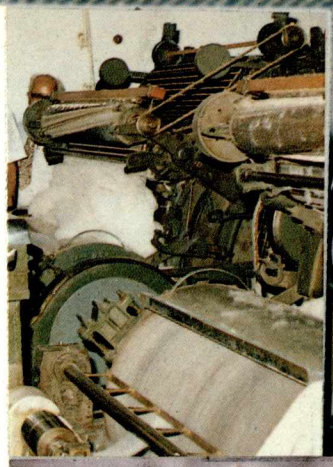
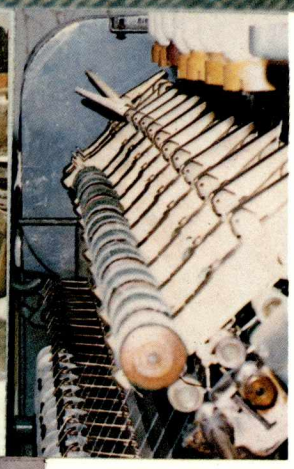




ICAR

Cotton Technological Research Laboratory

BOMBAY

Annual Report 1988

Cotton Technological Research Laboratory

Indian Council of Agricultural Research

Annual Report
1988

BOMBAY

Cover-theme: "Cotton is Grown to be Spun" — W. L. Balls

(The denim fabric in background on the cover is made from Cotton and Pineapple fibre blended yarn produced at CTRL)

Published by: **Dr. N. B. Patil**, M.Sc., Ph.D.
Director, CTRL, Bombay.

Edited and Compiled by : **Shri T. K. M. Das** and
Shri M. Mohan

Cover Design and Photography : **Shri T. K. M. Das** and
Shri R. M. Modi

CONTENTS

Dr. V. SUNDARAM, DIRECTOR
Who Retired from Service on 31.3.1988

1

Introduction

This is the sixty-fifth Annual Report of Cotton Technological Research Laboratory (CTRL) and covers the calendar year 1988.

Cotton Technological Research Laboratory (CTRL) was established in the year 1924 under the name "Technological Laboratory" by the Indian Central Cotton Committee (ICCC). The objectives then were to undertake spinning tests on various strains of cotton received from agricultural departments in the country and to test cotton for fibre properties and relate them with their spinning values. To carry out these activities, the Laboratory had established co-ordination with the Departments of Agriculture and Agricultural Universities located in major cotton producing tracts in India. All the commodity committees including the ICCC were abolished in 1966 and the Indian Council of Agricultural Research (ICAR) took over the administrative control of the Laboratory and since then, the research activities of the Laboratory were re-oriented and intensified to meet the challenges in respect of production and quality of cotton grown in the country. Side by side, research efforts are also directed towards better utilisation of cotton by-products, profitable use of cotton plant and their wastes, etc. so as to make cotton cultivation more remunerative in terms of providing new and increased avenues for self-employment, particularly to the rural folks.

The important functions of CTRL are listed below :

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

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

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

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

5. To help the trade and industry by providing reliable and accurate data on quality of representative trade varieties of Indian Cottons.

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

7. To collect and disseminate technical information on cotton.

Organisation

As could be seen from the organisational chart in Annexure I, the Director is the Head of the Laboratory assisted by a team of Senior and Junior Scientists. An Administrative Officer and an Assistant Administrative Officer provide him assistance in the general administration. A Finance and Accounts Officer assists him in matters concerning accounts and audit of the Laboratory.

Library

An up-to-date library of books on cotton, cotton technology and allied subjects are maintained at CTRL. During 1988, the total number of books was 4034 with the addition of 91 books during the year. Similarly, the total number of bound volumes added during the year was 250 increasing their total number to 5173. Out of 200 journals dealing with textiles and allied subjects, 104 journals were subscribed while the rest were received on complimentary/exchange basis. The journals subscribed included 65 foreign and 39 Indian journals.

The total expenditure for the library for 1987-88 was Rs. 1,15,033.45. Besides the staff of the Laboratory , the library facilities are also utilised by students and research workers from various institutes affiliated to the University of Bombay as well as sister institutions. Inter-library loan facilities are also available to other libraries in Bombay.

New Equipments

Several new equipments were procured in the Laboratory during 1988. A list of these is given in Annexure II.

Distinguished Visitors

Shri Hari Krishna Shastri, Hon'ble Minister of State for Agricultural Research and Education, Government of India, visited the Laboratory on December 20, 1988. Kum. Pushpa Devi Singh, Member, Lok Sabha also visited the Laboratory along with the Hon'ble Minister. The Hon'ble Minister went around the various Laboratories and showed keen interest in the current research activities.

A press team consisting of the following journalists accompanied by Shri S. K. Sharma, Public Relations Officer, ICAR, visited the Laboratory on April 1, 1988 to familiarise and collect information on the research activities of the Laboratory :

Shri Yogendra Bali, The Times of India, New Delhi

Shri Jaya Raj, United News of India, New Delhi

Shri R. K. Nayak, Press Trust of India, New Delhi

Shri B. Muralidhar, Hindu,
New Delhi
Shri Umesh Joshi, Jansatta,
New Delhi

In addition, Dr. N. S. Randhawa, Director General, ICAR, Dr. R. S. Paroda, Deputy Director General (CS), ICAR, Dr. A. Alam, Assistant Director General (AE), ICAR, Prof. Y. Sree Krishna, Director, CIFE, Bombay and many other ICAR officials visited the Laboratory on various occassions for official purposes. A list of other distinguished visitors to the Laboratory is given in Annexure III.

Retirement of Director

Dr. V. Sundaram, Director, CTRL retired on superannuation from service with effect from April 30, 1988. He was one of the seniormost Directors of the Institutes under ICAR. He had been Director of CTRL for the last 22 years. A well known scientist in the field of cotton technology, Dr. Sundaram was instrumental in the modernisation and development of the laboratory during the last two decades. He initiated and established the Ginning Training Centre of CTRL at Nagpur. From the very inception of All India Co-ordinated Cotton Improvement Project (AICCIP), he had been the principal investigator for technology. Dr. Sundaram was one of the recipients of ICAR Award for Team Research and the Indian Merchants' Chamber Award for outstanding contribution in the field of Agriculture during 1976 and FICCI Award for Science and Technology in 1977.

Apart from being a member of the Task Force which was constituted for setting up the Central Institute for Cotton Research (CICR) at Nagpur, he was functioning as the first Director of CICR for about a year from January — February 1977. Dr. Sundaram had short term assignments as cotton technologist, in Sri Lanka under the Asian Development Bank in 1973 and in Burma under FAO, in 1979. Dr. Sundaram was a recognised teacher of the University of Bombay and a number of students have obtained M.Sc./ Ph.D. degrees by research under his guidance.

Management Committee

During 1988, the Management Committee of CTRL met twice on February 3 and June 15 and 16.

The first meeting was a joint meeting with the members of the Quinquennial Review Team held at Delhi to discuss and finalise the QRT report.

In the second meeting, confirmation of the minutes of the previous meeting, action taken on the recommendations of the Committee, progress of expenditure, progress of works, action taken on the recommendations of the Institute Joint Council and Grievance Cell, which were the regular agenda items, were discussed. Progress of research during 1987 was discussed and a programme of research work for the year 1988 was finalised after some discussions. Three doctors were approved as A.M.A. for Chembur and Goregaon areas in Bombay and one doctor for Nagpur. The Committee considered

and approved the proposal for incrasing the fees for the two months training course in cotton quality evaluation, to Rs. 1,200/- and it also approved the proposal to incur an additional expenditure of Rs. 1.78 lakhs on the project Preparation of Medium Density Fibre Boards (MDF)/Hard Board (H.B.), subject to the availability of funds in the sanctioned B.E. of the Institute.

Silver Jubilee Celebration of Regional Quality Evaluation Unit of CTRL at Sriganganagar

To commomorate the completion of 25 years of Regional Quality Evaluation Unit of CTRL at Sriganganagar, which was established in 1961, a seminar on 'Present Status and Future Development of Cotton in Rajasthan' was jointly organised by CTRL and the Agricultural Research Station, Sriganganagar, of Rajasthan Agricultural University at Sriganganagar on October 26, 1988. Dr. K. N. Nag, Vice-Chancellor of Rajasthan Agricultural University inaugurated the seminar and released the brouchure brought out in this connection. The seminar was divided into two Technical Sessions. In the first session 5 papers and in the second session 2 papers were presented. In addition, 11 papers were presented in the poster session. Dr. T. H. Singh, Zonal Co-ordinator (North Zone), AICCIP, chaired the first session, while the second session was chaired by Dr. N. B. Patil, Director, CTRL. At the end, Dr. V. G. Munshi, Head, Quality Evaluation Division of CTRL, summed up both the sessions and also proposed a vote of thanks.

All India Cotton Production and Utilisation Conference

CTRL organised an All India Cotton Production and Utilisation Conference on April 23-24, 1988 at Bombay to provide a forum for interaction between persons engaged in agricultural and technological research on cotton on the one hand and those engaged in ginning, trade and textile industry on the other. The Conference was inaugurated by Dr. N. S. Randhawa, Director General, ICAR and was presided over by Shri J. K. S. Nicholson, Sheriff of Bombay. The Conference was held in four sessions excluding the inaugural session.

The first session on Cotton Production Technology held in the forenoon of April 23, 1988, which was chaired by Dr. A. B. Joshi, Retired Vice Chancellor, Mahatma Phule Krishi Vidyapeeth, Rahuri, had the following three lead papers :

1. Improved Varieties and Hybrids of Cotton : Their Production and Quality Characteristics — by Dr. A. K. Basu, Project Co-ordinator, All India Co-ordinated Cotton Improvement Project, Coimbatore.
2. Effect of Soil and Agronomic Practices on Cotton — by Dr. N. D. Mannikar, Director, Central Institute for Cotton Research, Nagpur.
3. Integrated Management of Pests and Diseases of Cotton — by Dr. S. Jayaraj, Director, Centre for

PLATE I

VISIT OF SHRI HARI KRISHNA SHASTRI, HON. MINISTER FOR DARE, GOVERNMENT OF INDIA

Hon. Minister is welcomed by Dr. N. B. Patil, Director, CTRL.

Hon. Minister near the Mechanical Processing Division. Alongwith him are (from L to R) Dr. N. B. Patil (Director, CTRL), Dr. N. S. Randhawa (Director-General, ICAR), Shri M. S. Parthasarathy, (Head, Mechanical Processing Division), Kum. Pushpa Devi Singh (M.P.)

PLATE II

ALL INDIA COTTON PRODUCTION AND UTILISATION CONFERENCE

Inaugural Address by Dr. N. S. Randhawa, Director-General, ICAR

An informal discussion of Dr. N. S Randhawa, Director-General with some of the distinguished delegates

Plant Protection Studies, Tamil Nadu Agricultural University, Coimbatore.

In the poster session that followed, different agricultural aspects such as cotton breeding, soil science, agronomy and physiology, plant pathology and entomology were presented.

The second session held in the afternoon of April 23, 1988 was chaired by Shri C. V. Radhakrishnan, Secretary-General, Indian Cotton Mills' Federation, Bombay. The three lead papers presented were :

1. Status of Cotton Ginning in India — by Shri M. S. Parthasarathy, Senior Scientist, CTRL, Bombay.

2. Cotton Quality in Relation to Yarn Quality — by Shri T. A. Subramanian, Deputy Director, Ahmedabad Textile Industries' Research Association, Ahmedabad.

3. Problems in Yarn Export and Requirements of Cotton Quality — by Shri R. G. Owalekar, Managing Director, All India Federation of Co-operative Spinning Mills', Bombay.

The poster session on topics like ginning, fibre quality, yarn and fabric production and their properties was held at 9.00 — 10.30 hrs on Sunday, April 24, 1988 in which 28 papers were presented.

The third session held on April 24, 1988 was on Mechanical Processing and Chemical Finishing. This session chaired by Hon. Major R. P. Poddar, President, Century Textile and Industries Ltd., Bombay had the following two lead papers :

1. Modern Development in Yarn and Fabric Production — by Prof. D. B. Ajgaonkar, Principal, DKTE Institute of Textiles, Ichalkaranji.

2. Modern Developments in Chemical Finishing — by Prof. W. B. Achwal, Head, Textile Chemistry Division, University Department of Chemical Technology, Bombay.

This was followed by a poster session on the topics of Chemical finishing, utilisation of cotton waste and plant by-products. 20 papers were presented in this poster session.

In the fourth session held between 14.00 — 15.00 hrs and chaired by Dr. S. M. Betrebet, Director, Bombay Textile Research Association, Bombay, two lead papers were presented as follows :

1. Utilisation of Cotton Seed and Its By-Products — by Shri G. V. Sirur, Chairman, All India Cotton Seed Crushers' Association, Bombay.

2. Economic Utilisation of Cotton Waste and By-Products — An Overview — by Dr. O. P. Vimal, Director, Department of Non-Conventional Energy Sources, New Delhi.

The valedictory function was chaired by Dr. Anwar Alam, Assistant Director General (Engg.), ICAR.

Internal Seminars

The following are the details of seminars/talks held at CTRL during January-December, 1988.

Sr. No.	Month and Date	Name and Address of Speaker	Topic
1.	15-3-1988	Shri S. Venkata Krishnan, CTRL	Anti-Soiling of Polyester (PET) by a Novel Method of Plasma Treatment and Its Evaluation by Colour Measurement
2.	24-3-1988	Dr. I. G. Bhatt, CTRL	Studies on Dermatological Effects of New Flame Retardant (FR) Treatment
3.	24-3-1988	Shri S. K. Chattopadhyay, CTRL	Influence of Fibre Length and Some Process Parameters on the Quality of Open-End Spun Yarns from Viscose Stable Fibres
4.	11.8.1988	Dr. N. L. Bhale, Director, Central Institute for Cotton Research, Nagpur	Impressions of Visit to Bangladesh

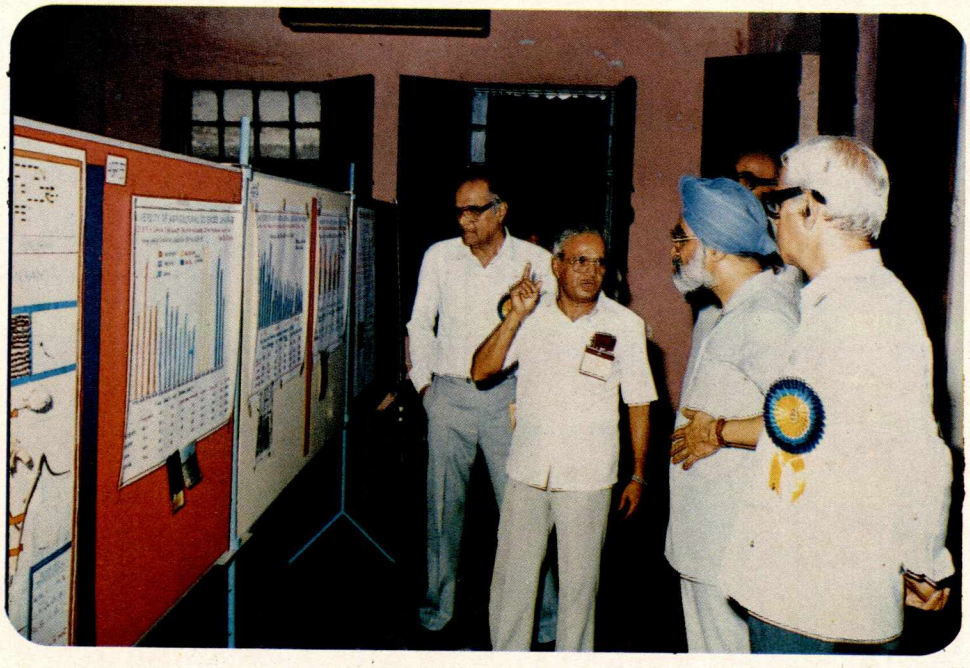
Staff Research Council

The preliminary sessions of the eighty-seventh meeting of the Staff Research Council (SRC) was held on February 6, 9, 18, 27 and March 2 and a final session with the Management Committee on June 15.

At the preliminary sessions, the research accomplishments of the ongoing research projects during 1987 were discussed in detail, discipline-wise and observations/comments/suggestions/recommendations were made on each project, wherever necessary. New Project proposals for 1988 were approved with observations/suggestions, wherever necessary. Dr. N. B. Patil, Director chaired all the sessions which was attended by all the Heads of Divisions and Management Committee members from CTRL, while Scientists and Technical Officers attended only the sessions pertaining to their respective disciplines.The final session, held on June 15, was a joint session in which the programme of work was finalised for the year 1988. This session was attended

PLATE II (Contd)

Welcome Address by Dr. V. Sundaram, Director, CTRL



Dr. S. N. Kadapa, Sr. Scientist (Cotton), UAS, Dharwad, explains a point to Director-General during the Poster Session

PLATE III

VISIT OF PRESS TEAM TO CTRL

The team at the Electron Microscope Section

Visit of the Press team to Apollo Tex ? Mills to see the CTRL Model Biogas Plant

by Scientists S-2 and above. In the SRC meeting, seven new project proposals were approved in various disciplines, while five projects were deleted from the programme of work as the objectives were accomplished.

Research Projects

There were 53 on-going research projects apart from seven common laboratory projects and one inter-institutional project "Technological Evaluation of Germ Plasm Material" which is currently going on, in collaboration with Central Institute for Cotton Research, Nagpur.

Hindi Day Celebration

The Hindi day which was celebrated on September 23, 1988, was presided over by Dr. V. R. P. Sinha, Director, Central Institute of Fisheries Education, Bombay. Smt. Sudha Shrivastava, Assistant Director, Hindi Teaching Scheme, Bombay, was the chief guest. Cash prizes were awarded by Dr. Sinha to successful candidates of the following competitions, organised during Hindi week.

1. Quiz programme — "Uchit Shabda Kya Hai ?
2. Fill in the blanks (only for Group D and T-1 staff)
3. Essay competition
4. Kavya Pathan
5. Hindi knowledge
6. Noting and drafting competition
7. Elocution contest

Inspection of Sub-Committee of Parliament on Official Language

The second Sub-Committee of the Parliament on Official Language carried out an inspection of the work of CTRL on the use and implementations of the Official Language Act. Prior to the actual inspection and meeting with the Director and other members of the Official Language Committee of this Laboratory, the questionnaire giving relevant information on various aspects of use and implementation of Hindi in CTRL, was supplied to the above Committee. In view of the large number of organisations to be inspected by the Sub-Committee, a joint discussion of the Committee with the Director and Senior Officials of CTRL was held at Centaur Hotel on 28-9-1988 at 10 a.m. The Parliamentary Sub-Committee meeting was chaired by Shri Chintamani Jena, M.P., in the absence of Shri N. Tombi Singh, M.P., who joined lateron in the discussions. The other members of the Committee who were present, were Shri Amar Roy Pradhan, M.P., Prof Manoranjan Haldar, M.P., Shri Harish Rawat, M.P., Dr. Bapu Kaldate, M.P., Shri Atal Bihari Vajpayee, M.P. and Shri Mirza Irshad Baigh, M.P. The Committee was assisted by Shri K. N. Vohra, Under Secretary, Shri K. K. Grover, Deputy Secretary and Shri R. K. Malhotra, Assistant in the Department of Official Languages, Ministry of Home Affairs. The members from CTRL who took part in the discussions included Dr. N. B. Patil, Shri M. S. Parthasarathy, Dr. V. G. Munshi, Dr. V. G. Khandeparkar, and Shri Muntazir Ahmed, who are members of the Raja-

bhasha Samiti at CTRL. Shri Rajendra Prasad Gupta, Sr. Hindi Officer from ICAR also attended the meeting.

Immediately after the discussions, the members of the Sub-Committee inspected the various exhibits (posters and specimens) highlighting a number of research activities of the Laboratory. The members showed keen interest in them and appreciated the research work being carried out in CTRL.

Post Graduate Training

The recognition granted to CTRL by the University of Bombay as post graduate institution was continued during the year. Nine post graduate students were being guided for M.Sc. (2 for Physical Chemistry, 2 for Organic Chemistry and 5 for Textile Physics). Two students were being guided for Ph.D. degree in Physics.

The following scientists were the recognised research guides for various degrees during 1988.

1. Dr. V. Sundaram, Director (Retired on 30-4-1988)
2. Dr. N. B. Patil, Senior Scientist (Physics) (Director from 1-5-88)
3. Shri M. S. Parthasarathy, Senior Scientist (Mechanical Processing)
4. Dr. V. G. Munshi, Senior Scientist (Quality Evaluation)
5. Dr. K. R. Krishna Iyer, Scientist (Physics)
6. Dr. P. K. Chidambareswaran, Scientist (Physics)
7. Dr. (Kum.) I. G. Bhatt, Scientist (Chemical Studies)
8. Shri A. V. Ukidve, Scientist (Physics)
9. Dr. (Mrs.) P. Bhama Iyer, Scientist (Physics)
10. Dr. K. M. Parlikar, Scientist (Physics)

Membership of Other Organisations

The Director, CTRL continued to be Member of the following Committees/ Bodies during the year :

1. Cotton Advisory Board of the Office of the Textile Commissioner, Government of India, Ministry of Commerce, Bombay.
2. Board of Directors of Cotton Corporation of India Ltd., Bombay.
3. Board of Management of the Victoria Jubilee Technical Institute (VJTI), Bombay.
4. Post Harvest Technology Panel of ICAR.
5. Cotton Development Council (Government of India) and Member of Sub-Committees on (i) Research and Development and (ii) Trade, Pricing and Exports.

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

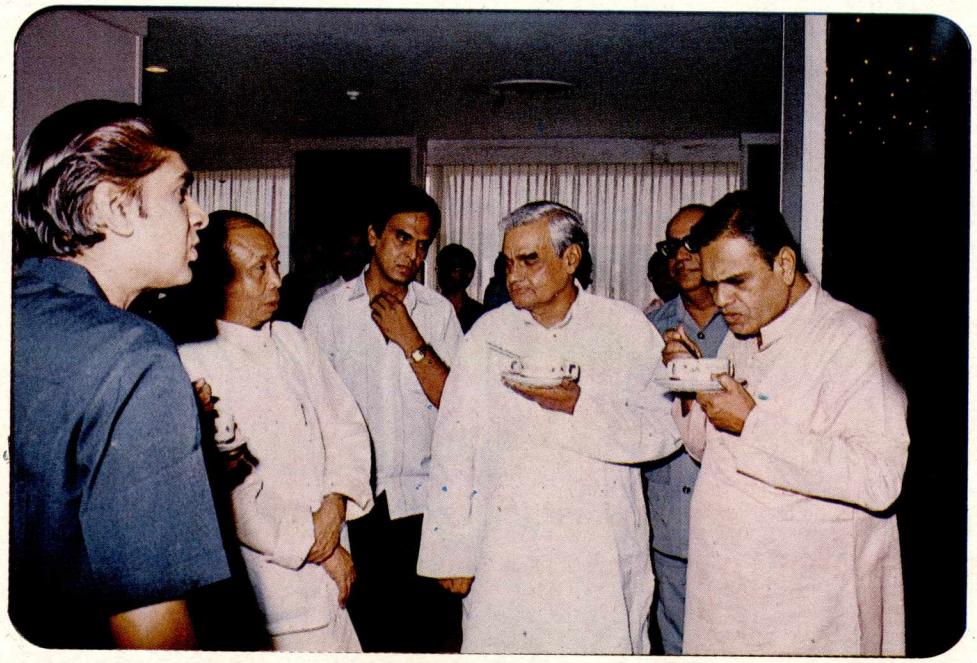
Institute Joint Council (IJC)

Three meetings of the IJC were held on 27-1-88, 28-5-88 and 4-10-88 to discuss various matters of general interest

PLATE IV

PARLIAMENT SUB-COMMITTEE ON HINDI IMPLEMENTATION

The Parliament Sub-Committee in Session



Some of the Distinguished Members of Parliament in the Sub-Committee (L to R) Shri Mirza Irshad Baigh (M.P.), Shri N. Tombi Singh (M.P.), Shri A. B. Vajpai (M.P.), Dr. Bapu Kaldate (M.P.) and Shri K. K. Grover (Deputy Secretary)

PLATE V

HINDI DAY CELEBRATION

Some of the participants of the competitions arranged during Hindi Day celebrations alongwith the Director and Judges.

PLATE VI

QUINQUENNIAL REVIEW OF CTRL

The Quinquennial Review Team visited Apollo Mills to see the functioning of CTRL Model Biogas Plant. At the centre is Dr. S. R. Ranganathan, Chairman of QRT.

to the staff. An inaugural meeting of the newly constituted IJC with members of old IJC was held on 29-12-88.

Finance

A statement showing sanctioned budget grant of CTRL and actual expenditure for the financial year 1987-88 has been furnished in Annexure IV. As could be seen from the statement, the actual expenditure under Non-Plan was Rs. 1,00,26,140 as against the sanctioned grant of Rs. 1,00,65,000. Further, an expenditure of Rs. 32,32,119 was incurred under the Plan budget as against the sanctioned grant of Rs. 32,00,000. An expenditure of Rs. 1,08,901 was incurred on the PL-480 research project, entitled "Cotton Fibre Tensile Properties in Relation to its Morphological and Fine Structure Parameters".

Significant Research Findings

The following new cotton varieties were recommended for release at the panel meeting of AICCIP for different zones :

1. Pusa-31
2. 378.BK
3. GDH.149
4. MCU.11
5. JK.119

Precleaning of cotton using four precleaners viz. CTRL Extractor, Inclined Cleaner, Finisher Extractor (FEC) and Platts' Opener, showed that Inclined Cleaner removed maximum trash ranging from 1.3% for AHH.468 to 3.5% for L.147. For H.4 variety, Platts' Opener removed a higher trash level of 1.3% as against 0.9% for Inclined Cleaner. The other two precleaners showed lower levels of cleaning. Productivity of gins did not differ between control and precleaned samples. Fibre properties did not show any trend between the different samples of the same variety, AKH.4 and AHH.468 and had low trash content when cleaned with Inclined Cleaner and Platts' Cleaner than with the other two precleaners. However, at yarn level it was found that classimat yarn faults (A, B and objectionable) were lower for Finisher Extractor — SR Gin combinations of AHH.4 and CTRL Extractor — SR Gin combinations of AHH.468.

Swelling and stretching of doubled yarns of coarse counts in aqueous Zinc chloride under optimum conditions resulted in the production of yarn with improved properties. Further, Zinc choloride swelling could also be used successfully for studying the inner fibrillar morphology of cotton fibres with SEM.

Studies on the resin finishing of cotton yarn through decrystallisation and stabilisation showed that the modification treatment involving two higher levels of acetylation enhances the reactivity of the cotton yarn towards the cross-linking resin and that the modified and cross-linked samples show higher moisture regain as compared to the unmodified and cross-linked samples. Best balance of mechanical properties were displayed through 20% NaOH preswelling.

Among the various catalyst systems studied, for cross-linking of cotton, terene blended fabric using Glyoxal,

the system consisting of Aluminium ammonium sulphate and Glycolic acid produced fabric with good strength and increased crease recovery properties with minimum yellowing effect.

Tertiary butyl hydroquinone was found to be effective in delaying the onset of rancidity of cotton seed oil to a very large extent.

Studies on cotton plant materials and dust using XRFS analysis revealed the presence of over 25 different elements in varying quantities. Even in plants grown in identical conditions differences in the elemental composition were observed.

Particle boards having optimum properties could be prepared from particles that could pass through 10 mesh and retained over 50 mesh and boards with 7 to 10% resin content were found to have strength properties in conformity with the standard specifications.

2

Progress of Research

A brief account of the research work carried out during 1988 at CTRL and its Regional Units including the Ginning Training Centre at Nagpur, is given below :

EVALUATION OF THE QUALITY OF COTTON SAMPLES RECEIVED FROM AGRICULTURAL TRIALS

Large number of cotton samples are received every year for the technological evaluation from the trials conducted by the All India Co-ordinated Cotton Improvement Project (AICCIP), Agricultural Universities and State Agriculture Departments. The number of samples received during 1988, for different tests has been given in Table 1(a). The total number of samples tested at various Regional Quality Evaluation Units of CTRL is presented in Table 1(b).

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

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

Samples tested state-wise for fibre characters and spinning performance have been given in Table 2 under two sub-heads — (i) AICCIP and (ii) Other State Schemes.

ALL INDIA CO-ORDINATED COTTON IMPROVEMENT PROJECT

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

As the cotton sowing and harvesting seasons differ widely from State to State, the breeding trials are conducted, zone-wise. Thus, three zones are identified according to agro-climatic conditions. The North Zone comprises the States of Punjab, Haryana, Rajasthan, Uttar Pradesh

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

Type of Test	Average for the quin-quennium 1981-85	1986	1987	1988
Fibre and Full Spinning	188	279	157	205
Fibre and Microspinning	1730	1904	1952	1851
Microspinning Alone	—	—	268	—
Fibre Tests Alone	212	244*	482**	83
Mill Tests	8	12	8	17
Standard Cottons	13	28	20	13
Trade Varieties	—	—	—	—
— Lint	15	105	46	18
— Kapas	52	32	40	25
Technological Research	138	13	—	45
Miscellaneous	20	3	—	5
Total	2376	2620	2973	2262

* Excludes 1251 lint samples received under Germ plasm and Agronomy Projects.

** Excludes 2246 lint samples received under Germ plasm and Agronomy Projects.

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

Regional Quality Evaluation Unit	Quality Parameters				Micro spinning tests
	Fibre length	Fibre fineness	Fibre strength	Fibre maturity	
Akola	1223	614	614	617	—
Coimbatore	1252	1943	1952	1952	460
Dharwad	1595	1595	1702	1875	—
Guntur	647	586	469	581	—
Hissar	338	553	423	571	—
Indore	920	920	1060	1060	—
Ludhiana	21	315	267	318	—
Nagpur	1417	923	923	923	—
Nanded	886	882	882	888	—
Rahuri	2188	2122	1021	2122	—
Sriganganagar	1594	936	1594	800	—
Surat	10,437	5347	2810	5716	429

TABLE 2 : NUMBER OF SAMPLES TESTED AND REPORTS SENT DURING 1988

(i) AICCIP

State	Fibre and Full spinning	Fibre and Micro-spinning	Fibre and OE-spinning	Fibre Test alone	Total
Punjab	43 (7)	10 (82)	—	1 (20)	18 (145)
Haryana	12 (3)	8 (44)	—	4 (31)	15 (87)
Uttar Pradesh	2 (1)	2 (10)	—	—	3 (12)
New Delhi	3 (3)	2 (41)	—	—	5 (44)
Rajasthan	8 (1)	3 (18)	—	1 (21)	5 (47)
Madhya Pradesh	1 (1)	9 (104)	—	—	10 (105)
Gujarat	30 (5)	2 (14)	—	—	7 (44)
Maharashtra	15 (5)	60 (392)	—	—	65 (407)
Andhra Pradesh	3 (1)	1 (12)	—	—	2 (15)
Karnataka	37 (6)	24 (354)	1 (2)	—	31 (393)
Tamil Nadu	11 (5)	13 (184)	—	1 (8)	19 (203)
Total	165 (38)	134 (1255)	1 (2)	7 (80)	180 (1502)

Note : Figures in brackets indicate the number of reports sent.

(ii) Other State Schemes

State	Fibre and Full spinning	Fibre and Micro-spinning	Fibre Test alone	Total
Punjab	1 (1)	—	40 (5)	41 (6)
Haryana	—	—	12 (1)	12 (1)
Uttar Pradesh	—	32 (1)	—	32 (1)
New Delhi	—	—	—	—
Rajasthan	13 (11)	—	—	13 (11)
Madhya Pradesh	6 (6)	—	36 (1)	42 (7)
Gujarat	14 (14)	—	—	14 (14)
Maharashtra	11 (9)	12 (1)	96 (4)	119 (14)
Andhra Pradesh	7 (4)	—	—	7 (4)
Karnataka	3 (3)	—	8 (1)	11 (4)
Tamil Nadu	6 (6)	4 (1)	—	10 (7)
Total	61 (54)	48 (3)	192 (12)	301 (69)

Note : Figures in brackets indicate the number of reports sent.

and New Delhi, the Central Zone includes the states of Madhya Pradesh, Gujarat and Maharashtra and South Zone is covered by the States of Andhra Pradesh, Karnataka and Tamil Nadu.

As many as 1550 samples were screened for fibre properties and spinning potential during the year. Test data on various trials were presented at the panel meeting of the respective zones held at Hissar for North Zone, Rahuri for Central Zone and Raichur for South Zone. The work done under various breeding trials is summarised below :

NORTH ZONE

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

G. hirsutum Trials

The Co-ordinated Varietal Trials (CVT) for Normal Plant Type as well as Compact Plant Type and Short Duration were conducted at Abohar, Faridkot, Hissar, Ludhiana, Mathura, Muktsar, Sirsa and Sriganganagar. The strains which recorded encouraging spinning performance at 30s and 40s counts at different locations under both the trials, are given below :

Location	*Count*	*Promising strains*
Abohar	30s	LH.956, LH.1041, LH.1134, B.N. and F.505
Faridkot	40s	HS(CP)23, HS (CP)33 and Pusa.116
	30s	F.846, F.806, LH.1031 and F.505
Hissar	30s	H.989, LH.922, HS (CP)23, H.1066 and H.777
Ludhiana	40s	HS(CP)33, Pusa.116 and B.N.
	30s	LH.886, LH.1031, LH.1134, B.N. and F.505
Mathura	40s	LH.1031, HS.137, CSH.485, LH.1062, LH.922 H.1066, HS(CP)23 and B.N.
Muktsar	40s	LH.922, Pusa.109 and B.N.
Sirsa	30s	H.974, HS(CP)23, HS(CP)33, LH.922 and H.989
Sriganganagar	30s	H.974, HS.2, RS.610, RS.696, CSH.485, LH.1050, F.1059, H.989, CSH.683-2, CSH.383-18 and G.Ageti

Table 3 shows the ranges of 2.5% span length, fineness and bundle strength alongwith assessment of maturity and spinning potential of the samples belonging to the above two trials.

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

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

Location	*Promising strains*
Faridkot	F.965, F.1057, F.821 and F.505
Hissar	HS.84-1 and CSH.385
Ludhiana	LH.1130, B.N. and F.505
Muktsar	F.771 and B.N.
Sirsa	LH.1096
Sriganganagar	LH.1096, LH.1031, HS.140, RST.19, RST.20 and G.Ageti

The Initial Evaluation Varietal Trial (IEVT) was conducted at Faridkot, Hissar and Sirsa. The following strains recorded satisfactory yarn strength at 30s at the locations indicated below :

Location	*Promising strains*
Faridkot	F.1065, Pusa.21, CSH.2186, F.1088, CSH.1186 and F.505
Hissar	F.1065, F.1088, Pusa.13 and H.777
Sirsa	H.1136 and H.777

G. arboreum Trials

The Co-ordinated Varietal Trial under this trial was conducted at Hissar, Ludhiana, Sirsa and Sriganganagar.

The object of this trial was to identify coarse, short staple and high ginning out-turn varieties suitable for blending purposes in place of the existing variety, G.27. The 2.5% span length of the strains tested under this trial ranged between 17.0 mm and 23.9 mm. The Micronaire value of the following samples was higher than 7.0 μg/in. at the locations indicated :

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

Location	No. of samples	Ranges of				Count	Spinning Performance		Control Variety
		2.5% span length (mm)	Micronaire value (μg/in)	Maturity	Bundle strength (g/t)		A	B	
1	2	3	4	5	6	7	8	9	10
				Normal Plant Type — BrO_4 (a)					
Abohar	7 F	22.6 — 28.2 (24.7)	4.2 — 5.4 (4.8)	79 — 88 (84)	42.3 — 46.6 (44.3)	30s	5	2	F.505
Faridkot	6 F	24.5 — 28.4 (26.1)	4.2 — 5.8 (5.0)	65 — 87 (78)	46.6 — 51.5 (48.6)	30s	4	2	F.505
Hissar	5 F	23.1 — 24.9 (24.1)	3.3 — 5.0 (3.9)	53 — 81 (70)	44.0 — 47.2 (45.6)	30s	1	—	H.777
Ludhiana	8 F	23.6 — 26.8 (25.6)	4.2 — 5.0 (4.7)	81 — 90 (85)	42.3 — 49.3 (44.3)	30s	1	3	F.505
Mathura	5 M	23.0 — 26.5 (24.6)	4.6 — 4.9 (4.7)	72 — 79 (77)	48.2 — 51.5 (50.1)	40s	4	4	Vikas
Sirsa	6 M	22.8 — 25.2 (24.0)	3.8 — 5.1 (4.4)	76 — 84 (79)	44.9 — 47.7 (46.1)	30s	1	3	H.777
Sriganganagar	8 F	23.2 — 27.8 (24.8)	4.0 — 5.2 (3.9)	66 — 88 (70)	46.6 — 50.4 (45.6)	30s	6	4	G.Ageti

1	2	3	4	5	6	7	8	9	10
			Compact Plant and Early Maturing Type — BrO_4 (b)						
Faridkot	6 F	24.2 — 26.1 (25.1)	4.1 — 5.3 (4.7)	74 — 82 (78)	44.9 — 50.9 (48.6)	40s	3	3	F.505
Hissar	5 M	22.1 — 25.5 (24.0)	3.6 — 4.1 (3.9)	77 — 83 (80)	44.0 — 50.4 (48.0)	30s	4	2	H.777
Ludhiana	7 F	22.3 — 26.9 (24.4)	3.2 — 4.9 (4.1)	72 — 82 (78)	44.5 — 49.3 (46.8)	40s	3	4	LH.900
Mathura	5 M	25.1 — 27.5 (25.9)	4.5 — 4.9 (4.7)	72 — 77 (74)	45.0 — 48.2 (46.8)	40s	4	4	Vikas
Muktsar	7 F	22.9 — 27.7 (25.1)	4.2 — 5.4 (4.7)	70 — 82 (76)	41.3 — 49.3 (44.5)	40s	3	4	LH.900
Sirsa	6 M	22.0 — 26.9 (24.6)	3.5 — 4.1 (3.8)	76 — 80 (78)	45.0 — 48.8 (46.4)	30s	4	4	H.777
Sriganganagar	6 F	22.9 — 26.1 (24.0)	3.5 — 4.7 (4.2)	71 — 77 (74)	48.8 — 52.0 (50.6)	30s	6	5	G.Ageti

F — Full Spinning.

M — Microspinning.

A — Samples spinnable to the count chosen.

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

Note — Values in bracket indicate averages.

Location	*Promising strains*
Hissar	CSA.12, LD.327, HD.107, HD.109, DS.1, DS.5 and G.27
Ludhiana	DS.15, RG.27, RG.21, LD.4333, RG.26, LD.230 and G.27
Sirsa	DS.2-1, CSA.40, HD.107, LD.341 and DS.5
Sriganganagar	LD.381, CSA.9-4, DS.5, CSA.40, G.1, RG.8 and G.27

Samples pertaining to Preliminary Varietal Trial under this programme were received from Hissar, Ludhiana and Sirsa. The object of this trial was to evolve high yielding superior cottons for spinning coarser counts. However, none of the strains gave desired yarn strength at 20s count.

Hybrid Trials

Intra-hirsutum hybrids involving **hirsutum** x **hirsutum** crosses were tried at Faridkot, Hissar, Ludhiana and Sriganganagar. The range of 2.5% span length was between 24.1 mm and 28.6 mm. Micronaire values ranged from 3.0 μg/in to 5.2 μg/in. Maturity was average to good. Bundle strength values were satisfactory. The following hybrids fared well in spinning performance at 30s count :

Location	*Promising hybrids*
Faridkot	PCHH.21, PCHH.13, FHH.3, FHH.5, CNHH.1 and F.505
Hissar	HHH.81, HHH.11, HHH.29, HHH.79 and H.777
Sriganganagar	PCHH.13, PCHH.32, FHH.3, FHH.5, RAHH.3 and G.Ageti

Miscellaneous Trials

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

Three pairs of released varieties, viz. (1) LD.230 and LD.327, (2) F.505 and F.286 and (3) LH.886 and LH.900 were tried at Ludhiana, to compare fibre properties between them. It was observed that there was no significant difference in mean fibre length, Micronaire fineness and bundle strength between LD.230 and LD.327; however, the other two pairs, F.505 and LH.900 were found to be superior in

length and strength to the other two varieties; viz. F.286 and LH.886, respectively and there was no significant difference in Micronaire value and maturity coefficient.

Pusa Hybrid.1 tried at New Delhi recorded mean fibre length of 30.0 mm (extra long staple category of cotton) with good length uniformity, fineness, maturity and bundle strength at both gauge lengths and fared well in spinning performance at 80s count.

In another trial of **G. barbadense** strains of Pusa at New Delhi, it was observed that out of eleven strains, all except one had mean fibre length of 26.9 mm and above (superior and extra long staple categories of cotton). As many as eight of these strains gave satisfactory spinning performance at 80s count.

A set of four samples of **G. hirsutum** under late and normal sown trial, was received from Sirsa. It was observed that in the case of late sown trial of HS(CP)23 and H.777 (control), both the strains were almost **on par** in mean fibre length, fineness, maturity and bundle strength. In spinning performance, HS(CP)23 recorded higher CSP values at both the yarn counts, viz. 30s and 40s than the control. In the case of normal sown trial, HS.6 was shorter in mean fibre length, coarser, poorer in strength and more mature as compared to the respective control, H.777. HS.6 gave satisfactory spinning performance at only 20s count, while the control, H.777 recorded desired CSP value at **40s count.**

CENTRAL ZONE

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

G. hirsutum Trials

Samples pertaining to the Co-ordinated Varietal Trial were received from Padegaon, Surat and Talod under irrigated conditions, from Akola, Badnapur, Jalagaon, Khandwa, Nanded and Parbhani under rainfed conditions and from Padegaon under advance sowing conditions. A set of samples approved for North Zone tried in the irrigated tracts of Deccan Canal was received from Padegaon.

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

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

Location	No. of samples	Ranges of				Count	Spinning Performance		Control Variety
		2.5% span length (mm)	Micronaire value (μg/in)	Maturity	Bundle strength (g/t)		A	B	
1	2	3	4	5	6	7	8	9	10
				Irrigated Trial — BrO_4 (a)					
Padegaon	5 M	23.9 — 29.2 (25.9)	3.4 — 3.7 (3.6)	63 — 79 (71)	41.8 — 44.5 (42.8)	40s	2	—	—
Padegaon	14 FT	22.7 — 29.1 (26.4)	2.7 — 4.3 (3.6)	59 — 81 (74)	38.6 — 49.8 (44)	—	—	—	—
Surat	7 F	25.9 — 29.6 (27.8)	3.4 — 5.2 (4.2)	75 — 86 (81)	45.0 — 48.8 (47.4)	40s	7	6	G.Cot.14
Talod	7 M	26.0 — 29.5 (28.1)	3.0 — 4.2 (3.6)	66 — 81 (75)	47.7 — 50.4 (48.8)	40s	6	4	G.Cot.14
Padegaon (N.Z.)	7 F	23.8 — 27.8 (25.5)	3.2 — 4.0 (3.8)	69 — 80 (74)	40.7 — 48.8 (43.2)	40s	6	3	Kop.498
				Rainfed Trial — BrO_4 (b)					
Akola	6 M	25.2 — 27.8 (26.0)	3.6 — 4.7 (4.0)	68 — 80 (75)	44.0 — 49.3 (46.0)	30s	—	—	—
Badnapur	6 M	22.8 — 26.2 (24.0)	3.7 — 4.2 (4.0)	65 — 79 (74)	40.2 — 43.4 (42.4)	40s	1	5	Purnima

1	2	3	4	5	6	7	8	9	10
Jalgaon	18 M	23.8 — 29.5 (25.6)	3.5 — 4.7 (4.1)	63 — 86 (79)	42.9 — 49.8 (46.3)	30s	—	—	—
Khandwa	18 M	22.8 — 28.6 (25.4)	2.6 — 3.8 (3.2)	60 — 81 (73)	41.3 — 48.2 (45.5)	30s	—	—	Khandwa.3
Khandwa (1986-87)	5 M	21.1 — 23.3 (22.1)	3.8 — 4.4 (4.0)	73 — 85 (79)	43.4 — 47.7 (45.7)	30s	—	—	—
Nanded	4 M	23.9 — 27.7 (25.5)	3.8 — 4.0 (3.9)	69 — 76 (74)	44.0 — 48.8 (45.8)	40s	4	—	Purnima
Parbhani	4 M	22.2 — 29.8 (29.8)	3.3 — 4.1 (3.6)	70 — 79 (76)	45.0 — 49.3 (46.8)	40s	—	—	—
Somnathpur	6 M	24.6 — 29.9 (27.0)	4.2 — 4.7 (4.4)	72 — 79 (76)	41.8 — 48.2 (45.2)	40s	2	1	Purnima
			Advance Sowing Trial — BrO_4 (c)						
Padegaon	8 M	25.1 — 27.9 (26.1)	3.2 — 4.5 (3.9)	64 — 81 (72)	40 2 — 44.0 (42.3)	40s	4	5	Kop.498
Padegaon	2 M	25.2 — 26.6 (25.9)	3.9 — 4.3 (4.1)	80 — 80 (80)	40.7 — 42.3 (41.5)	40s	—	—	—

F — Full spinning.

M — Microspinning.

A — Samples spinnable to the count selected.

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

FT — Fibre test only.

Note — Values in bracket indicate averages.

Location	*Count*	*Promising strains*
		Irrigated
Padegaon	40s	G.10.M and NH.258
Surat	40s	G.Cot. 10, DS.70-480, Suman, G.4808, G.4812, PH.93 and G.Cot.14
Talod	40s	G.4814, G.4812, G.5249, Suman, G.Cot.10 and G.Cot.14
		North Zone entries
Padegaon	40s	H.912, H.974, HS.2, Laxmi and KOP.498
		Rainfed
Akola	30s	G.Cot.10
Badnapur	40s	DCI.126
Jalagaon	30s	G.2987, G.4406, G(T) 325, PH.36, PA.39, NH.208, DCI.126, AKH.8247, AKH.938, 79-KH-1945, KH.81-1911, 79-BH-5-3, WH.216, SRT.1 and G.Cot.10
Khandwa	30s	G.2987, G.4406, PH.36, PH.93, PH.39, NH.208, DCI.126, AKH.8246, AKH.8247, AKH.938, 79-KH-1945, KH.81-1911, 79-BH-5-3, WH.216, G.Cot.10 and Khandwa 3
Nanded	40s	DCI.126, PH.93, G.Cot-10 and Purnima
		Advance sowing
Padegaon	40s	605, 615, 618 and Laxmi

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

Location	*Count*	*Promising strains*
		Irrigated
Talod	40s	G.84-109, G(T)895, G(B)20, G(B)2097, G.Cot.10 and G.Cot.14

Location	*Count*	*Promising strains*
		Rainfed
Khandwa	30s	JLH.109, NH.293, WH.21, PH.23, KH.98-2105, KH.100-2337, G.Cot.10 and Khandwa 3
Nanded	40s	KH.100-2237 and G.Cot.10
Parbhani	40s	KH.100-2237, PH.23, JLH.109, NH.293 and G.Cot.10

IEVT was conducted at Akola, Khandwa, Nanded and Parbhani under rainfed conditions. The following strains recorded desired yarn strength at the locations and the counts as indicated below :

Location	*Count*	*Promising strains*
Akola	40s	JLH.158
Khandwa	30s	KH.101-2238, G.3932 and KH.96-2105
Nanded	40s	NH.381 and Purnima
Parbhani	40s	NH.380, 081 and NH.394

G. arboreum Trials

Co-ordinated Varietal Trial was conducted at Akola, Badnapur, Nanded and Somnathpur. The following strains recorded satisfactory spinning performance at the locations and the counts given below :

Location	*Count*	*Promising strains*
Akola	20s	MDL.82-1825, 35.N, AKA.5 and AKH.4
Badnapur	20s	NA.347, PA.136, Eknath and Rohini
Nanded	30s	PA.141, NA.367, NA.362, NA.364, NA.347, NA.318, NA.315, NA.266, NA.339, PA.85-150, NA.80, PA.85-1 and Rohini
Somnathpur	20s	PA.85/160, PA.85/162, NA.266 and PA.136

G. herbaceum Trials

Samples pertaining to Co-ordinated Varietal Trial were received from Surat and were subjected to full spinning test. Four strains, viz., GH.458/1165, GH.489, SM.150B and G.Cot.11 recorded satisfactory spinning performance at 20s count, while two strains, viz;

GH.378-BK and GH.490 gave desired CSP values at 30s count.

Hybrid Trial

The object of this trial was to identify early maturing hybrids superior in yield and quality to the existing local hybrids such as Hybrid. 4, Hybrid. 6, JKHy.2, Godavari, etc. in Gujarat, Madhya Pradesh and Maharashtra. Considering the increasing demand for medium and superior medium categories of cotton, attempts are also made to identify **desi** hybrids.

Intra-hirsutum Hybrid Trial

Samples pertaining to this trial involving **G. hirsutum** crosses were received from Nanded, Parbhani, Padegaon and Surat under irrigated conditions and from Khandwa, Nanded and Parbhani under rainfed conditions.

The promising hybrids at different locations and counts are indicated below :

Location	*Count*	*Promising hybrids*
		Irrigated
Nanded	60s	NHH.302, NHB.12 and DCH.32
Parbhani	40s	NHB.12, PHH.146, PHH.134 and NHH.302
Padegaon	30s	CNHH.1, CNHH.2, G.Cot.HH.34, NIHH.45, NIHH.49, RHH.195 and B.N.
Surat	60s	WHH.37 and G.Cot.Hy-6(control)
		Rainfed
Khandwa	40s	NHH.307, WHH.50, MECH.49, WHH.90, NIHH.50, NIHH.45, MECH.134, MECH.138, Hybrid 4 and JKHy.2
Nanded	40s	NHH.307, NIHH.50, NHH.44, NHH.302, WHH.204, NH.413 and JKHy.2
	30s	NHH.44 and PHH.204
Parbhani	60s	NHH.12
	40s	MECH.134, MECH.138, WHH.204, NHH.44 and Godavari

Inter-specific Hybrid Trial

Hybrids involving **G. hirsutum** × **G. barbadense** crosses were tried at Nanded, Padegaon, Parbhani and Surat and those involving **G. arboreum** × **G. herbaceum** crosses at Akola and Surat. The promising hybrids from the spinning point of view, which fared well at the locations and the counts are as follows :

Location	*Count*	*Promising hybrids*
		G. hirsutum × *G. barbadense*
Nanded	80s	NHB.12 and DCH.32
Surat	60s	NHB.12 and GHB.148
Surat	60s	NHB.12 and MECH.10
		G. arboreum × *G. herbaceum*
Akola	20s	GDH.149, GDH.160, AKA.5 and GDH.22
Jalagaon	20s	GDH.22 and Jyoti
	30s	GDH.149 and GDH.160
Surat	30s	GDH.149 and GDH.160

Evaluation of Dwarf and Compact Material

In order to identify dwarf and compact type of plant, trials were conducted at Akola, Jalgaon and Nanded. The following strains recorded encouraging spinning performance at the locations and the counts indicated below :

Location	*Count*	*Promising strains*
Akola	30s	G.Cot.10 and LRA.5166
Jalgaon	30s	NH.5-1412, NH.262, G.Cot.10, IMH.2934, AKH.0133, G(T)996, SRT.1, Surat Dwarf, LRA.5166 and G.4231
Nanded	40s	LRA.5166 and G.Cot.10

Miscellaneous Trials

Results of a few miscellaneous trials conducted at different locations are given below :

The strains, viz. NA.266, 85/PA.139, PA.141, NA.106, PA.85/85, NA.135, NA.88 belonging to **G. arboreum** trial were received from Badnapur. The two local control varieties, viz. Eknath and Rohini were also received. Tests showed that all the samples fared well in spinning performance at 20s count.

Two samples of cotton were received from Indore under Inter-specific Hybrid Trial. Both the hybrids, viz. JICH.2 and JICH.4, recorded mean fibre length covered by the long staple category of cotton. Both the hybrids possessed good fibre fineness, maturity

and bundle strength at zero gauge, however, none of them fared well in spinning performance at 50s count.

A high yielding **G. herbaceum** strain, **KW(HR)1 received from Khandwa was** subjected to full spinning test. This strain with mean fibre length of 21.6 mm covering superior medium staple category gave satisfactory spinning performance at 20s count.

A set of eight samples was received from Nagpur under the trial of Inter-specific Hybrid Derivative Line. Of these, only two strains, viz. V.6 (SRT.1) and V.7(PKV.081) were found to record encouraging CSP values at 20s count.

In a miscellaneous trial of Inter-specific hybrids, two samples were received from Nanded. The two hybrids, viz. NHB.12 and DCH.32 were **on par** with respect to fibre properties, but in the case of spinning performance, NHB.12 was superior to the control, DCH.32 at both the counts of 60s and 80s. The hybrid NHB.12 alone recorded optium CSP at 80s count.

In another case, two sets of five samples each were received from Parbhani under the Combined Varietal Trial. Under irrigated conditions, two strains, viz. PHH.129 and NH.262 were found to fare well in spinning performance at 40s count, while under rainfed conditions, only one strain, viz. 081 recorded desired yarn CSP values at 40s count.

In another miscellaneous trial of long staple **G. arboreum** cottons, a set of three samples were received from Parbhani. The new strain, **PA.141** recorded mean fibre length of **24.5 mm** covering the long staple category of cotton as compared to the superior medium staple category of Rohini and Eknath, both being control varieties. All the three strains recorded good CSP values at 20s count.

SOUTH ZONE

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

G. hirsutum Trials

Co-ordinated Varietal Trial was conducted at Arabhavi, Coimbatore, Dharwad, Guntur and Raichur under irrigated conditions and at Dharwad and Kovilpatti under rainfed conditions. The ranges of 2.5% span length, Micronaire value, maturity and bundle strength along with the assessment of spinning performance made on the cotton samples received are given in Table 5.

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

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

Location	No. of samples	Ranges of				Count	Spinning Performance		Control Variety
		2.5% span length (mm)	Micronaire value (μg/in)	Maturity	Bundle strength (g/t)		A	B	
1	2	3	4	5	6	7	8	9	10
				Irrigated Trial — BrO_4 (a)					
Arabhavi	12 M	25.3 — 34.9 (30.0)	3.0 — 4.4 (3.7)	65 — 81 (72)	40.2 — 47.7 (41.4)	50s	9	4	LRA.5166
Coimbatore	12 M	25.9 — 31.8 (29.2)	3.0 — 4.5 (4.0)	—	—	50s	7	7	LRA.5166
Dharwad	12 M	28.3 — 32.2 (29.8)	3.3 — 4.6 (3.9)	74 — 78 (76)	40.7 — 44.5 (42.9)	40s	11	7	DS.59
Guntur	12 M	24.2 — 31.4 (26.7)	2.4 — 3.4 (3.1)	56 — 81 (70)	40.7 — 47.2 (44.3)	50s	3	4	LRA.5166
Raichur	12 M	25.0 — 32.2 (29.6)	3.2 — 5.2 (4.4)	58 — 76 (65)	41.3 — 48.2 (46.0)	50s	2	2	LRA.5166
Raichur	13 M	26.4 — 31.8 (28.8)	3.1 — 3.8 (3.4)	61 — 75 (70)	40.7 — 47.2 (43.8)	50s	—	7	Sharada
				Rainfed Trial — BrO_4 (b)					
Dharwad	8 M	26.5 — 29.4 (27.8)	3.5 — 4.4 (4.0)	70 — 77 (73)	36.4 — 42.3 (40.0)	40s	5	5	Sharada

Table 5 (Contd.)

1	2	3	4	5	6	7	8	9	10
Dharwad	8 F	23.7 — 25.4 (24.3)	3.0 — 4.4 (3.6)	53 — 73 (64)	39.1 — 44.5 (42.8)	40s	3	2	Sharada
Dharwad	8 M	23.5 — 28.0 (25.6)	3.4 — 4.6 (4.1)	63 — 78 (73)	41.3 — 45.0 (42.8)	40s	3	6	Sharada
Kovilpatti	8 M	27.7 — 32.0 (28.6)	3.6 — 4.7 (4.1)	—	—	40s	—	—	—

M — Microspinning.

F — Full spinning.

A — Samples spinnable to the count chosen.

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

Note — Value in bracket indicate averages.

Location	*Count*	*Promising strains*
		Irrigated
Arabhavi	50s	ACP.71-12-3, TKH.4-3, TCH.665, AHO.61-38-2, HLS.321729, RAS.311, JK.119-25-54, MCU.5, and LRA.5166
Coimbatore	50s	TKH.4-3, TCH.665, HLJ.321729, RAS.311, AHO.66-107-1/1, MCU.5 and MCU.9
Dharwad	40s	TKH.4-3, TCH.665, HLJ.321729, RAS.311, ACP.71-12-3, AHO.66-107-1/1, AMO.61-38-2, JK.119-25-54, MCU.5, LRA.5166 and DS.59
Guntur	50s	TKH.4-3, HLS.321729 and MCU.5
Raichur	50s	HLS.321729 and MCU.5
		Rainfed
Dharwad	40s	JK.236-2, DRC.153, CPD.11-1-2, L.1, LRA.5166 and Sharada
Kovilpatti	40s	CPD.11-1-2, JK.236-2, L.1, LRA.5166 and MCU.10

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

The following strains recorded encouraging CSP values at the counts and the locations given below :

Location	*Count*	*Promising strains*
		Irrigated
Arabhavi (MS)	40s	AH.107, LPS.141, AS.104, 1110-1, CPD.410, AS.154, L.2, CPD.412, L.8, TSH.162, L.10, AH.130, TSH.164, 170.CO_2, DC1.120 and LRA.5166
Arabhavi (LS)	40s	RAMP.69, L.571, CPD.415, TCH.1002, LK.861, NERR.2-3-2, TCH.959, CPD.408, L.389-1, 170-CO_2, HLS.56, TCH.1005, TCH.1001, HLS.54, DCI.126 and MCU.5

Location	*Count*	*Promising strains*
Coimbatore (MS)	50s	LK.861, L.389-1, HLS.54, HLS.56, TCH.959, L.571, MCU.5 and MCU.9
Raichur (MS)	50s	AH.130, L.2, AS.154 and LRA.5166
Raichur (LS)	50s	TCH.1002, TCH.1001, LK.861, CPD.408, L.389-1, HLS.54, HLS.56, TCH.959, NBPR.2313, L.57, AS.303 and MCU.5
Siruguppa (MS)	40s	AH.107, L.8, MESR.32, AH.130, L.2, AH.154, CPD.410, RAMP.154, TSH.164, TSH.162, DCI.120, L.10, CPD.412, LRA.5166 and DS.59
Siruguppa (LS)	40s	TCH.1002, TCH.1001, LK.861, CPD.408, L.389-1, CPD.415, HLS.54, HLS.56, TCH.959, NPBR.2-3/3, L.571 and MCU.5
		Rainfed
Dharwad	40s	LK.861, HLS.321729, JK.276-4, JK.260, TKH.497, NA.1269, L.10, and LRA.5166
Kovilpatti	40s	JK.260, JK.276-4, DRC.15, CPD.404, L.10, HLS.321729, DPI-24/81, NA.1269, TKH.497, SRG.804, NA.162, LK.861, LRA.5166 and MCU.10

MS — Medium Staple

LS — Long Staple

G. barbadense Trials

Co-ordinated Varietal Trial was conducted at Coimbatore, Dharwad and Raichur, under irrigated conditions. The following strains showed satisfactory yarn strength at the locations and the counts given below :

Location	*Count*	*Promising strains*
Coimbatore	80s	C.17, IMS.0721, IMS.2722, IMP.0131, TCB.87-6, TCB.292 and Suvin

Location	*Count*	*Promising strains*
Dharwad	80s	BCS.23-18-17, TCB.87-6, C.17, TCB.273-1-15, BCS.9-95, TCB-292, TCB.295, IMS.0721, IMS.2722, IMP.1021, IMP.0131 and Suvin
	60s	BCS.9-95, DCH.32 and Suvin
Raichur	80s	TCB.273-1-15, C.17, BCS.9-95, BCS.23-18-7, TCB.295, IMS.0721, IMS.2722, IMP.1021, IMP.0131 and Suvin

G. arboreum Trials

In the Co-ordinated Varietal Trial conducted at Kovilpatti, four out of ten strains fared well when spun to 30s count. They are TKA.188, KAS.1, 2220 and the local control, K.10.

Hybrid Trial

Intra-hirsutum Hybrids

The hybrid trial involving **hirsutum** × **hirsutum** crosses was conducted at Arabhavi, Coimbatore and Dharwad under irrigated conditions and at Dharwad under rainfed conditions. The following hybrids fared well in spinning performance at the locations and the counts given below :

Location	*Count*	*Promising hybrids*
		Irrigated
Arabhavi	50s	DHH.10, NH.198, $T_7 \times M_{12}$, CINHH.1, NHH.201, JKHy.1, CPHO.22, X.8309, LRA.5166 and MCU.5
Coimbatore	50s	NCH.4, GHH.334, NHH.198, NHH.20 TCHH.27, X.8309, JKHy.1, $T_7 \times M_{22}$, TCH.665, MCU.9, MCU.5 and LRA.5166
Dharwad	40s	$V_1 \times M_{26}$, CINHH.2, NHH.198, NHH.201, TCHH.27, X.8309 and LRA.5166
		Rainfed
Dharwad	40s	DHH.504, DHH.503, $T_7 \times M_{12}$, NHH.39, NHH.189, CNHH.104, $V_{29} \times M_{29}$, GHH.334, JKHy.1, LRA.5166, DHH.12 and Sharada
	50s	$T_7 \times M_{12}$, NHH.39, $V_{22} \times M_{29}$ and JKHy.1

Inter-specific Hybrids

The hybrids involving **hirsutum** × **barbadense** crosses were tried at Coimbatore, Raichur and Siruguppa under irrigated conditions and those involving **arboreum** × **herbaceum** crosses at Kovilpatti under rainfed conditions. The following hybrids fared well in spinning performance at the locations and the counts indicated below :

Location	*Count*	*Promising hybrids*
		hirsutum × *hirsutum*
Coimbatore	80s	H.226 and NHB.116
Raichur	80s	DHB.115, DHB.116, DHB.154, TCHB.213, CPHB.289 and H.226
		H.224, NHM.116 and H.226
		arboreum × *herbaceum*
Kovilpatti	30s	DDH.1, GDH.22, GDH.149, NCA.197 Jayadhar and K.10

National Elite Varietal Trial

Two sets of **G. hirsutum** samples, one consisting of 14 strains and the other of 11 strains were tried under irrigated conditions at Raichur. From the first set, out of fourteen as many as thirteen strains recorded encouraging spinning performance at 40s count. They are; LRA.5166, Sharada, MCU.5, RAS.303, JK.119-25-54, DEP.71-27-1/1, DRC. 68, DRC.153, JK.276-4, JK.260, RAMPBS.296, CDP.11-1-2 and RAS. 299-1. And from the other set, out of eleven only one hybrid, DCH.32 recorded desired CSP value at 80s count.

Miscellaneous Trial

A good number of trials having different objectives have been conducted at Arabhavi, Coimbatore, Dharwad, Kovilpatti, Nandyal and Raichur.

Two sets of two samples each were received from Coimbatore for full spinning test. In one set, two strains, viz. RKR.4145 and LRA.5166 were grown under rainfed conditions. The control variety, LRA.5166 which recorded better fibre properties than RKR.4145, gave encouraging spinning performance at 40s count, while RKR.4145 recorded desired CSP value at 20s count only. In the other set of two samples, MCU.9 was superior in fibre properties to MCU.11 and in spinning performance, MCU.9 was found spinnable to 50s count, while MCU.11 to 40s count.

A miscellaneous trial of extra long staple cottons of **G. hirsutum** was conducted at Coimbatore during winter season. Out of nineteen strains HLS.17, HLS.88 and HLS.92 along with the control, MCU.5 VT alone could satisfy the objective of the trial by recording mean fibre length of 30.0 mm and above. Further, as many as nine strains

fared well in spinning performance at 60s count.

Another set of 13 samples were received from Coimbatore under Long and Extra-Long Staple **Intra-hirsutum** Hybrid Trial. Considering the objective of the trial, mean fibre length recorded by the strains was covered by only superior long staple category, ranging between 26.3 mm and 29.0 mm. As many as nine strains, viz. T 54 × M 12, V 59 × M12, HLS.83 × M33, HLS.24 × M12, HLS.23 × M.33, HLS.24 × M.34, T.11 × M.12 including the two control varieties. Savita and MCU.5 VT, recorded satisfactory spinning performance at 60s count.

Twelve samples of DCH.32 grown under rainfed conditions at Dharwad were evaluated for fibre properties and spinning performance. The fibre properties, viz. mean fibre length, Micronaire value and bundle strength varied between 33.6 mm and 37.9 mm, between 2.7μg/in and 3.3 μg/in and between 42.9 g/t and 48.8 g/t, respectively. Maturity was good. Out of twelve, as many as five strains of DCH.32 were found suitable for spinning to 80s count.

A new promising Karungani **G. arboreum** strain, viz. TKA.188, along with the control variety, K.10, was tried at Kovilpatti. Both the cottons recorded promising spinning performance at 20s count.

Two **intra-hirsutum** hybrids, viz. NHH.39 and NH.14 grown at Nandyal were superior in length and fineness as compared to the control variety, JKHy.1. Further, the hybrid, NHH.39 recorded encouraging spinning performance at 50s count.

COTTON VARIETIES RECOMMENDED FOR RELEASE DURING 1988

(1) **Pusa.31**

This is a long staple category of cotton with mean fibre length of 24.2 mm having average fineness, good maturity and bundle strength. The spinning potential of this strain is about 40s count. This is a compact plant type and short duration of 150 days with excellent yield performance in comparison with the existing varieties of H.777 and B.N. in the states of Northern Zone, viz. Punjab, Haryana, Rajasthan, Uttar Pradesh, etc.

(2) **378.BK**

This is superior medium staple **desi** (G. herbaceum) cotton superior to the local variety, G.Cot.11 in ginning outtern, yield and earliness by 15 days. This variety is suitable for cultivation in South and Middle Gujarat State, under rainfed conditions like other **desi** varieties. However, spinning potential of this strain is about 16s count.

(3) **GDH.149**

This is a high quality **desi** hybrid **(G. herbaceum × G.arboreum)** strain belonging to superior long staple category of cotton recording encouraging spinning performance at 40s count and above. In yield potential, it is **on per** with **GDH.22** (G.Cot.Hy.7) and superior to G.Cot.11. This hybrid has

been identified for cultivation in South Gujarat (Irrigated) and Middle Gujarat (rainfed) cotton zones. Its maturation period is about 200 days.

(4) **MCU.11**

This is a hybrid derative from the cross between MCU.5 and Egyptian **hirsutum** released for the winter Combodia irrigated tract of Tamil Nadu. It is high yielding and early in maturation by 10 to 15 days as compared to the local varieties, MCU.5 and MCU.9. This is a superior long staple category of cotton with a spinning potential between 40s and 50s count.

(5) **JK.119-25-54**

This strain is recommended for release in the irrigated area of Karnataka and found to be superior to MCU.5 and LRA.5166 in yield. It has a high ginning out-term of 39% with a maturation period of 150 days. It is a superior long staple cotton suitable for spinning to 40s count.

The fibre properties and spinning potential of the above varieties are given in Table 6.

TABLE 6 : FIBRE PROPERTIES AND SPINNING POTENTIAL OF NEWLY RELEASED VARIETIES/HYBRIDS

No.	Variety/ Hybrid	2.5% span length (mm)	Micronaire value	Bundle strength ('0' gauge)	Spinning potential (count)	Recommended are of cultivation
1.	Pusa 31	27.4	4.1	46.2	30s — 40s	Northern zone
2.	378.BK	24.1	5.3	51.4	Below 30s	South and Middle Gujarat
3.	GDH.149	30.3	4.2	48.1	40s	South Gujarat (irrigated) and Middle Gujarat (rainfed), cotton zones
4.	MCU.11	30.0	3.8	45.3	40s — 50s	Winter combodia tract of Tamil Nadu
5.	JK.119-25-54	30.2	3.5	42.2	40s	Irrigated areas of Upper Krishna, Tungabhadra and Malaprabha project areas

PROMISING STRAINS

The following strains hybrids, have shown promising performance :

State	*Promissing strains/hybrids*
Punjab	LH.986, LH.1031, LH.1134, LD. 327
Haryana	H.974, HS (CP)23, DS.5
New Delhi	Pusa.116

State	*Promising strains/hybrids*
Uttar Pradesh	CA.10-2 (Vikas)
Rajasthan	RST.9, RS.610, RS.634
Gujarat	G.4812, GHB.418, GDH.160
Maharashtra	PH.93, DC.1.126, AKA.8401, NHB.12, PA.141, NHH
Madhya Pradesh	JKHy.2, KW(HR).1
Andhra Pradesh	NHH.39
Karnataka	JK.276-4, JK.260, BCS.9-95
Tamil Nadu	RKR.4145, H.224, H.226, C.17, TKH.4-3, TKA.188, LK.861, HLS.321729

Mill Test

A new strain which is promising in yield and technological performance after subjecting it to full spinning test for at least two to three seasons successively, is tested under the mill conditions before it is released for large scale cultivation. This Laboratory arranges mill tests on the new promising strains in co-operation with some of the textile mills in the country.

During the period, mill tests were arranged for samples received from Ludhiana, New Delhi and Kanpur from North zone, from Akola and Nagpur of Central zone and from Dharwad of South zone and the test results are incorporated in Table 7.

The CSP values recorded by the strain, LH.886 received from Ludhiana was lower as compared to that by the control variety, F.286 at both the counts, viz. 30s and 40s at the mill as well as at the Laboratory. Both the cottons recorded encouraging spinning performance at the mill, while the control variety, F.286 recorded desired CSP at 40s count at the Laboratory only.

The new improved strain, Pusa.31 received from New Delhi recorded mean fibre length of 24.8 mm covering long staple category of cotton with average to good fineness, good maturity and bundle strength. In spinning performance, it recorded desired CSP value at 40s count, both at the mill and at the Laboratory.

A new **G. arboreum** strain, Vikas (CA. 10-2) received from Kanpur was better in mean fibre length, length uniformity and bundle strength at $\frac{1}{8}''$ gauge length than the control variety, Pramukh. In spinning performance, Vikas recorded better CSP value at 20s count as compared to Pramukh, both at the mill and at the Laboratory.

TABLE 7 : COMPARATIVE SPINNING TEST RESULTS AT MILL AND AT CTRL FOR THE YEAR 1988

Place	Variety	Mill Test				Laboratory Test			
		Count (Ne)	Strength (lb)	CSP	Twist Multiplier	Count (Ne)	Strength (lb)	CSP	Twist Multiplier
Ludhiana	LH.886	30s	66.0	1980	4.0	30s	67.4	2022	4.0
		40s	44.0	1762	4.5	40s	46.6	1864	4.0
	F.286(C)	30s	69.5	2085	4.0	30s	73.8	2214	4.0
		40s	45.9	1836	4.5	40s	51.1	2044	4.0
New Delhi	Pusa.31	40s	56.0	2240	4.7	40s	56.7	2268	4.0
Kanpur	Vikas	20s	96.0	1959	4.5	20s	118.0	2386	4.0
	Pramukh(C)	20s	90.0	1853	4.5	20s	116.0	2278	4.0
Akola	AKA.8401	20s	91.0	1820	—	20s	91.3	1826	4.0
	AKH.4(C)	20s	88.7	1774	—	20s	97.9	1958	4.0
Nagpur	CICR.HH.1	30s	60.8	1825	4.5	30s	62.0	1863	4.0
Dharwad	JK.119	30s	63.0	1889	4.7	30s	77.5	2325	4.0
		40s	48.4	1934	4.8	40s	55.3	2215	4.0
	JK.276-4	30s	70.3	2148	4.7	30s	81.3	2439	4.0
		40s	53.7	1979	4.0	40s	58.0	2320	4.0
	Laxmi(C)	30s	69.9	2097	4.8	30s	68.4	2052	4.0
		40s	56.9	2275	4.8	40s	49.5	1980	4.0
	Sharada(C)	30s	57.6	1728	4.9	30s	76.6	2298	4.0
		40s	38.6	1545	4.9	40s	53.0	2120	4.0

C — Control Variety

The long staple **G. arboreum** strain, AKA.8401 received from Akola recorded fibre length more than that for the control variety, AKH.4. However, the CSP value recorded by AKA.8401 for 20s count was not found satisfactory either at the mill or at the Laboratory.

The **intra-hirsutum** hybrid strain, CICR.HH.1 from Nagpur did not fare well in spinning performance at 30s count either at the mill or at the Laboratory.

The spinning performance of the two new strains, viz. JK.119-25-54 and JK.276-4 along with the two control varieties, viz. Laxmi and Sharada, in terms of lea CSP was better at CTRL than at the mill. As regards the performance between cottons, both the strains, JK.119-25-54 and JK.276-4 gave higher yarn strength than the two control varieties both at 30s and 40s counts.

TECHNOLOGICAL EVALUATION OF GERMPLASM MATERIAL

In the course of breeding programmes, a good deal of valuable genetic material is developed, which might not get recognised as variety, but it might have some significant characteristics or combination of characters which may serve as the useful donors for the future breeding or crossing work. This project was taken up with the aim of registering and documenting such genetic material available in all the species of cotton, which may be useful for cotton breeders, depending on the quality character/s to be improved. During the period, about 150 germplasm stocks of **G. arboreum** and 100 samples of **G. hirsutum** were evaluated for fibre quality and the dominant character/s were identified. High volume instrument was used for determination of 2.5% span length, Micronaire fineness and tenacity at $\frac{1}{8}''$ gauge and Micronaire was used to determine the maturity coefficient with spacer technique.

(i) G. arboreum

2.5% span length varied between 19.7 mm and 24.6 mm. Genotypes H.47 and G.845 were short stapled with 19.7 mm and 20.2 mm, respectively, with 6.3 and 5.8 as Micronaire values whereas, the strain H.41 recorded superior medium (24.6 mm — span length) with 5.5 Micronaire value and 26.7 g/t at $\frac{1}{8}''$ gauge. Cultivars G.233, H.234, H.148, H.89, G.725 and G.53, also had superior medium staple. In respect of tenacity at $\frac{1}{8}''$ gauge, strain H.148 and H.150 recorded very high (29.3) g/t, followed by H.3, H.214, H.241, H.234, H.151, G.113 (all above 28.0 g/t) and G.47, G.845, H.41, H.94, H.120, H.174, H.190 and H.248 (all above 27.0 g/t). Variability in tenacity was between 17.0 g/t (Gao. 616) and 29.3 g/t (H.148 and H.150).

(ii) G. hirsutum

Variability in 2.5% span length was from 20.3 mm to 26.3 mm, whereas, tenacity at $\frac{1}{8}''$ gauge ranged between 16.9 g/t and 26.0 g/t. There is nothing significant to record, as, many of the genotypes tested lacked in Micronaire value (below 3.0) and tenacity was low except in a few cultivars.

INHERITANCE STUDY OF FINENESS IN DESI COTTONS

Parents selected for the study were :

G. herbaceum	G. arboreum
P1 — 2272	P5 — G.27
P2 — 3652	P6 — AKH.4
P3 — 785 IV/3	P7 — LD.210
P4 — 2340/58	P8 — NA.39

The F1 material of diallele crosses was sown during 1987-88. There were 36 enteries (28+8) in three replications. The F2 material was analysed for intrinsic fineness by gravimetric method.

The fibre fineness for parents ranged from 241 (NA.39) to 491 (LD.210) millitex. The variety NA.39 was the finest. The range and levels of the fineness between the parents is more or less similar to last year's data. General combining ability (gca) and specific combining ability (sca) were worked out by using model — 1 and method — 1 as described by Griffing. Component variance analysis was done as per the method described by Hayman. The analysis of variance for fineness of F.2 population and parents revealed significant differences among the genotypes, thereby indicating genetic diversity and analysis of variance for combining ability showed that variance due to gca and sca were significant.

The genetic component due to gca was 882.90 whereas, for sca it was 1126.18. The fibre fineness of the resultant hybrids ranged from 231 (3652 × AKH.4) to 358 (783 IV/3 × LD.210).

The estimates of the gca effects (diagonal) and sca effects (off diagonal) were determined.

The gca effects have shown that 2272, 3652, AKH.4 and NA.39 are negatively significant, which is desirable. The same genotypes were negatively significant even in F1 generation. These are good general combiners.

The cross involving G.27 × LD.210 exhibited maximum sca effect in the negative direction.

Heterosis study was done. A comparison of the parental and F2 means showed that majority of the hybrids are lower than their parents indicating heterosis.

The cross 3652 × AKH.4 (213) had given the finest value followed by AKH.4 × NA.39 (220). The extent of heterosis over midparent ranged from — 34 to 19% whereas, over better parent it was from — 25 to 29%.

INVESTIGATION OF THE ENVIRONMENTAL FACTORS AFFECTING FIBRE QUALITY — SOIL FACTOR

This is the fourth successive year of the study. Three varieties were grown in each of the eight soil profiles at Surat and simultaneously they were grown at the places from where the soil were brought.

The details of design and treatments were as follows :

Varieties : 3

V1 : G cot.10
V2 : G cot Hybrid 6
V3 : G cot Hybrid 7

Soil Profiles : 8

S1 : Surat
S2 : Anand
S3 : Bharuch
S4 : Arnej
S5 : Junagadh
S6 : Talod
S7 : Viramgam
S8 : Amreli

Environments : 2

E1 : Surat
E2 : the concerned place from where the soil was brought

Replications : 3

Design : Randomised Block Design

From trials at Surat, 72 samples were collected and evaluated for fibre length, fineness, maturity and bundle strength at zero gauge length. The mean values of three replications are given in Table 8.

The trials were successfully conducted at Bharuch, Anand, Viramgam and Talod; but they were vitiated at Arnej, Jungadh and Amreli due to severe drought conditions.

The soil samples from the microplots had been collected and analysed.

INFLUENCE OF AGRONOMIC TREATMENTS ON FIBRE AND ECONOMIC CHARACTERS OF COTTON GROWN UNDER DIFFERENT AGRO-CLIMATIC CONDITIONS

Lint samples received from several agronomy experiments carried out in 1986-87 season, at Surat and Khandwa were tested for the four major fibre properties. The samples received from Cotton Research Station, Surat were belonging to Agro 2 (b) and Agro 2 (c), where the objective was to find out the agronomic requirements of newly

TABLE 8 : MEAN VALUES OF FIBRE PROPERTIES OF THE THREE REPLICATIONS

Treatment	2.5% (mm) span length	Micronaire value (μg/in)	Bundle tenacity (g/t) (zero gauge length)	Mature fibres (%)
S1V1	27.6	3.4	48.4	58
S1V2	29.3	3.1	45.4	53
S1V3	23.2	5.1	46.4	71
S2V1	28.9	3.5	44.6	66
S2V2	28.7	3.6	46.4	67
S2V3	24.1	5.1	41.7	76
S3V1	26.4	4.0	46.1	75
S3V2	28.4	3.7	44.2	40
S3V3	24.0	4.8	43.9	73
S4V1	25.1	4.0	46.7	72
S4V2	27.4	3.3	46.8	67
S4V3	23.9	4.7	46.1	69
S5V1	26.5	4.3	46.6	72
S5V2	29.5	3.6	48.0	65
S5V3	24.2	5.8	45.3	85
S6V1	27.9	3.4	44.2	59
S6V2	29.6	4.0	43.8	75
S6V3	23.8	5.7	46.1	80
S7V1	27.2	3.3	43.6	72
S7V2	28.1	3.5	43.8	68
S7V3	22.9	5.5	41.7	76
S8V1	27.2	3.6	44.8	74
S8V2	28.9	3.9	44.8	64
S8V3	24.5	5.6	47.5	80

released and about to be released varieties under rainfed and irrigated conditions. In all, 144 lint samples belonging to these experiments were tested. To find out the production potential of G.Cot. Hybrid 6 under varying levels of management, six samples (unreplicated) were also tested for fibre properties. 48 lint samples belonging to study on response of different cottons, viz. Suman, NA.247, LRA. 5166 and Vikram, to planting geometry and varying nitrogen levels, conducted at ARS, Khandwa, were also tested for major fibre properties. The experimental design has recently been received. The data is being processed.

STUDIES ON IMPROVEMENT OF FIBRE QUALITY IN COTTON BY NUTRITIONAL MANIPULATION

The main aim of this project is to find out the effect of soil or foliar applications on the improvement of fibre quality parameters.

It was observed that the increase in sodicity of soil increased overall fibre quality of the cotton, but the extent of beneficial effect varied with varietal interaction. Therefore, different chelated cations, viz. Na, K, Ca, etc. responsible for sodicity of the soil were sprayed on the crop during the growth period after the flowering stage of plant.

Three sprays of these cations, individually and in combinations were given to the crop at an interval of 15 days. The plot sprayed with water alone, was kept as control for comparison. The experiment was done in the pot-culture in different soil as well as in the normal soil, with three replications. The important results obtained are summarised in Table 9.

TABLE 9: EFFECT OF CHELATED CATIONS ON FIBRE QUALITY PARAMETERS

	No.	EDTA	Ca	Na	K	Na+Ca	Na+K	Ca+K	Na+Ca+K
2.5% SL (mm)	27.56	28.34	27.30	29.90	26.52	28.34	28.34	26.26	26.52
Micronaire value	4.6	3.0	3.5	3.2	3.6	3.9	3.7	3.4	3.9
Maturity percentage	73	78	70	79	65	70	67	66	83
Fibre strength (lb/mg)	9.03	9.07	9.83	9.40	9.60	9.30	9.56	8.60	9.30
Fibre strength at $\frac{1}{8}$ in" gauge length (g/t)	27.43	26.56	28.93	26.37	26.43	27.50	30.50	26.33	28.80

From Table 9 it was observed that the spray of chelated cations either individually or in combination had little but beneficial effect on fibre quality as compared to the control. Fibre length increased with chelated Na. Higher fibre strength was obtained by chelated Ca spray followed by spray of K and Na+K. Fibre fineness was reduced due to most of the chelated cation sprays. It showed that cationic ratios, prevailing in plant tissue involve directly or indirectly in the formation of cotton fibres and seem to be of some consequence to fibre development. In general, the overall quality of cotton variety, can be improved by spraying the chelated cations.

STUDY OF QUALITY OF FIBRES FROM THE COTTON PLANT AFFECTED BY NEW WILT

The project was undertaken at the Cotton Research Station, Indore. During the year, 35 strains mostly **G. hirsutum** were grown. Seeds from both wilted and healthy strains of the same culture were tested for germination percent. It was observed that germination was less by 10% to 15% in some cases; but it was more in the hybrids which are having Reba-B-50 as one of the parents.

The growth of plant was normal as long as there was no moisture stress in the soil; but drying of plant started with the plant having more number of bolls. This may be due to the imbalance of nuturitional uptake.

It was observed that some cultures which were very badly affected during 1986-87 season were unaffected in 1987-88 season showing non-interference of gene for wilting.

Picking was done separately to find out the effect on yield level and quality. There was significant loss in yield. Fibre length of the strains, in general, decreased by 10% to 15%. Maturity was very low in wilted lint. The lint was neppy and of poor grade.

FABRICATION OF HARDNESS TESTERS FOR BOLL RIND AND COTTON SHOOTS

The work pertaining to the project consisted of completing fabrication of four units with all the accessories. This aspect was completed and one unit was delivered to Dharwad Agricultural University. Report from the concerned scientists indicate that the instrument had been functioning satisfactorily.

Regarding replacement of the needles, experiments were made in the laboratory with different needles. The results are reproducible, if the needles used belong to the same lot, i.e. the same number and the same manufacturer. A standard Singer sewing needle no. 16 has been found to be satisfactory for testing and is recommended for cotton boll hardness testing. It is further recommended that the needles may be kept in oil after thoroughly drying them up after the tests. As these needles rust due to prolonged exposure, this precaution becomes necessary.

STUDY OF THE QUALITY OF COTTON LINT IN DIFFERENT PICKINGS OF DIFFERENT CULTIVABLE SPECIES AND THEIR HYBRIDS

Species : 7

Varieties : 3 in each species

Pickings : 3

Replications : 3

Design : Randomised Block Design

The main findings based on the data on fibre properties are as follows :

G. arboreum : In this group considerable decrease in the length, increase in fineness and marginal reduction in strength at zero gauge and 3 mm gauge were observed for later pickings.

G. herbaceum : Micronaire value was slightly increased for subsequent pickings. Decreasing trend was also seen for later pickings in the case of $\frac{1}{8}''$ gauge strength. In the second picking more mature fibres were realised.

G. hirsutum : In this group, first and second pickings were **on par** in respect of almost all the quality parameters. Comparatively significant decreases were noticed in fibre length and tenacity of the fibre. Here again, later pickings had more number of mature fibres.

G. barbadense : For the last picking, decrease in length, bundle strength at zero gauge length and maturity were observed.

G. arboreum × G. herbaceum : Significant decrease in length and maturity and increase in Micronaire value were noticed for later pickings. Increase in both the strengths were noticed for latter pickings.

G. hirsutum × G. hirsutum : In this hybrid group, for the last picking, the extent of deterioration in fibre quality was more, as compared to the other groups. It is advisable to collect the last picking, separately.

G. hirsutum × G. barbadense : Fibre length and strength at zero gauge length were affected in the case of third picking, whereas, there was no significant change in the case of strength at $\frac{1}{8}''$ gauge length.

Species × Pickings : For 2.5% span length, the first two pickings were **on par.** Considerable decrease in length for the third picking was noticed in **G. hirsutum** group and **intra-hirsutum** group. Increase in fineness was noticed in almost all the species for subsequent pickings. Extent of variation was maximum in **intra-hirsutum.** Increase in zero gauge strength was noticed for second pickings, whereas, the trend was significant for the third pickings in majority of the species. Here also, for **G. hirsutum** and **Intra-hirsutum** hybrid groups, the variation was considerable. In the case of strength at $\frac{1}{8}''$ gauge length, except for **G. hirsutum** and **intra-hirsutum** species, the differences were marginal. In the second picking, maturity of the fibre increased in all species.

STUDIES IN THE CHANGES OF FIBRE CHARACTERS DURING THE DEVELOPMENT PERIOD OF COTTON BOLL WITH SPECIAL REFERENCE TO HYBRIDS

Size of green bolls of Hybrid 4, American Nectariless, Varalaxmi and Laxmi from Nanded for the season 1986-87 picked at the intervals of 18, 21, 24, 28, 35 and 42 days after post anthesis was determined by water displacement method. It was observed that the boll size of Hybrid 4 was consistently bigger than that of one of the parent variety, American Nectariless, during the period of development. Similarly, the boll size of the parent variety, Laxmi was invariably more than that of the interspecific hybrid variety Varalaxmi. It was observed that the boll size increased upto the age of 35 days and remained almost the same thereafter, but this trend was not consistent in all cottons.

Fibres collected from the cotton bolls of Hybrid 4, Gujarat 67, American Nectariless, Hybrid 6, G.Cot.10, G.Cot. 100, Varalaxmi, Laxmi, SB.289 E, DH.22, Sujay and G.27 picked at the intervals of 18, 21, 24, 28, 35, 42 and 49 days were tested for maturity by caustic soda method. It was observed that the maturity of the fibres of all the cottons increased with increasing age of boll upto about 35 days and remained more or less the same thereafter; however, the increase was not consistent in some cottons.

It was also observed that the level of maturity of fibres of the hybrids, viz. Hybrid 4, Varalaxmi and DH.22, was almost consistently between those of their parent varieties, viz. Gujarat 67, American Nectariless (for Hybrid 4), Laxmi and SB.289 E (for Varalaxmi) and Sujay and G.27 (for DH.22) during the period of development.

Fibres from the cotton bolls of Gujarat 67, American Nectariless, Hybrid 4, Varalaxmi and Laxmi from Nanded for the season 1985-86 picked during post anthesis at the intervals of 18, 21, 24, 28, 35, 42, 49, 56 and 63 days were tested for bundle strength at zero gauge length by Stelometer. It was observed that strength of fibres of American Nectariless was between those of Gujarat 67 and Hybrid 4 during the development period and that the strength of cotton increased with increasing age of boll upto about 35-42 days and subsequently remained almost constant for the remaining period.

EFFECT ON FIBRE QUALITIES AND YIELD LEVELS DUE TO EARLY PICKED GREEN BOLLS OF DIFFERENT SPECIES OF COTTON

In this trial, green bolls of different ages 40, 50 and 60 days after anthesis were picked and dried in the sunlight, in addition to the normal picking of bolls, so as to compare their yield levels and fibre quality parameters.

NA.48 (Rohini, **G. arboreum**), NH. 239 (Purnima, **G. hirsutum**), NHH.44 (intra-species hybrids), DCH.32 (inter-species hybrid) were sown in two replications in R.B.D. lay out at CRS, Nanded. Details of germination per-

centage of seeds and fibre properties of lint obtained from green bolls of 50 days old are given in Table 10 and 11 respectively.

TABLE 10 : AVERAGE GERMINATION PERCENTAGE OF SEEDS FROM GREEN BOLLS OF DIFFERENT AGES AND NORMALLY PICKED BOLLS

Variety	Seeds from green bolls		Seeds from well opened cotton boll
	40 days	50 days	
Rohini	43.2	62.8	70.2
Purnima	38.0	59.5	63.8

Green bolls of 40 days were partially developed in the case of **desi** cotton varieties whereas, 50 days old green bolls were fully developed and they were about to crack and open. A little hand pressing was sufficient for cracking of green bolls. Such fully developed bolls were picked and the produce was ginned for further studies.

It was observed that fibre quality of fully developed green bolls was **on par** with the naturally opened cotton bolls, but **kapas** yield was slightly lowered down. Crop duration was reduced which facilitated the second crop like wheat or gram under protective irrigation.

Seeds obtained from the green bolls of 40 and 50 days and naturally opened cottons of the above samples will be tested for oil content and estimation of gossypol content.

EFFECT OF IRRADIATIONS AND CHEMICAL TREATMENT ON ECONOMICAL AND PHYSICAL CHARACTERISTICS OF COTTON

Seeds of promising strain NA.39 **(G. arboreum)** were irradiated by 15, 20, and 30 kr. doses of gamma rays at the rate of 7 kr/min using Co^{60} source and were given chemical treatments of 0.1%, 0.2%, 0.4% and 0.5% of ethyl methane sulphonate (EMS) chemical mutagene was given to seeds for 24 hr. Treated as well as untreated seeds of NA.39 were sown. From the produce obtained, the seeds were collected and sown to raise generations up to M5. The following were the main observations :

(1) Significant changes could be noticed in the fibre properties, yield levels and ginning percentage as compared to the NA.39 (Control). Most of the fibre properties expressed similar trend in the M5 generation as showed in the M4 generation, confirming that most of the mutant single plant selections expressed stable quality characters.

(2) The **arboreum** strain NA.39 responded well to irradiation by way of mutations in the fibre properties by breaking the tight linkages between different para-

TABLE 11 : FIBRE PROPERTIES OF PRODUCE FROM SEEDS OBTAINED FROM THE GREEN BOLLS OF 50 DAYS OLD

Sl. No.	Variety/ Hybrid		Mean fibre length (mm)	Micro-naire value	Maturity coeffi-cient	Bundle strength (P.S.I) lb/mg	Yield (kg)	Ginning percent	Germi-nation percent	Seed index
1.	Rohini (NA.48)	A	24.13	4.6	0.77	9.6	1.700	32.7	62.8	4.8
		B	24.96	3.7	0.78	9.0	1.220	32.7	45.2	4.5
		C	19.50	2.6	0.74	8.6	0.980	30.1	—	4.0
2.	Purnima (NH.239)	A	21.58	3.4	0.67	9.5	1.840	34.1	59.5	7.5
		B	21.32	3.6	0.68	9.1	1.200	32.2	38.0	6.5
		C	18.72	2.5	0.70	8.1	0.980	30.1	—	4.0
3.	NHH.44	A	21.58	3.0	0.61	7.8	1.940	30.2	—	5.2
		B	20.02	2.9	0.63	8.1	1.240	30.0	—	5.0
		C	17.16	—	—	8.7	0.640	28.8	—	4.6
4.	DCH.32	A	23.92	3.0	0.64	8.7	1.020	30.2	—	5.4
		B	22.62	2.9	0.63	8.1	0.720	28.4	—	5.0
		C	20.28	—	—	7.6	0.360	27.0	—	4.2

A = 60 days field opened.
B = 50 days green bolls.
C = 40 days dried.

meters like length and fineness and length and ginning percentage. The above studies revealed the recombinations and genotypic correlations.

It was also observed that 15 kr. dose of gamma ray and 0.1% EMS mutagenic treatment produced morphological changes and variation in the fibre properties moderately with negligible loss of germination.

Higher dose of 30 kr. of gamma ray badly affected the germination (only 35% germination) with many more deformities like sterile plants and branch mutation. Changes in the plant type, undeveloped plants, abnormal growth and other morphological characters were observed, out of which some single plant selections showed interesting features like change in the flower colour, leaf size, plant height, branching, bolls size, number of bolls, earliness, naked seeds and resistance to jassids and pests.

A few promising selections were passed on to further generations upto M 5. Most of them expressed permanent changes in the fibre properties due to mutations.

Chemical mutagenic treatment of 0.4% and 0.5% EMS lead to 100% loss in germination.

A 0.2% EMS treatment for 24 hr before sowing was beneficial for obtaining divergent fibre property combinations for desirable selections.

SURVEY OF CONDITIONS OF GINNING FACTORIES IN MADHYA PRADESH, KARNATAKA AND ANDHRA PRADESH

As a first phase of this project, a survey of the conditions of ginning and pressing factories was planned in the state of Madhya Pradesh with the active co-operation of East India Cotton Association and some local factories' associations at Indore, Khandwa, Burhanpur, etc. Accordingly, personal visits were undertaken to 25 major cotton marketing and processing centres and about 50 ginning and pressing factories. Standard questionnaires were got filled up from 150 ginning and pressing factories' personnel. The questionnaires duly filled up by a few factories' personnel are awaited.

The tabulation of the questionnaires collected have been completed and the report of this survey for Madhya Pradesh will be finalised as soon as the questionnaires from Khandwa and Burhanpur are received.

During these visits it was observed that many of the factories have realised the superiority of double roller gins and accordingly, many have changed from single roller to double roller gins. However, no pre-cleaning machinery is being used in any factory; kapas is kept in open compound and, in some places, even without covering. It was also observed that unhealthy competition exists among some factories in fixing the ginning charges.

In the case of survey in Karnataka and Andhra Pradesh the Directors of Agriculture of respective states have been contacted and lists of ginning and pressing factories have been procured.

The Director of Agriculture, Karnataka has agreed to give necessary help in this survey. Printing of bilingual English-Kannada questionnaires have been completed and 650 blank questionnaires have been sent to Dy. Director of Agriculture (Cotton) at Bangalore for distribution to all the ginning factories, there.

Efforts are being made through suitable agencies for completing the questionnaires from ginning factories in Andhra Pradesh.

DESIGN AND DEVELOPMENT OF AN INCLINED TYPE COTTON CLEANER

Studies were conducted at different peripheral speeds of 9.75, 12.19, and 14.63 m/s. Fibre properties of **kapas** samples before and after precleaning on five cylinder inclined cleaner were evaluated. It was observed that with increase in peripheral speeds, cutting in fibre length was noticed during processing of **kapas** of H.4, AKH.4 and AHH.468. There was not much changes in other fibre properties.

Assembly drawing and drawing of different components have been prepared. This is a prototype of precleaning machine and involves lot of fabrication work for which special type of machines are required. Therefore, different machine manufactures/workshops are being contacted to take up the fabrication work of the proposed machine.

INFLUENCE OF DIFFERENT PRECLEANING AND GINNING TREATMENTS ON FIBRE AND YARN QUALITY WITH SPECIAL REFERENCE TO NEPS AND YARN FAULTS

Four **kapas** samples belonging to AKH.4, AHH.468, L.147 and H.4 varieties have been precleaned using four different precleaners and ginned on both S.R. and D.R. gins. The precleaners used were CTRL Extractor, Inclined Cleaner, Finisher Extractor Cleaner (EFC) and Platts' Opener. Control samples without precleaning have also been ginned on the roller gins as well as saw gins. The trash removed by the precleaners was estimated as also the ginning percentage of roller gins with and without precleaning.

Spinning as well as fibre analysis of lint samples of AKH.4 and AHH.468 was completed. Spinning of H.4 samples is under way.

In general, the maximum trash extracted at precleaner was by inclined cleaner ranging from 1.3% for AHH. 468 to 3.5% for L.147. However, in H.4, Platts' Opener removed a higher trash level of 1.3% as against 0.9% for Inclined Cleaner. The other two cleaners showed lower cleaning. Productivity of gins did not differ between control and precleaned samples.

While fibre properties did not show any trend between different samples of

the same variety, it was found that for both AKH.4 and AHH.468, the lint after precleaning by Inclined Cleaner and Platts' Opener had lower trash content than from the other two treatments. However, at yarn level it was found that Classimat Yarn Faults (A, B and objectionable) were lower for Finisher Extractor — SR Gin Combination for AKH.4 and CTRL Extractor — SR Gin Combination of AHH.468.

IMPACT OF DIFFERENT GINNING METHODS ON SEED QUALITY

Seeds of SRT.1, AKH.4, Jayadhar, PKV.081 and G.27 were sown on CICR Farm on June 29, 1988. Spacing of 60 cm was maintained between the rows and 30 cm between the plants in each row. Crop was raised under rain-fed conditions. Two sprays of systemic insecticides, one each of Rogar and Metasystox, four sprays for boll worm control (Endosulphan, Decis, Nuvaeron and Sumicidin in the order) and two sprays for disease control, one each of Copper sulphate plus steptomycin followed by wettable Sulphur 80% were sprayed on all five types of **kapas.** The harvesting of **kapas** is done manually. The **kapas** will be ginned under optimum conditions and the seeds will be tested for their germination property.

A STUDY ON CRYSTALLISATION OF CELLULOSE

Never-dried fibres collected from bolls of two different ages were dried slowly under conditions conducive for maximum crystallisation, as identified by earlier experiments. Sample that had higher % mature fibres showed slightly lower % increase in crystallinity during slow drying than that which had a lower % mature fibres. However, this result is to be reconfirmed with another variety grown in the normal season.

Hydrolysis (with 4 N HCl under reflux for 30 min) of dried and never-dried fibrils of different ages showed almost the same weight loss for both the samples except for the fully mature sample (39 days old) which showed a lower weight loss at the never-dried state. However, mature fibres (both dried and never-dried), when hydrolysed under milder conditions gave the same weight loss for both. X-ray crystallinity measurements of the hydrolysis residues gave slightly higher values for the dried fibres than for the never-dried fibres. On combining these results, it could be stated that a never-dried fibre is not as much amorphous as it appears to be, but it may have only a marginally lower crystallinity than its dried counterpart.

Amorphous celluloses were prepared from subtrate of different origin and were decrystallised. Irrespective of its origin, amorphous cellulose prepared by ball-milling always crystallised into cellulose II. On the contrary, amorphous cellulose prepared by saponification of cellulose triacetate (CTA) crystallised into cellulose I or cellulose II depending on the original substrate. Thus, amorphous cellulose from CTA film crystallised into cellulose II while amorphous cellulose obtained from fibrous CTA crystallised into cellulose I, indicating the presence of cellulose I nuclei in the latter.

STUDIES ON MORPHOLOGICAL DEFORMITIES AND THEIR CHARACTERISATION IN COTTONS

The SEM examination of fibres from one more varieties, Varalaxmi, in addition to four varieties already reported last year, has been completed. The results obtained for this cotton also show similar trend as observed earlier in respect of four cottons, that is, the frequency of occurrence of different kinds of deformities in fibres of shorter length groups is comparatively higher than that of the longer length groups.

In order to assess the distribution of different kinds of deformities along the fibre length, whole length of fibres (root end to apex) taken from seed cotton of three varieties, Suvin, AK.235, and Jayadhar were examined under SEM. Various kinds of deformities and the ribbon width at an interval of 1 mm along the fibre length, were noted. It has been observed that (i) the deformities of different kinds which have been characterised and reported last year, are uniformly distributed along the fibre length in all the three cottons examined, (ii) the tapering end, the ribbon width of which narrowed down to approximately one fifth of its size in middle portion of the fibre and on an average covering a length of 2.5 mm in Suvin and 1 mm in AK.235 and Jayadhar, is free from all the deformities and (iii) the frequency of occurrence of deformities obtained by examining the whole length of fibres agrees closely with that obtained by examining the middle segments of fibres. However, in the case of AK.235, the deformity "reversal of direction of convolution" is considerably low. This may be due to the fact that the seed cotton taken is not from the same lot from which the ginned cotton sample was taken for the study.

COTTON FIBRE TENSILE PROPERTIES IN RELATION TO ITS MORPHOLOGICAL AND FINE STRUCTURE PARAMETERS

This research project aims at assessing the influence of various morphological and structural parameters on the tensile properties of cotton fibres. Accordingly, 25 varieties from different species have been selected for the study. The parameters being evaluated include, convolutions and reversals per cm, convolution angle, ribbon width, wall thickness, cross-sectional area, perimeter and single fibre linear density, breaking load and extension. So far, the evaluation has been completed for 20 out of the 25 cottons and this work is in progress. Hence, at this stage, no attempt has been made to analyse the results.

RELAXATION OF MOLECULAR ORIENTATION IN STRETCHED FIBRES

Equilibrium birefringence, crystallinity and sonic static moduli were measured on wool, nylon and PET fibres at different strain levels. Birefringence and static modulus of wool fibres were also measured in different alcohols.

Slopes of birefringence-strain curve is similar to static stress-strain curve

and the change in birefringence is highest in wool followed by nylon and PET fibres. For a strain change of 50%, birefringence rises from 0.009 to 0.014 (by 50%) in wool fibres, from 0.06 to 0.08 (by 30%) in nylon fibres and from 0.18 to 0.21 (by 15%) in PET fibres. However, the rate of birefringence relaxation is low compared to the static stress relaxation in all the fibres.

In alcohol, birefringence increases with length of the alcohol chain and they follow the sequence : Glycerol > Isopropanol > n-Butanol > Ethanol > Methanol — Water.

Further analysis for calculation of relaxation spectra, network density and effect of structural mobility based on birefringence and other data is in progress.

STUDIES ON LATTICE CONVERSION BEHAVIOUR OF COTTON FIBRES

The peculiar behaviour of RbOH as regards its lattice conversion, vs. concentration curve was confirmed through further experiments. A region of retarded conversion around 4.50 N in an otherwise progressively increasing conversion vs, concentration curve (in the range of 2.0 N to 8.0 N) was clearly brought out. The Lateral Order Distribution (LOD) curve of NaOH treated samples was drawn using the experimental data. Four distinct regions could be clearly noticed in the curve. So far, only two regions have been reported in the literature. The two new zones found in the present work were of higher order compared to those known hitherto. To a first approximation, regions of intermediate order quantitatively predominate over zones having very low and very high hyrdogen bonding. The LOD in the extremely high ordered zone was much wider as compared to that in the other three zones.

Thus, the existence of a spectrum of three dimensional order in the cotton fibre has been more clearly demonstrated for the first time.

STUDIES ON MECHANICAL AND STRUCTURAL PROPERTIES OF CELLULOSICS SWOLLEN IN AQUEOUS ZINC CHLORIDE

It was reported earlier that stretching of cotton fibres after swelling in Zinc chloride under optimum conditions improved the tenacity at 3.2 mm gauge length considerably in almost all the varieties included in the study. In the current year, yarns spun from some of these varieties were subjected to swelling and subsequent stretching treatments so as to assess how far the improvement realised in the fibres is transmitted to the yarns. Since yarn strength is very much dependent on yarn geometry, single and doubled yarns of different counts were included in the study.

In general, the test results on yarn gave maximum increase in tenacity for Zinc chloride treatment carried out on doubled yarns under optimum conditions, which were found to be somewhat critical. Here again, yarns spun to coarser counts showed maximum

improvement, sometimes as high as about 40% over that of the control. The increase followed the order 10s > 20s > 30s > 40s in the case of doubled yarns. Variety of cotton had only a marginal effect. For comparison, the yarns were swollen slack in mercerizing strength of Sodium hydroxide (NaOH) solution and stretched back to original length.

Data for the NaOH treated yarns also showed some improvement in tenacity for the doubled yarns, but the percentage improvement was not as high as that for the Zinc chloride treated yarns. Zinc chloride treated yarns became very stiff and had a lower percentage of extension as compared to the NaOH treated yarns.

In the case of single yarns of various counts, no increase in tenacity was observed in both the treatments.

In order to find a proper explanation for the above phenomena observed with yarns having different geometry, certain parameters like the fibrillar orientation of the structural elements of yarn and yarn diameter and sonic modulus (which give some idea of the variation in packing of the elements resulting from treatments) were measured. Analysis of these data lead to the conclusion that opposite trends found in the single and doubled yarns in respect of tenacity after treatment are due to the interplay of two factors, viz. (a) the increase in fibre strength occasioned by improvement in fibrillar orientation and (b) the increase in packing density of fibres within the body of the yarn. While the first factor must be understood to be always helpful for yarn strength, the role of packing density could be different. While initial increase in packing may provide adequate interfibre friction beneficial for yarn strength, its further increase may lead to total inhibition of fibre slippage leading to poor yarn strength. In the present study, absence of strength increase in single yarns despite some improvement in fibrillar orientation seems to be due to the excessive packing density. In the doubled yarn, in addition to the increased fibrillar orientation, the fibre packing is also low enough to permit the requisite degree of fibre slippage conducive to yarn strength, so that higher strength realisation was possible. The difference in the tensile behaviour of doubled yarns of different counts also could be explained based on the factors discussed above. In order to get an insight into the lameller morphology of cotton fibres, six varieties of cotton widely varying in gravimetric fineness were treated in Zinc chloride under identical conditions for predetermined intervals of time and the surface features were examined with scanning electron microscope. Some of the important observations are listed below:

(1) Swelling in Zinc chloride is a time dependent phenomenon and the surface layers swell more than the interior layers during small intervals of time. The excessively swollen upper layers shrink and detach themselves to reveal the inner layers. (2) The fibrillar inclination of the inner layers are found to show a progressive de-

crease towards the core of the fibre. Some of the innermost layers had fibrils almost parallel to the fibre axis. It was evident that the inner layers generally had finer fibrils. (3) The structure of fibrils in the reversal region was noteworthy. On either side of a reversal, the fibrillar dimensions appeared to be distinctly different, one side having coarser fibrillar bundles which continued to be coarser till the next reversal was reached. (4) In a given layer itself, along the length of the fibre the dimensions of the fibrillar bundles varied considerably. (5) Coarser cottons, in general, had coarser fibrils. Further, in these varieties even the fibrils connecting layers were to be coarser.

A STUDY ON STRUCTURE-PROPERTY RELATIONS WITH LIOH AND KOH TREATED COTTON

The structure-property relationships of fibres belonging to the variety Suvin, swollen slack in different concentrations of LiOH, NaOH and KOH at 0°C, were examined. It was noted that tenacities both at zero (To) and 3.2 mm gauge (T_3) lengths were influenced significantly by amorphous content (Am %) and crystallite orientation ($1/\phi Y_2$) for fibres swollen in LiOH and NaOH. However, for fibres swollen in KOH, T_3 had only a marginal dependence on these parameters. Measurement of crystallite dimensions (crystallite length and breadth) showed maximum decrease during KOH treatment. It is likely that this greatly reduced crystallite dimensions might have some bearing on tenacity.

Another aspect examined was the influence of fibre fineness on swelling and subsequent changes in structure and property. Cottons having widely different fineness, but nearly equal maturity were swollen in 4.5 N solutions of the three reagents both at 0°C and 30°C. Analysis of the results showed that, T_0 decreased irrespective of the fineness of cotton. On the other hand, T_3 improved for coarse cottons while, for fine varieties it remained the same at room temperature and decreased substantially at 0°C. However, the actual extents were different for the three swelling agents.

Changes in fibre crystallinity and orientation had least dependence on fineness of cotton.

TO STUDY THE WEAK LINK EFFECT IN OE AND RING SPUN YARN

During the period, the study was extended to continuous filament yarns of nylon, polyester and viscose as well as to spun yarns of polyester and viscose. Analysis of the data yielded the following informations :

(1) Effect of gauge length on three tensile parameters, viz. breaking load, breaking extension and work of rupture for all these samples, was found to be similar. In all of them, an increase in test length was always accompanied by a drop in magnitude of these tensile parameters. But the extents of drop were different.

(2) The behaviour of spun yarns and continuous filament yarns was similar; but the amount of drop was more for

spun yarns at all levels of gauge length.

(3) In the case of continuous filament yarns, effect of weak links was more pronounced in nylon, comparatively less in polyester while, the viscose occupied an intermediate position.

(4) Amongst the spun yarns experimented, viscose recorded higher reduction in values than polyester in respect of test length variation.

(5) As observed in the case of cotton yarns in earlier work, the decrease in tensile properties with increase in test length was more drastic for breaking extension than for breaking load.

Tensile Properties and Yarn Irregularity

The decrease in tensile properties with increasing test length is generally known to result from weak links distributed along the length of yarn. If the latter could be characterized by U% obtained by using Uster Evenness Tester, one can expect a correlation between U% on the one hand and quantities like, strength-length gradient, strain-length gradient and energy-length gradient on the other. An experiment was carried out to study this correlation. Thirteen samples of cotton yarn with a wide range of irregularities were tested for U% using Uster Evenness Tester and their tensile properties were measured at six gauge lengths, viz. 5 mm, 8 mm, 15 mm, 30 mm, 50 mm, and 100 mm. The mean values of breaking load, elongation and work of rupture were obtained for each yarn sample. The strength-length gradient and strain-length gradient were calculated by using power law relationships. Since, the relationship between energy and test length was linear, the slope of the linear equation gave the energy length gradient value.

Correlation of the various gradients described above with U% was individually worked out. It was found that there existed no relation between U% and any of these gradients. This implied that mass variation along the length of yarn represented by U% alone cannot account for the observed variation in tensile characteristics with increase in gauge length.

ASSESSMENT OF FIBRE QUALITY PARAMETERS BY HVT AND THEIR INFLUENCE ON SPINNABILITY OF COTTON

Eighty-four cotton samples varying widely in length (22 mm to 36 mm), Micronaire value (2.6 μg/in to 5.5 μg/in) and tenacity at 3.2 mm gauge length (20.0 g/t to 33.0 g/t) were selected and tested on Fibrograph 530, Sheffield Micronaire and Stelometer and HVT System. The analysis of the fibre test data was carried out as detailed below :

Part I : Comparison of HVT and Conventional Methods

The 2.5% span length and Micronaire value were in good agreement,

the, correlation being 0.98 and 0.87, respectively. In the case of tenacity, marked differences were observed between HVT and Stelometer values. The HVT over-estimated tenacity values for very coarse cottons and underestimated for very fine cottons by about 3 to 4 g/t. The overall correlation was 0.78.

Part II : **Effect of Micronaire on HVT Tenacity Values**

To study the influence of Micronaire value on HVT tenacity, the test data of 84 cottons were divided into four groups. The average tenacity value and differences between HVT and Stelometer values of each group is given in Table 12 below :

TABLE 12 : TENACITY VALUES BY STELOMETER AND HVT IN RELATION TO MICRONAIRE VALUES

Group	No. of samples	Range of Micronaire value (μg)	Stelometer (g/t)	HVT (g/t)	Actual diff. (%)
I	12	2.6 to 3.4	30 23	28.58	—5.46
II	30	3.5 to 4.0	24.55	24.54	—0.04
III	30	4.1 to 4.6	24.84	25.42	+2.33
IV	12	4.7 to 5.8	24.65	25.68	+4.18

HVT values were lower than Stelometer values for Group I cottons. The average HVT values of group II and group III were in good agreement with the corresponding Stelometer values. The average tenacity values of HVT for group IV was higher than Stelometer values.

The factors influencing the tenacity values of HVT are being analysed.

CONTRIBUTION OF RING FRAME PROCESS TO THE FAULT LEVELS OF YARNS SPUN FROM INDIAN COTTONS

I. As reported earlier, the yarn fault level was determined for 60s yarn spun with varying total draft and break drafts.

The yarn fault results are tabulated in Table 13.

On analysis, it was found that the yarn faults, except objectionable faults, tend to increase with total spinning draft. At the break draft of 1.3, an increase in total draft from 24 to 40 results in significant increase of A, B and C classes of faults, as well as raw material faults and drafting categories of faults. But, a break draft of 1.5 results in increase of only A class and raw material fault category, significantly. Higher spinning draft results in increase of about 15% in A faults at both the break draft levels.

II. During 1988, Sujata cotton with the following fibre properties was taken up for processing :

TABLE 13 : EFFECT OF SPINNING DRAFT ON YARN FAULTS

(Morrocan Pima — 60s Carded Yarn)

Break draft		**1.3**		% change of X2 on X1		**1.5**		% change of X4 on X3
Total draft	24 (X1)	30	40 (X2)	$\frac{(X2 - X1 \times 100)}{X1}$	24 (X3)	30	40 (X4)	$\frac{(X4 - X3 \times 100)}{X3}$
Yarn results								
A	10,101	11590	11675	(+15.6)**	10,141	10,480	11,673	(+15.1)**
B	711	828	1012	(+42.3)**	677	714	790	(+16.7)
C	165	178	267	(+61.8)**	142	149	188	(+32.4)
D	22	25	32	(+45.5)	20	29	35	(+75.0)
RMF	10,894	12505	12904	(+18.5)**	10 888	11,398	12,470	(+14.5)**
DF	187	203	337	(+80.2)**	162	178	222	(+37.0)*
CBF	63	63	70	(+11.1)	55	59	56	(+ 7.3)

** Difference significant at 99% level.

* Difference significant at 95% level.

Fibre Properties

2.5% Span Length : 32.1 mm, Uniformity ratio = 50, Micronaire = 4.2. Maturity Coefficient = 0.7,

Bundle Strength : '0' gauge (g/t) = 9.8; 3 mm gauge (g/t) = 33.6

Sujata cotton was processed through blow room consisting of B.H., Air Stream Cleaner and Scutcher equipped with Kirschner Beater.

The laps produced were carded on metallic card using a doffer speed of 7 rpm.

The carded silver was given two passages of drawing using L.R. Draw Frame to produce 0.15 hk silver.

The drawn sliver was then divided into three equal parts. One part was processed through L.R. can fed to produce 1.5 hk. roving using three levels of twist multipliers at the can fed-inter, viz. 0.9, 1.0 and 1.1.

Similarly, the second and third parts were processed through L.R. can fed-inter to produce 2.5 hk. and 3.0 hk respectively using the same level of twist multiplier.

60s yarn was spun from each of the combinations on ring frame with two levels of break draft, viz. 1.3 and 1.5.

The testing work of the yarns produced from various combinations is under progress.

III. In addition to the above, an experiment was also under taken to ascertain the level of yarn faults in relation to different comber noil extraction. For this purpose, a Moraccan Pima cotton, which was used in earlier studies, was processed through blow room, card and draw frame. The draw frame sliver was, then, processed on autolap former to produce laps of 70 g/m. The laps were then combed on L.R. comber to extract 10%, 14%, and 18% noils. The combed slivers of each of these extractions were processed separately on drawing (two passages) and L.R. can fed-inter to produce 1.5 hk inter.

40s yarns were spun from the roving of different noil extraction.

Testing of yarns for yarn faults on Uster Classimat is under progress.

A STUDY OF COMPARISON OF YARN BUNDLE STRENGTH WITH LEA STRENGTH

A device was fabricated for preparing parallelised yarn bundles. A set of five bobbins can be used at a time to prepare a bundle using this device.

In the preliminary experiment carried out, yarns from two sets of five bobbins from the same samples were combined into a single bundle. The bundle prepared in this manner consisted of 200 strands corresponding to 20 strands from each bobbin. Four such bundles of a cotton yarn of 60s were tested on the Instron tensile tester. The coefficient of variation for these four tests has been found to be less than 1%.

The parallelised bundles prepared on this device of a 20s cotton yarn was

tested on the Instron tensile tester as well as on the Goodbrand type vertical fabric tester. Only four bundles were used in each case. Comparison of the results of these tests with normal lea tests clearly shows that the parallelised yarn bundles give results with low coefficient of variation even for very small number of tests.

	Instron	Fabric tester	Normal lea nesting
Av. Tenacity	11.0 g/tex	13.3 g/tex	11.0 g/tex
C.V.	1.35%	1.17%	4.48%
No. of tests	4	4	50

A STUDY OF SLIPPAGE METHOD OF YARN TWIST DETERMINATION

During the period, 16 yarn samples of counts 16s, 30s, 40s and 60s were taken up for the study. Four methods viz. untwist-retwist method, slippage method, twist-to-break method and straightened fibre method were used. Four gauge lenths, viz. 2 in, 5 in, 10 in and 20 in were used for the first 3 methods and $\frac{1}{2}$ in for the last method. Fifty readings were taken for each gauge length for the first 3 methods and 100 for the last method, to find out the value of twist. The results are being analysed.

EVALUATION OF SPINNABILITY OF COTTONS FROM SINGLE THREAD STRENGTH OF MICRO-SPUN YARNS

During the period under report, 31 small samples of Trade Varieties from 1987-88 season have been collected for micro-spinning, which were lateron spun to two suitable counts. In all, 126 samples were spun during the year using micro-spinning technique. Of these 34 were Standard cottons from 1986-87 and the remaining Trade Variety samples (30 from 1986-87 and 62 from 1987-88 seasons). These samples were spun to 9 different counts: 16s (9 samples), 20s (27 samples), 30s (31 samples), 40s (21 samples), 50s (19 samples), 60s (13 samples), 80s (4 samples), 100s (1 sample) and 120s (1 sample).

Out of these, 30 micro-spun and 22 full-spinning yarn samples of Trade Varieties were tested for single thread strength parameters for breaking strength (g), tenacity (g/t), breaking extension (%) and CV (%) of breaking strength on Uster single thread tester. The yarn evenness (U%) of many samples could not be carried out due to the failure of Uster Evenness Tester for quite some time. The data on single thread strength parameters of 20 (full-spinning) standard cottons have been collected for comparative studies.

The data of single thread strength values of micro-spinning and full spinning samples (30) have been given in Table 14 for 20s, 30s, 40s and 50s counts.

TABLE 14 : SINGLE THREAD STRENGT H VALUES OF MICRO-SPINNING AND FULL-SPINNING SAMPLES

Sl. No.	Variety	Micro-spinning			Full-Spinning		
		Tex	Breaking strength (g)	Tenacity (g/t)	Tex	Breaking strength (g)	Tenacity (g/t)
			Count : 20s				
1.	CJ.73	29.4	364.0	12.4	30.1	377.0	12.6
2.	SRT.1 (I)	29.4	402.0	13.7	29.8	417.0	14.0
3.	SRT.1 (II)	30.4	461.0	15.2	30.4	455.0	15.0
4.	G.Cot.11 (I)	30.8	393.0	12.8	29.9	400.5	13.4
5.	Digvijay	28.1	372.0	13.2	28.7	384.2	13.4
6.	AKH.4	28.3	366.0	12.9	29.6	367.7	12.4
7.	Jayadhar	29.6	342.0	11.5	30.1	382.0	12.6
8.	G.Cot.11 (II	27.5	365.0	13.3	30.4	434.0	14.3
9.	B.1007	28.5	367.0	12.9	31.0	440.5	14.2
10.	Sujay	27.6	325.0	11.8	29.6	392.3	13.3
11.	G.Cot.10	28.6	356.0	12.4	29.5	414.5	14.0
12.	V.797	28.9	341.0	11.8	30.2	364.2	12.0
13.	Sanjay	28.1	365.0	13.0	30.1	411.0	13.6
			Count : 30s				
1.	SRT.1 (I)	18.8	226.2	12.0	19.8	244.1	12.3
2.	SRT.1 (II)	19.1	243.6	12.8	19.8	258.7	13.0
3.	G.Cot.11	19.2	217.8	11.3	20.2	235.8	11.7
4.	AKH.4	18.9	190.2	10.1	19.9	206.8	10.4
			Count : 40s				
1.	MCU.7	14.2	214.0	15.1	14.1	209.2	14.8
2.	LRA.156	15.1	218.0	14.4	14.4	214.0	14.9
3.	Laxmi (1985)	15.1	200.0	13.2	14.8	192.8	13.0
4.	B. Narma	14.8	196.4	13.3	14.5	184.2	12.7
5.	Laxmi (1986)	15.3	206.8	13.5	15.2	219.2	14.4
			Count : 50s				
1.	G.Cot.Hyb.6	12.0	178.4	14.9	11.5	173.3	15.1
2.	G.67	11.0	132.4	12.0	11.7	159.4	13.7
3.	Hybrid4	10.5	140.0	13.3	12.0	166.4	13.9
4.	G.Cot.10	11.7	155.2	13.3	11.9	163.3	13.8
5.	B.1007	11.4	145.2	12 8	12.1	174.4	14.4
6.	Nimkar	10.7	126.7	11.8	12.4	155.2	12.5
7.	LRA.5166	11.9	165.2	14.0	11.9	170.4	14.3
8.	MCU.7	11.4	158.8	13.9	11.6	173.2	14.9

OPTIMAL BLENDING OF STANDARD VARIETIES OF INDIAN COTTONS FROM SOUTHERN INDIA

Spinning of Hybrid 4 to 20s, 30s, 40s and 50s was completed on ring frame and to 16s and 20s on openend spintrainer.

Blending of three trinary blends of MCU.5, LRA and Laxmi were also taken up and the three blends S-6 (50:30:20), S-7 (20:50:30) and S-8 (30:20:50) denoting the blend proportions respectively of MCU.5, LRA and Laxmi were spun to 30s, 40s, 50s on L.R. and SKF drafting systems as well as 20s on SKF and 16s and 20s on openend spinning system.

Two shorter staple cottons, viz. Jayadhar, and Suyodhar were individually taken up for spinning. Jayadhar has been spun to 16s and 20s in openend spintrainer.

The cleaning efficiency at blow room and cards for the four cottons of the longer group and Jayadhar from the shorter group was estimated. It was seen that the trash in the cotton affected the cleaning efficiency, significantly.

Span length determinations of major and minor hooks for the above five cottons at different stages of processing have also been completed.

PRODUCTION OF STANDARD COARSE AND MEDIUM FABRICS FROM ROTOR SPUN YARNS

Fifty kg of Jayadhar cotton was processed through the blow room, semi-high production card and two passages of high speed drawing. Half of the material was processed through can fed-inter and spun to 14s yarn on a Lakshmi-Rieter ring frame. The other half was spun on the Rieter Open-end Spintrainer with two twist multipliers of 4.5 and 5.0 at a rotor speed of 45,000 rpm. Tests for lea count and strength were completed. The results were as follows :

Counts	TM	Lea CSP	CV% of count	CV% of lea strength
14s OE	4.5	1593	1.7	6.8
14s OE	5.0	1517	1.2	6.6

Weaving of the yarn samples will be undertaken at the V.J.T. Institute, Matunga, using mini-warping facilities available there.

SOURCES AND CHARACTERISTICS OF WATER AND THEIR INFLUENCE IN FINISHING TREATMENTS AND LAUNDERINGS

To study the effect of washing and leaching, fabrics samples which were treated for DP and FR properties were dipped in well water (hard water) and distilled water (soft water) for 18-20 hours. These samples were subsequently evaluated for different properties such as add on (%), crease re-

covery angle (CRA), tearing strength and breaking strength and also subjected to vertical flame test, charred length and area, after flaming and after glow. The data is being analysed.

Using, different hardening agents in different proportions, some water samples were prepared and were used for the cross linking treatments to study the effect of hard water of different degrees of hardness.

EVALUATION OF THE RESPONSE OF RESIN FINISH TREATMENTS ON DECRYSTALLISED AND STABILISED COTTON YARN

The conditions of partial acetylation of cotton yarn swollen in 15% NaOH at normal stretch was standardised. The acetylated cotton yarns were then crosslinked with DMDHEU in nine different concentrations. The resin finished samples were evaluated for resin uptake, moisture regain, tensile strength and crease-recovery angle.

Another modification treatment involving two higher levels of acetylation was initiated. After standardising the conditions for obtaining 6% and 8% acetyl content, the modified yarn samples crosslinked with five different concentrations of DMDHEU were evaluated for their tensile and crease-recovery properties.

Experiments for carrying out the modification treatments in fabric were initiated. Grey fabric obtained from a local textile mill was desized and secured. The following three sets of experiments were carried out, after standardisation.

(a) The desized fabric crosslinked with 4% concentration of DMDHEU were evaluated for tensile properties.

(b) The desized fabric was mercerised with 20% NaOH under slack condition and adjusted the alkali pick up to around 100%, partially acetylated to 6% acetyl level and crosslinked with 4% DMDHEU.

(c) The desized fabric was held on a s.s. frame and mercerised with 20% NaOH without allowing the the fabric to shrink. The pick up was adjusted and partial acetylation was carried out. The resin finishing with 4% DMDHEU was carried out, as earlier.

The tensile strength of all the above fabric samples were determined. The crease-recovery property could not be done, as the instrument went out of order. The evaluation of N% and the moisture regain at 65% rh was in progress.

The results in general, show that the modification treatment involving swelling with alkali under normal stretch and partial acetylation without washing-off the alkali, has beneficial effect on the mechanical properties of the cotton yarn after crosslinking. Enhanced reactivity towards the resin is also observed in the modified samples; the treatment involving 20% NaOH pre-swelling concentration show especially, encouraging results with re-

gard to tenacity, elongation, toughness and wearlife as compared to the unmodified samples. The results of the modification treatment involving higher acetyl content are not encouraging and it seems that the diffusion of resin molecules inside the fibre matrix is impeded by higher acetyl content.

DURABLE PRESS FINISHING OF COTTON AND BLENDED FABRICS USING GLYOXAL AS CROSSLINKING REAGENT

A few promising treatments from earlier study of crosslinking of cotton fabrics with glyoxal (15%) were chosen for the crosslinking of cotton : terene blended fabric. These treatments consisted of the following catalyst systems :

(1) Aluminium amonium sulphate (0.5%)

(2) Aluminium sulphate (0.5%)

(3) Aluminium ammonium sulphate (1.0%)

(4) Ammonium sulphate (1.0%)

(5) Aluminium ammonium sulphate (0.5%) + Aluminium sulphate (0.5%)

(6) Aluminium ammonium sulphate (0.5%) + Glycolic acid (0.5%)

(7) Aluminium sulphate (0.5%) + Glycolic acid (0.5%)

Treated fabric samples were dried at 80°C for 5 min and cured at 160°C for 3 min. The control as well as finished samples were evaluated for fabric properties. The following observations were made.

(1) Catalyst system at No. 5 above produced fabric with highest add-on. The same treatment yielded the fabric with highest dry crease recovery angle (329°). Amongst the different catalysts studied, the one involving Aluminium ammonium sulphate always gave higher crease resistance property.

(2) Breaking and tearing strength retention values were always above 85% with all the catalysts.

(3) Yellowing effect with all the seven catalyst systems on cotton : terene blended fabric due to glyoxal was less than the similarly treated cotton fabric.

(4) Aluminium ammonium sulphate had less yellowing effect on the fabrics as compared to Aluminium sulphate, when glycolic acid was used as one of the ingradients in the catalyst system.

ANTISOILING FINISHES TO COTTON AND BLENDED FABRICS

Antisoiling finishing treatments were imparted to cotton fabrics using CMC (1.5%) along with two different softeners, viz. DMDHEU and TAE. To study the effect of nature of softner on soiling and soil release property, the following different types of softners (2.0%) were used; (1) nonionic (2) anionic (3) cationic (4) silicone based and (5) wax emulsion type. All the fabric samples were padded with padbath solution on a laboratory padding mangle to 80% wet-pick-up. Padded samples were dried at 80°C for 5

min and cured at 160°C for 3 min in an electrically heated air-draft oven. Cured samples were washed by standard procedures and air-dried.

Control and treated fabric samples were evaluated for different properties, viz. add-on, breaking strength, stiffness, crease recovery by standard ASTM methods. The reflectances of control, treated and soiled and washed samples were determined, separately by the method as described earlier. Soiling and washing of the fabric samples were also done by the method standardised earlier. Degree of soiling and soil release were calculated by using reflectance readings. To determine the washfastness of the treatment, quantitative estimation was carried out on all the fabric samples using BIS method.

It was observed from the data collected that all the samples treated by antisoiling finishing treatment had better strength retention compared to conventionally treated fabric. Highest strength retention was observed when silicone based softner was used in the treating solution. Though crease recovery angles of treated samples increased to a great content, durable press rating performance was average. Durable press ratings of silicone based softner treated samples were exceptionally good. Highest degree of soiling was observed when (1) treatments were carried out in the absence of softner and (2) when anionic softner was used in the treatment. Degree of soil release of anionic softner treated fabric was high and durability of this finish was average.

Durable press ratings of silicone based softner treated samples were exceptionally good. Highest degree of soiling was observed, when (1) treatments were carried out in the absence of softner and (2) when anionic softner was used in the treatment. Degree of soil release of anionic softner treated fabric was high and durability of this finish was average. Though the degree of soiling of nonionic softener treated fabric was low, this finish could not withstand even 5 washes. Silicone based softner treated fabric had lowest degree of soiling and highest degree of soil release. Durability of this finish was average.

ANTIBACTERIAL FINISHING OF COTTON FABRIC

Preliminary finishing treatments were given to cotton fabric with 12% Acetic acid, 12% H_2O_2, 10% Zinc acetate, 1% softner and 0.1% wetting agent. The bath ratio was 1:100 and the fabric samples were treated for 8 min. The treated samples were dried at 100°C for 7 min and cured at various temperatures (120°C, 140°C and 160°C) and time (5 min, 4 min and 3 min) to ascertain the appropriate curing temperature and time to get maximum add-on. The add-on was found to be maximum at 140°C for 4 min curing.

After standardisation, finishing treatments were given to cotton fabrics using various concentrations of chemicals, viz. Zinc acetate (10%, 12% and 14%), 12% Acetic acid, 12% peroxide, 1% softner and 0.1% wetting agent. The fabric samples were dried

at 100°C for 7 min and cured at 140°C for 4 min. The cured samples were washed with water and a neutral detergent and then air dried. The add-on was determined by difference in weight of the fabrics. The add-on varied from 1.3% (10% Zinc acetate) to 3.4% (14% Zinc acetate).

The treated samples alongwith the untreated control were evaluated for tensile strength and antibacterial performance by finding out the zone of inhibition using s-aureus and k-pneumoniae organisms. All the treated samples recorded no zone of inhibition indicating no antibacterial activity. This may be due to the insolubility of the peroxide complex which is bound to the fabric. Therefore, a modified Quinn test method has to be adopted for assessing the antibacterial performance of the fabrics and the tests are underway.

DURABLE FLAME RETARDANT (FR) FINISHES FOR (A) TEXTILES (B) SEWING THREAD

(A) **Textiles**: The process of imparting FR finish to cellulosic fabrics was demonstrated to M/s. Tata Mills, a mill under NTC in Bombay. A 400 mt length of drill fabric was treated during the demonstration. Further, 500 mt of furnishing fabrics were processed for them and a report communicating the results of analysis of the treated fabrics also was sent. At the instance of naval authorities, 500 mt of fabrics were given FR finish and supplied. Similarly, 25,000 mts of special fabrics was given FR treatment for defense purposes and the treated fabric was analysed and reports sent.

(B) **Sewing Thread**: Sewing thread in lea form was treated for FR finish. It was observed on testing that the treatment was not uniform. Attempts are being made to design and fabricate a device to treat the thread in the form of single yarn.

PREPARATION OF SUPERABSORBENTS BY IRRADIATION

Tapioca starch sample obtained from a starch manufacturing firm was grafted with acrylonitrile (AN) by the mutual irradiation technique using five different dosages of gamma radiation. The conditions for irradiation, grafting, etc. were similar to those used for maize starch. Subsequent alkali hydrolysis of the grafted material gave the final absorbent product. Acid hydrolysis of the grafted product separated the polyacrylonitrile (PAN) from the backbone. Molecular weight of PAN was also determined according to the procedure followed earlier. The dosage of radiation given in this study was low, viz. 0.18 M.rad/hr. A separate study was also conducted to find out the effect of higher dosage rate of radiation on the properties of the grafted starch. The rate of 0.35 M.rad/hr. was selected as the higher dosage rate. Conditions for preparing the superabsorbent product, molecular weight determination of PAN, etc. were the same as mentioned above. The following table gives the comparative values for the various grafting parameters and absorbency.

Dose rate/hr. M. rad	Dose	Grafting (%)	Mol wt. of PAN (10^5)	Viscosity of 1% dispersion cps spindle No. 5	Absorbency (g/g)
0.18	0.1	40.62	3.180	3,360	218
	0.2	44.60	2.664	4,120	216
	0.3	42.78	1.994	6,800	277
	0.4	38.08	2.436	6,960	301
	0.5	41.03	2.287	4.360	258
0.35	0.1	—	—	1,960	181
	0.2	38.46	2.980	2,680	203
	0.3	37.21	2.360	4,480	296
	0.4	37.86	2.475	7,500*	378
	0.5	39.67	2.287	5,200	332

* The viscosity in this case was determined by using spindle No. 6.

The above table does not give a definite trend in respect of the samples prepared at two different dosage rates. This might be due to the short interval of time between the consecutive dosages which results in far less the time of exposure of the samples to the source in the case of 0.35 M.rads. A longer duration of exposure might bring about some significant differences and therefore, studies are continued keeping this end in view.

A large scale experiment to prepare superabsorbent from maize starch was attempted at ISOMED (BARC) using 750 g of dry starch. The various properties studied were as follows :

Hot water solubles	—	39.06 g
% grafting	—	33
Absorbency	—	213.0 g/g
Yield of the final air dried material	—	1485 g

As the % grafting and absorbency values are less than the expected values, it has been decided to repeat the whole experiment with a little more exposure to gamma ray radiation and at better hydrolysis conditions.

FURTHER STUDIES ON THE ENZYMOLYSIS OF NEVER-DRIED COTTON CELLULOSE AND OTHER CELLULOSIC MATERIALS

The studies during the period on the enzymolysis of never-dried cotton cellulose at different stages of boll development, were confined to 20 days old cottons as well as bolls about to burst, pertaining to Laxmi, Suvin and G.27 cotton varieties. The enzyme from **Pencillium funiculosum** F_1 was used and enzymolysis was carried out as before at 50°C in appropriate buffer

system for different periods. Weight loss, total reducing sugars and specific glucose estimates were made from the samples after hydrolysis.

The results indicated that as much as 96% to 99% total reducing sugars were obtained from 20 day old bolls after 3 hours of incubation in the case of Laxmi variety as compared to 6 hours required to obtain the same quantity of reducing sugars, when 40 day old bolls were used earlier. The specific glucose yield was, however, higher in the early stages (27%) than the matured ones.

In the case of Suvin, the corresponding sugar yield was 75% and 83%. Again, the glucose yield was higher in their early stages of development (35%) as against only 14% in the matured stage.

When G.27, an **arboreum** cotton was used for enzymolysis, a reverse trend was observed with regard to the specific glucose yield, i.e. 12% in the early stages and 20% in the later stages. The probable reasons for the lower yield of reducing sugars in the case of Suvin and G.27 at 20 days could be due to the lower cellulose content available for enzymolysis and hence, lower sugar yield. However, the higher glucose content in the early stages could be due to the poor organisation of cellulose and efficient cellulolysis. After acquiring full maturity, the higher order cellulose organisation probably resist the enzyme action and hence the lower glucose yield.

Never-dried cotton fibres collected at two different stages of growth and also belonging to different species mentioned above as well as their residues after enzymolysis were subjected to x-ray examination for structural evaluations. Analysis of the results indicated that, fibres belonging to earlier stages particularly those of Laxmi and Suvin were more accessible in the sense that decrystallization during enzymolysis was higher in these fibres. Fibres belonging to G.27 behaved in a peculiar way in that there was no decrystallization after enzymolysis irrespective of their growth. This behaviour is similar to earlier findings on the variety DH.3-12 (**G. herbaceum**) which was also subjected to enzymolysis for the same period. Some differences in the decrystallization rates were found between fibres of Suvin and Laxmi, both collected after 20 days of postanthesis. This could be due to the differences in the organization of cellulose between these fibres even during the early stages of development.

Never-dried cotton cellulose from the variety Suvin on mercerization becomes resistant to enzymolysis contrary to untreated fibres. To find out the reasons for this effect, the never-dried fibres before and after mercerization were fragmented and examined with the help of Transmission Electron Microscope (TEM). The results indicated that the untreated fibres show clear cell walls and individual microfibrils. Mercerized fibres, however, showed agglomeration of the fibrils. This agglomeration must be coming in the way of cellulolysis.

PREPARATION OF LOW VISCOSITY STARCHES USING BACILLUS SUBTILIS-159 AMYLASE

Bacillus subtilis-159 was grown in Modified Tendlers Non-Synthetic (MTNS) medium for 42 hr and it was centrifuged to get clear enzyme filterate which was subsequently used to prepare low viscosity starch.

A slurry of 8% maize starch was gelatinized at 100°C and incubated at 60°C in a constant temperature water bath with continuous stirring. **Bacillus subtilis-159** enzyme filterate was added to it and incubated further for 15 min at 60°C during which a drop in viscosity was noticed. The partially hydrolysed starch was kept in boiling water bath and 0.6% mutton tallow was added to it and incubated for 15 min. This was spread over glass plates covered with plastic sheets with TLC spreader to get thin films of low viscosity starch. The films were dried at room temperature. Films from commercially available thin boiling starch were also prepared under similar conditions. Tensile strength and elongation at break of these films were measured using 1 cm test length at 65% R.H. It was observed that the films of enzymatically hydrolyzed starch showed tensile strength of 27.92 N/sq. mm while, films of commercially available thin boiling starch showed tensile strength of 17.59 N/sq. mm. Elongation at break by these films were found to be 3.22% and 3.04% respectively. These results, thus, showed that the films of enzymatically prepared low viscosity starches have better strength and thus, the product could be suitable for sizing purpose.

Fermentation studies were continued to optimise amylase production of **B. subtilis-159** in 5-litre fermenter containing 2-litres of MTNS medium. It was observed that the organism could produce a maximum amylase of about 1660-1730 units/100 ml in 84 to 96 hr when, the medium was fortified with 0.2% starch and 3.8% cottonseed meal. Effect of wheat bran, a cheap carbon source, on amylase production was also studied at various aeration rates. It was observed that 1660-1800 units/100 ml of amylase could be obtained at 96 hr at 1 lit/min to 1.5 lit/min aeration rate.

STUDIES ON THE OCCURRANCE OF GRAM NEGATIVE BACTERIA IN THE COTTON PLANT AS A SOURCE OF ENDOTOXINS

In earlier studies, it was established that the population of **Beijerinckia** sp., a free living nitrogen fixing bacterium is more in varieties having higher gossypol content. Since, gossypol inhibits gram positive bacteria, it was concluded that **Beijerinckia** being gram negative, must have been specifically encouraged on various parts of cotton plant. The study was, therefore, extended to glandless varieties. Two glandless varieties, viz. MWCV-107 and MWCV-137 received from Indore were raised in pots and **Beijerinckia** population were enumerated from the serial parts, after opening of the bolls. The gossypol content from the leaves of these varieties was 0.08 and 0.10 respectively. The variety, MHCV-107 had

65 × 10^3 cells per g of the material whereas, the variety MWCV-137 had 50 × 10^4 per g of the material on oven dry basis.

QUANTITATIVE ESTIMATION OF LINTERS IN COTTON SEEDS USING X-RAY DIFFRACTION METHODS

Thoroughly delinted cotton seeds and cotton linters were powdered separately. Samples containing different proportions of linters and seeds were synthesised. Each sample was prepared in triplicate. Six samples with linter contents in the range 5% to 30% were, thus prepared. Detailed analysis of their X-ray diffractograms enabled definition of an X-ray Linter Index (XLI)

$$\text{as } \frac{[\,I(002) - I(20.3)\,]}{I(002)} \times 100 \text{ for}$$

the estimation of linter content percentage. In this index, I(002) refers to the maximum intensity in the region ($2\theta = 22.6° \sim 22.8°$) where, the I(002) peak of cellulose from linter occurs, I(20.3) is the intensity at $2\theta = 20.3°$ where, the maximum in the scan of the seed occurs. The XLI was found to vary linearly with linter content.

When a few seed samples were tested for linter content using this calibration, however, the estimates were found to vary considerably from the true values because of differences in particle size distributions between synthesised samples and experimental samples. As it was found to be very difficult to achieve a distribution identical to that in the synthesized sample through grinding and crushing of seed samples, it was decided to use well ground seed samples themselves for drawing the calibration lint.

Accordingly, a new calibration line was set up using seven different seed varieties with wide linter content variation. Using this calibration line which was also linear, the linter contents of 12 seed samples were estimated. The error of estimate came out as ±0.77% at 1.96 ~ level when, samples were tested in duplicate, which is satisfactory for most estimation needs. The error of estimate may be further reduced by increasing the number of tests when necessary.

EFFECT OF BLEACHING TREATMENTS ON THE LINTERS OF PURE VARIETIES

Cottonseed samples of 14 more varieties, viz. SRT.1, Ganganagar Ageti, Digvijay, Laxmi, Vikram, A.51.9, Desi, Bijaynagar, Khandwa 2, LRA.5166, C.J.73, K.2, C.Indore 1 and G.Cot.12 were collected and delinted on a laboratory model delinting machine. The linter samples obtained were kiered and bleached.

The effect of bleaching treatment was evaluated with respect to degree of polymerisation and colour.

Eleven purified linter varieties, viz. Hybrid 4, JK.Hy. 1, Bikaneri Narma, Deviraj, MCU.5, DCH.32, V.797, Virnar, Maljari and N.534 were analysed for degree of polymerisation after kiering and bleaching.

Visual observations indicated that eventhough kiering and bleaching conditions for purifying the linter samples were identical the whiteness varied for different samples. Quantification of the whiteness of purified linters is being attempted by using three different instruments, viz. (1) High Volume Tester (2) Spectrophotometer and (3) Data Colour.

Eleven linter samples were tested on High Volume Tester. The results showed variation in whiteness from variety to variety. Estimation of whiteness on Spectrophotometer has been standardised and whiteness measurement of linter samples on spectrophotometer and Data colour will now be taken up shortly.

PREPARATION AND CHARACTERIZATION OF CELLULOSE DERIVATIVES

After standardising the method for preparation of cellulose acetate (soluble in a mixture of dichloromethane and methanol) from bagasse pulp, it was prepared from both bagasse pulp and cotton stalk pulp. The ash content which is an indicator for the purity of the product, was determined for both the samples. It was found to be 0.003%. The degree of polymerization (DP) was determined in both the cases using dichloromethane and methanol mixtures (90:10) at 5°C. The degree of substitution was determined using standard method.

X-ray diffractograms were recorded on cellulose triacetate prepared from bagasse pulp and cotton stalk pulp. The **'d'** spacings were calculated in both the cases. Four peaks were observed at $2\theta = 10.28°$, 13.5°, 18.0° and 22.5° in the case of cellulose triacetate prepared from bagasse pulp. The peaks were at $2\theta = 10.5°$, 13.0°, 18.0° and 22.5°. The **'d'** spacings are in well agreement with those reported earlier for cellulose triacetate II prepared from wood pulp and cotton cellulose. Hence, the product obtained is cellulose triacetate II.

STUDIES ON RANCIDITY OF COTTONSEED OIL

The studies were continued during the year with one more refined cottonseed oil (Farsan) and five antioxidants — Butylated Hydroxy Anisole (BHA), Butylated Hydroxy Tolune (BHT), Tacopherol, Tertiary Butyl Hydro Quinone (TBHQ) and a natural antioxidant (NAO). Peroxide value and free fatty acids (FFA) of the portions of Farsan oil samples treated with antioxidants and kept at room temperature in plastic containers were determined at regular intervals.

There was a marginal increase in FFA of these samples over a period of 11 months, the values ranging from 0.38 to 0.57. However, there was a rapid increase in the peroxide values after three months. Most of the samples showed flavour reversion between fourth and fifth months of the antioxidants used; only TBHQ was found effective in delaying the onset of rancidity.

In the case of the refined oil sample (Maruti) tried earlier also, the FFA values increased marginally over a

period of 1½ years. However, the FFA increased considerably in the case of raw cotton seed oils of Hybrid 4 and V.797 during the same period. It is interesting to note that the FFA of raw Jayadhar cotton seed oil samples remained practically unchanged, for a period of 8 months. These samples had high FFA initially (8.08), which increased very rapidly to about 26.0 during the first 7 months. Peroxide value of all these oil samples increased steadily during the storage. At the end of 1½ years, peroxide values ranged from 20.6 to 35.6 for raw Hybrid 4 cotton seed oil, from 30.9, to 44.5 for V.797 raw cottonseed oil, from 14.1 to 26.7 for Jayadhar raw cottonseed oil and from 121.0 to 156.2 for Maruti refined oil. Thus, the increase in peroxide values of refined oil was found to be about 3 to 4 times higher than those of the raw oils during the same period. A new test, Anisidine value, was standardised to study the total oxidation of oil samples.

PRODUCTION OF BIOGAS AND BIOMANURE FROM WILLOW-DUST BY DRY FERMENTATION

Trials on the production of biogas by dry fermentation in the experimental plant installed at the Laboratory have been completed. The plant is working satisfactorily to date, since February, 1987. As much as 250 m^3 of biogas is being produced in 45 days from one tonne of willow-dust.

To evaluate the digested slurry for manurial value, experiments were laid out at Arabhavi in Belgaum District, Karnataka, on cotton crop under irrigated conditions. Datas from last year trials have indicated that application of digested slurry at the rate of 5 tonnes per ha is equivalent to application of 80 : 40 : 40 NPK per ha. The yield data from this season is also expected. Regarding the preparation of Techno-Economic Feasibility Report (TEFR), efforts are underway to entrust the work to one of the consultants in Bombay. The report is expected to be ready in about 3 months.

STUDIES OF COTTON PLANT MATERIALS AND COTTON DUST

Standardisation and setting up of experimental procedures using XRFS instrument were carried out. This included instrument settings, crystal calibration, detector calibration, channel assembly and assembly of analytical programmes.

A number of experiments were conducted employing different methods of sample preparation for the type of materials to be analysed under the project. This involved studies of different extents of grinding and pulvarissing, using mixer, grinder, mortar and pestle, etc. The effect of moisture content and particle size, homogenising and binding additives and the magnitude and duration of pressure application were also studied and standardised. A die and plunger arrangement to produce sample pellets of consistant compactness and smooth surface finish was fabricated.

A few cotton plant samples drawn from the four cultivated species were obtained. Each plant was divided

into four parts, viz. root, bottom, middle and top (based on the distance from the soil level of the main stem). Except for the root portion, the leaf, bract and them belonging to each portions were separated. Thus, ten samples per plant were generated. The soil near the root was also collected for the analysis.

Qualitative examination of the samples has been started. Over 25 elements were detectable in most of the samples. Considerable variation within different plant parts as well as between plants of the same variety grown in the same location appeared to be present.

SOME NEW APPROACHES FOR IMPROVING PARTICLE BOARDS PREPARED FROM COTTON PLANT STALKS

(a) Effect of particle size on the properties of boards

To study the effect of particle size on the properties of the particle boards, the boards were prepared using cotton stalk particles of different mesh sizes keeping all other conditions like pressure, temperature, resin content, etc. constant. It was observed that the particles passing through 10 mesh and retained over 50 mesh were considered to be the best, in view of subsequent trials, for separate fractions as well as the mixture, which yielded highest strength to the boards.

As optimisation of resin content is as important as the optimum particle size, different lots of the particle size mixtures were treated with different concentrations of resin (viz. 5% to 18%) and the boards were prepared keeping all other parameters constant, and were tested for different properties like bending strength, thickness, density, water absorption, etc.

The bending strength of the board increased from 111 kg/cm^2 to 230 kg/cm^2. The boards with 7% to 10% resin content gave the strength properties in conformity with the standard specifications.

(b) Effect of pressure on the properties of the board

Boards were also prepared keeping particle composition, resin content and other parameters constant and varying only the pressure during board preparation from 15 kg/cm^2. It was observed that for optimum density and strength of the board, a pressure of 35 kg/cm^2 to 45 kg/cm^2 was found to be adequate.

(c) Preparation of medium and low density boards

Particles boards were prepared using a mixture of cotton plant stalk particles and baggase dust, with the binder in different concentrations and at different pressures. Boards of different bending strength and different densities were obtained which are being tested for various properties. These boards have different end-uses depending on their densities and strength.

(d) Preparation of multilayered boards

To study the effect of proportion of coarse and fine particles in different

layers of the same board on the overall properties of the board, multilayered boards were prepared keeping the percentage of coarser particles from 50% to 70%. Other conditions for particle board preparation were kept constant.

Study on the particle composition and the chemical analysis of the baggasse dust sample (waste-material of paper and pulp factory) was undertaken during this period to exploit its use for the preparation of particle boards.

FEASIBILITY AND STANDARDISATION STUDY OF COTTON STALK FOR PREPARATION OF VARIOUS GRADES OF PULP AND PAPER

Laboratory scale trials were conducted for the preparation of large size hand made paper from cotton stalk. Two types of pulp, viz. soda and kraft, were prepared using cotton stalk as the chief raw material. Soda pulp was prepared using 14% NaOH while kraft pulp was prepared using 16% kraft liquor. Large size hand made paper sheets were prepared on a vat and then tested for various strength properties. The quality of the paper sheets produced by both the processes was satisfactory. Preliminary corrugation trials were also conducted to ascertain the suitability of the above paper sheets the for preparation of CFB boxes. The trials gave promising results.

Large scale production of CFB boxes

Large scale pulping of cotton stalk was carried out at Handmade Paper Institute, Pune. Two types of pulps, viz. soda and kraft were prepared.

Soda pulp

Soda pulp was prepared by digesting 15 kg of cotton stalk chips with 14% NaOH on oven dry (O.D.) weight of the raw material at 160°C for two hours in a stationary digester. The material to liquor ratio was 1:5 (on O.D. weight of the raw material).

Kraft pulp

Kraft pulp was prepared by digesting 15 kg of cotton stalk chips with 16% kraft liquor on O.D. weight of the raw material at 175°C for two hr in a stationary digester. The material to liquor ratio was 1:5 (on O.D. weight of the raw material).

The cooked material from the both the digestions was washed throughly and then tested in a pilot plant beater to get the pulp of desired freeness.

Sheet making and testing

Large size hand made paper of different grammage was prepared from both the pulps on a vat. The sheets were dried in the air and tested for various properties employing standard test methods.

Corrugation trials

The paper sheets prepared from the above pulps were subjected to corrugation in a mini-make corrugating machine and 3 ply and 5 ply corrugated boards were prepared. With the assistance of a local factory, CFB boxes of various dimensions were prepared.

Testing of corrugated boards and boxes

In order to ascertain the suitability of the boards and CFB boxes for packaging of fruits and vegetables, the boards and boxes were sent to Indian Institute of Packaging for carrying out various tests, viz. drop test, compression strength, puncture resistance, edge crush test, burst factor, etc. The test results were encouraging indicating the suitability of the boxes for packaging of fruits, canned food, bottles, etc.

PREPARATION OF PULP FOR VARIOUS END USES FROM COTTON STALKS AND OTHER POST-HARVEST LIGNOCELLULOSIC MATERIALS VIA ANAEROBIC DIGESTION

The technology developed in making good quality pulp from cotton stalk for various end uses requires atleast 12% alkali, apart from cooking at 160°C for a specified time. Preliminary trials undertaken in the preparation of pulp from cotton stalks through anaerobic digestion indicated that the alkali requirement can be brought down to 8% and cooking temperature lowered to 100°C. However, when spent cotton stalks obtained after raising edible mushroom crop, **Peurotus sajor-caju** was subjected to anaerobic digestion for 15 days, the requirement of alkali was found to be only 2% at 100°C. The results thus indicated that the paper sheets prepared from the paper sheets prepared from the biologically softened spent material was comparable with the quality of paper produced from the control sample, except for the burst factor and the number of double folds which came down slightly for the former samples. However, the brightness of the former was higher than the latter.

BIOENRICHMENT OF COTTONSEED HULLS AND PREPARATION OF PROTEIN HYDROLYSATES FROM COTTONSEED MEAL

Enzymatic hydrolysis of cottonseed meal to obtain protein hydrolysates at different pH for varying periods of incubation with changes in enzyme concentration, was done earlier. The effect of temperature on the hydrolysis of the cottonseed meal with two proteolytic enzymes, viz. trypsin and pancreatin, was undertaken during the period.

The pre-cooked meal was treated with trypsin and pancreatin at 0.12% concentration. The pH was adjusted to 7.5 and 8.2 respectively and the hydrolysis was carried out with a substrate to water ratio of 1:4 for 2 hr at different temperatures of 30°C, 40°C and 50°C. The hydrolysed products were extracted with hot water and dried in vacuum.

The results indicated that 50°C was the optimum temperature for both the enzymes with a hydrolysis rate of about 40%. The hydrolysed products were having a nitrogen percentage of about 9.6.

STUDY ON VEGETABLE FIBRES (OTHER THAN COTTON) WITH A VIEW TO EXPLORE ITS INDUSTRIAL APPLICABILITY, PARTICULARLY IN TEXTILE FIELD

As reported earlier, the treated and cut (32 mm) pineapple fibre was given

a preliminary opening using SRRL opener. This was then blended with cotton (V.797), which was cleaned earlier using SRRL and Kirschner beaters, in the proportion 20:80 (pineapple : cotton). The blended material was then processed through blow room. The laps produced was carded using MMC card equipped with metallic clothing. The carded sliver was drawn twice employing 4/4 graduated drafting system. 1.2 hk rovings were prepared using slubber with suitable twist multiplier. A 12s count yarn was spun from the rovings produced. Similarly, a control yarn from V.797 cotton of 20s count was also spun for comparison. The yarns produced were tested for yarn characteristics as per procedures followed at CTRL.

The yarn characteristics of control as well as blended yarn are tabulated below :

Particulars	V.797 (control)	80% G.797 and 20% pineapple fibre
Actual count	11.4	11.9
Actual strength (lbs)	153.8	113.2
Corrected CSP	1810	1324
Single thread tenacity (g/t)	11.9	10.6
Elongation at break	9.7	9.2
CV% of breaking strength	11.5	17.8
U%	16.8	20.3
Thin places/100 meter (M)	8	45
Thick places/100 M	30	90
Neps/M	46	86

Both the control as well as blended yarn was woven to a Denim type of fabric at the All India Weaver's Service Centre using the following particulars :

Reed — 32s (4 in a dent)
Pick — 40

The fabrics produced were tested for strength both in warp and weft directions using a strip size 2.5 cm × 10 cm, on Instron Tensile Tester with the following conditions :

Cross head speed — 5 cm/min
Gauge length — 10 cm

The results of fabric strength are tabulated below :

Particulars	Control V.797	80% G.797 and 20% Pineapple fibre blend
Warp way		
Breaking load (kg)	30.2	32.8
Breaking extension (%)	13.2	11.9
Weft way		
Breaking load (kg)	50.2	49.9
Breaking extension (%)	10.8	9.9

It is, thus, seen that there is no significant differences in strength and elongation of the control and pineapple blended fabric although the blended yarn shows lower strength compared to control. Similarly, appearance of the blended yarn was poorer. However, this difference in yarn appearance has not been reflected in the fabric state. Further chemical finishing treatment is under progress.

RESEARCH WORK DONE AT THE REGIONAL QUALITY EVALUATION UNITS

Coimbatore

Effect of different sowing time on fibre properties :

The variety MCU.9 was sown on 6 different timings from August 1 to September 22, 1986. The lint samples from the sowing on first August recorded comparatively better quality characteristics. As the sowing date was delayed, the fibre length and tenacity values deteriorated.

Sriganganagar

Studies on the fibre quality of lint obtained from bigger and smaller bolls: The study completed during 1988 exhibited marked differences for ancilliary and quality characters from the different sized bolls.

Studies on quality parameters of lint collected from Tirak affected and healthy bolls also has been completed during the year.

Hissar

Effect of fumigant on the quality of cotton fibre :

An experiment on fumigation of seed cotton (Variety H.777) with Aluminium phosphide at different depths (top, middle and bottom) was undertaken with three replications. The calculated quality of fumigant was placed at the top, centre and the bottom of the container which was kept air tight for 72 hours. Cotton in container without any treatment was kept as control. The chemical released phosphene gas which is heavier than air and flows down from the top. The marginal reduction noticed in the fibre length, Micronaire value and maturity coefficient might be due to ill effects of the gas on the celluiose layer of the fibre.

3

Publications

A. Annual Report

Annual Report of the Cotton Technological Research Laboratory for the calendar year 1987.

B. Research Publications (CTRL Publications — New Series)

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C. Other Publications

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3. S. G. Vinzanekar, A. G. Jogdev, B. Srinathan, M. S. Parthasarathy and V. Sundaram — A Study of Rotor-spun Doubled Yarns (Published in the Indian Journal of Textile Research, Vol. 13, p. 58-62, June, 1988).

4. Jatin Vaidya, I. G. Bhatt and V. Sundaram — Dermatological Effects of New FR Treatment (Published in the Indian Textile Journal, Vol. 98, No. 9, p. 52-56, June, 1988).

5. S. D. Pai, V. G. Munshi and A. V. Ukidve — Abrasion Resistance, Physical, and Mechanical Properties of Sewing Threads (Published in the Indian Textile Journal, Vol. 98, No. 9, p. 144-147, June, 1988).

6. R. H. Balasubramanya, V. G. Khandeparkar and V. Sundaram — Large-Scale Digestion of Willow-dust in Batch Digesters (Published in Biological Wastes, Vol. 25, p. 25-32, 1988).

7. S. N. Nagwekar, S. D. Pai, A. S. Mehta and B. P.S. Lather — Effect of Removal of Bracts on Boll Weight, Seed Cotton Yield and Fibre Quality in North Indian Cottons (Published in Haryana Agricultural University Journal of Research, Vol. 18, No. 3, p. 215-217, September, 1988).

8. P. K. Mandhyan, A. V. Ukidve and G. Viswanathan — Comparison of the Moisture Content Result of an Indirect Portable Moisture Tester with the Standard Oven-Dry Method (Published in the Journal of the Textile Association, Vol. 49, No. 4, p. 129-131, July, 1988).

9. P. K. Chidambareswaran, J. K. S. Warrier and V. Sundaram — Structure — Property Relations in Cotton Fibres Part I : Fibrillar Orientation And Its Usefulness In Cotton Quality Improvement Research (Published in the Journal of Indian Society for Cotton Improvement, Vol. XIII, No. 2, p. 129-139, September, 1988).

10. J. K. S. Warrier, V. G. Munshi and P. K. Chidambareswaran — Structure-Property Relations in Cotton Fibres Part II : Studies on Fibrillar Orientation Distribution and Tensile Properties of Cotton Fibres — Recent Findings (Published in the Journal of the Indian Society for Cotton Improvement, Vol. XIII, No. 2, p. 140-149, September, 1988).

11. V. Sundaram, V. G. Munshi and I. K. P. Iyer — Cotton Fibre Quality and Support Price (Published in the Indian Textile Journal, Vol. 99, No. 1, p. 100-102, October, 1988).

12. B. Srinathan, S. K. Chattopadhyay and M. S. Parthasarathy — Viscose-Staples on OE Rotor Machine (Published in the Indian Textile Journal, Vol. 99, No. 2, p. 124-128, November, 1988).

13. J. K. S. Warrier and V. G. Munshi — Instron/Stelometer : Comparison of Correction Methods (Published in the Indian Textile Journal, Vol. 99, No. 2, p. 174-177, November, 1988).

14. Charulata R. Raje and Radhika P. Bhat — Cross-linking of Cotton Cellulose with Glyoxal (Published in the Indian Textile Journal, Vol. 99, No. 3, p. 84-89, December, 1988).

D. Papers presented at Seminars/ Conferences/Symposia

1. R. H. Balasubramanya, H. U. Gangar, V. G. Khandeparkar and V. Sundaram — Modified Janatha Biogas Plant to Process Willow-dust : A Solid Cellulosic Textile Mill Waste (Presented at the 28th Annual Conference of the Association of Microbiologists of India held at Pune from 16th January to 18th January, 1988).

2. V. Sundaram and V. G. Munshi — Effect of Application of Insecticides for Control of Bollworms, on Cotton Fibre Quality (Presented at Group Discussion on Bollworm Resistance held at Central Institute for Cotton Research, Nagpur from 8th March to 9th March, 1988).

3. B. Srinathan, S. K. Chattopadhyay and M. S. Parthasarathy — Influence of Fibre Length and Some Process Parameters on the Quality of Open-end Spun Yarns from Viscose Staple Fibre (Presented at the 29th Joint Technological Conference held at the Bombay Textile Research Association, Bombay from 27th March to 29th March, 1988).

4. N. Thejappa and I. G. Bhatt — Nutritional Aspects of Cottonseed Oil (Presented at the Seminar on Strategies for Making India Self-Reliant in Vegetable Oils held at Indian Society of Oilseeds Research, Hyderabad from 5th September to 9th September, 1988).

5. R. M. Gurjar and I. G. Bhatt — Cotton Plant Stalk — A Potential Raw Material for Particle Board Manufacture (Presented at Workshop/Seminar on Futurology of Pulp, Paper and Board Products held at Regional Research Laboratory, Jammu-Tawi from 15th November to 16th November, 1988).

6. A. J. Shaikh and I.G. Bhatt — Cotton Plant Stalk — A Promising Raw Material for Packaging Industry (Presented at Workshop/ Seminar on Futurology of Pulp, Paper and Board Products held at Regional Research Laboratory, Jammu-Tawi from 15th November to 16th November, 1988).

7. A. J. Shaikh, P. V. Varadarajan and I. G. Bhatt — Utilisation of Linseed Stalk for Preparation of Pulp and Paper (Presented at Workshop/Seminar on Futurology of Pulp, Paper and Board Products held at Regional Research Laboratory, Jamu Tawi from 15th November to 16th November, 1988).

8. R. H. Balasubramanya, H. U. Gangar, V. G. Khandeparkar and V. Sundaram — Production of Biogas from Willow-Dust by Dry Fermentation (Presented at the Course-cum-Symposium on Advances in Bioprocess Engineering held at Indian Institute of Technology, New Delhi from 18th December to 20th December, 1988).

E. Technological Circulars on Trade Varieties of Indian Cottons

T. C. No.	Variety	Place
	1986-87 Season	
2362	AHH.468	Sawner
2363	SRT.1	Bhavanagar
2364	Hybrid 4	Chindanwara
2365	Sankar 6	Surendranagar
2366	Suvin	Attur
2367	Hybrid 4	Jalgaon
2368	JK.Hy.1	Khandwa
2369	Khandwa 2	Nimad
2370	Laxmi	Kallupatti
2371	SRT.1	Sattur
2372	Sanjay	Botad
2373	Digvijay	Banaswara
2374	G.Cot.11	Jambusar
2375	G.Cot.12	Dhrangdhra
2376	Narmada	Khandwa
2377	Bikaneri Narma	Kankroli
2378	Bengal Desi	Bijainagar
2379	LRA.5166	Erode
2380	Ganganagar Agethi	Sriganganagar
2381	Vikram	Dhar
2382	Hybrid 4	Khargone
2383	Maljari	Khargone
	1987-88 Season	
2384	Hybrid 6	Bharuch
2385	Hybrid 4	Baroda
2386	SRT.1	Bhavanagar
2387	Sanjay	Bhavanagar
2388	G.Cot.10	Bodeli
2389	Hybrid 6	Sabarkanta

T. C. No.	Variety	Place
2390	Hybrid 4	Manavadar
2391	DCH.32	Chitradurga
2392	MCU.9	Guntur
2393	F.414	Kotkapura
2394	Hybrid 4	Bhainsa
2395	Sankar 4	Raichur
2396	LRA.5166	Arvi
2397	Hybrid 4	Anjad
2398	J.34 S/G	Hanumangarh
2399	J.34 R/G	Hanumangarh
2400	Buri 1007	Pusad
2401	Digvijay	Kapadvanj
2402	Bengal Desi	Hanumangarh
2403	Jayadhar	Gadag
2404	G.Cot.11	Baroda
2405	JKHy.1	Ganapavaram
2406	V.797	Dhanduka
2407	G.Cot.13	Dhanduka
2408	Hybrid 4	Hingangadh
2409	Y.1	Sendhwa
2410	J.34	Bhilwada
2411	Ganganagar Agethi	Pali
2412	Maljari	Khargone
2413	V.797	Mehsana
2414	Suvin	Attur
2415	LRA.5166	Gopichettipalayam
2416	LRA.5166	Kovilpatti
2417	Digvijay	Banaswara
2418	Desi	Bhilwada
2419	Hybrid 4	Khargone
2420	DCH.32	Khargone

F. Technological Circulars on Standard Cottons

S. C. No.	Variety	Place
	1986-87 Season	
319	MCU.7	Kovilpatti
320	AKH.4	Achalpur
321	Sanjay	Amreli
322	G.Cot.10	Bharuch
323	LRA.5166	Kovilpatti
324	Deviraj	Junagadh
325	L.147	Yavatmal
326	Digvijay	Bharuch
327	G.Cot.11	Surat
328	Hybrid 4	Surat
329	G.Cot.12	Surat
330	G.Cot.13	Chharodi
331	V.797	Chharodi
332	Hybrid 6	Surat
	1987-88 Season	
333	Hybrid 4	Surat
334	AKH.4	Rambhapur
335	Narmada	Khandwa
336	Khandwa 2	Khandwa
337	AKH.4	Achalpur
338	G.Cot.12	Dhrangdhra
339	Bikaneri Narma	Sriganganagar
340	Ganganagar Agethi	Sriganganagar

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Extension

CTRL has no agricultural farm attached to it and therefore, no direct linkages are established with the farming community. However, close collaboration exists with all the cotton breeding centres under the various State Agricultural Universities and other institutes under ICAR. The Scientists and Technical Officers who are incharges of the Regional Quality Evaluation Units established in the major cotton growing tracts in the country function in close collaboration with the Agricultural Universities and State Departments of Agriculture. They associate themselves with the research programmes, by giving technological assistance and adequate support in the various trials.

CTRL has neither separate extension unit nor separate staff for the extension work. The nature of extension work is mainly that of supply of reliable and accurate data on the quality aspects of cotton, yarn and fabrics, reply to queries of technical nature from personnel in agriculture, textile and related fields, consultancy services for establishing testing laboratories, publication of research results for the benefit of the user group, etc. The Director and some of the Senior Scientists are members of several committees constituted by Bureau of Indian Standards for standardisation of test methods for cotton and textiles, preparation of specifications for various cotton products, etc. in which the knowledge and expertise available at CTRL are fully utilised. Similarly, Director and few Senior Scientists are actively associated with many research advisory panels of other institutions. The Scientists and Technical Officers regularly participate in various Conferences/Symposia by presenting papers based on research findings or otherwise and thus, disseminate expertise and informations to user groups.

Technical Queries

Several queries have been replied during the year pertaining to cotton, by-products, agricultural waste utilisation, new processes, etc. In addition, information on various facets of cotton technology used to be given to those who visit the laboratory personally for the purpose.

Paid Tests

Apart from the research samples received from various agricultural

stations. CTRL continued to receive a large number of samples of fibre, yarn and cloth from Government and Semi Government organisations, as well as from Trade and Industry for tests on payment of prescribed test fees. The activities of the Testing House increased considerably during the year. The demand for testing on High Volume Tester (HVT) has steadily increased during the year with parties like M/s. Cotton Corporation of India, Maharashtra State Co-operative Cotton Growers' Marketing Federation, Ltd. and a leading textile mill, sending a large number of samples for tests. About Rs. 1,00,000/- were realised towards testing charges from these parties alone. As in the earlier years, a number of samples from different parties were tested on Uster Classimat and Open End spintrainer. The recent installation of the Knitting Unit also invoked keen interest from different parties for knitting trials on the yarn produced by them. The following table gives an indication of the spurt in the number of samples received in the Laboratory for paid tests:

Number of samples received for paid tests:

Type of Tests	Average for the Quinquennium 1981-85	1986	1987	1988
Spinning	50	59	22	105
Fibre	117	459	337	1457
Yarn	145	182	142	93
Cloth	60	36	57	40
Moisture	31	28	37	3
Miscellaneous	32	9	18	23
Total	435	773	613	1721

The total testing fees realised during the calendar year 1988 for carrying out the tests on samples received amounted to Rs. 1,76,038/- as against Rs. 60,384/- during 1987.

Calibration Cotton Samples

It is proposed to process Calibration cottons having three different ranges of fineness, viz., coarse, medium and fine and evaluate for different fibre properties.

During the year 5 Kg. of one type of Calibration cotton having Micronaire value of 3.2 was prepared and tests were carried out for 2.5% Span length, Uniformity ratio, Micronaire value

and Tenacity at zero and 3.2 mm gauge lengths. Packets weighing 200 gm each were prepared for supplying to interested parties. Necessary labels and format for giving particulars about the samples and their values were got printed for affixing and sending along with the sample. Two more samples having different ranges are being prepared.

Special Tests

The following special tests were also carried out in addition to the routine ones on the samples received as paid tests and the reports on them were submitted :

1. Two sets of yarn samples were received from a local firm for carrying out knitting trials on the newly installed knitting unit. Two types of fabrics were knitted from the yarn supplied.

2. X-ray crystallinity and related tests were carried out on 6 samples of Microcrystalline cellulose samples received from a chemical firm in Baroda. Xerox copies of the X-ray scans were despatched to the party alongwith the report.

3. Six fibre bundle strength and elongation testers were received from a local firm for calibration and testing of their performance. The instruments were calibrated and the report on their performance sent.

4. Fifteen samples — ten from a textile unit in Madras and five from a Bombay based spinning and textile manufacturing company, were received for measurement of degree of yellowness on High Volume Tester. The reports were duly despatched to the parties immediately after tests.

5. Six cotton samples from a Bombay based spinning and textile manufacturing company and five cotton samples from a mill in Bombay were received for honeydew analysis. The reports were sent to the party as soon as the tests were over.

6. A statement showing the technological performance of 78 **kapas** samples were prepared for M/s. Maharashtra State Co-operative Cotton Growers' Marketing Federation, Ltd. The samples selected were of different grades of each variety (total 15 cottons having at least three grades of **kapas** in the statement). The objective was to assess as to how far the technological properties for different varieties estimated by the cotton graders of Maharashtra State Co-operative Cotton Growers' Marketing Federation Ltd. talley with the actual instrumental grades of **kapas**. The statement was later on sent to the party.

Training

During 1988, two full time training courses in 'Cotton Testing Methods' were conducted for persons deputed by Cotton Trading Organisations, industry, Co-operative Secter, etc, the details of which are as follows :

Name of the trainee (1)	Name of the sponsoring organisation (2)	Duration (3)
Course I		
1. Shri N. G. Shah	N. Mulji and Co., Bombay	July 18 to Sept. 17, 1988
2. Shri K. S. Deshmukh	Maharashtra State Co-operative Cotton Crowers' Marketing Federation Limited, Bombay	,,
3. Shri M. M. Hayat	,,	,,
4. Shri M. N. Bharambe	,,	,,
5. Shri S. A. Pawar	,,	,,
Course II		
1. Shri K. Parameshwarappa	Sri Basaweswara Ginning & Processing Factory, Adoni (A.P.)	October 3 to Dec. 3, 1988
2. Shri S. A. Ladhad	Sha Kanji Devji, Hubli	,,
3. Shri S. N. Hiremath	Shri Swami Samarth Shetkari Winkari Sahakari Soot Girni Niyamit, Valsang, Dist. Sholapur	,,
4. Shri D. M. Rane	Maharashtra State Co-operative Cotton Growers' Marketing Federation Limited, Bombay	,,
5. Shri A. G. Kedar	,,	,,

In addition, two weeks training course in 'Cotton Testing Methods', exclusively for cotton graders sponsored by the Maharashtra State Co-operative Cotton Growers' Marketing Federation, Ltd. Bombay was conducted in seven batches.

The names of the trainees are given below :

Batch I (June 13 to 25, 1988)

1. Shri S. S. Pannase
2. Shri D. A. Nikam
3. Shri P. J. Raut
4. Shri U. S. Patil
5. Shri G. B. Choudhari
6. Shri M. B. Choudhari
7. Shri B. A. Jagdale
8. Shri D. S. Patare
9. Shri S. G. Keley
10. Shri A. H. Kolarkar
11. Shri S. W. Shete
12. Shri U. B. Shinde

13. Shri B. B. Kalbande
14. Shri S. M. Vyawahare
15. Shri J. P. Bhuyar
16. Shri N. B. Rajurkar
17. Shri A. P. Patil
18. Shri R. G. Wankhede
19. Shri A. V. Thakur
20. Shri S. B. Dhere

Batch II (July 4 to 16, 1988

1. Shri S. T. Nichal
2. Shri D. B. Nageshwar
3. Shri R. K. Manekar
4. Shri V. R. Somavanshi
5. Shri G. G. Patil
6. Shri R. G. Songde
7. Shri C. S. Chilwe
8. Shri N. M. Dahake
9. Shri P. E. Borle
10. Shri B. V. Satpute
11. Shri G. S. Nikose
12. Shri T. A. Patil
13. Shri A. M. Nirgude
14. Shri S. N. Chamle
15. Shri I. S. Thorat

Batch III (July 26 to August 6, 1988)

1. Shri V. P. Kamde
2. Shri M. S. Gode
3. Shri A. M. Sahade
4. Shri B. E. Masane
5. Shri M. D. Kamble
6. Shri F. R. Mogal
7. Shri D. U. Nichat
8. Shri A. P. Choudhary
9. Shri P. B. Borchate
10. Shri J. P. Patil
11. Shri S. T. Thakre
12. Shri S. B. Shirurkar
13. Shri S. K. Jagdale
14. Shri U. S. Karande
15. Shri V. S. Shelar

Batch IV (August 16 to 27, 1988)

1. Shri S. S. Deokar
2. Shri A. U. Kakade
3. Shri A. B. Khunkar
4. Shri W. A. Upare
5. Shri S. P. Ganorkar
6. Shri G. K. Gadekar
7. Shri A. V. Deshmukh
8. Shri S. D. Dalvi
9. Shri R. A. Lahankar
10. Shri W. H. Patil
11. Shri D. B. Chaudhari
12. Shri P. P. Patil
13. Shri S. T. Deore
14. Shri V. T. Patil
15. Shri A. B. Baviskar
16. Shri S. L. Kalpande
17. Shri A. D. Patil
18. Shri S. K. Gunjekar
19. Shri R. K. Pawade

Batch V (September 5 to17, 1988)

1. Shri S. T. Dhakite
2. Shri Y. H. Patil
3. Shri K. P. Kawathalkar
4. Shri M. N. Jadhav
5. Shri R. S. Bhuyar
6. Shri V. M. Khose
7. Shri V. V. Deshmukh
8. Shri D. B. Kadam
9. Shri S. D. Paul
10. Shri B. U. Satpute

11. Shri D. B. Bodekar
12. Shri V. M. Mohod
13. Shri N. B. Sheikh
14. Shri B. K. Kukade
15. Shri S. K. Nichal
16. Shri B. U. Khode
17. Shri D. R. Kadam
18. Shri S. C. Bhoyar
19. Shri W. R. Rathod

Batch VI (September 26 to October 7, 1988)

1. Shri G. R. Khot
2. Shri A. B. Adichwal
3. Shri B. R. Thawari
4. Shri M. B. Patil
5. Shri A. B. Wankhade
6. Shri T. J. Sontakke
7. Shri K. B. Dhangar
8. Shri S. D. Bhugul
9. Shri A. U. Sarkate
10. Shri S. B. Bajad
11. Shri S. A. Gavali
12. Shri A. A. Karankal
13. Shri N. R. Kacharde
14. Shri B. S. Solav
15. Shri H. Y. Patil
16. Shri M. J. Marge

Batch VII (October 17 to 29, 1988)

1. Shri K. A. Chougule
2. Shri B. M. Pawase
3. Shri P. N. Khawale
4. Shri S. T. Bangar
5. Shri G. G. Bhode
6. Shri T. G. Tifane
7. Shri M. R. Lande
8. Shri B. K. Gulhane
9. Shri M. M. Datey
10. Shri P. N. Khante
11. Shri R. G. Bhoge
12. Shri H. D. Patil
13. Shri R. V. Rane
14. Shri G. N. Harne
15. Shri S. M. Pawar
16. Shri N. A. Kulkarni
17. Shri P. S. Thorve
18. Shri V. K. Borse

At the Ginning Training Centre, Nagpur, practical training programmes are conducted on a regular basis and each course is spread over for a period of two weeks. Normally, candidates sponsored by ginning industries are admitted for this programme. Candidates are trained in operation and maintenance of different types of pre-cleaning and ginning machines. One such training programme was conducted from June 13 to 27, 1988 and the following persons participated :

Sr. No.	Name of the trainee	Organisation
1.	Shri Babarao Pundalikrao Pachekar	M/s. Badridas Narayandas & Sons, Arvi-442 201
2.	Shri Tilak Mangilal Vasawale	The United Ginning & Pressing Factory, Khandwa-450001
3.	Shri Mohan Va Deoram	"
4.	Shri Anarsingh Ranjitsingh	Abhishek Udyog, Sanawad-451 111

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Conferences and Symposia

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

Sl. No.	Meeting/Conference/ Seminar/Symposia, etc.	Place	Date	Name(s) of the Scientist(s) and Technical Personnel who attended the Conference/Meeting, etc.
1.	XXVIII Annual Conference of the Association of Microbiologists of India	University of Pune	16-1-88 to 18-1-88	Dr. V. G. Khandeparkar, Dr. R. H. Balasubramanya and Dr. S. G. Gayal
2.	Conference of the Indian Society of Agricultural Engineers	Punjabrao Krishi Vidhyapeeth, Akola	21-1-88 to 23-1-88	Dr. G. R. Anap
3.	National Workshop on Post-harvest Technology of Fruits & Vegetables	Konkan Krishi Vidhyapeeth, Dapoli	27-1-88 to 29-1-88	Dr. (Miss) I. G. Bhatt and Shri A. J. Shaikh
4.	Seminar on Modern Trends in Analytical Techniques in Life Sciences	Bombay	29-1-88	Dr. V. G. Khandeparkar, Dr. R. H. Balasubramanya and Smt. S. P. Bhatawdekar
5.	Seminar on Textile Exports Problems and Perspectives	BTRA, Bombay	24-2-88	Shri M. S. Parthasarathy
6.	Group Discussion on Bollworm Resistance in Cotton	CICR, Nagpur	08-3-88 & 09-3-88	Dr. V. Sundaram, Dr. G. R. Anap and Dr. V. G. Munshi
7.	29th Joint Technological Conference of ATIRA BTRA, SITRA and NITRA	BTRA, Bombay	27-3-88 to 29-3-88	Dr. V. G. Munshi, Shri S. K. Chattopadhyay, Shri B. Srinathan, Dr. (Miss) I. G. Bhatt and Shri A. W. Shringarpure

Sl. No.	Meeting/Conference/ Seminar/Symposia, etc.	Place	Date	Name(s) of the Scientist(s) and Technical Personnel who attended the Conference/Meeting, etc.
8.	All India Cotton Production and Utilisation Conference	CTRL, Bombay	23-4-88 and 24-4-88	All Scientists and Technical Personnel of CTRL.
9.	Physical Methods of Test, Sectional Committee Meeting (TDCI)	BIS Office, Novelty Chamber, Bombay	27-5-88	Dr. V. G. Munshi
10.	Annual Rabi Oilseeds Workshop of Rapeseed Mustard, Rabi/Summer Groundnut, Sunflower and Linseed	College of Agriculture, Pune	10-8-88 to 13-8-88	Dr. N. B. Patil and Dr. (Miss) I.G. Bhatt
11.	Seminar on Strategies for Making India Self Reliant in Vegetable Oils	Hyderabad	05-9-88 to 09-9-88	Dr. N. B. Patil, Dr. (Miss) I. G. Bhatt and Shri N. Thejappa
12.	Workshop-cum-Seminar on Cotton Production Technology	CICR, Nagpur	16-9-88 to 26-9-88	Dr. V. G. Munshi
13.	R & D Meeting on Biogas	Nagpur	06-10-88 & 07-10-88	Dr. V. G. Khandeparkar, Dr. R. H. Balasubramanya and Shri U. H. Gangar
14.	Present Status and Future Development of Cotton in Rajasthan	Agricultural Research Station, Sriganganagar	26-10-88	Dr. V. G. Munshi and Shri R. M. Gurjar
15.	International Conference on Role of Women in Agriculture	Vigyan Bhavan, (ICAR), Delhi	29-11-88 to 04-12-88	Dr. (Miss) I. G. Bhatt
16.	Seminar on Oppurtunities for Chemical from Agro-Resources	Taj Mahal Hotel, Bombay	08-12-88	Shri P. V. Varadarajan
17.	International Symposium on Recent Advances in Bioprocess Engineering	IIT, New Delhi	18-12-88 to 20-12-88	Dr. V. Sundaram, Dr. V. G. Khandeparkar and Dr. R. H. Balasubramanya

6

Summary of the Report

This sixty-fifth Annual Report covers the calendar year 1988.

As in the past, CTRL continued to collaborate actively during 1988 also, with State Departments of Agriculture, as well as Agricultural Universities situated in different parts of the country, in their endeavour to evolve improved cotton varieties in terms of quality and yield, better utilisation of cotton and cotton plant by-products. CTRL continued to play a major role in cotton improvement research under the AICCIP by (i) laying down norms for fibre properties, (ii) continuous monitoring of the fibre quality of the breeders' materials at various stages of breeding so as to enable the breeders to take corrective measures as and when necessary, (iii) technological evaluation of pre-release materials through detailed fibre tests, ginning and spinning trials and (iv) final evaluation through mill trials. In addition, CTRL had been playing more or less a similar role in the cotton improvement programme launched by state departments of agriculture. Over 10,000 samples belonging to the above mentioned categories have been tested during the year for fibre properties as well as spinning performance at the headquarters and at the regional stations. 91 books have been added to the library during 1988 making the total number of books in the library at 4034. Supply of abstracts of articles in the areas of cotton ginning and cotton testing have been initiated on a regular basis for the TEXINCON of the National Information Centre for Textile and Allied Subjects (NICTAS) functioning at ATIRA, Ahmedabad.

The following five new varieties have been recommended for release through AICCIP: (i) Pusa 31, (ii) 378.BK, (iii) GDH.149, (iv) MCU.11 and (v) JK.119-25-54.

250 GP stocks belonging to **G. arboreum** and **G. hirsutum** species were evaluated for fibre quality characters. Variability in 2.5% span length was 19.7 mm to 24.6 mm for **G. arboreum** and between 20.3 mm and 26.3 mm for **G. hirsutum.** Similarly, the variability in tenacity at 1/8″ gauge was from 17.0 g/t to 29.3 g/t in the case of **G. arboreum** and between 16.9 g/t and 26.0 g/t for **G. hirsutum.**

Inheritance study of fineness in **Desi** cottons was studied with eight parents crossed among themselves adopting partial diallele mating design. The results of analysis of intrinsic fineness of the produce by gravimetric method for two years were quite confirmatory and specific. It was well observed that the fibre fineness character was governed by additive type of gene action. For both F1 and F2 generations, general combining ability was significant. Favourable genes can be best utilised for the improvement of this trait by conventional breeding method in desirable parents by selection.

Investigations on the soil factor affecting fibre quality revealed that all the four major fibre properties viz. length, fineness, maturity and strength were significant for different soils. The interactions between soils and varieties were also found to be significant for fibre length, fineness and maturity of the fibre.

Lint samples received from different agronomy trials conducted at Surat and Khandwa were tested for major fibre properties. In all, 148 samples belonging to Agro. 2b, Agro. 2c, Agro. 14 and Agro. 4 were tested for major fibre properties. Similarly, 48 lint samples received from Khandwa pertaining to Agro. 2 were also tested. Data are being analysed.

The foliar application of chelated cations, viz. Ca, Na, K and their combinations on the cotton plant improved the overall fibre quality. Na and Ca sprays increased fibre length by about 15% and 8% respectively. Application of Na yielded finer fibres.

A study on the quality of fibres from the cotton plant affected by a new wilt revealed that :

(1) Physiological disorder and imbalance in nutritional uptake may be one of the reasons for this new wilting.

(2) Quality of the lint affected due to this disease was very poor as compared to healthy lint.

The four Boll Hardness Testers fabricated earlier were completed in all respects. One of the instruments was delivered to Dharwad University. Reports indicated that the instrument has been functioning satisfactorily. Reproducibility of results was tested and certain precautions like keeping the needles in oil after testing and using needles from the same lot have been recommended for continuous satisfactory performance of the equipment.

Quality of cotton lint from different pickings of different species and hybrids were studied with 3 cottons each from the four species and three hybrids. The pooled analysis of data revealed that, while the mean length was less only for **G. hirsutum** cotton, there was a general increase in Micronaire value in all the species for the last picking and this increase was specific for third picking in **G. hirsutum** cottons. The maturity was significant for interspecific American hybrids in

which latter pickings yielded more mature fibres. For strength at 3 mm gauge length, except G. hirsutum × G. barbadense, the rest of the groups showed significant variation in one or two years. However, **G. hirsutum** varieties recorded significant changes in all the three years.

In connection with the studies on changes in fibre characters during the development period of cotton boll, tests were made on samples collected at weekly intervals, pertaining to H.4, Ame. Nectariless, Varalaxmi and Laxmi from Nanded. It was observed that the boll size and maturity of fibre increased upto the age of 35 days and remained more or less the same later on. However, the trend was not consistent. As far as strength is concerned, the increase was upto about 35 — 42 days and then remained constant.

Green cotton bolls of NA.48, NH.239, NHH.44 and DCH.32 from Nanded after anthesis were picked, dried in sunlight and the various physical properties of the fibres, along with control were determined. It was observed that though the fibre quality of fully developed green bolls which were picked before natural opening and the naturally opened bolls was almost the same, the crop duration got reduced facilitating a second crop like wheat or gram under protective irrigation.

Seeds of NA.39 irradiated by gamma rays in three different doses and EMS treatment were sown and from the produce obtained, the seeds were collected and sown upto M-5 generations. It was observed that most of the mutant single plant selections had stable quality characteristics and that the strain NA.39 responded well to irradiation by way of mutations in the fibre properties and recombinations and genotypic correlations. The 15 kr. dose of gamma ray and 0.1% EMS treatment brought about morphological changes and variation in fibre properties moderately with negligible loss in germination.

A survey of the conditions of ginning factories in Madhya Pradesh has been completed by visiting 25 major cotton marketing and processing centres and 50 ginning and pressing factories, as also by collecting information through questionnaires from 150 ginning and pressing factories' personnel.

As part of the designing and development work of an inclined type cotton cleaner, different peripheral speeds were evaluated by determining fibre properties of cotton samples before and after pre-cleaning. There was fibre breakage when the peripheral speed is increased. Different machine manufacturers were being contacted to undertake the fabrication work.

Influence of different pre-cleaning and ginning treatments on fibre and yarn quality was assessed using AKH.4, AKH.468, L.147 and H.4 cottons and it was found that in general, the maximum trash was extracted by the inclined type pre-cleaner and that the productivity of gins did not differ between

pre-cleaned samples and the control. The fibre properties also did not show any trend between different samples of the same variety. At yarn stage, the Classimat yarn faults were lower for Finisher Extractor-SR Gin combinations for AKH.4 and CTRL Extractor-SR Gin combination for AHH.468.

To study the impact of different ginning methods on seed quality, crop was raised and harvested of SRT-1, AKH. 4, Jayadhar, PKV.081 and G.27.

In a study on crystallisation of cellulose, data of hydrolysis obtained on dried and never-dried fibres suggest that the latter is only marginally lower in crystallinity than the former when the samples were drawn having the same % mature fibres.

The studies on the morphological deformities and their characterisation in cottons were continued by SEM examination of one more variety, viz. Varalaxmi. It was observed that, as in the case of samples examined in previous years, the frequency of occurrence of different kinds of deformities in fibres of shorter length groups is comparatively higher than that of the longer length groups. The distributions of deformities along the fibre length were also examined for Suvin, AK.235 and Jayadhar and some observations were reported.

In order to study the influence of various morphological and structural parameters on the tensile properties of cotton fibres, 20 cottons out of 25 were evaluated so far, for convolutions and reversals per cm, convolution angle, ribbon width, wall thickness, cross-sectional area, perimeter and single fibre linear density, breaking load and extension.

Relaxation of molecular orientation in stretched fibres has been investigated by testing equilibrium birefringence, crystallinity and some static moduli on wool, nylon and PET fibres at different strain levels. Birefringence and static modulus of wool fibres were measured in different alcohols also. Slope of birefringence — strain curve is similar to static stress — strain curve and the change in birefringence is highest in wool, followed by nylon and PET fibres. The rate of birefringence relaxation is low compared to the static stress relaxation in all the fibres. In alcohol, birefringence increased with length of the alcohol chain in all the fibres.

During studies on lattice conversion behaviour of cotton fibres, the existence of a spectrum of three dimensional order in cotton fibre has been more clearly demonstrated, for the first time.

Swelling and stretching of doubled yarns of coarse counts (20s or less), in aqueous zinc chloride under optimum conditions, had resulted in the production of yarns with improved properties. Swelling of cotton fibres in aqueous zinc chloride, followed by successive removal of upper layers revealed the morphological features of the inner layers. SEM studies of these morphological features led to certain interst-

ing observations regarding the nature of (1) fibrillar bundling near reversals (2) fibrils that connect different layers (3) inclination of fibrils in the interior layers and (4) the variation in fibrillar morphology along the length of the fibre.

The structure property-relations in fibres swollen at 0°C in various concentrations of LiOH, NaOH and KOH were found to be different for the three reagents. It was also noted that, while tenacity was dependent on the fineness of the variety, structure was independent.

Tensile properties like strength, extensibility and work of rupture were measured on continuous filament yarns of nylon, viscose and polyester as well as spun yarns of viscose and polyester at different gauge lengths. In all the cases, the values of tensile parameters were found to decrease with increase in test length. The extent of decrease was different for each type of yarn. Spun yarns generally showed "higher reduction" with increase in test length as compared to continuous filament yarns. In the latter case, the effect was more pronounced in nylon and comparatively less in polyester. Of the two spun yarns, viscose recorded higher drop than polyester. The effect of weak links was more detrimental to breaking elongation than breaking load.

From the work carried out on cotton yarns of varying evenness (measured in terms of U%), it was found that there existed no relation between U% and strength-length, strain-length gradients and energy-length gradient. This implied that mass variation along the length of yarn cannot account for the decrease in tensile characteristics with increasing specimen length.

Eighty-four cottons widely varying in fibre quality parameters were tested on Fibrograph 530, Sheffield Micronaire, Stelometer and HVT System and the data analysed. It was observed that except tenacity, other parameters viz. 2.5% span length and Micronaire value showed good agreement between HVT and conventional methods. The Micronaire values were found to influence the tenacity determined by HVT.

In a study to assess the contribution of ring frame process to fault levels of yarns spun from Indian cottons, fault level was determined for 60s yarn with varying total draft and break drafts. It was found that except objectionable faults, the yarn faults generally tend to increase with total spinning draft and that at higher spinning draft, there was about 15% increase in 'A' faults at both the break draft levels.

A device has been fabricated for preparing parallelised yarn bundles meant for tensile tests. Preliminary experiments carried out on two cotton yarn samples made into bundles with the help of the new device have shown very low CV%, demonstrating the superiority of the bundle over conventional lea.

Twist of sixteen yarn samples of counts 16s, 30s, 40s and 60s, was found

out using four methods, viz. untwist-retwist methods, slippage method twist to break method and straightened fibre method, for a study on slippage method of yarn twist determination.

For the evaluation of spinnability of cottons from single thread strength of microspun yarns, thirty-one small samples of cotton lint have been collected for microspinning. In all, 126 samples have been subjected to microspinning for different counts of 16s, 20s, 30s, 40s, 50s, 60s, 80s, 100s and 120s. Fifty-two microspun and fullspun yarns have been tested for single thread strength parameters. From the analysis of available data, it was observed that single thread strength (g) values of full-spun yarns were higher than that of microspun yarns for 20s, 30s, 40s and 50s counts. The same trend was observed in the case of yarn tenacity (g/t) also. CV% of breaking strength of microspun yarns was much higher than that of full-spun yarns.

Spinning of H.4 cotton to different counts on ring frame as well as Open-end spintrainer (OE), blending of trinary blends of MCU. 5, LRA. and Laxmi and further processing to yarns of different counts, apart from Jayadhar cotton spun on OE spintrainer were taken up in connection with studies on optimal blending of standard varieties of Indian cottons from Southern India. The cleaning efficiency at blow room and card for all the cottons tested, was significantly affected by the presence of trash.

For the production of coarse and medium fabrics from rotor spun yarns, 50 kg Jayadhar cotton was spun to 14s yarn and tested for count and strength.

To compare the difference in the effect of well water and distilled water on washing and bleaching of fabrics, Durable Press and FR treated fabrics were soaked for 18 to 20 hours. These samples were evaluated for various physical and chemical properties. Using different hardening agents, water samples were prepared to different levels of hardness and used for treatments, to study the effect of diffrent levels of hardness on the above mentioned properties during finishing treatments.

In order to evaluate the response of resin finishing treatments on decrystallised and stabilised yarn, apart from modification treatment involving 15% NaOH pre-swelling, two more treatments on yarn involving higher levels of acetylation were carried out and the modified samples were crosslinked with five concentrations of resin and properties evaluated. The higher levels of acetylation appears to affect the diffusion of resin molecules inside the fibre matrix. Modification treatment involving 20% NaOH pre-swelling concentration was carried out on fabric samples under slack as well as stretched conditions. Subsequent crosslinking of the above modified fabrics with 4% resin, displayed encouraging results as far as strength is concerned.

Trials were conducted for crosslinking of cotton : terene blended fabric using the non-formaldehyde crosslinking agent Glyoxal and different cata-

lyst systems consisting of Aluminium sulphate, Aluminium ammonium sulphate and Glycolic acid. The total concentration of catalyst system varied from 0.5% — 1.0%. Treated and control fabric samples were evaluated for fabric properties. Highest crease recovery was obtained when a mixture of Aluminium sulphate (0.5%) and Aluminium ammonium sulphate (0.5%) was used as catalyst. Use of Glycolic acid in the treatment retarded the yellowing effect of Glyoxal.

Antisoiling finishes imparted to cotton fabrics using CMC and different types of softners were evaluated for properties had shown that all the samples had comparatively better strength retention and crease recovery angle. Highest degree of soiling was observed when treatments were carried out in the absence of softener and when anionic softener was used in the treatment. Silicon based softener treated fabric had lowest degree of soiling and highest degree of soil release, though durability of the finish was average.

A new antibacterial finishing treatment was developed for cotton fabric and its effectiveness was tested by finding out the zone of inhibition using S-aureus and K-pneumonial organisms. As the test was not satisfactory due to insolubility of the peroxide complex which is bound to the fabric, a modified quinn test was being carried out for the assessment of antibacterial performance.

Three separate mill trials were undertaken for imparting FR finishing on 400 metres, 500 metres and 500 metres of fabric samples in a NTC mill in Bombay. 25,000 metres of special grade fabrics were also given FR finishing treatment, at the instance of defense authorities. A special device is being fabricated to give FR finish to single yarn used for sewing threads.

Gelatinized tapioca starch was grafted by the mutual irradiation technique to five dosages of mutual irradiation with different dose rates, viz, 0.18 and 0.35 M rad/hr. The properties of the samples prepared at these dose rates were compared. As the results are not significant, efforts are underway to change certain conditions of the experiment. A scale up reaction on maize starch was conducted at ISOMED (BARC) to prepare the absorbent polymer on a large scale.

Cellulolysis was carried out on the never-dried cotton cellulose from the varieties, Laxmi, Suvin and G.27 at early stages and after complete maturity. The results indicated that, though the total reducing sugars was high, the glucose yield was high only in the early stages in the case of Laxmi and Suvin whereas, in the case of G.27, a reverse trend was observed. X-ray studies revealed that decrystallization during enzymolysis was higher in the case of Laxmi and Suvin during their early stages of development. In the case of G. 27, there was no decrystallization after enzymolysis irrespective of their growth period.

Low viscosity starch was prepared from maize by hydrolyzing it using B. subtilis-159 amylase. To ascertain

the suitability of the low viscosity starch for sizing purpose, films were prepared from it and its mechanical properties like strength and elasticity were measured and compared with the films prepared from a commercially available low viscasity starch.

The films of hydrolysed starch showed better strength and elongation at break and thus, the product was found suitable, for sizing purpose.

Studies were carried out to optimise the production of amylase by **B. subtilis-159** in a 5 litre fermenter containing 2 litre medium where, wheat bran and cottonseed meal were used as carbon and nitrogen sources, respectively. It was observed that a maximum of 1600-1800 units/100 ml of amylase could be obtained at 96 hr.

The occurrence of **Beijerinckia,** the free living nitrogen fixing bacterium, on the aerial parts of cotton plants could be due to the presence of gossypol in all the varieties tested including the glandless varieties.

A x-ray diffraction method which is easy and quick as compared to the existing techniques has been evolved for determining the linter content in cotton seeds.

Eleven linter samples were evaluated for D.P. after kiering and bleaching to study the effect of bleaching treatments on linters of pure varieties. Quantification of whiteness of purified linters also was attempted by HVT, Spectrophotometer and Datacolour.

The modification treatment involving 15% NaOH pre-swelling concentrations was carried out. Two more modification treatments on yarn involving higher levels of acetylation were also tried and the modified samples crosslinked with five concentrations of resin and properties evaluated. The higher levels of acetylation seems to affect the diffusion of resin molecule inside the fibre matrix. Modification treatment involving 20% NaOH pre-swelling concentration was carried out on fabric samples under slack as well as stretched conditions. Subsequent crosslinking of the above modified fabrics with 4% resin displayed encouraging results as far as strength is concerned.

In connection with the study on rancidity of cotton seed oils, peroxide values of refined cotton seed oil samples were compared with that of other edible oils and it was observed that this value increased much faster for cotton seed oil than those of the raw oils. But the increase in free fatty acids (FFA) of the refined oils even over a period of 1½ years was very marginal. While the increase in FFA was significant in the case of raw oil samples, increase in peroxide value was slower. Thus the raw oils showed a better stability to oxidation compared to the refined oils. FFA values did not increase after reaching a maximum. Of the five antioxidants studied, only TBHQ was found to be effective in delaying the onset of rancidity. The antioxidant did not affect the FFA of the samples. Colour of the refined oils remained unchanged over a period of one year,

while the raw oils got darkened during the same period.

Trials undertaken on the experimental biogas plant for dry fermentation processes indicated that as much as 250 m^3 of biogas could be produced in 45 days from one tonne of willow-dust. The results on the manurial trials undertaken at Arabhavi are yet to be obtained. Regarding the technoeconomic feasibility report (TEFR), the work has been entrusted to one of the consultants in Bombay.

The XRF instrumental conditions as well as sample preparation techniques for carrying out qualitative analysis of cotton plant parts were standardised. Analysis of a few cotton plants was undertaken. Over 25 elements could be detected and their concentration was found to vary within as well as between plants.

Effect of particle size on properties of the cotton stalk particle boards was studied by preparing boards of varying particle size (from 10 mesh (B.S.) to 100 mesh (B.S.) keeping conditions like pressure, temperature and resin content constant. This was very important to know the optimum size of the particle responsible for requirement of resin per unit volume of the size and shape of particle. The particles of 10 M & 50 M size were considered to be best for geting optimum properties in subsequent trials. The boards were also prepared by treating different lots of particle size mixture with 5% to 18% of the binder. When boards were subjected to different tests, it was observed that boards with 7% to 10% resin content gave the properties which were on par with the standard specifications. As pressure is an important parameter for particle board manufacture, the boards were prepared under different pressures and were tested for physical properties. Medium and low density boards prepared under different pressure and resin concentrations were being tested for various properties. To study effect of properties of coarse and fine particles in different layers of the same board and its effect in the properties of the board, few boards were prepared in 70:30, 60:40 and 50:50 proportion. The optimum particle size passing through 10 mesh and retained over 50 mesh was considered to be the best for getting optimum properties in subsequent trials and 7% to 10% resin concentration was found to be optimum.

Laboratory scale trials were undertaken to prepare large size hand made paper from soda as well as kraft pulp using cotton stalk. Preliminary corrugation trials were conducted to ascertain the suitability of the papersheets for CFB boxes for packing of fruits and vegetables and various tests were carried out on the boards as well as on boxes at the Indian Institute of Packaging. The test results indicated suitability of the boxes for packaging of fruits, canned food, bottles, etc.

The spent cotton plant stalks obtained after harvesting of oyster mushroom crop was processed through anaerobic digestion for preparing pulp for paper making. The results indicated that the

paper sheets prepared from the biologically softened spent material was comparable with the quality of paper produced from the control samples, except perhaps for the burst factor and the number of double folds. However, the brightness of the former was much higher than of the latter.

Preparation of protein hydrolysates from the cottonseed meal with trypsin and pancreatin was achieved best at 50°C at their optimum pH and substrate to water ratios. The hydrolysed products were having a nitrogen percentage of about 9.6.

Pineapple fibres were successfully blended with V.797 cotton in 20:80 proportion and yarns were prepared. Both blended as well control yarns were woven into a denim type fabric at the All India Weavers' Service Centre. There was no significant difference in strength and elongation properties of pineapple blended and control fabrics. Fabric appearance was also more or less similar.

The research work done at the Regional Quality Evaluation Units included :

1. Effect of different sowing time on fibre properties.
2. Studies on the fibre quality of lint obtained from bigger and smaller Bolls.
3. Effect of fumigant on the quality of cotton fibre.

7

Personnel

Major activities in 1988 under personnel function at CTRL are given below :

A. APPOINTMENTS

Sr. No.	Name	Grade	Effective date of appointment
	Technical Staff		
1.	Shri A. K. Antony	Tech. Officer, T-6	30-1-1988
2.	Kum. I. K. P. Iyer	Tech. Officer, T-6	30-1-1988
3.	Shri T. K. M. Das	Tech. Officer, T-6	30-1-1988
4.	Shri B. S. Ganvir	Tech. Officer, T-6	30-1-1988
5.	Shri S. N. Nagwekar	Tech. Officer, T-6	11-4-1988
6.	Shri Gopal B. Hadge	Tech. Asstt. T-II-3	9-5-1988
7.	Shri K. Narayanan	,,	17-5-1988
8.	Shri Jal Singh	,,	10-6-1988
	Administrative Staff		
1.	Smt. U. N. Bhandari	Jr. Stenographer	20-6-1988
2.	Shri T. S. Patil	Jr. Clerk	3-12-1988
3.	Kum. S. K. Goankar	Hindi Typist	8-12-1988
4.	Kum. S. V. Pai	Jr. Clerk-cum-Telephone Operator	31-12-1988
	Supporting Staff		
1.	Shri S. R. Patode	Supporting Staff Gr. I	30-4-1988

B. ASSESSMENT

Scientific Staff

The Five Yearly assessment of eligible Scientific personnel of CTRL was held and Promotions Advance/Increments granted as follows :

Promotions

Sr. No	Name	Grade to which promoted	Effective date of promotion
1.	Dr. S. G. Gayal	Scientist S-2	1-1-1985
2.	Shri Muntazir Ahmed	Scientist S-2	1-7-1985

Advance Increment

Sr. No.	Name	Grade	Effective date of advance increment
1.	Shri U. N. Borkar	Scientist S-1 (Farm Machinery & Power)	1-7-1985

Technical Staff

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

Promotions

Sr. No.	Name	Grade to which promoted	Effective date of promotion
1.	Shri V. V. Kshirsagar	Conditioning Plant Operator T-5	1-1-1988
2.	Smt. S. R. Kamath	Senior Technical Assistant T-4	1-1-1988
3.	Shri S. M. Gogate	,,	1-7-1988
4.	Shri S. Mukundan	,,	1-7-1988
5.	Shri G. D. Narkar	Carpenter T-I-3	1-1-1988
6.	Shri S. S. Patekar	Driver T-I-3	1-1-1988
7.	Shri P. J. Ahire	Senior Operator T-I-3	1-1-1988
8.	Shri D. B. Gadankush	Operator T-2	1-1-1988
9.	Shri S. G. Shinde	Operator T-2	1-1-1988

Advance Increments

Sr. No.	Name	Grade	No. of advance increments	Effective date of increment
1.	Shri H. U. Gangar	Technical Officer T-6	Two advance increments	1-7-1987
2.	Smt. Santa V. Nayar	Technical Officer T-5	,,	1-1-1988

Sr. No.	Name	Grade	No. of advance increments	Effective date of increment
3.	Shri T. K. M Das	Technical Officer T-5	Two	1-1-1988
4.	Shri M. C. Bhalod	„	„	1-7-1988
5.	Shri D. V. Kambli	Wireman T-1	„	1-1-1988

C. PROMOTIONS

Administrative Staff

Shri B. S. Bhenwal to the post of Assistant w.e.f. 20-1-1988.

Kum. Sujatha G. Nayar to the post of Senior Clerk w.e.f. 1-2-1988.

Shri P. V. Jadhav to the post of Junior Clerk w.e.f. 1-2-1988.

Auxiliary Staff

S/Shri M. B. Thokrul, R. G. Chiplunkar and T. R. Kadam to the post of Operator T-1 w.e.f. 10-5-1988.

Supporting Staff

Shri John Robert to the post of S.S. Gr. IV w.e.f. 24-5-1988.

S/Shri V. M. Subramanyan, G. G. Ambare, M. R. Nevrekar to the post of S.S. Gr. III w.e.f. 15-6-1988, 30-5-1988 and 19-5-1988, respectively.

S/Shri B. H. Umredkar, A. R. Gujar, V. Y. M. Suvarchala Rao, M. B. Chandanshive to the post of S.S. Gr. II w.e.f. 30-5-1988, 19-5-1988, 23-5-1988 and 19-5-1988, respectively.

Shri L. R. Indurkar to the post of S.S. Gr. III w.e.f. 21-10-1988.

D. TRANSFER

Scientific Staff

Shri S. B. Jadhav, Scientist S-1 from Q.E. Unit of CTRL, Indore to CTRL, Bombay w.e.f. 16-5-1988.

Technical Staff

Shri B. S. Ganvir, Tech. Officer T-6 from CTRL, Bombay to Q.E. Unit of Indore w.e.f. 12-2-1988.

Shri S. N. Nagwekar, Tech. Officer T-6 from CTRL, Bombay to G.T.C., Nagpur w.e.f. 11-4-1988.

Shri V. L. Rangari, Tech. Asstt. T-II-3 from Q.E. Unit of CTRL, Hissar to Q.E. Unit of CTRL, Surat w.e.f. 7-6-1988.

Shri K. Thiagarajan, Tech. Asstt. T-II-3 from Q.E. Unit of CTRL, Dharwad to Q.E. Unit of CTRL, Coimbatore w.e.f. 20-6-1988.

Shri V. D. Kalsekar, Tech. Asstt. T-II-3 from Q.E. Unit of CTRL, Surat to CTRL, Bombay w.e.f. 21-7-1988.

Shri E. A. Pachpinde, Tech. Asstt. T-4 from Q.E. Unit of CTRL, Surat to CTRL, Bombay w.e.f. 7-10-1988.

Shri S. N. Nagwekar, Tech. Officer T-6 from G.T.C., Nagpur to CTRL, Bombay w.e.f. 15-11-1988.

Administrative Staff

Shri G. Sasidharan, Asstt. Admn. Officer from CTRL, Bombay to G.T.C., Nagpur w.e.f. 5-5-1988.

Supporting Staff

Shri G. N. Mayawanshi, S.S. Gr. I from NDRI, Karnal to CTRL, Bombay w.e.f. 7-9-1988.

Deputation

Shri Gopalakrishnan, Senior Clerk from CPRI, Simla transferred on deputation to the post of Assistant at G.T.C., Nagpur w.e.f. 1-9-1988.

E. RESIGNATION/TERMINATION OF SERVICE

Shri C. R. Yadav, Tech. Asstt. T-II-3 resigned w.e.f. 31-1-1988 (AN).

Shri Biswanath Chatteraj, Tech. Asstt. T-II-3 resigned w.e.f. 12-4-1988 (AN).

Kum. Anna Fernandes, Jr. Clerk resigned w.e.f. 3-8-1988 (AN).

Shri Babulal Meena, Hindi Assistant resigned w.e.f. 31-8-1988 (AN).

Shri Ramsingh Thapa, SS. Gr. I resigned w.e.f. 10-5-1988 (AN).

F. RETIREMENT

Dr. V. Sundaram, Director retired from service w.e.f. 30-4-1988 (AN).

Shri K. N. Iyer, Jr. Clerk retired on invalid grounds w.e.f. 30-6-1988 (AN).

Shri R. P. Bhat, Tech. Officer T-5 retired voluntarily from service w.e.f. 31-8-1988 (AN).

Shri P. Ramamurthy, Sr. Administractive Officer retired from service w.e.f. 31-8-1988 (AN).

Smt. Veena Kotwani, Assistant retired voluntarily from service w.e.f. 1-12-1988.

Shri D. L. Kalsekar, Asstt. Administrative Officer retired from service w.e.f. 31-12-1988.

G. STUDY TOUR ABROAD

Shri B. Srinathan, Scientist S-3 deputed to USSR for study in joint research on cotton breeding and cotton seed processing under INDO-USSR Protocol for 1988 work-plan for a period of 28 days from August 26 to September 16, 1988.

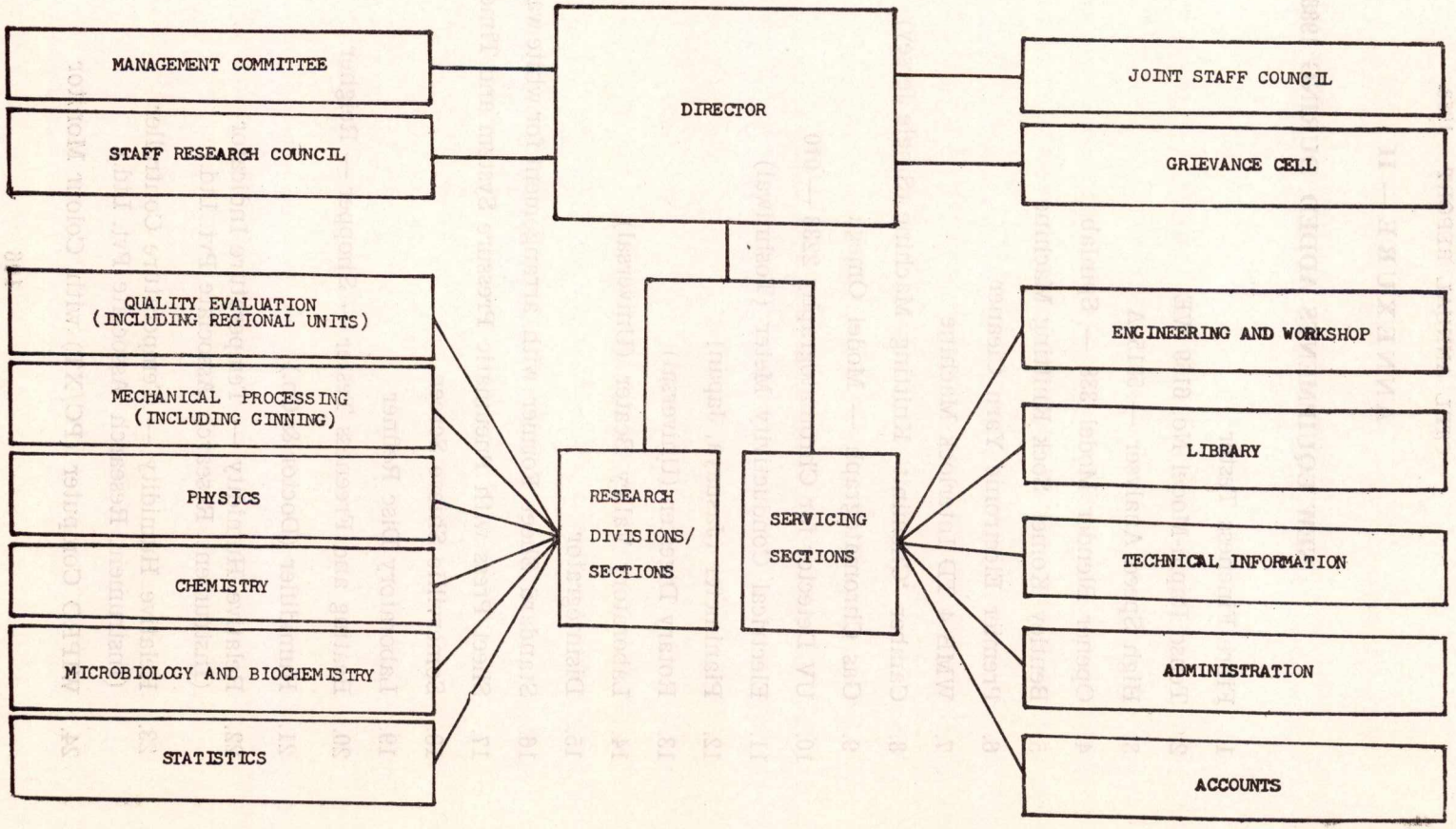
8

Annexures

ANNEXURE — I

COTTON TECHNOLOGICAL RESEARCH LABORATORY

ORGANISATION CHART



ANNEXURE — II

NEW EQUIPMENTS ADDED DURING 1988

1. Fibre Fineness Tester
2. Tenso Rapid-Model No. 6159 WE
3. High Speed Analyser — 5815 A
4. Opener Blender Model 338 — Spinlab
5. Bentley 'Komet' Sock Knitting Machine
6. Premier Electronic Yarn Cleaner
7. WMB 4 TD Interlock Machine
8. Camber 'Cheminit' Knitting Machine (Single Jersey)
9. Gas Chromatograph — Model Omega
10. UV Detector for Chromatography 2238 — 010
11. Electrical Conductivity Meter (Toshniwal)
12. Planimeter (Jasuaya, Japan)
13. Rotary Digester (Universal)
14. Laboratory Valley Beater (Universal)
15. Disintegrator
16. Standard Sheet Former with arrangement for white water re-circulation
17. Sheet Press with Pneumatic Pressure System and Timer
18. Somervillie Shieve Screen
19. Laboratory Disc Refiner
20. Beating and Freeness Tester — Shopper — Reigher
21. Humidifier (Doctor & Co.)
22. Relative Humidity — Temperature Indicator (Instrument Research Associate Pvt. Ltd.)
23. Relative Humidity — Temperature Controller (Instrument Research Associate Pvt. Ltd.)
24. WIPRO Computer (PC/XT) with Colour Monitor

ANNEXURE — III

DISTINGUISHED VISITORS

1. Mr. Nitin Amersey,
   Amersey Damoder,
   Bombay.

2. Prof. G. Thyagarajan,
   Dean of Academic Studies,
   Department of Physics,
   Indian Institute of Technology,
   Bombay.

3. Shri Yogendra Bali,
   The Times of India,
   New Delhi.

4. Shri Jaya Raj,
   United News of India,
   New Delhi.

5. Shri R. K. Nayak,
   Press Trust of India,
   New Delhi.

6. Shri B. Murali Dhar Reddy,
   The Hindu,
   New Delhi.

7. Shri Umesh Joshi,
   Janasatta,
   New Delhi.

8. Prof. K. Madusudhana Rao,
   Head of Fisheries Extension Unit,
   Central Institute for Fisheries Education,
   Bombay.

9. Dr. Y. Sreekrishna,
   Director,
   Central Institute for Fisheries Education,
   Bombay.

10. Shri K. S. Parmar,
Managing Director,
All India Cotton Federation of Co-operative Spinning Mills,
Bombay.

11. Dr. R. G. Owalekar,
Technical Consultant,
All India Federation of Co-operative Spinning Mills Limited,
Bombay.

12. Shri G. S. Nurpuri,
Managing Director,
Punjab State Co-operative Spinning Federation,
Chandigarh.

13. Mrs. Marylin Goodwin,
Regional Officer,
India Unit of British Council,
London.

14. Dr. Charles A. Lawson,
Science Programme Officer,
O/c Co-operative Science & Technology Programms,
U.S. Department of State,
Washington.

15. Mr. Thurmond H. Border,
Counslate General of U.S.A.
Bombay.

16. Mr. George Norvian,
Second Secretary,
American Embassy,
New Delhi.

17. Mr. John Covlter,
GDA,
London.

18. Dr. Oldrich Jirsak
Department of Non-Wovens,
College of Mechanical and Textile Engineering,
Libevec,
Czechoslovakia.

ANNEXURE — IV

FINANCIAL STATEMENT

EXPENDITURE AND RECEIPTS OF LABORATORY DURING 1987-88

	Sanctioned Grant Rs.	Actual Expenditure Rs.	Savings (—) Deficit (+) Rs.
A. EXPENDITURE			
I. CTRL including Q.E. Units (Non. Plan)			
(a) Capital expenditure including expansion of the Laboratory	6,76,000.00	6,76,673.80	(+) 673.80
(b) Working expenditure	93,89,000.00	93,49,466.39	(—) 39,533.61
	1,00,65,000.00	1,00,26,140.19	(—) 38,859.81
II. Scheme for modernisation and strengthening of CTRL for intensive research on cotton (Plan)	32,00,000.00	32,32,119.35	(+) 32,119.35
III. PL-480 Research Project FG-IN-672 entitled "Cotton Fibre Tensile Properties in Relation to Its Morphological and Fine Structure Parameters".	—	1,08,901.82	—

B. RECEIPTS	
Sale proceeds of fruits, vegetables, plants, etc.	520.00
Sale proceeds of vehicles, tools, plants and other non-consumable stores	160.00
Analytical and testing fees	98,367.00
Rent	1,13,600.40
Fees for training, application fees, etc.	80,760.00
Sale of publications	6,321.50
Interest on loans & advances granted to Council's employees	11,524.00
L. S. & Pension contributions	832.25
Miscellaneous receipts (including sale of mixed cotton waste)	5,49,140.66
	8,61,225.81

9

Appendices

APPENDIX — I

STAFF WORKING AT THE COTTON TECHNOLOGICAL RESEARCH LABORATORY AS ON DECEMBER 31, 1988

(List does not include vacant posts)

LIST OF STAFF IN THE HEADQUARTERS

Scientific Personnel

Director

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

Scientist S-4

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

Scientist S-3

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

Scientist S-2

1. Shri Muntazir Ahmed, B.Sc., B. Text. (Text. Tech.)
2. Dr. R. H. Balasubramanya, M.Sc., Ph.D.
3. Smt. S. P. Bhatawdekar, M.Sc.
4. Dr. S. G. Gayal, M.Sc., Ph.D.
5. Shri G. F. S. Hussain, M.Sc.
6. Dr. (Smt.) P. Bhama Iyer, M.Sc., Ph.D.
7. Smt. J. K. Iyer, M.Sc.
8. Smt. Vatsala Iyer, M.Sc., M. Phil.
9. Shri R. P. Nachane, M.Sc.
10. Smt. Prema Nair, M.Sc.
11. Dr. K. M. Paralikar, M.Sc., Ph.D., F.R.M.S.
12. Shri B. M. Petkar, M.Sc.

13. Kum. C. R. Raje, M.Sc.
14. Shri D. Rama Rao, M.Sc.
15. Shri A. J. Shaikh, M.Sc.
16. Dr. S. Sreenivasan, M.Sc., Ph.D.
17. Shri A. V. Ukidve, M.Sc., F.T.A.
18. Shri P. V. Varadarajan, M.Sc.
19. Dr. N. C. Vizia, M.Sc., Ph.D.

Scientist S-1

1. Shri P. Bhaskar, M.Sc.
2. Shri S. K. Chattopadhayay, B.Sc. Tech. (Text.), M.Tech. (Text. Engg.)
3. Shri R. M. Gurjar, M.Sc.
4. Shri A. K. Gupta, M.Sc., L.L.B., W.P.M.M.T.
5. Dr. D. N. Makwana, M.Sc., Ph.D.
6. Shri D. V. Mhadgut, M.Sc.
7. Shri G. S. Patel, M.Sc.
8. Shri K. H. Sawakhande, M.Sc.
9. Kum. Sujata Saxena, M.Sc.
10. Shri N. Thejappa, M.Sc.
11. Smt. J. K. S. Warrier, M.Sc.

Technical Personnel

Technical Officer T-7

Quality Evaluation

Shri M. S. Sitaram, B.Sc.

Technical Officer T-6

Electrical Engineering

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

Quality Evaluation

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

Technical Information

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

Technical Officer T-5

Photography

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

Quality Evaluation

1. Shri K. V. Ananthakrishnan, M.Sc., D.B.M.
2. Shri K. Chandran, B.A.
3. Shri S. Chandrasekhar, L.T.M., A.T.A., Cert. S.Q.C.
4. Smt. P. A. Dabholkar, B.Sc.
5. Shri H. R. Laxmivenkatesh, D.T.T., A.T.A.
6. Smt. N. D. Nachane, B.Sc.

7. Smt. S. D. Pai, M.Sc.
8. Shri C. R. Sthanu Subramony Iyer, B.Sc.
9. Smt. S. V. Sukhi, M.Sc., D.F.L. (German)
10. Shri V. B. Suryanarayanan, B.Sc.
11. Shri G. Viswanathan, M.Sc., A.T.A.

Senior Technical Assistant T-4

1. Shri S. M. Gogate, B.Sc.
2. Shri S. J. Guhagarkar, B.Sc.
3. Shri I. H. Hunsikatti, B.Sc. A.T.A.
4. Smt. A. A. Kathe, B.Sc.
5. Shri P. K. Mandhyan, B.Sc.
6. Shri E. A. Pachpinde, B.Sc.
7. Shri R. S. Pathare, B.Sc.
8. Shri K. B. Rajagopal, B.Sc.
9. Shri D. Radhakrishnamurthy, M.Sc., M. Phil.
10. Shri S. Sekar, B.Sc.
11. Smt. R. K. Shahani, B.Sc., B. Lib.
12. Shri S. Vancheswaran, B.Sc.
13. Shri S. Venkatakrishnan, M.Sc.
14. Shri T. Venugopal, B.E. (Civil)
15. Smt. Vishala Devender, B.Sc.

Technical Assistant T-II-3

1. Shri Amar Pal, B.Sc.
2. Shri N. O. Anthony
3. Shri S. L. Bhanuse, B.Sc.
4. Shri S. G. Dalvi, S.S.C., Cert. Wireman, Cert. Ref. & A.C., Govt. Elec. Sup.
5. Shri P. B. Gurjar
6. Shri Gopal B. Hadge, B.Sc.
7. Shri Atul S. Jaywant, B.Sc.
8. Shri V. D. Kalsekar, B.Sc.
9. Kum. S. S. Kamerkar, B.Sc., B. Lib.
10. Shri M. Mohan, M.Sc.
11. Shri V. V. Murudkar, L.T.M.
12. Shri R. D. Nagarkar, B.Sc.
13. Kum. Y. D. Pai, B.Sc.
14. Shri M. M. Shaikh
15. Kum. M. G. Sheela Devi, B.Sc.
16. Shri S. Kumar Subramaniam, B.Sc.
17. Shri D. L. Upadhye, S.S.C. (Tech.), N.C.T.V.T., (I.T.I. & C.T.I.)
18. Shri M. V. Vivekanandan, B.Sc.

Technical Assistant T-I-3

1. Shri R. K. Landge
2. Shri R. B. Pawar

Technical Assistant T-2

1. Smt. K. K. Kale
2. Shri S. B. Kambli

Technical Assistant T-1

1. Shri P. G. Kadam
2. Shri D. V. Kambli

APPENDICES

Auxiliary Personnel

Conditioning Plant Operator T-5

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

Hindi Translator

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

Senior Operator (Mechanical Processing) T-1-3

Shri Purushottam Vira

Plumber T-1-3

Shri H. B. Tambe

Carpenter T-1-3

Shri G. D. Narkar

Driver T-1-3

Shri S. S. Patekar

Senior Operator T-1-3

Shri P. J. Ahire

Operator T-2

1. Shri P. K. Gopalan
2. Shri Bechan Nokhai
3. Shri H. K. Pawar
4. Shri D. B. Gadankush
5. Shri S. G. Shinde

Driver T-2

Shri B. B. Gaykar

Operator T-1

1. Shri R. G. Chiplunkar
2. Shri T. R. Kadam
3. Shri K. K. Kasar
4. Shri K. D. Mohite
5. Shri S. V. Patil
6. Shri M. M. Rupawate
7. Shri M. B. Thokrul

Administrative Personnel

Accounts Officer

Shri K. V. Vasu

Assistant Administrative Officer

Shri D. L. Kalsekar

Superintendent

1. Shri P. D. Sonawane, B.A.
2. Shri K. S. Deshpande
3. Shri K. Sudhakaran

Assistant

1. Shri D. P. Naidu
2. Shri G. Moosad, B.Com.
3. Smt. S. S. Dongae, B.A.
4. Smt. Jayagouri Sivaramakrishnan
5. Shri M. Z. Bhagat
6. Smt. M. V. Kamerkar, B.A.
7. Shri K. V. Khamkar, B.A.
8. Shri S. N. Salve
9. Shri B. D. Sawant
10. Shri A. B. Dalvi
11. Shri D. G. Kulkarni
12. Shri B. S. Bhenwal

Senior Stenographer

Shri Venu Thanikal

Stenographer

Kum. V. T. Bhuvad, M.A.

Junior Stenographer

1. Kum. T. A. Rodrigues
2. Smt. U. N. Bhandari

Senior Clerk

1. Smt. S. S. Shanbhag
2. Smt. V. V. Desai
3. Smt. S. D. Ambre
4. Smt. S. M. Desai
5. Shri A. P. Natu
6. Smt. J. J. Karanjavkar
7. Kum. S. G. Nayar

Junior Clerk

1. Shri E. T. Gurav
2. Shri K. Parleshwar
3. Smt. S. R. Shirsat, B.A.
4. Shri N. V. Kambli
5 Kum. B. P. Govalkar, B.Com.
6. Shri J. R. Mangale
7. Shri S. A. Telpande, B.Com.
8. Shri S. D. Ambolkar
9. Shri R. K. Pallewad
10. Shri P. V. Jadhav
11. Shri T. S. Patil
12. Kum. S. K. Gaonkar, B.A.

APPENDICES

Telephone Operator

Kum. S. V. Pai

Supporting Staff Grade III

1. Shri Obilal Parsuram
2. Shri Chatrapal Mhatri
3. Shri R. R. Khurdekar
4. Shri Babu Aba Babar
5. Shri G. G. Ambare
6. Shri M. R. Nevrekar

Supporting Staff Grade II

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

Supporting Staff Grade I

1. Shri N. R. Kamble
2. Shri O. T. Thapa
3. Shri B. R Satam
4. Shri D. M. Chaugule
5. Smt. T. V. Bhowar
6. Shri S. D. Gurav
7. Shri M. K. Ghadge
8. Shri M. Z. Rathi
9. Shri Narayan Singh
10. Shri Mohsin Ahmed
11. Shri C. S. Salvi
12. Shri D. M. Raje
13. Shri D. B. Temgire
14. Smt. Birmo R. Balmiki
15. Shri C. P. Solanki
16. Shri M. J. Sumra
17. Shri K. T. Mahida
18. Shri R. R. Gosai
19. Shri R. S. Rane
20. Shri H. B. Vaismiya
21. Shri P. G. Ghogale
22. Shri C. V. Shivgan
23. Shri S. S. Angane
24. Shri L. S. Takkar
25. Shri M. M. Katpara
26. Shri G. N. Mayawanshi

LIST OF STAFF AT THE QUALITY EVALUATION UNITS

1. AKOLA :

Senior Technical Assistant T-4
Shri N. V. Bansode, B.Sc.

Technical Assistant T-II-3
Shri Adil Zubair, B.Sc.

Supporting Staff Grade I
Shri S. R. Patode

2. COIMBATORE :

Technical Officer T-6
(Quality Evaluation)
Shri A. K. Antony, B.Sc.

Technial Office T-5
(Quality Evaluation)
1. Smt. Santa V. Nayar, B.Sc.
2. Shri C. P. Venugopalan, B.Sc.

Technical Assistant T-II-3
Shri K. Thiagarajan, B.Sc.

Auxiliary Staff
(Senior Operative T-2)
Shri K. V. Nair

Supporting Staff Grade IV
Shri N. Arumugham

Supporting Staff Grade III
Shri V. M. Subramanyan

3. DHARWAD :

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

Senior Technical Assistant T-4
Shri M. T. Danolli, B.Sc.

Technical Assistant T-II-3
Shri K. Narayanan, B.Sc.

Supporting Staff Grade III
Shri Y. R. Sone

Supporting Staff Grade I
Shri C. J. Bagalkoti

4. GUNTUR :

Technical Officer T-5
(Quality Evaluation)
Shri R. Dwarakanath, B.Sc.

Technical Assistant T-4
Shri S. Mukundan, B.Sc.

Supporting Staff Grade IV
Shri Ch. Thimmanna

Supporting Staff Grade II
Shri V. Y. M. Suvarchala Rao

5. HISSAR :

Senior Technical Assistant Grade T-4
Shri V. K. Madan, M.Sc.

Technical Assistant T-II-3
Shri Jal Singh, M.Sc.

Supporting Staff Grade IV
Shri Gian Singh

6. INDORE :

Technical Officer T-6
(Quality Evaluation)
Shri B. S. Ganvir, B.Sc.

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

Supporting Staff Grade IV
Shri John Robert

Supporting Staff Grade III
Shri H. S. Bhabar

7. LUDHIANA :

Technical Assistant T-II-3

1. Shri Hamid Hasan, M.Sc.
2. Shri Udi Vir Singh, B.Sc., B.Ed.

Supporting Staff Grade III
Shri Kammikkar Singh

8. NAGPUR :

Scientist S-2
Dr. G. R. Anap, M. Tech., Ph.D.

Scientist S-1
Shri U. N. Borkar, B.Sc. (Agri.), B.Sc. (Agri. Engg.), M. Tech. (Agri. Engg.)

Senior Technical Assistant Grade T-4
Shri V. M. Kulmethe, B.Sc.

Technical Assistant T-II-3

1. Shri Gyan Singh, M.Sc.
2. Shri R. C. Yadav, Dip. Mech. Engg.

Electrician Grade T-1
Shri P. N. Raout

Senior Operative

Shri B. V. Shirsath, I.T.I., B.A.

Assistant Administrative Officer

Shri G. Sasidharan, B.A., L.L.B.

Assistant

Shri L. R. Gopalakrishnan

Junior Clerk

1. Shri B. D. Dhengale
2. Smt. G. G. Palorkar, B.A.

Driver

Shri R. A. Suddawar

Supporting Staff Grade II

Shri B. H. Umredkar

Supporting Staff Grade I

1. Shri Satyanarayan Gope
2. Shri M. P. Tohakar
3. Shri H. B. Thapa
4. Shri A. R. Chutale
5. Shri J. B. Patel
6. Shri T. B. Khan
7. Shri C. L. Mundale
8. Shri R. B. Kautkar
9. Shri P. S. Panchbudhe

9. NANDED :

Scientist S-1

Shri L. D. Deshmukh, M.Sc.

Tehnical Assistant T-II-3

1. Shri D. N. Moon, B.Sc.
2. Shri R. S. Prabhudesai, B.Sc.

Supporting Staff Grade III

Shri L. R. Indurkar

10. RAHURI :

Senior Technical Assistant T-4

Shri R. S. Darade, B.Sc.

Technical Assistant T-II-3

Shri C. M. More, B.Sc.

Supporting Staff Grade I

Shri D. G. Kamble

11.	SRIGANGANAGAR	:

Technical Officer T-7
(Quality Evaluation)
Shri Ram Parkash, B.Sc., L.L.B.

Technical Assistant T-II-3
Shri Matish Chandra, M.Sc.

Supporting Staff Grade IV
Shri Vijendra Singh

Supporting Staff Grade II
Shri Sanwarmal Saini

12.	SURAT	:

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

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

Senior Technical Assistant T-4
Shri G. G. Mistry, B.Sc.

Technical Assistant T-II-3

Shri M. B. Patel, B.Sc.
1. Shri M. B. Patel, B.Sc.
2. V. L. Rangari, B.Sc.

Junior Clerk
Shri J. I. Parmar

Senior Operative (Mechanical Processing)
Shri J. B. Dhodia

Supporting Staff Grade II
Shri K. M. Rathod

APPENDIX — II

Statement showing the total number of Government servants and the number of Scheduled Castes and Scheduled Tribes amongst them as on December, 1988

Group/Class	Permanent / Temporary	Total No. of employees	Scheduled Castes	Percentage to total employees	Scheduled Tribes	Percentage to total employees	Remarks
Gr. A (Class I)							
Permanent							
(i) Other than lowest rung of Cl. I		30	1	7%	—	—	—
(ii) Lowest rung of Cl. I		13	2				
Total		43	3				
Temporary							
(i) Other than lowest rung of Cl. I		—	—	17%	—	—	—
(ii) Lowest rung of Cl. I		12	2				
Total		12	2				
Gr. B. (Cl. II)	Permanent	42	2	5%	1	2%	—
	Temporary	1	—		—		
Gr. C. (Cl. III)	Permanent	34	4	15%	—	4%	—
	Temporary	48	8		3		
Gr. D. (Cl. IV) (Excluding Sweepers)	Permanent	59	11	20%	3	5%	—
	Temporary	17	4		1		
Gr. D. (Cl. IV) (Sweepers)	Permanent	3	3	100%	—	10%	—
	Temporary	7	7		1		

APPENDIX — III

Statement showing the number of Reserved Vacancies filled by Members of Scheduled Castes and Scheduled Tribes during the year 1988

Class of post	Total No. of vacancies		No. of vacancies reserved		Scheduled Castes					Scheduled Tribes			
	Notified	Filled	Out of Col. 2	Out of Col. 3	No. of SCs candidates appointed	No. of SCs vacancies carried forward from the previous year	No. of STs candidates appointed against vacancies reserved for SCs in the 3rd year of carry forward	No. of reservations lapsed after carrying forward for 3 years	No. of vacancies reserved: Out of Col. 2	No. of vacancies reserved: Out of Col. 3	No. of STs candidates appointed	No. of STs vacancies carried ward from the previous year	No. of SCs candidates appointed against vacancies reserved for STs in the 3rd year of carry forward	No. of reservations lapsed after carrying forward for 3 years
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
I — Posts filled up by direct recruitment														
Other than lowest rung of Class 1	1	1	—	—	—	—	—	—	—	—	—	—	—	—
Lowest rung of Class I	5	5	—	—	—	—	—	—	—	—	—	—	—	—
Class II	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Class III	8	8	—	—	1	—	—	—	—	—	—	—	—	—
Class IV (Excluding Sweepers)	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Class IV (Sweepers)	—	—	—	—	—	—	—	—	—	—	—	—	—	—

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