4.3	0.78	40.7	7.6
ELS.191	,,	27.9	1.10	154	3.9	0.83	39.1	7.3
ELS.201	,,	28.2	1.11	146	3.7	0.75	41.8	7.8
ELS.250	,,	29.0	1.14	169	4.3	0.82	38.1	7.1

TABLE 7 : RESULTS OF EXTRA-LONG STAPLE (27 MM AND ABOVE) COTTONS TESTED IN 1973—(*Concld.*)

Variety	Place	Mean fibre length		Fineness		Maturity coefficient	Bundle strength	
		mm	in.	Millitex	Micronaire value		Tenacity (zero gauge) g/t	PSI (zero gauge) lb/mg
Karnataka—(Contd.)								
IAN.579-188	Siruguppa	28.2	1.11	150	3.8	0.79	39.1	7.3
IAN.4757	,,	28.7	1.13	157	4.0	0.77	41.3	7.7
MCU.5	,,	30.0	1.18	138	3.5	0.78	45.0	8.4
SS.167	,,	27.0	1.06	134	3.4	0.72	45.0	8.4
Madhya Pradesh								
66BH.5-91	Badnawar	27.2	1.07	154	3.9	0.70	50.9	9.5
70IH.452	,,	27.0	1.06	169	4.3	0.84	43.4	8.1
Indo B.4757	,,	27.4	1.08	150	3.8	0.82	49.3	9.2
Kampala	,,	27.7	1.09	126	3.2	0.69	42.3	7.9
MCU.5	,,	30.0	1.18	118	3.0	0.67	43.4	8.1
Badnawar 1	Dhar	27.7	1.09	142	3.6	0.69	46.6	8.7
ERB.4488	Indore	29.7	1.17	173	4.4	0.72	50.9	9.5
ERB.4492	,,	29.7	1.17	169	4.3	0.71	44.5	8.3
IAN.579-188	,,	27.0	1.06	114	2.9	0.57	46.1	8.6
66BH.5-91	Khandwa	29.8	1.17	150	3.8	0.73	45.0	8.4
Khandwa 1	,,	27.4	1.08	173	4.4	0.77	42.9	8.0
Maharashtra								
Hybrid 4	Badnapur	27.9	1.10	146	3.7	0.67	40.2	7.5
Laxmi	,,	28.2	1.11	146	3.7	0.69	39.1	7.3
MCU.5	,,	30.0	1.18	126	3.2	0.62	47.2	8.8
Hybrid 4	Kopargaon	27.2	1.07	146	3.7	0.69	37.0	6.9
MCU.5	,,	31.2	1.23	118	3.0	0.60	43.4	8.1
H.4	Nanded	27.9	1.10	173	4.4	0.78	31.6	5.9
Tamil Nadu								
46-1	Coimbatore	30.0	1.18	122	3.1	0.61	40.2	7.5
ELS.177	,,	28.7	1.13	122	3.1	0.62	38.6	7.2
ELS.191	,,	28.2	1.11	126	3.2	0.63	36.4	6.8
ELS.234-5	,,	27.7	1.09	122	3.1	0.62	36.4	6.8
ELS.268	,,	28.7	1.13	114	2.9	0.62	39.7	7.4
ELS.271A	,,	30.0	1.18	118	3.0	0.61	42.9	8.0
ELS.334	,,	29.7	1.17	122	3.1	0.63	39.7	7.4
MCU.5	,,	29.3	1.15	138	3.5	0.68	42.3	7.9

TABLE 8 : COMPARATIVE MILL AND LABORATORY TESTS—SPINNING TEST RESULTS

Place	Variety	Laboratory Results				Mill Test Results			
		Waste, %	Count	Strength	t.m.	Waste, %	Count	Strength	t.m.
Madhya Pradesh									
Khandwa	Khandwa 2	16.3	30s	57.8	4.0	—	30s	62.6	4.0
„	Maljari	16.6	30s	51.0	4.0	—	30s	52.4	4.0
„	66BH.5-91	14.4	40s	49.2	4.0	—	40s	57.2	4.0
„	Khandwa 1	10.6	40s	40.1	4.0	—	40s	46.7	4.0
Punjab									
Ludhiana	J.205	14.5	30s	63.2	4.0	—	30s	50.2	4.0
„	J.34	10.8	30s	52.1	4.0	—	30s	48.2	4.0
Tamil Nadu									
Kovilpatti	K.8	8.5	30s	76.4*	4.0	7.4	30s	76.0	4.0
„	K.7	7.5	30s	62.7*	4.0	8.2	30s	48.2	4.0

* SKF Drafting System.

Note : The spinning system and machinery employed by the mills are in many respects different from those adopted at this Laboratory and hence the strength values are not strictly comparable.

It will be seen that in Madhya Pradesh, Khandwa 2 and 66BH.5-91 gave better spinning performance than the control varieties Maljari and Khandwa 1, respectively, at both the mill and the Laboratory. In Punjab, J.205 gave better spinning performance than J.34 at the mill as well as at the Laboratory. In Tamil Nadu, K.8 was definitely better than K.7 at the mill as well as at the Laboratory.

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

Lint samples of fair-average quality of the Major Trade Varieties of Indian Cottons are being obtained through the East India Cotton Association, Ltd., Bombay, each season. Representative *kapas* samples of the varieties are procured from the State Departments of Agriculture for determination of ginning percentage. The fibre and spinning test results, ginning percentage and other test results on each variety of cotton were published as Technological Circulars as early in the season as possible for the information of the cotton trade and industry. Such circulars were issued on 37 varieties during 1973. The test results on all the Trade Varieties of 1971-72 season were compiled together and published as "Technological Report on Trade Varieties of Indian Cottons, 1971-72 Season". Most of the 1972-73 season samples have been received and tested.

Evaluation of the Quality of Standard Indian Cotton Varieties Maintained at Chief Cotton Research Stations

In order to assess the seasonal fluctuations in the characteristics of Indian cottons and with a view to judging the comparative superiority or otherwise of the newly evolved strains, a number of selected varieties of Indian cottons, called Standard Indian Cottons, are tested at the Laboratory every year. These are grown under identical conditions from year to year on the government farms under departmental supervision. Extensive fibre and spinning tests are regularly carried out on such samples. The results obtained on the samples received are published as Technological Circulars for the information of the Cotton Breeders and other research workers as early in the season as possible. During 1973, such circulars were issued on 14 varieties. The results of all the samples pertaining to the 1971-72 season were consolidated and published at the end of the season as "Technological Report on Standard Indian Cottons, 1971-72 Season". Most of the samples of Standard Indian Cottons of the 1972-73 season have been received and tested.

Evaluation of Linter, Oil and Gossypol Contents of Various Genetic Stocks for Evolving Varieties with Higher Oil and Low Gossypol Content

Seed index and oil content of 28 cotton seed samples were determined. Oil content on 10% moisture basis varied from 16.4% (MCU.4) to 22.1% (Glandless 5632/3435/5294). Linter and kernel per cent were determined on six cotton

seed samples. Free gossypol content was estimated in the kernels of 28 samples and the gossypol content varied from 0.10% (BC.68 × Acala-423/5215/8950) to 2.22% (Glandless 5630/3418/5284). Of these, nine samples, mostly glandless varieties received from Surat, were almost free from gossypol. Some of these varieties had higher content of protein than the glanded varieties.

Determination of protein content in the kernels of 15 seed samples showed that the protein content varied from 33.2% (Glandless 5632/3438/5294) to 41.5% (Glandless 5631/3422/5288). The oil content varied from 29.1% (MCU.4) to 38.5% [(ISC.67 Glandless) (Fo/3669/3478/5305)] in the kernels of 10 seed samples.

Evaluation of Protein Composition of Indian Cotton Seeds

It is proposed to collect basic information on protein composition of Indian cotton seeds. Amongst the different methods tried for the preparation of suitable hydrolyzate from defatted cotton seed kernels for amino acid analysis, acid hydrolyzate method was found suitable. This method has been standardised. Further work is in progress.

Study of Free Radicals Formed by Gamma-ray Radiation in Chemically Modified Cottons

It was observed from previous studies that benzoylation treatment offered maximum radio-protection to cellulose molecule. The tenacity retained, D.P. retained and the protection coefficient values of the benzoylated samples of varying degrees of substitution (D.S.) irradiated to a dosage of 1×10^7 rads showed a transitional stage between D.S. 1.28 and 1.58. The structural changes revealed by x-ray techniques also pointed out that at a D.S. of 1.58, cellulosic peaks (101) and ($10\bar{1}$) merge together. With a view to find out a reason for this behaviour, it was thought desirable to study the relative reactivities of the primary and secondary hydroxyl groups in cellulose benzoate of increasing D.S. Various chemical methods, such as oxidation, chemical substitution, etc., were tried for estimating relative reactivity of hydroxyl groups of cellulose benzoate but these attempts were not successful. As earlier investigations had shown that free primary hydroxyl groups at C-6 position of cellulose got oxidized to uronic acid on irradiation with gamma-rays, an attempt was made to determine the relative reactivity of various hydroxyl groups indirectly by estimating the presence of free hydroxyl groups at C-6 position in cellulose benzoate.

Benzoylated cellulose samples of varying D.S. were irradiated to dosage of 1×10^7 rads and the amount of uronic acid formed in each case was estimated. Knowing the amount of uronic acid formed on irradiation of untreated cellulose, the percentage of free hydroxyl groups at C-6 position in the cellulose benzoate was calculated. The percentage of hydroxyl groups at C-2 and C-3 could then be estimated from the D.S. of the cellulose benzoate. The

results indicated that initially at lower D.S., substitution took place predominantly at C-6 group. However, at a D.S. of 1.58 the reactivity of C-2 and C-3 groups was higher than that of C-6. This change in relative reactivity also caused the observed changes in the properties of cellulose benzoate at the D.S. of 1.58.

Chlorodeoxy celluloses of four different chlorine contents, viz., 0.3, 1.2, 1.9 and 3.5%, were prepared and analysed. The tenacity values did not show degradation but the formation of reducing groups increased considerably. Chlorodeoxy cellulose of chlorine content, 1.9%, was treated with anhydrous ethylene diamine to prepare diaminodeoxy cellulose. Further work is in progress.

Response of Indian Cottons to Crosslinking Treatment with a View to Evolve Cotton Varieties Most Suitable for Chemical Finishing Treatments

In the previous Annual Report it had been mentioned that samples of Digvijay, Sanjay, Gujarat 67, Deviraj, Sujata and Suvin were treated in fibre form with formaldehyde. The samples were tested on Instron Tensile Tester for load-elongation characteristics. The typical curves are shown in Figure 1.

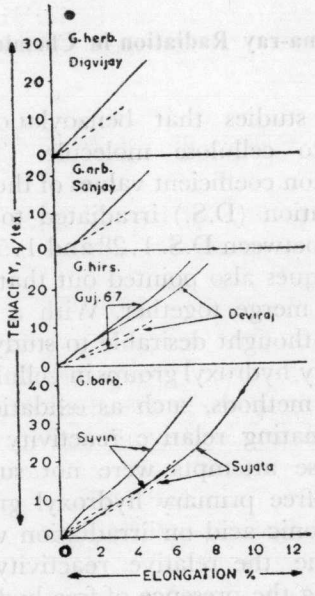

Fig. 1: Typical tenacity-elongation curves for single fibres of six formaldehyde crosslinked cottons, widely differing in physical properties (original—; crosslinked....)

The investigation was extended to cotton yarns during the year. Yarns of six varieties of cotton, viz. Digvijay, Sanjay, Deviraj, Gujarat 67, MCU.1 and Hybrid 4, were crosslinked with formaldehyde employing 'Form W' process. The bound formaldehyde in treated samples was maintained around 0.5%. The treated and untreated yarn samples were evaluated for strength-elongation characters on the Intsron Tensile Tester. The tenacity retained ranged from 41 per cent (MCU.1) to 33 per cent (Hybrid 4). Elongation retained varied from 55 per cent (MCU.1) to 40% (Hybrid 4).

Dimethylol dihydroxy ethylene Urea (DMDHEU), another resin, widely used in the textile industry as a crosslinking agent was also employed to treat a number of varieties of cotton in both fibre and yarn form. The varieties screened so far are : Digvijay, Sanjay, Deviraj, Gujarat 67, MCU.1, Hybrid 4, Suvin and Sujata. Preliminary work on standardisation revealed that 8 per cent DMDHEU concentration was adequate to impart wash-wear properties to the yarns. The formulation of 8 per cent DMDHEU, 3 per cent Mg $Cl_2 6H_2O$, 1 per cent polyethenol (softener) and 0.1 per cent wetting agent was used. Nitrogen estimation was carried out on crosslinked fibre and yarn samples to determine DMDHEU uptake. Strength and elongation characteristics were determined on yarn and fibre samples on the Instron Tensile Tester. Tenacity retention in treated yarns was very high in Sanjay 81.0 per cent followed by Digvijay 70.0 per cent and low in Deviraj 53.0 per cent. Elongation retention was very high in Sanjay (90 %) followed by Digvijay (87%) and low in Deviraj (57%).

In the case of fibres crosslinked with DMDHEU, single fibre tenacity retention varied from 52% (Sanjay) to 29% (Hybrid 4). Elongation retention was very high in Sanjay (80%) and low in Hybrid 4 (41%).

Among the six cottons screened for the response to DMDHEU treatment in yarn form, Sanjay, Digvijay and MCU.1 responded well with respect to the retention of tenacity and elongation.

Study of the Effect of Crosslinking Treatments on the Structure, Number and Distribution of Crosslinks

Purified lint sample of MCU.3 cotton was treated with formaldehyde under 'D' and 'W' baths. Treatments were carried out for different periods of time. Crosslinked samples were studied for moisture regain at two levels of humidity, 65 per cent and 85 per cent rh.

Purified lint samples were swollen with different swelling agents, viz. phosphoric acid (80%), sulphuric acid (60%), zinc chloride (63%) and sodium hydroxide (20%). These samples were crosslinked with formaldehyde by 'Form D' and 'Form W' processes for different periods of time. Treatment in 'Form D' bath varied from 5 min. to 30 min. and in 'Form W' bath from 5 min. to 2 hr. These samples were studied for moisture regain at 65 per cent and 85 per cent rh, and for number of effective linkages employing the sol-gel technique.

Data on the swollen and crosslinked samples showed higher moisture sorption and marked increase in insolubility per cent with increase in reaction time compared to the unswollen sample.

Fabrication of an Extractor for Improving the Ginning of *Kapas*

The changes made in the position and the speed ratios of various rollers and cylinders in the extractor affected the cleaning efficiency and sometimes

caused choking. In order to obtain optimum cleaning efficiency for *kapas* containing bigger and finer impurities and to avoid choking of *kapas* in the machine, the position of rollers with suitable speed ratios were readjusted. Preliminary trials carried out on this machine using a few samples of trashy *kapas* gave encouraging results.

It is proposed to conduct regular trials on trashy cottons in order to ascertain the cleaning efficiency of the machine before the machine can be released for use in ginning factories.

Investigation of the Microbial Decomposition of Cellulose in Indian Environments with Special Reference to Cellulolytic Enzymes Produced by Fungi Isolated from Cotton and Cotton Products

Productions and characterization of cellulase enzyme

Various cellulosic agricultural waste materials are being screened for cellulase production by *Penicillium funiculosum*. The *Trichoderme viride* medium (TVM) earlier used for growing *P. funiculosum* is being modified to enhance the enzyme production.

Cotton seed hulls, rice husk, rice straw and wheat bran were suitably treated with alkali and a bleaching agent. In addition, unbleached and bleached samples of wheat straw pulp and bagasse pulp were also obtained from commercial sources. All these cellulosic materials were screened as substrates for cellulase production by *P. funiculosum*. Rice husk proved a good substrate for the enzyme production.

The TVM was supplemented with various sodium salts of organic acids and different higher alcohols. Sodium formate was toxic but sodium succinate gave encouraging cellulase production. Among the alcohols, polyethlene glycol and mannitol enhanced cellulase production.

Various inorganic and organic nitrogen compounds were incorporated in TVM to replace ammonium sulphate and peptone, respectively. Diammonium hydrogen phosphate was found to be a superior inorganic nitrogen source while tryptone, tryptose and to a certain extent corn steep liquour proved better sources of organic nitrogen.

Incorporation of commercial surfactants in TVM showed little improvement in cellulase production. Among the six surfactants that were tried Tween 80 proved helpful to some extent.

Precipitation : The cell-free filtrate was precipitated with chilled acetone at —20°C and the water soluble part of the precipitate was lyophilized to a white enzyme powder. This powder showed good activity.

The concentrated enzyme filtrate was chromatographed on Sephadex G-75 and DEAE Sephadex to separate the components of the cellulase enzyme complex. Further work is in progress.

Microcrystalline cellulose (Avicel), hydrocellulose and purified cotton samples were treated with cellulase from *P. funiculosum* which is rich in C_1

factor. The samples were subjected to x-ray analysis to study the changes in crystallinity and crystallite width.

Marine fungi : Enzyme kinetic studies were completed on three cellulolytic marine fungi.

Chitinase : Chitosan is deacetylated chitin obtained from prawn shell waste. Central Institute of Fisheries Technology (CIFT), Cochin, has developed the technology to produce chitosan from this waste material. Chitosan may have many applications in the textile industry particularly as a sizing and finishing material. An enzyme to remove the chitosan may, therefore, be needed. About 18 actinomycetes and 6 bacteria were isolated from chitin and chitosan enrichments during last year. Identification of the cultures, and rapid screening of the isolates for enzyme elaboration by zone clearance on opaque plates is in progress. Among the bacteria, a *Bacillus* sp. seems promising.

Isolation and Study of Thermophilic Amylolytic Microorganisms to Produce Desizing Enzyme Stable at High Temperature

Amylolytic microorganisms were isolated by enrichment culture technique and their activity tested on starch plates. Eight mesophilic (grown at 30°C) and six thermophilic (grown at 50°C) cultures were isolated from compost and soil. No promising isolate could be obtained from sewage samples.

The above isolate were further studied in modified Davis medium. Two cultures, one mesophilic and one thermophilic, were good producers of amylase. *Bacillus subtilis* culture obtained from Prof. J. V. Bhat of Indian Institute of Science, Bangalore, is a better isolate for amylase.

A colorimetric method for studying amylase activity was standardised. Further isolation of cultures from various soil samples and compost is in progress.

Study of the Effect of Drying Temperature on the Formation of Convolutions and Spiral Angle of Cotton Fibre Extracted in Turgid State from Cotton Boll and the Bilateral Structure of Cotton

Convolutions and spiral angle

The fibres extracted from 56 days old cotton bolls of Digvijay were dried at four temperatures, viz. 28°C, 60°C, 105°C and 120°C and number of convolutions and reversals of each samples were determined. These results and earlier results on Sujata cotton showed that the number of convolutions and reversals increased marginally when the samples were dried at 60°C. This finding was in conformity with the earlier results. No further changes were observed when the samples were dried at 105°C and 120°C.

Electron microscope investigations

To investigate the 'bilateral' structure in cotton fibre, and other related studies at the ultrastructural level, the newly acquired Hitachi electron microscope has been commissioned. The Porter Blum ultramicrotome has also been installed and is working satisfactorily. The technique of embedding and making ultra-thin sections suitable for electron microscopy work has been standardised.

Various techniques, viz : (*i*) thin carbon supporting film for the grids, (*ii*) layer expansion, (*iii*) replica, (*iv*) fragmentation, (*v*) cuene solubility, and (*vi*) metal shadowing have been standardised. Work is in progress on normal and chemically treated cottons. So far, 170 electron micrographs have been taken.

Some Optical and X-ray Studies on Cotton Fibres

Work on the setting-up of the Fibre Refractometer was completed. The performance of the refractometer was tested with fibres like nylon, viscose rayon and cotton. Samples of six varieties of cotton covering a wide range in orientation were slack mercerized and their refractive indices determined on the refractometer. The birefringence values of all the cottons calculated from their refractive indices were nearly the same indicating nearly equal orientation and possibly equal spiral angle in all slack mercerized cottons.

A Study of the Bulk Resilience of Cotton

Preliminary work has been taken up to design and fabricate an apparatus for measurement of bulk resilience of cotton fibres.

Crystallite Orientation in Textile Fibres as Studied by Their Meridional (040) X-ray Diffraction Arcs

Attempts were made to resolve the 002 and 040 profiles of a few cottons, chosen from different genetic species, and ramie to obtain and compare the value of the spiral angle and the crystallite orientation angle. The method adopted by Deluca and Orr was modified slightly for this purpose with a view to achieving greater precision in the estimates of the above parameters. However, the profiles of some samples could not be resolved by either of the above methods. Results obtained so far indicated that the 040 profile gives higher values of the spiral angle and the crystallite orientation angle compared to those yielded by the 002 profile, which is in agreement with the lower values of the orientation factors obtained from the meridional profiles compared to those derived from the equatorial profiles.

Studies on the Lateral Compressibility of Chemically Modified Cotton

With a view to standardising the procedure for measuring the lateral compressibility, some preliminary work was done by taking two standard wool top samples supplied by the USDA and testing them for lateral modulus with the aid of the apparatus fabricated for this purpose. Twenty wool fibres of nearly equal diameter were chosen from each sample, the lateral and longitudinal moduli were calculated for each set of 20 fibres. A positive correlation was observed between the two moduli signifying a fair degree of mechanical isotropy perhaps on account of poor molecular orientation in these fibres.

Studies on Linear Density and Its Influence on Fibre Tenacity

Using the vibroscope attachment made on the Instron Tensile Tester, the linear density as well as breaking strength were determined for individual fibres taken from Sanjay, Sujata, Egyptian Giza, Laxmi and Hybrid 4 cottons. The wall thickness was also measured for the broken fibres.

Cotton	Maturity coefficient, Mc	CV (%) in linear density of individual fibres	CV(%) in tenacity	
			Using individual linear density	Using average linear density
Sanjay	0.89	25.7	39.4	43.7
Sujata	0.82	28.6	37.0	43.1
Egyptian Giza	0.81	28.7	33.1	46.7
Laxmi	0.75	33.8	34.1	48.3
Hybrid 4	0.62	41.9	34.6	52.1

It was seen from the above results that linear density varied widely from fibre to fibre within a cotton. The extent of variability as assessed by the CV% was least for cottons characterised by high maturity and vice versa. Further, fibre tenacity based on individual linear density showed appreciably lesser variability (coefficient of variation, CV%) compared to that based on the average linear density of bulk sample which is the method commonly used in practice.

Regarding breaking strength of fibres, it was observed that the value increased with increasing linear density in the beginning, but thereafter levelled off. For each cotton, the value of linear density at which fibre strength levelled off was close to the average linear density of the cotton. On account of this effect, fibres with linear density higher than the average would actually show lower breaking tenacity. This indicated that in a highly mature fibre, a portion of the cellulosic material (fibrils) constituting the fibre wall does not contribute its share to the breaking strength of the fibre.

Effect of Insecticide Treatments on the Quality of Cotton

Verticillium-wilt resistant selections of MCU.5

Fourteen samples of MCU.5 variety (1971-72) from *Verticillium*-wilt resistant selections treated with the insecticides, Carbaryl and Endosulfan, received from the IARI, Coimbatore, were subjected to usual fibre and micro-sipnning tests. It was observed that there was no significant change in fibre characters and yarn strength compared to control.

Samples of Sujata cotton

Samples of Sujata cotton from the insecticidal trials were received for three seasons during 1969-71. The treatments were common and the insecticides were Carbaryl, Endosulfan, Phosalane and Monocrotophos. The test results of the samples treated with the above insecticides were analysed and compared. It was observed that only two fibre characters, viz. mean length and bundle strength at 1/8 in. gauge, were affected. However, no consistent trend in the changes of these characters was observed. The treatment with Monocrotophos showed significant increase in fibre length in all the three seasons, whereas there was a slight reduction in bundle strength at 1/8 in. gauge.

Fabrication of a New Fibre Stapler

Revised regression equations have been arrived at for predicting the Baer Sorter equivalents of fibre length characteristics for cotton obtained from the Interferometric Fibre Stapler (IFS), based on the results of 50 cottons, including the results of 24 cottons tested earlier.

These equations and the correlation coefficients are given below :

Length parameter	Correlation coefficient	Regression equation
Mean length	0.99	B = I + 0.03
Effective length	0.97	B = 1.06 I + 0.02
SF%	0.64	B = 0.62 I + 5.6
CV%	0.63	B = 0.81 I + 6.5

B and I denote the corresponding length parameters obtained by the Baer Sorter and IFS, respectively.

A formula for calculating the coefficient of variation (CV%) of length and a procedure for evaluating the effective length and SF(%) have been prepared so as to eliminate the need to construct the distribution curve.

A Study of the Influence of Fibre Taper on the Thickness Profile of an Aligned Tuft

Six samples of cotton having mean length ranging from 0.67 to 1.14 in. were selected for the study. Sufficient number of slivers were prepared for each cotton sample with the help of a draw box. Using the Baer Sorter instrument, fibres of four different length groups were separated and the tuft of fibres of each length group was scanned on the Interferometric Fibre Stapler (IFS). From the readings noted, the thickness profile of the tuft was drawn for each length group.

The thickness profile of each length group was symmetric with a peak or a plateau in the middle of the length for all the six samples. This indicates that individual fibres are thicker at or near the mid-point irrespective of the individual fibres showing any symmetry in their profile at the base and tip ends. Attempts are being made to construct the envelope of the profiles of all the groups when they are superimposed.

Study on the Evenness and Strength of Material at Different Stages of Processing with Different Systems of Processing

One more cotton A.51-9 was spun to 40s count. The irregularity of the material was determined at different stages of processing. The yarns spun on four different ring frames were tested for yarn characteristics. All the yarn samples were tested for visual observation by ASTM yarn gradation method. It is proposed to continue the work further so as to cover five cottons in each count range.

Standardisation of Imperfection Indicator

With introduction of SKF drafting system for spinning finer counts under the modernisation scheme of the Laboratory, it was found desirable to study variation in imperfections in the yarns spun with 3 different systems in vogue now viz., 3-Roller, A-500 and SKF, and fix up suitable norms for different parameters obtained in Uster Evenness Test, namely U%, thin places, thick places and neps for 125 m length of yarns. For this purpose, yarns of 40s count spun on 3-Roller system were tested. For measuring imperfections —50, 2, 2 positions were kept for thin places, thick places and neps respectively on Imperfection Indicator. The results of analysis were as follows :

Parameter	Range	Mean	CV%	SE%	CD%	CD for mean
U%	18.6- 27.8	23.7	3.02	0.96	2.7	0.6
Thin places ..	66 - 672	317	21.8	6.9	19.0	61.0
Thick places ..	33 - 385	302	16.1	5.1	14.0	29.0
Neps	12 - 274	113	17.1	5.4	15.0	17.0

It was observed that if 10 bobbins in a sample were tested, the values of U%, thin places, thick places and neps will have an accuracy of 2%, 14%, 10% and 10%, respectively.

Thirty samples of 50s count spun on SKF system were tested for yarn unevenness and imperfections [at(—50), 3, 3 sensitivity positions] on Uster Evenness Tester during the period under report. The data relating to 50s count spun on SKF were analysed. These results are given below :

Parameter	Range	Mean	CV%	SE%	CD%	CD for mean
U%	17.3- 25.1	20.2	3.7	1.1	3.4	0.7
Thin places ..	14 - 199	65	32.8	10.4	20.4	19.2
Thick places ..	60 - 344	163	16.1	5.1	14.4	23.4
Neps	60 - 484	186	14.3	4.5	12.8	23.8

It was observed that, if 10 bobbins in a sample were tested, the values of U%, thin places, thick places and neps will have an accuracy of 2.3%, 20%, 10% and 9%, respectively. Further work is in progress.

Studies on the Bundle Strength of Cotton in Non-conditioned Atmospheres

Ten varieties of cotton covering a wide range of tenacity were chosen for the study. Sufficient number of slivers were prepared for each of the 10 cottons as well as for five USDA calibration cottons, covering the same range of tenacity. The slivers were conditioned at 65% r.h. in a box after predrying over anhydrous calcium chloride.

By the above procedure, all the 10 cottons have so far been tested at an ambient humidity of 75% besides at the control 65% r.h. It has been observed that the above procedure of preserving both test cotton and the calibration cotton at 65% r.h. and testing them at an ambient humidity of 75% r.h. gives nearly the same value as when the test is done at 65% r.h. itself, within experimental errors.

Evaluation of Nep-potential by Nepotometer

In order to evaluate the grades of neps formed on Nepotometer, it was decided to process separately 20 grains and 25 grains of each sample at two different running times, viz. 4 and 6 min., to study which of the four combinations of quantity and time correlate with the neps in the yarn or yarn appearance grade. Twelve cottons from each of the three micronaire fineness groups: (*i*) fine—3.0 to 3.9, (*ii*) medium—4.0 to 4.9, and (*iii*) coarse—5.0 and above were selected. During the period, determination of nep potential with the Nepotometer was done on all 12 samples from each of coarse and medium groups. The yarns spun from them are being tested for neps on Uster and for appearance grade by ASTM method. Further work is being continued.

Effect of Different Systems of Processing on the Spinning Performance of Superior Quality Cottons

During the period under report, one more superior quality cotton, viz. Sudan XG2VS was taken up for study. It was combed to 8%, 12%, 16%, 20% and 24%. Fibre tests were done on the combed sliver and comber noil at all the levels of combing. The material from 8%, 12%, 16% and 20% combed sliver has been spun to 3 counts, viz. 50s, 60s, and 70s, and the yarns have been tested. Further tests on this cotton are in progress.

Fixation of Suitable Strength Standard for Estimation of Spinning Performance of Improved Varieties

Under the modernisation scheme of the spinning unit of the Laboratory, new items of machinery have been procured and installed. New improved drafting systems of spinning have been introduced and gradually more samples will be processed by using the new systems.

The laboratory standards being adopted for lea strength have to be revised so as to correspond to the new systems of drafting. For this purpose selected cottons are proposed to be spun on the old and new systems and the data analysed in order to arrive at proper standards. Preliminary studies have been undertaken on this aspect.

Studies on Blends of Indian Cottons with Polyester Staple Fibre

Blending of Hybrid 4 and Sudan cottons with three different makes of indigenous polyester fibre and in different proportions of cotton: polyester (75 : 25, 50 : 50, 33 : 67) was carried out during the period. The results of these blending trials along with those done earlier with Sujata and Giza 45 were studied. It was observed that :

There was a good scope for blending superior varieties of Indian cottons with polyester staple fibre. Though the yarn strength of individual Indian cottons was poorer than that of the corresponding imported cottons with which they were compared, the differences in strength tended to reduce sub-

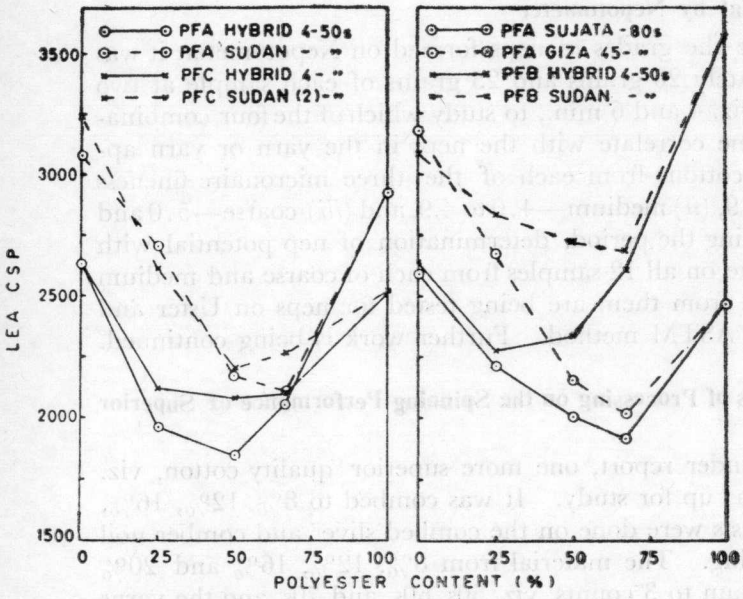

Fig. 2 : Lea CSP *vs* Percentage Polyester Content

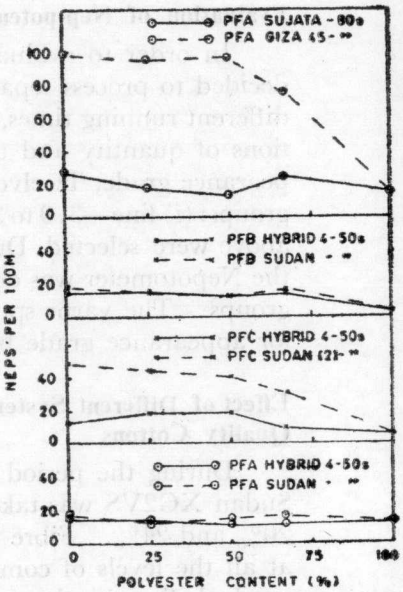

Fig. 3 : Neps *vs* Percentage Polyester Content

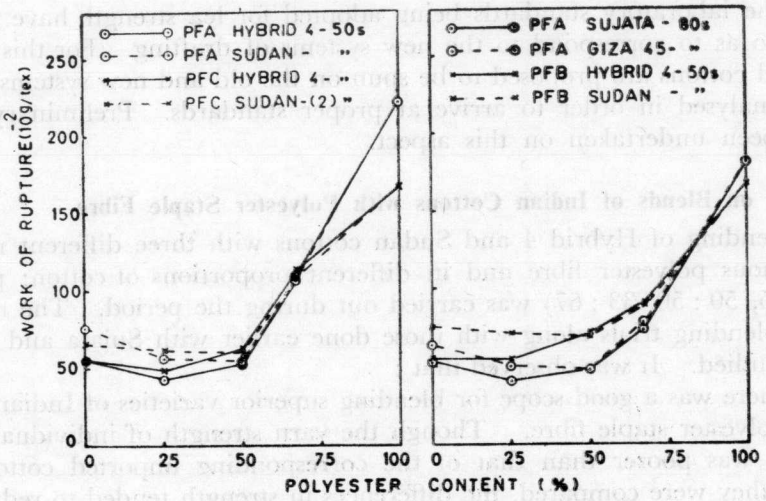

Fig. 4 : Work of Rupture *vs* Percentage Polyester Content

stantially when they were blended with polyester, with the latter forming 50 per cent and more of the blend (Fig. 2). The regularity of the yarns from blends of Indian cottons with polyester was quite good; though they were slightly inferior in evenness to the blends with imported cotton by about 0.6% on an average they had less neps than the latter (Fig. 3). The extensibility of blended yarns of polyester with Indian cottons was higher than that of blends with imported cottons thus diminishing the differences between the two when the work of rupture was considered (Fig. 4).

Further work on blending of Varalaxmi cotton with polyester has been taken up.

A Study of the Performance of the Modern Blow Room Line

The new Platt Blow Room Line has been commissioned and its performance is being assessed in order to fix the optimum processing conditions for good opening and cleaning of different varieties of cotton. The blow room is equipped with bale blenders, SRRL opener, Shirley opener, Air Stream cleaner and Kirschner beater with provisions for by-passing some of the beaters. The cottons would be spun to yarns of suitable counts and tested for strength, evenness and imperfections. During the period under review, two samples : (*i*) Laxmi and (*ii*) mixing of AK.277, Westerns, Y.1 and Virnar were processed to 30s and 20s counts, respectively. The testing of yarn samples and estimation of cleaning efficiency for different combinations have been completed and the results are being analysed.

Work on finer cottons has been started and initial trials on Hybrid 4 and Varalaxmi are underway.

Evaluation of Techiniques—Used for Measurement of Neps

There are many methods for estimation of neps in cotton, either in the raw or processed form. While an evaluation of neps can be made by actual counting by spreading fibres from all the processed form of cotton like web, sliver, roving, etc., on a velvet plush, methods like Nepotometer, Shirley Template and Uster Imperfection Tester can be used only for particular processes. A study has been undertaken to : (*i*) relate the different methods of nep evaluation and (*ii*) assess the behaviour of different types of cottons with regard to their nep proneness and changes in neppiness during spinning.

Twentysix cottons belonging to Standard and Trade Varieties were processed during this period and material was collected from different stages of spinning for estimation of neps. Tests on the Uster Evenness Tester for analysis of imperfections were also completed on a total of 18 yarns. Study of card web using Shirley Template for all the samples was carried out. It was seen that the neps in card web correlated highly with the major fibre properties like maturity coefficient, percentage of immature fibres, micronaire value and 2.5% span length.

Study of Yarn Strength for Different Counts in Relation to Chief Fibre Properties

For the above investigation, correlation coefficients between the average CSP and each of the fibre properties pertaining to 1969-70 and 1970-71 season samples were given in the previous Annual Report.

During the period under review, 222 samples of 20s yarns, 405 samples of 30 yarns, 307 samples of 40s yarns, and 192 samples of 50s yarns, all belonging to 1972-73 season, were subjected to similar analysis and the following correlation coefficients were obtained, between CSP(C) and the fibre properties, viz. mean fibre length(l), micronaire value(f) and tenacity in g/tex at zero gauge length(s).

Count of yarn	Correlation coefficients		
	r_{cl}	r_{cf}	r_{cs}
20s	+ 0.93**	— 0.88**	+ 0.03NS
30s	+ 0.95**	— 0.90**	+ 0.07NS
40s	+ 0.89**	— 0.60*	+ 0.74**
50s	+ 0.74**	— 0.34NS	+ 0.79**

* Highly significant at 1% level.
** Significant at 5% level.
N.S. Not significant.

The regression equations obtained from the data for predicting the average CSP from the fibre properties for the yarns of 20s, 30s, 40s and 50s counts are given below :

For 20s yarns

$c = 131.6\ l - 1176.0 \quad (r^2 = 0.86)$

$c = -351.2\ f + 3395.1 \quad (r^2 = 0.77)$

For 30s yarns

$c = 140.3\ l - 1665.2 \quad (r^2 = 0.90)$

$c = -534.6\ f + 3885.1 \quad (r^2 = 0.81)$

For 40s yarns

$c = 189.4\ l - 3206.8 \quad (r^2 = 0.79)$

$c = 151.6\ s - 4910.2 \quad (r^2 = 0.55)$

For 50s yarns

$c = 144.4\ l - 2249.9 \quad (r^2 = 0.55)$

$c = 70.9\ s - 1482.0 \quad (r^2 = 0.62)$

The partial and multiple correlation coefficients were also worked out for the samples of all the three seasons. Further work is in progress.

Survey of Cotton Ginning Factories in India

Defective ginning of cotton in old and ill-maintained ginning and pressing factories may lower the quality of a cotton which has been developed after several years of research. With a view to ascertain the working conditions of the ginning and pressing factories in India, a comprehensive survey was sponsored in collaboration with the ATIRA, BTRA and SITRA. A detailed questionnarie was prepared by the CTRL in consultation with the other bodies. The questionnaire was got translated into the regional languages so as to facilitate easy filling up of the returns by the factory staff. Besides getting the questionnaires filled by the factories concerned, it had also been proposed to depute specially trained investigators for visiting a certain number of factories and making an on-the-spot assessment of the actual working conditions. For this purpose, two investigators each from ATIRA, SITRA and CTRL, and one from BTRA were given instruction in the functions of the various parts of the gin and training, in making proper adjustments required for good ginning, at the CTRL as well as in some selected local factories situated in various States. The survey in Gujarat is being done by the ATIRA, in Tamil Nadu by SITRA and that in Maharashtra jointly by CTRL and BTRA.

For the survey in Maharashtra, 700 questionnaire forms were sent to the various ginning and pressing factories in the State through the Maharashtra State Co-operative Marketing Federation. So far, 211 factories have sent the forms duly completed. The investigators were deputed to various ginning centres during the ginning season 1973-74. The first round of the survey was done in September-October 1973 in Phaltan and Ahmednagar zones where the cotton is grown mostly under irrigation. The second round was carried out during November-December in Akola, Dhulia and Nagpur zones. It was observed that a large number of factories were closed during the season as the cotton production was low in this season and the procurement of cotton by the Federation was also very low.

RESEARCH WORK DONE AT REGIONAL STATIONS

COIMBATORE

In order to study the variation in fibre properties of Madras-Cambodia-Uganda cotton grown in different agro-climatic conditions in Tamil Nadu, samples of MCU.5 cotton were collected from Tirunelveli, Madurai and Ramnad districts and tested for important fibre properties. It has been observed that the samples from most of the places recorded very low values of fibre length.

DHARWAR

(a) The effect of Cycocel (CCC) spray on the yield and quality of Jayadhar at Dharwar and of Hampi at Siruguppa was studied. 40 ppm CCC sprayed at 80 days stage recorded the highest yield at Dharwar and the increase was noticed at Siruguppa also (40 ppm CCC at 40-50 days stage). Quality characters were found to be unaffected.

(b) Cotton seeds of GS.23, Mysore Vijaya and Hampi grown at three different locations were soaked in different concentrations of Succinic acid with and without fertilizer and grown at Arabhavi, Siruguppa and Dharwar. It was observed that while the fibre properties showed no change, the yield was higher than the controls.

HISSAR

A new procedure to find out the Micronaire value of a small-sized sample with the ATIRA Fineness Tester was worked out by testing samples of the mixing with a lint sample of known Micronaire value.

LUDHIANA

Twenty samples of Bikaneri Narma from different parts of Punjab were tested for fibre and seed characters. This variety was found to be inferior to 320F, and J.34 cottons in respect of fibre length and Micronaire value.

NANDED

A technological investigation on the effect of soil and climatic conditions on the fibre characters of some prominent *hirsutum* strains was carried out at different locations in Maharashtra State during 1970-73. It was observed that fibre maturity and bundle strength were influenced by weather and soil conditions, respectively.

SURAT

Two seasons' (1971-73) data on genetical selection for fibre strength were compared. It was found that the range of strength values for these seasons did not show much change for *hirsutum* cottons, while it was lower in 1972-73 as compared to 1971-72 for *herbaceum* cottons.

III. Publications

During the period, two Technological Reports, seven Research Publications and one Annual Report were published, and 51 Technological Circulars were issued. Further, two articles were published and six more articles were sent for publication. The details are given below :

A. Technological Reports

No. 13. Technological Report on Trade Varieties of Indian Cottons, 1971-72 Season.

No. 14. Technological Report on Standard Indian Cottons, 1971-72 Season.

B. Research Publications (CTRL Publication—New Series)

No. 35. Changes in strength and twist parameters of yarns brought about by mercerisation—by A. V. Ukidve, V. Sundaram and P. G. Oka (reprinted from *Journal of the Textile Association*, March, 1973 issue).

No. 36. A brief note on the changes due to mercerisation in the relationship between Uster values (U%) and yarn strength parameters—by A. V. Ukidve, V. Sundaram and P. G. Oka (reprinted from *Journal of the Textile Association*, March, 1973 issue).

No. 37. Gamma-Radiolysis of acetylated cotton cellulose—An ESR study—by P. K. Chidambareswaran, V. Sundaram and B. B. Singh (reprinted from Part A-1, Vol. 10, 2655-2660, *Journal of Polymer Science*, September, 1972 issue).

No. 38. Varietal response of Indian cottons to formaldehyde crosslinking treatment—by M. S. Sitaram, S. M. Betrabet and V. Sundaram (reprinted from *Colourage*, Vol. 20, No. 8, 25-27, April 19, 1973 issue).

No. 39. Rapid strides in cotton quality improvement—by V. Sundaram (reprinted from the *Indian Farming*, October, 1972 issue).

No. 40. Some aspects on the structural differences between *herbaceum* and *hirsutum* cottons—by S. M. Betrabet, (Smt.) K. L. Datar and V. Sundaram (reprinted from *Cotton Development Journal*, Vol. 3, July, 1973 issue).

No. 41. Some studies on the bundle strength of cotton fibres—by K. R. K. Iyer and G. F. S. Hussain (reprinted from *Journal of the Textile Association*, Vol. 34, No. 2, June, 1973 issue).

C. Articles and Papers

(*a*) *Published*

1. Structural peculiarities of *G. herbaceum* cottons—by (Smt.) K. L. Datar, S. M. Betrabet and V. Sundaram (Published in *Textile Research Journal*, December, 1973 issue).
2. Interferometric Fibre Stapler—by K. R. K. Iyer (Published in *Journal of the Textile Association*, September, 1973 issue).

(*b*) *Sent for Publication*

1. बिनौले की उपयोगिता—by S. N. Pandey.
2. A Note on the comparative merits of roller ginning and saw ginning —by D. G. Shete and V. Sundaram.
3. Determination of cotton fibre maturity with the Micronaire instrument using two different techniques—K. N. Seshan, Harirao Navkal and V. Sundaram.
4. Definition of some technical terms used in Cotton Development, Trade and Technology—by V. Sundaram.
5. Effect of phosphoric acid treatment on physical and chemical properties of cotton fibre—by S. N. Pandey and (Smt.) Prema Nair.
6. Enzyme hydrolysis of cotton and crystalline cellulose—by S. M. Betrabet, V. G. Khandeparkar and N. B. Patil.

D. Annual Report

1. Annual Report of the Cotton Technological Research Laboratory for the calendar year 1972.

E. Technological Circulars

1. Nos. 94 to 107 on Standard Indian Cottons
2. Nos. 1740 to 1776 on Trade Varieties of Indian Cottons.

Standard Indian Cottons

S.C. No.	*Variety*	*S.C. No.*	*Variety*
	1971-72 Season		
94	H.14		
	1972-73 Season		
95	Narmada	101	Gaorani 22 (Mysore)
96	Gaorani 22 (Maharashtra)	102	Deviraj (Gujarat)
97	Sanjay (Amreli)	103	MCU.4
98	H.14	104	Bharathi
99	Sujay (3943)	105	K.7
100	Hybrid 4 (Gujarat)	106	Gaorani 46
		107	Gujarat 67

Trade Varieties of Indian Cottons

1971-72 Season

T.C. No.	*Variety*	*T.C. No.*	*Variety*
1740	Laxmi (Tamil Nadu)	1742	Krishna
1741	Karunganni 6	1743	Laxmi (Gadag)

1972-73 Season

1744	Bengal Desi (Ganganagar)	1760	Jayadhar (Hubli)
1745	Bengal Desi (Punjab)	1761	Laxmi (Raichur)
1746	Sanjay (Botad)	1762	Laxmi (Gadag)
1747	J.34	1763	Hybrid 4 (Gujarat)
1748	H.14 (Haryana)	1764	MCU.5 (Coimbatore)
1749	Sea Island Andrews (A.P.)	1765	Deviraj (Mysore)
1750	Hampi	1766	Badnawar 1
1751	Buri 147 (Vidarbha)	1767	V.797
1752	Buri 1007 (Vidarbha)	1768	Gujarat 67 (Kutch)
1753	Maljari	1769	Suyodhar
1754	Comillas	1770	Wagad (Saurashtra)
1755	320F (Punjab)	1771	AK.277
1756	Laxmi (Maharashtra)	1772	Gaorani 22
1757	Sea Island Andrews (Mysore)	1773	Digvijay (Palej)
1758	L.147 (Adilabad)	1774	Deviraj (Manavdar)
1759	Gaorani 6 (Bhainsa)	1775	Virnar (Khandesh)
		1776	Digvijay (Kapadvanj)

IV. Extension

This Laboratory has no farm attached to it and no field work is carried out directly under its own charge. All the field work is carried out at various agricultural research stations in the States and the samples of the improved cotton strains evolved under different research projects are tested for quality characteristics at the main Laboratory as well as at the Regional Stations maintained under its charge. This Laboratory does not directly deal with the farmers but indirectly helps them through the State Departments of Agriculture. Further, the Technological Circulars issued on Trade Varieties of Cotton are useful to the growers, the trade and the industry as these circulars indicate the quality of the commercially grown crop.

The Laboratory also renders considerable assistance to those engaged in cotton trade and to other government and civic organisations by undertaking tests on samples received from these organisations by imparting training in cotton technology and by supplying useful testing instruments.

Testing Work

Apart from the research samples received from various agricultural stations, this Laboratory continued to receive a number of samples of fibre, yarn and cloth for special tests from commercial firms and government and semi-government organisations. Such samples were tested on payment of the prescribed fees. The number of such samples received for various tests during the year 1973, together with the corresponding figures for 1971, 1972 and for the quinquennium 1966-70 are given in Table 10.

TABLE 10: NUMBER OF SAMPLE RECEIVED FOR PAID TESTS

Type of test	Average for the quinquennium 1966-70	1971	1972	1973
Spinning	14	6	5	10
Fibre (EICA)*	68	84	21	123
Fibre (others)	81	56	327	244
Yarn	109	55	22	43
Cloth	81	58	43	46
Moisture	75	164	84	11
Miscellaneous	21	13	11	12
Total	449	436	513	489

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

The total test fees realised during 1973 for carrying out tests on these samples amounted to Rs. 16,261 against Rs. 15,257 during 1972.

Apart from the usual tests of routine nature, some of the special investigations carried out during the year under report are listed below :

1. Two nylon-cotton blended samples and one cotton sample were tested for abrasion test. For this purpose the abrasion test was standardised.
2. Asbestos cloth was tested for moisture regain.
3. Two samples of asbestos cloth were tested for breaking strength in dry and wet condition.
4. A canvas cloth (hessian) was tested for fabric construction and breaking strength.

Training Facilities

The Laboratory conducts two training courses each of two months' duration for persons employed in Cotton Trade or Co-operative Marketing Societies. One course is for those in Bombay City and the other for those coming from mofussil centres. During the year, the following candidates were selected and given training in fibre tests and elements of statistics :

1. Shri Joachim S. Machade,
   C/o Messrs Patel Volkart Limited,
   Bombay 400 002.
2. Shri Mahendrakumar S. Patel,
   C/o Asian Textiles & Rajlaxmi Corporation,
   Bombay 400 002.
3. Shri Devdutt Vyas,
   Standards Department,
   The Coorla Spg. & Wvg. Co. Limited,
   Kurla, Bombay 400 070.
4. Shri Sohanlal Babulal Kabra,
   C/o Sohan Cotton Traders,
   Ganj Bazar, Khandwa, Madhya Pradesh.
5. Shri A. K. Bajpai,
   C/o The Bengal Nagpur Cotton Mills Limited,
   Rajnandgaon, Madhya Pradesh.
6. Shri G. S. Patel,
   C/o Uttar Gujarat Sahakari Ru Vechan Sangh Limited,
   2207/3, Manekchowk, Ahmedabad 380 001, Gujarat.
7. Shri N. Sreenivasa Rao,
   C/o N. Sudhendra Rao & Bros.,
   Cotton Merchants, Gosha,
   Hospital Road, Adoni, Andhra Pradesh.

Supply of Equipments

The following equipments were supplied during the year 1973 :

1.	Laboratory model gins with electric motors	81
2.	Ginning Percentage Balances	118
3.	A. N. Stapling Apparatus	10

V. Conferences and Symposia

The Director and/or other Scientific Officers of the Laboratory participated in the following scientific and technological conferences and meetings connected with the work of this Laboratory :

	Meeting	*Place*	*Date and Month*
1.	International Textile Seminar organised by the Textile Association	Delhi	6th to 9th January
2.	Task Force for setting up of a new Central Institute of Cotton Research	New Delhi	25th January
3.	Fourteenth Joint Technological Conference at SITRA	Coimbatore	28th to 30th January
4.	Third Meeting of the Specialist Panel for Examining the Second Draft Revision of IS:171 Cotton Yarn, Grey	Coimbatore	30th January
5.	32nd Meeting of the Cotton and Cotton Products Sub-Committee, TDC 2 29th Meeting of the Cotton and Cotton Products Sub-Committee, TDC 2 : 1	Coimbatore	31st January
6.	Field Day Celebrations of IARI	Coimbatore	31st January and 1st February
7.	Symposium on Diffusion of Solvents in Solution and in Fibre Systems	Bombay	4th February
8.	Meeting of the Task Force for considering the Fifth Plan Proposals of CTRL	New Delhi	22nd February
9.	Second General Congress of SABRAO	New Delhi	22nd to 28th February

	Meeting	*Place*	*Date and Month*
10.	Regional Seminars organised by NCST at BARC	Bombay	22nd to 25th February
11.	SASMIRA Eighth Technological Conference	Bombay	7th and 8th March
12.	North Zone Panel Meeting of AICCIP	Ludhiana	3rd and 4th April
13.	Meeting on Collaborative Research Project on blending of cotton with jute and ramie	Calcutta	6th and 7th April
14.	Second Meeting of the Sub-Committee for Research and Liaison (Physics, Physical Testing and Electronics) at BTRA	Bombay	17th April
15.	Meeting of State Cotton Development Officers and Cotton Specialists at Directorate of Cotton Development	Bombay	26th April
16.	Tenth Meeting of the ICDC	Bombay	28th April
17.	Panel Meeting on the Plant Breeding for the Central Zone under AICCIP	Poona	4th and 5th May
18.	Meeting of the Plant Breeding Panel for Southern Zone under AICCIP	Coimbatore	16th to 18th May
19.	Conference of Directors of Research Institutes under ICAR	New Delhi	26th to 29th June
20.	Workshop on Library Science	Jabalpur	27th and 28th June
21.	44th Meeting of the Physical Methods of Test Sectional Committee, TDC 1	Calcutta	11th July
22.	Scientific Panel on Animal Products	Calcutta	30th July
23.	Symposium on "Grafting of Monomers on Polymeric Compounds" at BTRA	Bombay	12th September
24.	Symposium on Maintenance Audit Programme in Spinning at BTRA	Bombay	22nd September
25.	All India Textile Conference organised by Textile Association	Ahmedabad	6th and 7th October
26.	First Meeting of the Grading of Raw Cotton Sub-Committee, TDC 2 : 7	Bombay	11th October

	Meeting	*Place*	*Date and Month*
27.	33rd Meeting of the Cotton and Cotton Products Sectional Committee, TDC 2 jointly with 30th Meeting of the Cotton and Cotton Products Sub-Committee, TDC 2 : 1 and 3rd Meeting of the Market Varieties of Cotton Fabrics Panel, TDC 2 : 1 : 1	Bombay	12th October
28.	Advisory Board, Annual General Meeting of the ICAR Society ; Meeting of the Directors of Research Institutes under ICAR	New Delhi	14th to 19th December
29.	Fifteenth Indian Standards Convention	Coimbatore	17th to 22nd December
30.	Golden Jubilee Celebrations and Convention of Chemists, 1973 at Indian Chemical Society	Calcutta	24th to 29th December

In addition to the above, Dr. S. M. Betrabet delivered a lecture on "The development on new cottons in India" at Mafatlal Services Pvt. Limited, at Bombay on 21st February, 1973, and Dr. V. Sundaram, Director, delivered a lecture to the participants in the specialised training course on cotton production and technology organised by the Punjab Agricultural University at Ludhiana on 30th October, 1973.

VI. Summary of the Report

The Cotton Technological Research Laboratory has entered its Golden Jubilee Year and this is the fiftieth Annual Report of the Laboratory pertaining to the year 1973.

The research activities and the testing work progressed satisfactorily as in the past. During 1973, the Laboratory continued to serve the needs of the State Departments of Agriculture in the authoritative evaluation of the improved cotton strains evolved at various cotton research centres and was a co-ordinating centre on Cotton Technology under the All India Co-ordinated Cotton Improvement Project. The scheme for modernisation and expansion of the Laboratory made some head way and a part of the new machinery for the spinning work has been installed. Further imports of other equipments are underway.

The World Bank Team visited the Laboratory during the year and was highly impressed with the facilities and research activities of the Laboratory. It strongly recommended the setting up of a Training and Advisory Service in the CTRL for improving the ginning industry in India, both by conducting training courses and imparting technical guidance to the ginning industry. The Achievement Audit Committee which reviewed the work of the Laboratory submitted its report in March 1973. This Committee also has appreciated the work carried out so far and has made various recommendations to increase the research facilities at the Laboratory so that it can become a National Centre for Cotton Research for the whole country.

During the financial year 1972-73, the actual expenditure was Rs. 16.44 lakhs as against the sanctioned grant of Rs. 18.23 lakhs for Technological Research. An expenditure of Rs. 9.68 lakhs was incurred under the Fourth Plan Scheme for modernisation and strengthening of the CTRL for intensive research on cotton against the sanctioned grant of Rs. 11.46 lakhs, leaving an amount of Rs. 1.78 lakhs unutilised. Apart from this, an expenditure of Rs. 2.14 lakhs was incurred on the AICCIP and Rs. 6,000 on an ICAR Scheme financed from the Agricultural Produces Cess Fund, against the sanctioned grants of Rs. 2.60 lakhs and Rs. 10,000, respectively. The savings in these schemes to the tune of Rs. 46,000 and Rs. 4,000, respectively, were mainly due to non-materialisation of purchases of certain equipments and also due to non-filling up of the posts under the respective schemes on account of ban on recruitment.

Research Activities

Various research investigations on cotton quality evaluation, basic research, better utilization of cotton and by-products were undertaken. The progress made in the important research investigations during 1973 is indicated briefly below :

During the year about 1,600 samples pertaining to various trials conducted at different Cotton Research Stations were tested for the fibre properties and spinning performance. Many new promising strains were identified. Some of them are given below :

North Zone (Punjab, Haryana, Uttar Pradesh and Rajasthan)	SH.269, SH.369, SH.469, SS.167, SS.264, SS.265, D.37, D.40, RS.89 and J.207	Suitable for 40s/ 50s
Central Zone (Madhya Pradesh, Gujarat and Maharashtra)	66BH.5-91, DHY.286, 70IH.446, 70IH.452, IAN.579-188, IAN.4757, CP.2-51, CP.515 and LL.60	,, 50s
	Crosses of Gujarat 67 with SB.289E, USSR.76, Maraad and ERB.4530	,, 60s/80s
	IBSI.53, IBSI.57, N.27, Giza 7, CBS.34, CBS.148 and Sujata	,, 80s/100s
	Suvin 62/6 and Suvin 62/17	,, 120s
South Zone (Mysore, Andhra Pradesh and Tamil Nadu)	SS.169, IAN.579-188, MCU.5, EL.031 and ELS.191	,, 50s
	Sujata, Giza 7, IBSI.53, IBSI.57, N.27 and CBS.156	,, 80s
	Suvin 62/17	,, 100s

The following new varieties were released for general cultivation in the tracts indicated :

Jyoti — Jalgaon and Dhulia districts and parts of Nasik district.
MCU.8 — Summer Cambodia tract of Tamil Nadu.

Seeds of a number of new strains were tested for protein content and gossypol content. Some strains having high protein content ranging from 33.2 to 41.5% and low gossypol content were identified.

Continuing the study of free radicals formed by gamma-ray radiation in chemically modified cottons, various methods were tried to observe the relative reactivities of the primary and secondary hydroxyl groups in cellulose benzoate of different degrees of substitution (DS).

An investigation is under way to screen the existing varieties and new strains of cottons most suitable for easy-care properties. In all, six cottons viz., Gujarat 67, MCU.1, Deviraj, Hybrid 4, Digvijay and Sanjay were screened in the yarn form for the response to DMDHEU treatment. Sanjay, Digvijay and MCU.1 responded well with respect to the retention of tenacity and elongation. Hybrid 4 gave rather poor performance.

For studying the effect of crosslinking treatments on the structure, number and distribution of crosslinks, a purified lint sample of MCU.3 cotton was treated with formaldehyde. It was observed that there was marked increase in percentage of insoluble fraction with increase in reaction time. The swollen and crosslinked samples showed higher moisture sorption compared to unswollen samples.

The fabrication of an extractor for cleaning of *kapas* from its chief impurities, such as immature locks and hulls, has been completed. Tests with trashy *kapas* samples are proposed to be undertaken.

A provisional claim for a patent on, "A method for the production of highly active thermostable cellulose enzyme by *Penicillium funiculosum*, utilizing cellulosic waste material" has been filed. For growing *P. funiculosum* to produce cellulase, waste material like saw-dust, rice-husk, jute stick pulp, etc., can be profitably utilized. The enzymes will have several practical applications.

Isolation and identification of thermophilic bacteria producing desizing amylase is in progress. Such an enzyme will be very useful to the textile industry.

A fibre refractometer has been set up for undertaking studies on the structure of cotton. Initially, six varieties of cotton, covering a wide range of orientation, were slack mercerized and their refractive indices determined on the refractometer. These cottons had nearly the same orientation.

An apparatus for measuring the bulk resilience on cotton is being fabricated.

While studying the crystallite orientation in cotton fibres, attempts were made to resolve the 002 and 040 profiles of a few cottons and it was observed that the 040 profile gave higher values of the spiral angle and crystallite orientation angle compared to those yielded by the 002 profiles.

For measuring the lateral compressibility of chemically modified cottons an apparatus has been fabricated and some preliminary work has been done with wool-top fibres.

Using the Interferometric Fibre Stapler (IFS), the thickness profiles of cotton tufts for four different length groups were obtained and attempts are

being made to construct the envelope of the profiles of all the groups when they are super-imposed.

Linear density and breaking strength were determined on the Instron Tensile Tester for individual fibres from Sujata, Egyptian Giza, Hybrid 4, Sanjay and Laxmi cottons. It was seen that the linear density varied widely from fibre to fibre. The extent of variability as assessed was least for cottons characterised by high maturity and vice versa. It was also observed that in a highly mature fibre, a portion of a cellulosic material (fibrils) constituting the fibre wall does not contribute its share to the breaking strength of the fibre.

Fibre tests and microspinning tests were carried out on samples received from some insecticidal trials with a view to find whether there was any deleterious effect of the insecticides on the cotton fibre quality.

Interferometric Fibre Stapler is a recently designed and patented CTRL instrument for determining fibre length. The length parameters obtained on the instrument are comparable to those obtained by the standard Baer Sorter method.

In order to study the evenness and strength of material at different stages of processing, samples of sliver, roving and yarn of Narmada cotton were tested for their various properties. Some more cottons are yet to be processed and tested.

Yarns of 40s counts spun on the 3-roller system and 50s counts on the SKF system were tested for yarn evenness and imperfections. The results have been analysed and the number of bobbins required to be tested for satisfactory accuracy have been determined.

Some experiments on bundle strength measurement have shown that by preserving the test cotton and the calibration cotton at 65% rh and testing them at an ambient atmosphere of 75% rh, it is possible to get almost the same Pressley Strength Index as when the two samples are conditioned and tested at 65% rh.

In order to standardise the evaluation of nep-potential by Nepotometer, 12 cottons from each of three fineness groups were selected and tested using 20 grains and 25 grains samples and with a running time of 4 minutes and 6 minutes. The experimental work is being continued.

For studying the effect of different systems of processing on the spinning performance of superior quality cottons, samples of Sudan XG2VS were combed to varying levels of comber waste and spun into fine counts, such as 50s, 60s and 70s, and yarns tested for different characteristics.

For modernisation of the spinning unit of the Laboratory, new systems of processing are being introduced and this has necessitated the revision of the yarn strength standards adopted at the Laboratory since long. For comparative evaluation of various cottons, particularly superior ones, suitable standards have to be arrived at and for this purpose, some cotton samples are being processed into different counts.

Suitability of Indian cottons for blending with polyester is being investigated. Comparative study undertaken on blending of superior Indian cottons, such as Hybrid 4 and Sujata, with polyester in different proportions as against imported cottons, such as Sudan and Giza 45, indicated that there was good scope for blending superior varieties of Indian cottons with polyester staple fibre. Though the yarn strengths of individual Indian cottons were poorer than those of the corresponding imported cottons, the quality was improved when blended in suitable higher proportions of polyester. The yarns from blends with Indian cottons were quite good in evenness and although not as good as blends with imported cottons in evenness, were less neppy and had higher extensibility, especially when the polyester constituted more than 50% in the blend.

Making use of the new Platt Blow-room line, different varieties of cottons are being processed with a view to fix optimum processing conditions for good opening and cleaning. Tests are being conducted for ensuring cleaning efficiency as well as production of good quality yarns.

A study has been undertaken to evaluate the neppiness of cottons at different stages of processing and by different instruments, such as Nepotometer, Shirley Template and Uster Imperfection Tester. The different methods of nep-evaluation will be compared while assessing the changes in neppiness during spinning at different stages.

The relationship of chief fibre properties with yarn strength at different counts has been examined on the basis of the large data collected during the last three seasons—1969-72. Regression equations have been worked out for estimating the count strength product from the chief fibre properties for different counts.

With a view to ascertain the condition of the ginning and pressing factories in India, a comprehensive survey was undertaken in collaboration with the ATIRA, BTRA and SITRA. Besides collecting detailed information through a questionnaire, specially selected investigators trained in the operation of the various parts of the gin were deputed to various centres to have on-the-spot assessment of the actual working conditions of the factories. The survey part of the work is in progress in Maharashtra State and nearly one-third of the cotton growing areas have been covered. About 39 per cent of the factories have responded by returning completed questionnaires. The surveys in Gujarat and Tamil Nadu are being done by ATIRA and SITRA, respectively.

At the various Regional Stations maintained by the Laboratory, the technological staff continued to assist the Cotton Breeders in the quick evaluation of the various new strains evolved and in other research work. It was observed that Cycocel spraying increased the yield of Jayadhar at Dharwar and that of Hampi at Siruguppa. It was also seen that pretreatment of cotton seed with succinic acid increased the yield to some extent.

Other Activities

A number of samples of textile materials were received from the Government and semi-Government organizations, textile trade and industry, etc. These samples were tested and authoritative reports were issued.

The CTRL is recognised as a Post-graduate Institution by the University of Bombay for guiding students for M.Sc. and Ph.D. in Textile Physics and M.Sc. in Physical Chemistry. Recognition has now been extended for M.Text. in Spinning Technology, and Ph.D. in Biophysics.

Four persons from mofussil centres and three from Bombay City underwent the training course in fibre testing and elements of statistics conducted at this Laboratory during the year 1973.

Laboratory-designed equipments viz., Laboratory Model Gin, Ginning Percentage Balance, A. N. Stapling Apparatus, etc., were being supplied to Cotton Corporation of India, Cotton Marketing Federation, etc.

Publications

During the period, two technological reports, seven research publications and one Annual Report were published and 51 technological circulars were issued. Further two articles were published and six more articles were sent for publication in various journals.

VII. Personnel

A large number of posts remained vacant during the period under report on account of the ban imposed by the ICAR on filling up vacancies of scientific and technical posts pending a decision being taken by the Government of India on the Report of the ICAR Enquiry Committee.

Appointments

The following appointment to the post of Senior Research Assistant was made by direct recruitment during the year.

Name	*Date of appointment*
Shri Arun S. Sathe	1-12-1973

Retirements, Resignations, Transfers and Discontinuation of Services

The undermentioned Research Assistants resigned their posts and were relieved from duty on the dates indicated :

S. No.	*Name*	*Date of resignation*
1.	Shri A. Janardanan	5-2-1973
2.	Shri S. S. Baljekar	1-3-1973
3.	Shri S. Balakrishnan	7-3-1973

Shri R. S. Chouhan, Research Assistant at Surat was transferred to a similar post at this Laboratory on the 12th January, 1973. Shri S. S. Iyer was transferred as Senior Research Assistant to the Regional Station at Surat on the 2nd July, 1973, vice Shri L. R. Jambunathan transferred to this Laboratory. Shri S. K. Saha was relieved on the 5th February, 1973, to take up the post of Senior Research Assistant in the Central Institute of Fisheries Technology, Cochin.

VIII. Appendices

APPENDIX I

FINANCIAL STATEMENT

Expenditure and Receipts of the Laboratory during 1972-73

A. EXPENDITURE

	Sanctioned grant (Rs.)	Actual Expenditure (Rs.)	Savings (—) Deficit (+) (Rs.)
I. Technological Research			
Technological Research Laboratory including out-stations (Non-Plan)			
(*a*) Capital expenditure including expansion of Laboratory	3,41,400	3,17,796	(—) 23,604
(*b*) Working expenses	14,81,600	13,25,717	(—) 1,55,883
	18,23,000	16,43,513	(—) 1,79,487
II. Scheme for Modernisation and Strengthening of CTRL for Intensive Research on Cotton (Plan) ..	11,46,000	9,68,303	(—) 1,77,697
III. All India Co-ordinated Cotton Improvement Project	2,59,900	2,13,687	(—) 46,213
IV. Scheme financed from A.P. Cess Funds	10,000	5,720	(—) 4,280

B. RECEIPTS

Sale proceeds of goods, products fabricated/manufactured by the Institute	1,03,126
Sale proceeds of fruits, vegetables, plants, seedlings, etc.	108
Analytic and Testing fees	13,929
Rent	20,925
Fees for training, application fees, etc.	2,533
Sale of publications, etc.	2,802
Interest on loans and advances granted to employees	3
Leave salary and pension contribution, etc. ..	8,407
Miscellaneous receipts (including sale of waste cotton)	21,121
	1,72,954

APPENDIX II

Scientific and Technical Staff Working at the Cotton Technological Research Laboratory as on the 31st December, 1973

Director	Dr. V. Sundaram, M.Sc., Ph.D., A.R.I.C., F.T.I.
Senior Microscopist	Dr. S. M. Betrabet, M.Sc., Ph.D.*
Senior Physicist	Dr. N. B. Patil, M.Sc., Ph.D.*
Senior Spinning Technologist	Shri M. S. Parthasarathy, M.Text. (Bom.), M.Sc., Tech. (Manchester)*
Senior Testing Technologist	(Vacant)*
Instrumentation Technologist	(Vacant)*
Senior Scientific Officers	Dr. V. G. Munshi, M.Sc., Ph.D.
Chemist	(Vacant)
Statistician	(Vacant)
Spinning Technologist	(Vacant)
Junior Spinning Technologist	(Vacant)@
Junior Physicists	Shri B. Srinathan, B.Sc. (Text.)
	Shri P. G. Oka, M.Sc.**
	Dr. K. R. Krishna Iyer, M.Sc., Ph.D.*
Junior Engineer	Shri H. V. Tamhankar, L.M.E., L.E.E.*
Junior Microbiologist	Shri V. G. Khandeparkar, M.Sc.*
Junior Ginning Technologist	Shri D. G. Shete, L.M.E.*
Junior Chemist	Dr. S. N. Pandey, M.Sc., Ph.D.†
Junior Biochemist	(Vacant)*
Junior Quality Evaluation Officers	(Vacant at Surat)*
	(Vacant at Coimbatore)*
Junior Scientific Officer (*Statistics*)	Shri G. S. Rajaraman, M.A.
-do- (*Chemistry*)	Kum. I. G. Bhatt, M.Sc.,
-do- (*Physics*)	Shri P. K. Chidambareswaran, M.Sc.
-do- (*Testing*)	Shri A. V. Ukidve, M.Sc.
	(One post vacant)
Senior Research Assistants (*Statistics*)	Shri K. Venkateswaran, B.A.**
	Shri K. Chandran, B.A.
-do- (*Spinning*)	Shri K. S. Bhyrappa, L.T.T.
	Shri S. Chandra Shekar, L.T.M.
	Shri H. R. Laxmi Venkatesh, D.T.T.*
	Shri A. S. Sathe, B.Text.@
Senior Research Assistant (*Microbiology*)	Shri Joe D'Souza, M.Sc.
-do- (*Biochemistry*)	Smt. S. P. Bhatawdekar, M.Sc. (on *ad hoc* basis)
-do- (*Electrical*)	Shri A. Kalimuthu, B.Sc. (Elec. Engg.)
-do- (*Ginning*)	Shri M. L. Sounkaria, Dip. in Mech. Engg.
-do- (*Physics*)	Shri A. W. Shringarpure, B.Sc.*
	(Two posts vacant)*
-do- (*Chemistry*)	Smt. Vatsala Iyer, M.Sc.*
	Shri N. Thejappa, B.Sc.**
-do- (*Instrumentation Foreman*)	Shri G. S. Patel, B.Sc.*
-do- (*Instrumentation Technician*)	Shri K. M. Paralikar, M.Sc.*
-do- (*Technical Information*)	(Vacant)*
Senior Research Assistants (*Testing*)	
Shri L. R. Jambunathan, B.Sc., A.T.I.**	Shri S. G. Nayar, B.Sc., LL.B.
Shri S. Ramanathan	Shri B. M. Petkar, B.Sc. (Hons.)
Shri M. S. Sitaram, B.Sc.†	Shri K. R. Kamath, B.Sc.
Smt. S. B. Pai, B.Sc. (Hons.)	Shri P. K. Jairam, B.Sc.
Smt. K. L. Datar, M.Sc.	Kum. I. K. P. Iyer, B.Sc.
Shri S. R. Ganatra, B.Sc.	Smt. S. D. Pai, B.Sc.
	(One post vacant)**

Research Assistants (Statistics)	Smt. Janaki K. Iyer, M.Sc.
	Kum. Lalitha Padmanabhan, M.Sc.
	Shri D. V. Mhadgut, M.Sc.
-do- (*Spinning*)	(Two posts vacant)
-do- (*Workshop*)	(Vacant)
-do- (*Testing*)	
Shri A. K. Gupta, B.Sc. (Hons.)	Shri V. B. Suryanarayanan, B.Sc.
Smt. J. K. S. Warrier, B.Sc.	Shri G. F. Sulaiman Hussain, M.Sc.
Shri T. K. M. Das, B.Sc.	Kum. C. R. Raje, M.Sc.
Shri V. Jose Joseph, B.Sc.	Shri B. S. Ganvir, B.Sc.
Shri P. Bhaskar, M.Sc.	Shri P. K. Bhatnagar, M.Sc.
Shri G. Varadraj Rao, M.Sc.	Shri Ram Singh Chouhan, M.Sc.
Smt. Prema Nair, M.Sc.	Kum. P. S. Kulkarni, B.Sc.
Shri C. R. Sthanusubramoni Iyer, B.Sc.	Shri Y. P. Tripathi, M.Sc.
Shri K. V. Ananthakrishnan, B.Sc.	Shri R. Sreenivasan, B.Sc.
Smt. R. P. Bhatt, B.Sc.	Shri. S. G. Gayal, M.Sc.
Kum. S. R. Jage, B.Sc.	Kum. A. K. Deshpande, M.Sc.**
Shri G. Viswanathan, B.Sc.	Kum. R. Girija, B.Sc. (Hons.)**
	(Seven posts vacant)

Regional Stations

Station	*Senior Research Assistant*	*Research Assistant*
Coimbatore	Shri S. K. Iyer, B.A.	Smt. Santa V. Nayar, B.Sc.
		Shri C. P. Venugopalan, B.Sc.**
Dharwar	Shri E. S. Abraham, B.Sc.	Shri I. H. Hunsikatti, B.Sc.
		(One post vacant)
Hissar	Shri S. N. Nagwekar, B.Sc.**	—
Indore	Shri. W. R. Sharma, B.Sc.	(Vacant)
Ludhiana	—	Shri Ram Parkash, B.Sc.**
Nanded	Shri. A. K. Antony, B.Sc.	Shri E. Kesavankutty, B.Sc.**
		(One post vacant)
Nandyal	Shri R. Dwarkanath, B.Sc.	Shri Y. Subrahmanyam, M.Sc.**
Sriganganagar	(Vacant)**	Shri Tula Ram, B.Sc. (Hons.)
Surat	Shri S. S. Iyer, B.Sc.	Shri M. C. Bhalod, B.Sc.**
		Shri P. V. Varadharajan, M.Sc.
		(one post vacant)**

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* Under the Fourth Five-Year Plan scheme for modernisation and strengthening of the CRTL for intensive research on cotton.

** Under the All India Co-ordinated Cotton Improvement Project.

† Under the scheme for response of Indian cottons to crosslinking treatments with a view to evolve cotton varieties suitable for chemical finishing treatments.

@ Under the scheme for studies on spinning from blends of cotton with wool, jute and ramie on cotton system.