Cotton Technological Research Laboratory

Indian Council of Agricultural Research

Annual Report

1981

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I. INTRODUCTION

This is the fifty-eighth Annual Report of Cotton Technological Research Laboratory (CTRL) and covers the calendar year 1981.

Founded by the Indian Central Cotton Committee (ICCC) in the year 1924 with the two-fold objectives of (i) undertaking spinning tests on various strains of cotton received from the agricultural departments situated in different parts of the country and (ii) carry out tests on the fibre properties of cottons so as to relate these properties with the spinning value of cotton, CTRL has been functioning in close collaboration with the state departments of agriculture for evolving new improved strains from time to time. When the commodity committees including ICCC were abolished in 1966, the administrative control of the Laboratory was passed on to the Indian Council of Agricultural Research (ICAR). Since then, the research work of the Laboratory has been re-oriented and intensified, keeping in view the responsibility of co-ordination of agricultural research and education vested on ICAR. All through the years that followed, concerted efforts were made to help the agricultural scientists and cotton breeders to produce more and better quality cottons and also to increase better utilisation of cotton lint as well as cotton plant by-products so as to improve economy of the country in general, and that for cotton cultivation in particular.

The main functions of CTRL are :

1. to participate actively in the programmes for improvement in production and quality of cotton in India, by evaluating the quality of new strains evolved by agricultural scientists and giving them necessary technical guidance;
2. to carryout research on physical, structural and chemical properties of cotton in relation to quality and processing performance;
3. to carryout research investigations on the ginning problems of cotton;
4. to investigate the greater and better utilisation of cotton, cotton waste, linters, cotton seed, 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 other government departments, the trade and other bodies; and
7. to collect and disseminate technical information on cotton.

Library

An up-to-date library of books on cotton, cotton technology and related subjects is maintained by CTRL. With the addition of 205 books during the year 1981, the total number of books in the library rose to 4,026. In addition, the total number of bound volumes of scientific journals was 3,759 at the end of the year as against 3,656 last year. The library continued to receive regularly about 290 journals covering a wide range of subjects, of which 99 were being subscribed for and the remaining received on exchange basis or as complimentary.

New Equipments Purchased

A list of some of the new equipments purchased during 1981 has been given in Annexure I.

Visit of Parliament Committee on Official Language (Hindi)

A team of six Members of Parliament consisting of Sarvashri Nathuram Mirdha, Ganpat Hiralal Bhagat, Ramavtar Shastri, Narsingh Makwana, Krishan Chander Pandey, and Smt. Aziza Imam, along with Shri K. K. Grover (Under Secretary, Committee of Parliament on Official Language) visited CTRL in January, 1981. The purpose of the visit was to assess the extent of use of Hindi in conducting official business, and to suggest steps to make further improvements in this regard. The Director and Senior Officers of CTRL appraised the Honourable Members of the efforts made to implement the Official Language policy. Sarvashri R. P. Gupta (Director, Official Language, Agriculture and Co-operation Department, Ministry of Agriculture) and M. S. Dhasmana (Senior Hindi Officer, ICAR) also attended the meeting. Certain specific measures for further promotion of the use of Hindi were identified as a result of the discussions.

Distinguished Visitors

Shri Sujan Singh, Member of Parliament and Member, Governing Body of ICAR, visited the Laboratory on August 4, 1981, and was much impressed by the research work being carried out at CTRL. Dr. M. S. Swaminathan, Member, Planning Commission, visited the Laboratory on July 4, 1981, mainly to inspect the experimental bio-energy generation plant set up at CTRL. Dr. N. S. Randhawa, Deputy Director General (Soils & Engineering), ICAR, Dr. M. V. Rao, Deputy Director General (Crops), ICAR, Dr. S. K. Mukherjee, Chairman, National Agricultural Research Project Review Committee, Maharashtra, Dr. C. C. Pandurangarao, Director, Central Institute of Fisheries Technology, Cochin,

VISIT OF MEMBERS OF PARLIAMENT TO CIRL

Members of Parliament and officials of CTRL *(See page 2)*

Introductory Remarks by Chairman : (L to R) Shri G. H. Bhagat M. P., Shri N. Mirdha, M.P. (Chairman) and Shri K. K. Grover (Under Secretary, Committee of Parliament on Official Language)

THE QUINQUENNIAL RFVIEW OF CTRL

The Quinquennial Review Team at Akola (see page 8)

The Quinquennial Review Team at Coimbatore (see page 8)

Dr. J. S. P. Yadav, Director, Central Soil Salinity Research Institute, Karnal, and Dr. P. K. Thomas, Director, Central Tuber Crops Research Institute, Trivandrum, visited the Laboratory for official purposes. Names of other distinguished visitors to the Laboratory have been given in Annexure II.

Management Committee

The Management Committee of CTRL, met three times during the year — March 20, 1981, August 28, 1981, and December 18, 1981.

In the first meeting, in addition to usual items such as action taken on the recommendations of grievance cell and Institute Joint Council and review of progress of research work, new project proposals etc., review of delegations of powers, review of objectives of CTRL and revised Sixth-Plan proposals also figured in the deliberations. Suitable recommendations/suggestions/observations were offered for follow up action, which included amendment of objective (ii) of CTRL from 'spinning performance' to 'processing performance' and preparation of a statement indicating powers redelegated to the Heads of Divisions/ Administrative Officer/Assistant Administrative Officer.

The second meeting had items such as progress of construction work, proposal for a consultancy project of cotton seed meal and a new project proposal, in addition to usual items. The main recommendations made on progress of research included exploring feasibility of suggesting some of the items of equipment developed by CTRL for grant of awards from ICAR, commissioning of bio-gas plants on commercial basis using textile mill cellulosic waste as chief raw material and publicity to be given about mushroom growing on cotton stalks and willow-dust chiefly by bringing out publications in the northern part of the country, as growing of mushrooms will be more economical in Punjab-Haryana regions having congenial climate and environmental conditions, in addition to availability of plenty of cotton stalks during harvest seasons.

Discussions were held during the third meeting on progress of construction work, need for strengthening administrative divisions, project on bio-gas and proposal for patenting the ginning percentage indicator devices designed and fabricated in the Laboratory, in addition to the action taken on the recommendations of Staff Joint Council and Grievance Cell. The Committee was glad to note that the Planning Commission had taken over the technology of bio-gas production from willow-dust for exploring the feasibility for commercialisation in mills and as a first step, a committee had been constituted comprising Shri Moosa Raza, Managing Director, National

Textile Corporation (Chairman), Dr. V. Sundaram, Director, CTRL (Convener), Dr. S. M. Betrabet, Director, Bombay Textile Research Association, Bombay, and Dr. B. R. Nagar, Consultant (Agri.), Planning Commission to prepare a detailed R & D Project to implement the project in various mills of National Textiles Corporation as well as in some private mills.

The Committee also appreciated the endeavour for the development of the three ginning percentage indicators as the three models recorded reasonably accurate results, in addition to their advantage of simplicity in construction and operation, and recommended the same for patenting through ICAR.

Staff Research Council

The eightieth meeting of the Staff Research Council (SRC) was held in different preliminary sessions on March 2, 3, 9 and 12, 1981 and a final session on March 20, 1981, with the Management Committee. While the preliminary sessions were devoted to discipline-wise discussions on the progress of research work during the year 1980, in different divisions/sections of the Laboratory, the new project proposals and finalisation of the programme of work for the year 1981, the combined session with the Management Committee considered and approved, with modifications wherever necessary, the recommendations/suggestions made in the earlier sessions. Dr. V. Sundaram, Director, chaired all the sessions and all heads of divisions and scientist members of the Management Committee from CTRL also attended all the sessions, as well. Scientists (S, S-1, S-2) and Technical Officers (T-5 and T-6) attended only the sessions pertainting to their respective disciplines/projects. In the joint session, all Scientists in the S-2 grade and above as well as Technical Officers (T-6) were present. Of the 10 new project proposals submitted for consideration and approval, nine were approved with modifications/suggestions, in certain cases.

Inter-Institutional Projects

The following three inter-institutional projects were in operation during the year, of which no progress could be made on the first project due to non-receipt of scoured wool samples in spite of repeated reminders to CSWRI with which project collaboration has been made and the Rajasthan Sheep and Wool Marketing Federation, Jaipur.

1. Studies on deburring of raw-wool using mechanical device (in collaboration with Central Sheep and Wool Research Institute (CSWRI), Avikanagar.
2. Electron microscopical investigation of dye diffusion and dye aggregation in unmodified and modified cotton fibre (in collaboration with University Department of Chemical Technology (UDCT), Bombay.
3. Enrichment of cattle feed by microbiological methods (in collaboration with Punjabrao Krishi Vidyapeeth (PKV), Akola.

Integrated Cotton Development Project

It was reported last year that CTRL has been entrusted with the responsibility of organising a Ginning Training Centre at Nagpur as part of the Integrated Cotton Development Project (ICDP) launched by ICAR and Government of India with the World Bank assistance for improving cotton production in the country. Much headway has been made during the period with respect to construction of buildings, development of necessary infra-structure, procurement of equipment, etc.

Construction Work : The construction of godown for storage of *kapas*, etc., was completed last year. The construction of building for installation of ginning machinery also has been nearly completed. CPWD has been requested to submit estimates for preparing foundation for erection of these machines on the basis of drawings received from the manufacturers. Payment in full has been made to Central Public Works Department (CPWD), Nagpur, for the construction of the building for the proposed Ginning Training Centre. As regards Trainees' Hostel, estimates amounting to Rs. 13.68 lakhs for a common building for the trainees from CTRL as well as from the National Bureau of Soil Survey and Land Use Planning, (NBSS and LUP) have been received from CPWD and the same have been forwarded to ICAR for approval; the share of CTRL will be about Rs. 5.00 lakhs.

Development of Infrastructure Facilities : Two instalments each of Rs. 2.68 lakhs have been paid in this connection, to CPWD, Nagpur. The construction of roads and compound wall are in progress. The Executive Engineer (Elec.) has been asked to take up the electrical work immediately, as the machinery to be installed has arrived and is under clearance.

Equipment : A modern saw gin with bale press ordered from USA through DGS&D in January, 1979, at a cost of Rs. 7.00 lakhs has arrived in Bombay port and is under clearance.

Study Tour : In accordance with the earlier proposals, two scientists were to be deputed from CTRL for short term study/training at ginning factories in USA. So far only one scientist could be deputed for a short term (3 weeks) study tour involving visits to a few cotton quality evaluation centres and ginning factories. A report on his visit has already been submitted to ICAR.

Post-Graduate Training

An extension for a period of five years with retrospective effect from July 2, 1980, has been granted for CTRL to continue as a post-graduate institution by the University of Bombay. The recognition given was for guiding students for M.Sc. and Ph.D. degrees in Physics (Textiles), M.Sc. degree in Physical and Organic Chemistry, M. Text. degree in Spinning Technology, and Ph.D. degree in Bio-Physics. Two more seats for Ph.D. (Tech.) in Textile Technology (Spg.) have been granted for a period of four years from June 16, 1981.

Ten members of the Staff were being guided for M.Sc. and three for Ph.D. degrees in Physics (Textiles), two for M.Sc. degree in Physical Chemistry and one for M. Text. in Spinning Technology.

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

Membership on Other Organisations

The Director and other Scientists of CTRL represented CTRL and ICAR on various Committees of the Indian Standards Institution, as in the past.

In addition, the Director was nominated as a member of the Research Advisory Committee of ATIRA and Chairman on the Panel of Experts of 'Physics Oriented Studies of ATIRA'.

The Director continued as member in the following Committees/Bodies during the year :

1. Cotton Advisory Board of Textile Commissioner, Government of India, Ministry of Commerce, Bombay.
2. Board of Directors of Cotton Corporation of India, Bombay.
3. Scientific Panel on Post Harvest Technology of ICAR, New Delhi.

4. Management Committee of the Krishi Vigyan Kendra, Kosbad Hills, Thana.
5. Research Advisory Committee of SITRA, Coimbatore.
6. Governing Committee and General Advisory Committee on Research and Liaison of BTRA, Bombay.
7. Cotton Research Advisory Sub-Committee of ICMF Cotton Development and Research Association, Bombay.
8. Board of Management of Victoria Jubilee Technical Institute, Bombay.
9. Editorial Board of Journal of Textile Association.

Expansion and Modernisation

The construction work of the multi-storeyed building envisaged under expansion and modernisation programme is nearing completion. An order has been placed with the Indian Telephone Industries Ltd., for the installation, testing and commissioning of electronic internal telephone exchange. In addition, the materials which include 50.7 A Type Electronic Private Automatic Exchange along with Tie lines, AC/DC converter and 50 Auto Desk Telephones, have been procured and the wiring work for the installation of the Automatic Exchange is in progress.

Staff Amenities

Residential quarters had been provided for 16 staff members in Grade D, 22 in Grade C, 10 in Grade A, and another 20 in Grades A and B. Efforts were being made to construct a building of 10 tenements for type II quarters at the vacant space available at the staff quarter premises at Mahim.

Departmental Canteen

The Managing Committee was reconstituted with the following members :

Chairman	:	Shri M. S. Parthasarathy
Hon. Secretary	:	Shri U. K. Iyer (Administrative Officer)
Members	:	Shri A. W. Shringarpure (Nominated by Director)
	:	Kum. Rachael Varghese, (")
	:	Shri R. S. Pathare (Nominated by Institute Joint Council)
	:	Shri K. K. Kasar (")

Subsequently, when Shri U. K. Iyer resigned from the Laboratory, Shri V. N. Wadhwani, Assistant Administrative Officer, assumed charge as Hon. Secretary.

At the first meeting of the Committee Shri A. W. Shringarpure was unanimously elected as Hon. Treasurer for the year 1981.

Quinquennial Review Team

A Quinquennial Review Team (QRT) consisting of the following scientists was constituted in September, 1980, by the Director General, ICAR, with a view to ensure that the objectives with which the various items of work are carried out are being achieved, and to plan new programmes of work taking into consideration the present and possible future needs :

1. Shri T. V. Ananthan, — Chairman
   Retd. Director,
   Bombay Textile Research Association, Bombay.
2. Dr. H. C. Srivastava, — Member
   Deputy Director,
   Ahmedabad Textile Industry's Research Association,
   Ahmedabad.
3. Dr. C. T. Patel, — Member
   Research Project Co-ordinator,
   The ICMF Cotton Development and Research Association,
   Surat.
4. Dr. S. B. Bandyopadyay, — Member
   Retd. Director, Jute Technological Research Laboratory,
   Calcutta.
5. Dr. V. Sundaram — Convener
   Director, Cotton Technological Research Laboratory,
   Bombay.

The first meeting of QRT was held at CTRL, Bombay, from August 17 to 19, 1981. Shri T. V. Ananthan, Chairman of QRT, presided and Dr. S. B. Bandyopadhyay and Dr. H. C. Srivastava, Members of QRT were present. The Committee discussed in detail all the aspects of the guidelines and the terms of reference as also the documents supplied about the various facets of the activities of the Laboratory. Discussions were also held with the Heads of Divisions and scientists working in the different disciplines so as to get a proper insight

into the various on-going research projects, their relevance to the overall objectives of the Laboratory and gaps, if any, in the identification and execution of research projects, etc. It was decided in the meeting that the Regional Quality Evaluation Units at Akola and Coimbatore should be visited to ascertain as to how far outstations have been strengthened, as per recommendations of the last QRT. Dr. C. T. Patel, Member, QRT, could not attend the meeting due to illness.

Subsequently, the team assembled at CTRL on November 30, 1981, visited the Regional Quality Evaluation Units of CTRL at Akola on December 1, 1981, and at Coimbatore on December 3 and 4, 1981, and reassembled at Bombay for a final meeting on December 5 and 6, 1981, to discuss and prepare the draft report of QRT. The meeting on December 5, 1981, had been mainly centred round discussions on various research projects in different disciplines as well as with the staff in the Technical Cadre. Based on the findings during the meetings, a draft report was prepared incorporating all the relevant terms of reference.

Finance

A statement showing sanctioned budget grant of CTRL and actual expenditure for the financial year 1980-81 is furnished in Appendix I. As could be seen from the statement, the actual expenditure under non-plan was Rs. 44,98,965.00 as against the sanctioned grant of Rs. 44,99,000.00. An expenditure of Rs. 36,65,234.00 was incurred on the scheme for 'Modernisation and strengthening of CTRL for intensive research on cotton' as against the sanctioned grant of Rs. 39,26,000.00 (including an expenditure of 56,880.00 in connection with Integrated Cotton Development Project). Besides, (i) a sum of Rs. 38,063.00 was spent on the scheme for 'Investigation of the effects of high energy radiation on the induction and half-life of excited, free and/or ionised radicals in cotton cellulose to obtain basic information needed for the development of potentially new useful cotton products,' against the sanctioned grant of Rs. 49,600.00; (ii) a sum of Rs. 45,015.00 was incurred on scheme for 'Optimal blending of standard varieties of Indian cottons', against the sanctioned grant of Rs. 1,00,000.00 and (iii) a sum of Rs. 17,804.44 was incurred on Regional Committee No. 7 against the sanctioned grant of Rs. 20,000.00. The savings during the year were mainly due to non-filling up of posts and non-materialisation of certain purchases, etc.

Significant Findings

Panel Meetings of the Breeding and Technology group of North, Central and South Zones of AICCIP recommended the release of the following improved varieties of cotton :

S. No.	*Name of the Strain/Hybrid*	*Particulars*
1.	LD.230	A short staple coarse *desi* strain, evolved by the Punjab Agricultural University, which has a yield potential higher than that of the existing G.27 variety.
2.	76IH.20	A selection from the *G. hirsutum* strain IC-1036. It is compact type and is superior to the existing varieties in fibre properties. Spinning potential is about 40s count. Suitable for growing in Malwa and Nimar tracts as well as in the Districts of Jhabua and Mandsaur of Madhya Pradesh.
3.	68KH.33-1146 (Khandwa 3)	Developed by the Jawaharlal Nehru Krishi Viswa Vidyalaya from a cross between Khandwa 1 and Akola 44-2. This strain has GP over 33% and spinning potential 60s count. Adaptable to the entire cotton growing tracts of Nimar region.
4.	JKHy.11	An interspecific hybrid obtained from a cross between Khandwa 2 and ERB.4492, this variety has tolerance to jassids and to certain extent against blackarm disease. Spinning potential is about 60s count.
5.	PA.32	Identified as H-576 from the cross Bani x Cernuum, this *G. arboreum* strain is recommended for Marathwada region of Maharashtra. The plant has maturity period of 170-180 days and is suitable for spinning 20s count.

S. No.	*Name of the Strain/Hybrid*	*Particulars*
6.	ABH.4208 (PKV Hy.1)	A cross between AK.32 and ERB.4292, this interspecific hybrid has good boll opening and is suitable for spinning 60s count. This requires less plant protection measures and is recommended for the rainfed tracts of Vidarbha region of Maharashtra.
7.	AHH.468 (PKV Hy. 2)	This interspecific hybrid, which is a cross between AK.32 and DHY.286, is recommended for cultivation in rainfed and irrigated tracts of Vidarbha in Maharashtra, has dwarf compact plant structure and recorded consistently good yield. GP about 36% and spinning potential-40s count.
8.	AKH.5	*G. arboreum* strain from a cross between H.253 and CJ.73, it has recorded about 15% more yield than the existing varieties, AKH.4 and AK.234. Recommended for the rainfed tract of Vidarbha. Spinning potential-30s count.

A working model of seed-cotton cleaner has been fabricated and tested for identifying the constraints that could be eliminated before mounting the machine on the gin and also to improve the design.

Three Ginning Percentage Indicators based on hydro-metric principles have been designed, fabricated and tested. The estimated accuracy of the instruments is better than 0.2% and was approximately $\pm 0.1\%$ for most cases.

In an attempt to establish relationship between tensile properties and x-ray parameters, it was found that 20% x-ray angle is best suited for the prediction of tenacity at zero gauge length as compared to other x-ray angles, while 75% x-ray angle has more association with percentage elongation.

The regression equation connecting the maturity coefficient (M_C) and the Micronaire difference (M_D) derived from recent data (1971 to 1979 seasons) gives higher values of Mc than predicted by the equation currently in use in the Laboratory. The reason for this appears to be the relatively small range (1.10 to 2.20 micrograms/in) of the Micronaire difference obtained on recent samples for the same spread

of Mc values (0.60 to 0.90). The present result thus, highlights scope for the revision of the prediction formula currently in use.

Decrystallisation by limited substitution after preswelling in NaOH can under suitable conditions reduce strength loss suffered by fabric on subsequent crosslinking treatments.

Using the Open end (OE) Spinning Machine, spinning of flat strips from blends of polyester-viscose with different proportions of polyester and viscose and of different length-fineness combinations produced yarns of satisfactory regularity and extension values compared to ring spun yarns from the same material. The main advantage of OE spinning in the case of man-made fibre blends seems to be with productivity, without any advantage in terms of regularity or extension; but this is associated with a significant drop in strength.

An electron microscopic study of location and aggregation of dyes in cotton cellulose gave evidence of the existence of pores in cotton cellulose.

Flame proofing finish given to fabrics by radiation technique showed better retention of strength and flame retardant characteristics.

Another application of *P. funiculosum* was found in the preparation of pectin from the peels of citrus fruits.

Of the substrates tried to enhance protein with the free living nitrogen fixing bacterium *Beijerinekia mobilis*, paddy straw and groundnut shells were found to be the best while *Pleurotus sajor caju* was found to grow well on all the substrates without pre-treatment and enhances crude protein by about 1.5 to 2.0 times more.

An experimental plant for bio-gas production from willow-dust was designed and fabricated. The plant generated, on an average, about 600 litres of gas daily for a period of 30 days. The digested slurry was found to be rich in nitrogen and lignin and therefore, would serve as good manure.

Edible mushrooms *Pleurotus sajor caju* were grown on willow-dust, cotton stalks and cottonseed hulls and it was observed that on an average, 500 g to 600 g of fleshy fruiting bodies could be obtained during winter months in Bombay, without any nutrient supplementation.

2. PROGRESS OF RESEARCH

Considerable progress has been made in various research and related activities at CTRL, a resume of which is given below :

Evaluation of the Quality of Cotton Samples received from Agricultural Trials

A large number of samples are received every year from breeding, agronomy and several other trials as part of the technological participation in collaboration with Agricultural Scientists in the development of new varieties, apart from samples under All-India Co-ordinated Cotton Improvement Project (AICCIP) and those pertaining to various on-going research investigations.

The number of such samples received for various tests from trials conducted by the Agricultural Universities, State Departments of Agriculture, etc., during the years 1979, 1980 and 1981 together with the corresponding average figures for the quinquennium 1976-80, are given in Table 1(a). Table 1(b) summarises the number of samples tested at the Regional Quality Evaluation Units of CTRL during 1981.

The samples received from agricultural trials are tested in the order of their receipt and test reports are issued as soon as possible. The results of tests on samples of Trade Varieties and Standard Indian Cottons are reported as Technological Circulars as and when tests are completed and later on compiled for the whole season and published as two separate Technological Reports — one for Trade Varieties of Indian Cottons and the other for Standard Indian Cottons.

Test reports are not issued, generally, on the technological research samples used exclusively for various research project purposes, as the test results will appear in relevant research publications.

Apart from these, some samples are received for miscellaneous tests, such as determination of quality of ginning, neppiness, oil content in cotton seed, etc.

The state-wise figures for the number of samples which were tested for fibre characteristics and spinning performance have been given in Table 2 under two heads, (i) All-India Co-ordinated Cotton Improvement Project and (ii) Other State Schemes.

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

Type of Test	Average for the quinquennium 1976-80	1979	1980	1981
Fibre and Full Spinning	175	247	178	137
Fibre and Microspinning	2,093	1,933	2,041	1,570
Microspinning alone	—	—	—	—
Fibre Tests alone	225	193	338	131
Mill Tests	14	6	27	14
Standard Cottons	24	24	26	18
Trade Varieties — Lint	29	19	33	25
Trade Varieties — *Kapas*	81	42	79	75
Technological Research	97	77	63	104
Miscellaneous	—	40	53	2
Total	2,738	2,581	2,538	2,076

TABLE 1(b). NUMBER OF SAMPLES TESTED AT QUALITY EVALUATION UNITS

QE Unit	Quality Parameter			
	Length	Fineness	Maturity	Strength
Akola	937	937	937	937
Coimbatore	1,818	1,818	1,868	1,818
Guntur	368	321	342	327
Dharwad	1,716	1,620	1,620	1,620
Hissar	615	4,440	4,690	716
Indore	627	627	627	591
Ludhiana	878	878	667	6
Nagpur	431	334	361	369
Nanded	1,139	1,094	1,094	1,094
Sriganganagar	608	194	194	6
Surat	10,480*	7,955	8,033	6,940

* 5,360 samples were evaluated on Fibrograph on the basis of one pair of Combs only.

Note : At the QE Unit, Surat, 481 samples were spun on the Shirley Miniature Spinning Plant and 277 samples were tested for trash content on the Shirley Analyser.

TABLE 2: NUMBER OF SAMPLES TESTED AND REPORTS SENT IN 1981

State	Fibre and Full Spinning	Fibre and Micro-Spinning	Micro-Spinning	Fibre Tests	Total
		(i) AICCIP			
Punjab	12 (2)	26 (5)	—	12 (1)	50 (8)
Haryana	16 (3)	44 (7)	—	17 (3)	77 (13)
Uttar Pradesh	—	10 (2)	—	—	10 (2)
New Delhi	—	11 (2)	—	—	11 (2)
Rajasthan	—	203 (12)	—	—	203 (12)
Madhya Pradesh	—	110 (8)	—	—	110 (8)
Gujarat	52 (9)	62 (4)	—	—	114 (13)
Maharashtra	—	158 (14)	—	38 (2)	196 (16)
Andhra Pradesh	2 (1)	3 (1)	—	—	5 (2)
Karnataka	18 (4)	267 (19)	—	—	285 (23)
Tamil Nadu	10 (2)	125 (1)	—	—	135 (3)
Total	110 (21)	1019 (75)	—	67 (6)	1196 (102)
		(ii) Other State Schemes			
Punjab	3 (2)	—	—	—	3 (2)
Haryana	15 (4)	72 (13)	—	—	87 (17)
Uttar Pradesh	—	—	—	—	—
New Delhi	4 (1)	—	—	26 (1)	30 (2)
Rajasthan	13 (3)	44 (2)	—	—	57 (15)
Madhya Pradesh		21 (13)	—	—	32 (13)
Gujarat	31 (17)	12 (1)	—	—	43 (18)
Maharashtra	43 (32)	188 (13)	—	126 (4)	357 (49)
Andhra Pradesh	11 (11)	—	—	21 (2)	33 (13)
Karnataka	27 (24)	58 (10)	—	—	85 (31)
Tamil Nadu	15 (3)	5 (1)	—	—	20 (4)
Total	173 (117)	400 (43)	—	173 (7)	747 (167)

Note : Figures in brackets indicate number of reports issued.

ALL-INDIA CO-ORDINATED COTTON IMPROVEMENT PROJECT

In order to intensify the research programmes on cotton, ICAR sponsored the All-India Co-ordinated Cotton Improvement Project (AICCIP) with effect from 1967. The work on this project is carried out on an all-India basis with active collaboration of the Central Institutes, Agricultural Universities and the State Departments of Agriculture. In this project, a number of progenies or crosses under test are screened through various trials, such as Initial Evaluation Trial, Preliminary Varietal Trial, Co-ordinated Varietal Trial, Pilot Project Demonstration Trial, etc. Yield is the prime factor in the Initial Evaluation trial, while quality together with yield are the criteria considered for further selections in the subsequent trials.

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

North Zone

This zone is mainly known for its medium staple American *G. hirsutum* and short staple *desi G. arboreum* types of cotton. The main object of the trials here is to identify strains superior to the current varieties. Emphasis is also given to evolve strains of early maturing or short duration type, with a view to make the fields available for a second crop of food grains, etc. Trials of North Zone strains are also carried out in Gwalior-Morena region of Madhya Pradesh which is close to the North Zone and the Deccan Canal Region of Maharashtra where cotton is grown under irrigation and the crop is sown in April without waiting for the onset of monsoon.

G. hirsutum Trials

The Co-ordinated Varietal Trials of *G. hirsutum* for normal plant type as well as for early maturing (short duration) type were conducted at Hissar, Ludhiana, Mathura, New Delhi, Sirsa and Sriganganagar. Table 3 shows the data on the ranges of 2.5% span length, fineness and bundle strength along with the assessment of maturity for the samples tried out in the above two trials.

The following strains tried out at different locations under both the trials, viz. Normal Plant Type and Short Duration Type, gave encouraging spinning performance for 30s/40s counts.

Location	*Count*	*Promising Strains*
Hissar	30s	RS. 481, RS.488, H. 805-1, H. 777, B.N., FP.233 and H.854
Ludhiana	40s	B.N., H. 874, RS. 488, H. 808, F. 414, LH. 580, H.861, RS. 485, FP. 233 and H. 854
Mathura	30s	Nil
New Delhi	30s	H. 854 and H. 862
Sirsa (HAU)	30s	RS. 488, B.N., PRT. 8-26, PRT. 8-33, FP. 277, FP. 233 and H. 777
Sirsa (IARI)	30s	H.862, SH.2374,LH.315 and B.N.
Sriganganagar	30s	LH. 357, FP. 286, FP. 132, LH. 573 and SH. 2374

Samples pertaining to Preliminary Varietal Trial were received from Hissar, Ludhiana, and Sriganganagar under normal plant type and from Abohar, Hissar, Ludhiana, New Delhi, Sirsa and Sriganganagar under Compact Plant Type. The ranges of mean fibre length, Micronaire value, bundle strength and maturity have been compiled in Table 4.

The following strains fared well at the locations indicated:

Location	*Count*	*Promising Strains*
Abohar	30s	FP. 470 and FP. 123
Hissar	30s	H. 777, H. 878, B.N. and H. 908
Ludhiana	30s	H. 858, LH. 604, RS. 514, B.N., F. 414, FP. 470, FP. 123, H. 878 and CPD.81.1
New Delhi	30s	B.N., 29-105 and DH. 85
Sirsa	30s	B.N., PL. 319 and H. 777
Sriganganagar	30s	RS. 520, FP. 123, DH. 85 and DH. 66-4

TABLE 3: SUMMARY OF TEST RESULTS OF STRAINS TRIED IN CO-ORDINATED VARIETAL TRIAL (CVT) OF *G. hirsutum* IN NORTH ZONE

Location	No. of Samples	Range				Count	Spinning performance		Control
		2.5% span length (mm)	Micronaire value (μg/in)	Maturity	Bundle strength (g/t)		A	B	
Normal Plant Type — Code No. Br04(a)									
Hissar	7F	23.7—25.3 (24.5)	4.1—5.2 (4.4)	Average to good	42.3—49.8 (46.8)	30s	4	Nil	H.777
Ludhiana	6F	24.4—29.0 (25.8)	4.3—5.1 (4.6)	Good	45.6—48.2 (47.0)	40s	5	3	F.414
Mathura	10M	23.4—26.7 (24.4)	3.4—4.2 (3.8)	Average to good	43.4—53.1 (48.0)	30s	Nil	8	SH.131
Sirsa	6M	23.4—27.8 (25.2)	3.5—5.1 (4.4)	Good	39.7—47.2 (44.2)	30s	5	4	H.777
Sriganganagar	18M	20.2—28.0 (23.3)	2.8—4.0 (3.3)	Low to average	40.2—47.2 (45.1)	30s	4	—	*
Short Duration Type — Code No. Br04(c)									
Hissar	7F	22.9—25.1 (23.9)	4.1—6.0 (4.8)	Average to good	45.6—49.3 (47.7)	30s	4	1	H.777
Ludhiana	6F	24.7—25.8 (25.1)	4.4—4.8 (4.5)	Average to good	45.0—50.4 (47.7)	40s	6	1	F.414
New Delhi	5M	23.9—26.1 (24.8)	4.2—4.8 (4.5)	Good	44.5—49.3 (46.8)	30s	2	—	*
Sirsa (IARI)	8M	22.9—28.8 (24.4)	3.8—5.4 (4.8)	Good	42.9—51.5 (45.6)	30s	4	3	B.N.
Sirsa (HAU)	6M	23.5—26.2 (24.5)	3.6—5.1 (4.5)	Average to good	43.4—50.9 (51.0)	30s	4	2	H.777

TABLE 3: SUMMARY OF TEST RESULTS OF STRAINS TRIED IN CO-ORDINATED VARIETAL TRIAL (CVT) OF *G. hirsutum* IN NORTH ZONE (Contd.)

Location	No. of Samples	Range				Count	Spinning performance		Control
		2.5% span length (mm)	Micronaire (µg/in)	Maturity	Bundle strength (g/t)		A	B	
		Short Duration Type — Code No. Br04(c) (Contd.)							
Sriganganagar	17M	21.5—28.2 (23.3)	3.0—5.3 (4.0)	Average to good	39.7—49.0 (45.2)	30s	1	4	B.N

Note : Values in brackets indicate averages.
A — No. of samples spinnable to the count selected.
B — No. of samples better than or on par with control.
F — Full spinning.
M — Micro spinning.
* — Control variety not received.

TABLE 4: SUMMARY OF TEST RESULTS OF STRAINS TRIED IN PRELIMINARY VARIETAL TRIAL (PVT) OF *G. hirsutum* IN NORTH ZONE

Location	No of Samples	Range				Count	Spinning performance		Control
		2.5% span length (mm)	Micronaire value (μg/in)	Maturity	Bundle strength (g/t)		A	B	
Normal Plant Type — Code No. Br03(a)									
Hissar	6M	23.6—25.8 (24.9)	3.8—5.0 (4.3)	Average to good	41.3—49.8 (45.6)	30s	1	Nil	H.777
Ludhiana	6M	23.7—27.1 (24.8)	4.4—5.0 (4.6)	Good	43.4—50.9 (47.5)	30s	5	Nil	F.414
Sriganganagar	24M	21.8—25.9 (23.9)	3.4—5.0 (4.3)	Average to good	34.5—48.8 (44.9)	30s	2	—	*
Compact Plant Type — Code No. Br03(b)									
Abohar	6M	22.7—26.2 (24.3)	3.8—5.0 (4.6)	Average to good	43.4—48.8 (45.9)	30s	2	2	F.414
Hissar	6M	23.9—25.2 (24.3)	4.2—5.0 (4.4)	Average to good	41.3—48.2 (45.5)	30s	4	3	H.777
Ludhiana	7M	23.1—28.2 (25.5)	4.2—4.9 (4.5)	Good	43.4—49.8 (46.4)	30s	6	2	F.414
New Delhi	6M	24.0—26.0 (25.3)	4.2—4.6 (4.4)	Good	41.8—45.0 (43.6)	30s	3	2	B.N.
Sirsa	6M	22.9—29.0 (25.2)	3.8—4.6 (4.2)	Good	37.0—47.2 (44.0)	30s	4	2	H.777
Sriganganagar	10M	20.8—25.3 (23.6)	2.5—4.5 (3.1)	Low to average	41.8—47.7 (45.0)	30s	3	5	B.N.

Note: Values in brackets indicate averages.
A — No. of samples spinnable to the count selected.
B — No. of samples better than or on par with control.
F — Full spinning.
M — Micro spinning.
* — Control variety not received.

The Initial Evalution Trial was conducted at Hissar and Sriganganagar. The following strains recorded satisfactory yarn strength at the counts indicated:

Location	*Count*	*Promising Strains*
Hissar	30s	LH. 808, H. 870, B. 701-A-1 and H. 777.
Sriganganagar	30s	LH.807 and FP.341.

G. arboreum Trials

Samples pertaining to Co-ordinated Varietal Trial of *G. arboreum* were received from Hissar, Ludhiana and Sirsa for fibre tests only. The object of this trial was to identify the coarser and shorter staple varieties suitable for blending purposes in place of existing variety G.27. 2.5% span length of the strains tested under this trial ranged between 16.3 mm and 19.7 mm. Micronaire value for the following samples only were higher than that of G.27(7.4):

LD.251 (7.5), LD.252 (7.7), LD.133 (7.9), HD.45 (7.6), LD.205 (7.6) and HD.11 (7.8).

Miscellaneous Trials

A new strain identified as Pusa Ageti was raised in the Pilot Project Demonstration Trial at Sirsa. It was slightly superior over the control H.777 in respect of mean fibre length and maturity. It is coarser and recorded lower bundle strength at both zero and 3 mm gauge lengths. Its spinning performance was poorer than H. 777.

The technological performance of two new promising strains, RS.487 and RS.488, was compared with the two controls, Bikaneri Narma and Ganganagar Ageti, raised at Sriganganagar. Both the strains recorded identical performance at 20s and 30s count, respectively as compared to controls.

CENTRAL ZONE

In this zone varieties belonging to *G. hirsuttum, G. herbaceum* and *G. arboreum* species are under commercial cultivation. However, during recent years, emphasis has been given to the development of high yielding hybrids to replace Hybrid 4 and Varalaxmi. As more and more irrigation facilities become available, trials under irrigated as well as rainfed conditions are being conducted in this zone.

G. hirsutum Trials

In the Co-ordinated Varietal Trial, samples were received from Padegaon and Surat under irrigated conditions and Aurangabad, Badnawar and Bharuch under rainfed conditions.

The summary of the fibre test results and spinning performance has been compiled in Table 5.

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

Location	*Count*	*Promising Strains*
Padegaon (I)	40s	B.N., F.605, FP.286, RS.481, RS.488, H.689-1, H.808, SH.274, LH.318, LH.372, LH.357 and 468-10.
Surat (I)	50s	76IH.20, G.925, G.Cot.10 and G.Cot.100
	40s	68KH.33-1146.
Aurangabad (R)	20s	JLH.72, 761H.20, JWH.79, PKV.0011-7, SRT.1 and CJ.73.
Badnawar (R)	40s	BSTD.35, G.Cot.10, PKV.0011-7 and 78BH5.
Bharuch (R)	40s	78IH.20, PKV.60-17, JLH.79, 76IH.23, and G.Cot. 10

I — Irrigated, R — Rainfed

Samples pertaining to Preliminary Varietal Trial under irrigated conditions were received from Padegaon and under rainfed conditions from Amravati.

The fibre and spinning test results of the samples pertaining to this trial are also incorporated in Table 5. The promising strains from the spinning point of view, are indicated below :

Location	*Count*	*Promising Strains*
Amravati	40s	PKV.0012-14, ISTD.34, G.Cot.10, JLH.84, IAN.3866, PKV.0151, NH.231, NH.205 and LRA.5166.
Padegaon	40s	B.N., J.329, H.841, H.844, H.845, H.847, FP.236, LH.318, LH.604, LH.613, RS.489, RS.521, 4-1-1, SH.179(FB), KOP.203, KOP.571, N.-1(CH), Laxmi and RS.487.

In the initial Evaluation Trial conducted at Badnawar and Padegaon, the strains NH.202, PKV.0724, PKV.0726, DP.225, G.3159 and Badnawar 1 recorded satisfactory yarn strength at 40s count at Badnawar, while the cross .of Vishnu x CP.1998F (Supriya) recorded satisfactory yarn strength at 60s court at Padegaon.

TABLE 5: SUMMARY OF TEST RESULTS OF STRAINS TRIED IN CO-ORDINATED VARIETAL TRIAL (CVT) AND PRELIMINARY VARIETAL TRIAL (PVT) OF *G. hirsutum* IN CENTRAL ZONE

Location	No of Samples	Range				Count	Spinning performance		Control
		2.5% span length (mm)	Micronaire value (μg/in)	Maturity	Bundle strength (g/t)		A	B	
(i) CO-ORDINATED VARIETAL TRIAL (CVT)									
Irrigated Trial — Code No. Br04(a)									
Padegaon	15M	23.9—34.4 (27.4)	3.6—4.7 (4.0)	Average to good	37.5—48.8 (42.7)	40s	13	8	B.N.
Surat	7F	26.0—31.5 (27.9)	3.4—4.9 (4.2)	Good	37.5—47.2 (43.0)	50s	4	2	G.Cot.10
Rainfed Trial — Code No. Br04(b)									
Aurangabad	7M	24.5—27.5 (25.8)	3.5—5.2 (4.0)	Good	46.1—50.9 (47.3)	20s	6	2	SRT. 1
Badnawar	14M	24.1—28.6 (26.0)	3.1—4.3 (3.7)	Good	40.7—51.5 (47.5)	40s	5	3	G.Cot.10
Bharuch	6F	24.8—28.0 (26.3)	3.6—4.5 (4.1)	Good	43.4—47.7 (45.1)	40s	6	4	Local Check
(ii) PRELIMINARY VARIETAL TRIAL (PVT)									
Irrigated Trial — Code No. Br03(a)									
Padegaon	27M	22.4—31.4 (26.0)	2.9—4.6 (4.4)	Average to good	31.6—48.2 (43.7)	40s	20	1	Laxmi
Rainfed Trial No. Br03(b)									
Amravati	14M	24.7—29.4 (27.4)	3.3—5.3 (4.0)	Average to good	42.9—52.5 (46.6)	40s	10	9	G.Cot.10

Note: Values in brackets indicate averages.
A — No. of samples spinnable to the count selected.
B — No. of samples better than or on par with control.
F — Full spinning.
M — Micro spinning.

G. barbadense Trials

Samples pertaining to Co-ordinated Varietal Trial were received from Surat for full spinning test. Range of 2.5% span length was between 31.9 mm and 38.8 mm. Maturity was good for all the strains. Bundle strength values ranged between 46.1 g/t and 52.5 g/t. The strains ERB.13758, SILS.53/568, GU.76, ERB.13754, MU.4512 fared well at 60s count.

G. herbaceum Trials

The Co-ordinated Varietal Trial was conducted at Nanded, Yavatmal and Washim.

The following strains recorded desired yarn strength at 20s count :

Location	*Count*	*Promising Strains*
Nanded	20s	AKH.28, 781A.1, AKH.607, AKH.496 and AKH.4
Washim	20s	AKH.496, AKH.607, SC.97, JIA.26, MA.8, 78IA-1, AKH.28, SC.75, JLA.9, PA.32, AKH.597, AKH.487, AKH.605, SC.136, SC.117, MA.10 and AKH.4

Initial Evaluation Trial of *G. arboreum* was conducted at Washim. Only one strain, G.16-6-13-9, showed satisfactory yarn strength at 30s count.

G. herbaceum Trials

The Co-ordinated Varietal Trial was conducted at Surat under irrigated conditions. 2.5% span length ranged between 24.5 mm and 26.6 mm. Bundle strength values were good and ranged from 47.7 g/t to 49.3 g/t. The strains 4042, 5497, G.Cot.11, 10746 and 10941 fared well at 20s count.

In the Preliminary Varietal Trial conducted at Surat, the strains indicated as 3549 and 7502 fared well at 30s count. The other strains G.Cot.11, 6455, 4283, 3604 and 5510 showed promising spinning performance at 20s count.

Hybrid Trials

Intra-hirsutum Hybrid Trial : The object of this trial was to identify hybrids superior in yield and quality to local hybrids, viz. Hybrid 4, JKHY.1, etc. in Gujarat, Madhya Pradesh and Maharashtra, either under irrigated or rainfed conditions. However, samples pertaining to

this trial were received from Surat, Badnawar and Bharuch only. The promising hybrids at different locations and counts are indicated below:

Location	*Count*	*Control*	*Hybrids better than or on par with the Control*
Surat (I)	50s	Hybrid 4	JKHY.3, G. Cot. Hy.6 and ACHH.3.
		G. Cot Hy. 6	ACHH.3 G.Cot.Hy. 6
Bharuch (R)	50s	JKHY.1	G.Cot.Hy.6, GHH.15 and L.C
		G.Cot.Hy.6	Nil

I—Irrigated R—Rainfed

SOUTH ZONE

Cottons belonging to *G. hirsutum* species cover a large area in this zone. Cotton from other species, viz. *G. arboreum*, *G. herbaceum* and *G. barbadense*, are also grown in some tracts of this zone.

G. hirsutum Trials

The Co-ordinated Varietal Trial was conducted at Siruguppa and Srivilliputtur under irrigated conditions and at Dharwad under rainfed conditions. The trial was also conducted in the rice-fallows at Aduthurai and Srivilliputtur. The Preliminary Varietal Trial was conducted at Siruguppa and Srivilliputtur under irrigated conditions and at Dharwad under rainfed conditions.

The test results of these two trials are compiled in Tables 6 and 7.

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

Location	*Count*	*Promising Strains*
Siruguppa	60s	NLS.10, AV.3373-4, MCU.5, EL.0668-D and AV.3500.
	50s	IC.1245, LRA.5166, RRD.12-30, RRD.309-1 and DS.56-36.
Srivilliputtur	50s	ELS. 27A.1, ELS.501, AV.3373/4, MCU.5WT, MCU.5, CP.2/1, ADB.10050, NLS.10, CP.25/1, NLS.13, ELS.525, ELS.517, ELS.503, ELS.524, AV.3391, RF.22, 5019, SVPR.124, NMF.175 and ELS.668D.

TABLE 6: SUMMARY OF TEST RESULTS ON STRAINS TRIED IN CO-ORDINATED VARIETAL TRIAL (CVT) OF *G. hirsutum* IN SOUTH ZONE

Location	No of Samples	Range				Count	Spinning performance		Control
		2.5% span length (mm)	Micronaire value (μg/in)	Maturity	Bundle strength (g/t)		A	B	
				Irrigated Trial — Code No. Br04(a)					
Siruguppa	10M	31.2—35.5 (33.5)	3.0—4.7 (3.9)	Good	39.7—46.6 (44.0)	60s	3	5	Hampi
Siruguppa	14M	28.1—32.2 (30.2)	3.1—4.6 (3.9)	Average to good	37.5—42.9 (40.0)	50s	5	11	Hampi
Srivilliputtur	18M	29.2—35.1 (32.4)	2.7—4.0 (3.3)	Average to good	45.0—50.9 (48.2)	50s	10	5	MCU.5
				Rainfed Trial — Code No. Br04(b)					
Dharwad Set I	14M	26.6—30.7 (28.4)	3.5—4.5 (4.0)	Average to good	37.0—43.4 (38.9)	40s	7	1	Laxmi
Dharwad Set II	14M	26.1—29.8 (27.5)	3.3—4.5 (4.0)	Good	39.1—44.5 (42.0)	50s	1	13	CPD.8-1
				Short Duration Type — Code No. Br04(c)					
Aduthurai	12M	25.1—28.9 (26.8)	3.1—3.7 (3.5)	Good	44.0—50.9 (47.5)	40s	Nil	—	*
Srivilliputtur	11M	27.2—31.5 (28.8)	3.0—3.8 (3.5)	Good	43.4—48.2 (45.5)	50s	3	8	MCU.7

Note: Values in brackets indicate averages.
A — No. of samples spinnable to the count selected.
B — No. of samples better than or on par with control.
M — Micro spinning.
* — Control variety not received.

TABLE 7: SUMMARY OF TEST RESULTS OF STRAINS TRIED IN PRELIMINARY VARIETAL TRIAL (PVT) OF *G. hirsutum* IN SOUTH ZONE

Location	No. of Samples	Range				Count	Spinning performance		Control
		2.5% span length (mm)	Micro-value naire (ug/in)	Maturity	Bundle strength (g/t)		A	B	
Irrigated Trial — Code No. Br03(a)									
Siruguppa	20M	29.7—36.6 (33.4)	3.2—4.3 (3.7)	Average to good	37.0—46.1 (40.5)	60s	2	17	Hampi
Srivilliputtur	15M	28.2—34.9 (31.6)	3.4—6.0 (4.1)	Good	45.6—53.1 (49.5)	50s	6	1	MCU.5
Rainfed Trial — Code No. Br03(b)									
Dharwad Set I	18M	26.6—30.2 (28.4)	3.3—4.6 (4.1)	Good	40.2—45.0 (42.2)	40s	14	1	Laxmi
Dharwad Set II	18M	25.8—31.9 (28.4)	3.7—4.9 (4.2)	Good	38.1—45.6 (41.8)	60s	Nil	4	Laxmi

Note: Values in brackets indicate averages.
A — No. of samples spinnable to the count selected.
B — No. of samples better than or on par with control.
M — Micro spinning.

Location	*Count*	*Promising Strains*
Dharwad	40s	Laxmi, DP.338, CPD.19-5-7, DP.336, DS.35, JK.60-18, JK.78-16, NA.606, 2028-4, JK.152-1, DS.22, DS.14, JK.67P.65, CPD.34-25, CPD.4-68-13 and CRH.65.

In the Initial Evaluation Trial conducted at Siruguppa under irrigated conditions, the strains DP.1560, ACP.56-9 1, ACP. 51-85-2, ACP.56-89-26, SRG.374, ACP.71-18-1, ACP.71-43 1, AC.40-20-29, ACP.71-47-1.b, ACP.40-20-4 and MCU.5 fared well at 50s count.

G. barbadense Trials

Co-ordinated Varietal Trial was conducted at Amaravathi and Shimoga. The values of 2.5% span length ranged between 29.2 mm and 35.6 mm for the strains tried at Amaravathi and between 28.4 mm and 33.8 mm for the strains tried at Shimoga. Fibre maturity was good for the strains tried at Amaravathi and was average for the strains tried at Shimoga. The following strains fared well at the locations and counts indicated :

Location	*Count*	*Promising Strains*
Amaravathi	60s	CBS.203, BCS.10-91, BCS.9-70, CBS.34, CBS.200, Menoufi, PSH.1, Suvin, BCS.9-96 and TCB.15.
Shimoga	60s	CBS.203, BCS.10-91, CBS.202, CBS.34, Marad, CBS.200, Menoufi, PSH.1, Suvin, and S.I. Andrews.

Hybrid Trials

Intra-hirsutum hybrids : This trial was conducted at Coimbatore and Dharwad under rainfed conditions. The following hybrids fared well at the locations and the counts indicated :

Location	*Count*	*Promising Strains*
Coimbatore	60s	IRH.1-2
	50s	JKHY.1, M5xIC.469, M5xJ(RKR), M5xLRA, M5xIC.278, M5xIC.1946 and M5xZZZ-4-1
Dharwad	50s	NHH.3

Inter-specific hybrids: This trial was conducted at Coimbatore and Siruguppa. 2.5% span length of the hybrids tried at Coimbatore ranged between 31.2 mm and 40.6 mm. Maturity was good and bundle strehgth values were satisfactory. The hybrids H.64, H.61, H.65, H.134, H.144 and H.354 showed promising spinning performance at 80s count. 2.5% span length values of the eight hybrids tried at Siruguppa ranged between 30.0 mm and 35.6 mm. Maturity and bundle strength values were found to be good. Only three hybrids, H.134 K.2.HC and H.64 recorded good yarn strength when spun to 80s count.

Pilot Project Demonstration Trial

This trial was conducted at Shimoga, Siruguppa and Srivilliputtur. The following strains fared well at the locations and counts indicated below :

Location	*Count*	*Promising Strains*
Siruguppa	50s	AV.3373, MCU.5 and LRA.5156
Srivilliputtur	60s	MCU49 and AV.2775/II/1

EXTRA-LONG STAPLE COTTONS (27MM AND ABOVE)

Test results on extra-long staple cottons tested during 1981 are shown in Table 8, which includes the test results of samples received only for full spinning. However, there were many samples which have recorded mean fibre length 27 mm and above and the results on them are not included in the table since the quantity of lint available was only about 200 g.

MILL TEST

Taking into consideration the results of field trials and tests for quality and spinning performance carried out at CTRL, selected improved varieties of cotton are being subjected to actual mill test to assess their spinning performance under mill conditions.

The recommendation for large scale propagation of these improved varieties will be generally made only after its performance under mill conditions is confirmed. CTRL arranges mill tests on promising strains with the co-operation of a few textile mills in the country.

During the year, such mill tests were carried out on a few improved strains pertaining to 1980-81 season along with their respective controls. Their comparative performance at the mill and CTRL is given in Table 9.

The observations on various strains shown in Table 9 are given as follows :

TABLE 8: RESULTS OF EXTRA-LONG STAPLE (27mm AND ABOVE) COTTONS TESTED DURING 1981

Variety	Place	Mean fibre length		Fineness			Bundle strength		
		mm	in.	Millitex	Micronaire value (μg/in)	Mature fibre percent	Tenacity-zero gauge (g/t)	PSI-zero gauge (lb/mg)	Tenacity-3mm gauge (g/t)
Andhra Pradesh									
1. NBH.80	Nandyal	32.0	1.26	130	3.3	72	47.7	8.9	28.3
2. Varalaxmi	"	32.8	1.29	126	3.2	65	48.2	9.0	29.8
Gujarat									
1. G.Cot.100	Surat	28.2	1.11	134	3.4	69	42.9	8.0	24.8
2. Suvin	"	34.3	1.35	138	3.5	76	52.5	9.8	33.2
3. ERB.13758	"	30.2	1.29	177	4.5	82	47.2	8.8	32.3
4. SILS.53/568	"	32.3	1.27	150	3.8	77	51.5	9.6	35.4
5. GU.76	"	28.7	1.13	173	4.4	77	46.1	8.6	29.4
6. ERB.13754	"	30.2	1.19	157	4.0	75	47.7	8.9	28.5
7. MU.4512	"	28.7	1.13	185	4.7	77	47.7	8.9	29.5
8. G.Cot.Hy.6	"	27.2	1.07	157	4.0	69	46.6	8.7	28.0
Karnataka									
1. Varalaxmi	Dharwad	29.2	1.15	110	2.8	46	44.5	8.3	28.0
2. DCH.32	"	32.5	1.28	118	3.0	51	46.6	8.7	28.7
3. RRD.2767	"	27.7	1.09	165	4.2	74	40.2	7.5	22.7

TABLE 9: COMPARATIVE SPINNING TEST RESULTS AT MILL AND CTRL FOR THE PERIOD 1981

Sr. No.	Place	Variety	Waste (%)	Mill test results			Waste (%)	Laboratory test results		
				Count	Lea strength (lb)	CSP		Count	Lea strength (lb)	CSP
1.	Guntur	AV.3373	3.5	60s	40.8	2448	4.5	60s	40.2	2412
		MCU.5*	5.5	60s	41.9	2517	4.0	60s	36.2	2172
2.	Bharuch	G.Cot.11	4.1	30s	48.0	1441	1.0	30s	61.0	1841
		Digvijay*	5.9	30s	51.0	1538	3.4	30s	66.0	1976
3.	Indore	76IH-20	NA	28s	65.3	1828	NA	30s	70.5	2115
		Khandwa 2*	NA	28s	63.5	1778	NA	30s	60.7	1819
4.	Raichur	DB.3-12	NA	20s	83.4	1668	1.8	20s	87.9	1758
		Raichur 51*	NA	20s	82.8	1556	6.3	20s	87.2	1744
5.	Dharwad	DB.3-12	5.13	20s	94.8	1897	4.3	20s	101.0	2020
		Jayadhar*	8.86	20s	88.1	1762	3.6	20s	94.5	1890

NA — Not Available.
* — Control sample.

Andhra Pradesh :

The technological performance of AV.3373 was identical to that of MCU.5 (control). Both have shown spinning potential of 60s count. The higher value of CSP for both the strains at the mill may be due to combing procedure and greater twist multiplier used at the mill. MCU.5 recorded lower CSP than that of AV.3373 on account of lower staple length.

Gujarat :

The performance of G.Cot.11 was inferior to that of Digvijay both at mill and CTRL. Higher strength values for both the strains at CTRL may be due to the care taken in the maintenance of machinery and processing of the samples.

Madhya Pradesh :

The strain 70IH.20 recorded marginally higher yarn strength than the control variety, Khandwa 2, at the mill. The yarn strength for the yarn spun at the Laboratory for 70IH.20 was, however, significantly higher than that for Khandwa 2.

Karnataka :

The new strain, DB.3-12 recorded identical spinning performance and higher yarn strength as compared to Raichur 51 (control) both at the mill as well as at the Laboratory.

NEW COTTON VARIETIES RECOMMENDED FOR RELEASE

Strains/Hybrid	*Traits*
LD.230	A short staple coarse desi variety from Punjab Agricultural University (PAU) which has a yield potential higher than the existing variety G.27 released by Government of Punjab.
76IH.20	A selection obtained from IC.1036, a *G. hirsutum* cotton. It is compact, even type and is superior to the existing varieties. Spinning potential : 40s count. Suitable for growing in Malwa and Nimar tracts as well as in the Districts of Jhabua and Mandsaur of Madhya Pradesh.

Strains/Hybrid	*Traits*
68KH.33-1146 (Khandwa 3)	This strain developed by Jawaharlal Nehru Krishi Viswa Vidyalaya, was from a cross of Khandwa 1 X Akola 44-2 and is adaptable to the entire cotton tract of Nimar. It has a GP over 33% and is suitable for spinning up to 30s count.
JK.Hy.11	This inter-specific hybrid obtained by crossing Khandwa 2 x ERB.4492 has tolerance to jassids and to a certain extent, blackarm. Spinning potential : 60s count.
PA.32	This *G. arboreum* strain identified as H.576 isolated from the cross Bani x Cernuum is recommended for Marathwada area of Maharashtra and the plant has a maturity period of 170-180 days and is suitable for spinning up to 20s count.
ABH.4208 (PKVHy.1)	An inter-specific hybrid (cross between AK.32 and ERB.4292), it is recommended for the rainfed tracts of Vidarbha of Maharashtra. It has good boll opening and requires less plant protection measures; suitable for spinning 60s Count.
AHH.468 (PKVHy.2)	An intraspecific cross between AK.32 and DHY.286, it has dwarf compact plant structure and has consistantly good yield under rainfed as well as irrigated conditions. It is recommended for cultivation in rainfed and irrigated tracts of Vidarbha in Maharashtra State. GP is 36%; suitable for 40s count.
AKH.5	A *G. arboreum* strain derived from a cross between H.253 and CJ.73, it has recorded about 15% higher yield compared with existing *G. arboreum* varieties, AKH.4 and AK.234. It has spinning potential of 30s count and is recommended for the rainfed tract of Vidarbha.

PROMISING STRAINS

The Panel Meetings of the Breeding and Technology Groups of North, Central and South Zones under AICCIP identified the following strains as promising :

Strain/Hybrid	*Traits*
H.842	A *G. hirsutum* cross between Bikaneri Narma and K.3199 — GS.577 developed at Haryana Agriculture University, Hissar. It is an early maturing type, maturing earlier than H.777 by a fortnight. GP varies from 33% to 35% and is adjudged to be suitable for 30s count.
LRA.5166	A derivative of cross involving Laxmi, Reba B.50 and Krishna. In the Trials, LRA.5166 has recorded higher yield compared with MCU.5. It is suitable for cultivation in irrigated and rainfed areas under MCU.5 at present. It is suitable for cultivation in the irrigated and rainfed areas of MCU.5 tract in Tamil Nadu. It has recorded high GP and is suitable for 50s count.
NHH.44	An interspecific hybrid which is a cross between Bikaneri Narma and AC.738. Plant matures about three weeks earlier than Hybrid 4 and has GP comparable to Hybrid 4. It is suitable for 40s count.

Besides, varieties H.854, RS.513, RS.514 and LH.580, all pertaining to North Zone, have also been found to be promising in economic and fibre characters.

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

Lint samples of fair average quality of the major varieties of Indian cottons are being obtained for each season through the East Indian Cotton Association (EICA), Ltd., Bombay, and some regional cotton associations. Representative *kapas* samples of these varieties are also procured from the State Departments of Agriculture for determination of ginning percentage. The fibre and spininng test results, ginning percentage and other test results on each variety of cotton are being published as Technological Circulars as early in the season as possible for information of cotton trade and industry. Such circulars were issued during 1981 on 75 samples of cotton. These include 17 samples of 1979-80 season and 58 samples belonging to 1980-81 season. The test results of all the Trade Varieties of 1979-80 season were compiled together and published as 'Technological Report on Trade Varieties of Indian Cottons, 1979-80 season'.

Evaluation of the Quality of Standard Indian Cottons

To assess the seasonal fluctuations in the characteristics of Indian cottons and to gauge the comparative superiority or otherwise of the newly evolved strains, a number of selected varieties of Indian cottons, called Standard Indian Cottons, are tested at CTRL every year. These varieties are grown on government farms every year under identical conditions and under departmental supervision. Extensive fibre and spinning tests are regularly being done on such samples and the test results are published as Technological Circulars for information of Cotton Breeders and other research workers as early in the season as possible. During 1981, such circulars were issued on 11 varieties and thus, most of the samples of Standard Indian Cottons of 1980-81 received and tested have been covered. The results on all the samples pertaining to 1979-80 season were consolidated and published as 'Technological Report on Standard Indian Cottons, 1979-80 Season'.

Identification of Cotton Varieties (grown at the Cotton Research Station, Surat for Experimental Purposes) with Different Levels of Nep Content and Study of Varietal Variability and Inheritance of the Characteristics of Neppiness in Cotton

As reported earlier, 30 varieties for which pure lines were available at the Cotton Research Station, Surat, were examined for their nep-content (number of neps per 100 sq. cm. of card web obtained on the Shirley Miniature Spinning Plant) and classified into the four nep grades proposed, viz. low (up to 2.3), average (2.4-4.6), high (4.7-7.1) and very high (above 7.0). From among these, two varieties were chosen (from each of the four categories) and diallele crosses made therefrom. The 28 crosses thus made, along with the eight parent varieties have been sown in the field during current season. The nep-content in the lint from these will be studied as soon as the picking is over.

Study of the Effect of Nitrogen, Phosphorus and Potash on the Quality of Cotton, Hybrid 4

Evaluation of the effects of nitrogen, phosphorus and potash and their interactions at the different levels on the economic characteristics and fibre properties as well as on the yarn CSP at 44s count has been continued during the year.

The experiments were carried out in randomised blocks design with three replications and 12 treatments having three levels of nitrogen — N_1 —160, N_2 —240 and N_3 —320 Kg/ha, two levels of phosphorous — P_0 —0 and P_1 —80 Kg/ha and two levels of potash — K_0 —0 and K_1 —80 Kg/ha. The spacing was 120 cm x 60 cm and the number of plots was 36 and the plot size 4.8 m x 4.8 m net.

The mean values of various fibre properties at different NPK levels for the year 1980-81 as well as for the two seasons, 1979-80 and 1980-81, are given in Tables 10 and 11, respectively.

In general, the three fertilisers failed to make any tangible impact on the fibre properties, viz. fibre length, length uniformity, fineness, maturity and bundle strength during the two seasons. In the year 1979-80, significant effects were noticed on the bundle strength for nitrogen as well as phosphorus levels and on CSP at 44s count for phosphorus levels. In the current season, alongwith the fibre characteristics, viz. fibre length, length uniformity, fineness, maturity and bundle strength, a few other factors like yield, GP, seed index and lint index as well as yarn CSP at 50s count have been studied. No significant effects were noticeable in any of the properties, including yield. To get further confirmation of the results, it is proposed to carry out the trial for one more season.

Influence of the Insecticide Treatments on the Quality of Cotton and Cottonseed

The statistical analysis of the data on fibre tests and yield on 30 samples of Hybrid 4 for the season 1978-79 from the entomological trials conducted at the Gujarat Agricultural University, Surat, was carried out during the period. It was observed that Phosalone, Monocrotophos and Endosulfan significantly affected 2.5% span length, whereas all treatments showed significant improvement in GP and yield; the improvement in yield was highly significant as compared to control.

Twentyfour samples of Hybrid 4 cotton pertaining to the entomological trial on 'Chemical Control of Bollworms' which consisted of eight insecticide treatments, were received from the Gujarat Agricultural University, Surat, for tests. These samples were evaluated for 2.5% span length, uniformity ratio, bundle tenacity at zero and 3 mm gauge lengths, maturity coefficient and Micronaire value. The data on GP and yield were obtained from Surat. Statistical analysis of the data revealed that cypermethrin imparted significant improvement in bundle tenacity at 3 mm gauge length at 5% level, while all the treatments significantly improved the yield.

Design, Fabrication and Testing of Seed-Cotton Cleaner

One model of the seed-cotton cleaner has been fabricated for demonstration of the principles underlying the process. This machine

TABLE 10: MEAN VALUES OF FIBRE PROPERTIES OF COTTON AT VARIOUS NPK LEVELS DURING THE SEASON 1980-1981

Fibre property	N levels			P levels		K levels	
	N1	N2	N3	P0	P1	K0	K1
1. Yield (kg/ha)	816	832	1042	943	850	902	891
2. Ginning percentage	33.6	34.6	35.9	35.8	34.9	35.4	35.3
3. Seed index	11.0	11.0	11.2	11.1	11.0	11.0	11.1
4. Lint index	6.1	5.9	6.4	6.2	5.9	6.1	6.1
5. 2.5% span length (mm)	29.7	30.1	29.8	29.7	30.1	29.9	29.9
6. Length uniformity ratio	45	46	46	45	46	45	46
7. Fineness (µg/in.)	4.4	4.6	4.4	4.5	4.5	4.5	4.4
8. Maturity coefficient	0.80	0.81	0.81	0.81	0.80	0.81	0.79
9. Bundle strength-zero gauge (g/t)	41.9	41.7	41.0	41.2	41.9	41.4	41.7
10. Count strength product	1562	1632	1595	1556	1636	1559	1633

TABLE 11 : MEAN OF FIBRE PROPERTIES AT VARIOUS NPK LEVELS FOR THE TWO SEASONS, 1979-80 AND 1980-81

Fibre properties	N levels			P levels		K levels	
	N1	N2	N3	P0	P1	K0	K1
1. Yield (kg/ha)	959	1088	1292	1146	1080	1120	1106
2. Ginning percentage	36.1	36.0	35.8	36.2	35.8	35.9	36.0
3. Seed index	10.4	10.3	10.5	10.3	10.4	10.4	10.3
4. Lint index	5.8	5.9	5.8	5.8	5.8	5.8	5.8
5. 2.5% span length (mm)	28.8	29.1	29.2	29.0	29.2	29.1	29.0
6. Length uniformity ratio	46	46	46	46	46	46	46
7. Fineness (µg/in.)	4.2	4.3	4.2	4.2	4.2	4.2	4.2
8. Maturity coefficient	0.82	0.82	0.82	0.82	0.82	0.82	0.80
9. Bundle strength — zero gauge (g/t)	39.4	40.2	40.2	39.3	40.6	39.8	40.0
10. Count strength product	1581	1629	1584	1558	1638	1570	1624

consists of stationary support, seed-cotton hopper, rotating spike roller, rotating saw roller, curved stationary spike support, oscillating grid, device for oscillation and power transmission unit.

The aim of fabricating this model was to encounter and identify the constraints, which could be eliminated before mounting the machine on the gin and also to enhance and improve the design.

On operating the working model, it was observed that for satisfactory opening of the seed-cotton, the distance between spike roller and spike support has to be kept at optimum level and that the distance between every two spikes on the roller as well as on the support required optimum setting. The grid oscillation (horizontal and vertical) rate, type of grid and size and shape also have greater influence on the cleaning efficiency as well as delivery of the opened seed-cotton to the saw roller. Speed and size of the spike roller and the saw roller were found to be the two important factors affecting the performance of the machine. Keeping all these in view, a final design of the machine incorporating all the modifications is being prepared.

Fabrication of Ginning Percentage Indicator

Three separate ginning percentage indicator devices, based on the principles of laws of floatation, have been designed, fabricated and tested. The first two employ the linear characteristics of a hydrometer in conjunction with special scale devices. The accuracy of these two instruments has been estimated as better than $\pm 0.2\%$ and approximates to $\pm 0.1\%$ in most cases. The third device uses an exponential shape of float in conjunction with a special scale set up and this has the advantage over the other two in that only one single operation is needed to obtain the ginning percentage directly in contrast with the two operations needed by the other two. Additionally the scale set-up can conveniently be mounted on the drum containing the hydrometer. It is proposed to improve the performance of these instruments through further trials.

A Study of the Statistical Prediction Formulae for Estimating Mean Fibre Length, Fineness and Maturity of Cotton Using Recent Data

The regression equation connecting the maturity coefficient by Caustic Soda Method and the difference in Micronaire values measured with and without spacer was derived and compared with the equations of the earlier workers, as given in Table 12.

TABLE 12: SIMPLE CORRELATION COEFFICIENTS AND REGRESSION EQUATIONS CONNECTING MATURITY COEFFICIENT (MC) AND MICRONAIRE DIFFERENCE (MD)

Author/Year	Number of cottons	Correlation Coefficient	Regression equation
R.L.N. Iyengar and V. Sundaram (1958)	46	0.80**	$Mc = 0.1694\ M_D + 0.4508$ (1)
Jai Prakash, V. Sundaram and R.L.N. Iyengar (1962)	40	0.8058**	$Mc = 0.1753\ M_D + 0.3934$ (2)
K. N. Seshan (1964)	130	0.8471**	$Mc = 0.1720\ M_D + 0.4085$ (3)
Present Study (1980)	200	0.7540**	$Mc = 0.2335\ M_D + 0.3712$ (4)

** Highly significant (0.01 level)

In the present study, it was noticed that the values of Micronaire difference (MD) fell within a narrow range of 1.10 to 2.20 μg/in whereas the range in the earlier investigations was much wider, viz. 1.00 to 2.70 μg/in for the same spread of maturity coefficient values (0.60 to 0.90). The present equation thus turns out to be different from the earlier equations. Also the values of maturity coefficient estimated from the present equation (equation 4) are higher than those predicted from equation 2 which is currently in use in this Laboratory, for predicting the maturity coefficient from the Micronaire difference. Table 13 gives the values of maturity coefficient predicted from the equations 1, 2 and 4.

TABLE 13: ESTIMATED VALUES OF THE MATURITY COEFFICIENT FROM THE DIFFERENCE IN MICRONAIRE VALUES MEASURED WITH AND WITHOUT SPACER

Micronaire difference (microgram/in.)	Estimated Values of Maturity Coefficient		
	Equation (1)	Equation (2)	Equation (4)
1.0	0.62	0.57	0.60
1.1	0.64	0.59	0.63
1.2	0.65	0.60	0.65
1.3	0.67	0.62	0.67
1.4	0.69	0.64	0.70
1.5	0.70	0.66	0.72
1.6	0.72	0.67	0.74
1.7	0.74	0.69	0.77
1.8	0.76	0.71	0.79
1.9	0.77	0.73	0.81
2.0	0.79	0.74	0.84
2.1	0.81	0.76	0.86
2.2	0.82	0.78	0.88
2.3	0.84	0.80	0.91

On comparing the predicted values, it is noticed that the relationship between maturity coefficient and Micronaire difference worked out earlier has undergone a moderate transformation and that there is scope for the revision of the prediction formula currently in use.

Design and Fabrication of an Electronic Fibre Length Tester

Trials of the electronic circuits were quite successful and hence they were adopted to printed circuit boards for modular design. The work on the mechanical supporting system and hardware is in progress. Preliminary drawings and plans of these have been completed.

Optical Scanning Technique for Determination of Fibre Fineness and Maturity

Twentyfive varieties of cotton covering a wide range in maturity were selected. These samples were tested for the percentage mature fibres (Pm %) by the Caustic Soda Method, by IIC Fineness-Maturity Tester and by Fibrograph. The maturity parameters obtained by the three methods were correlated. The correlation coefficients obtained were as follows :

$\gamma_{ac} = 0.546^{**}$ $\gamma_{bc} = 0.523^{**}$ $\gamma_{ab} = 0.532^{**}$

(**highly significant)

where,

a = Pm % by Caustic Soda Method.

b = Pm % by IIC Fineness-Maturity Tester.

c = Fibrograph estimate of maturity.

It is proposed to extend this work for comparing the fineness/maturity parameters obtained by IIC Fineness-Maturity Tester with those values measured using the existing techniques in CTRL.

Fabrication of an Instrument for Cotton Fibre Maturity

Test for fibre maturity was carried out on over 100 cotton samples by the new technique and the 'immaturity index' obtained in this manner was compared with the 'mature fibre percentage' (Pm) which is the measure currently in use at CTRL. The samples were mostly *G. hirsutum* cottons, with a few belonging to other species, besides hybrids.

The correlation between immaturity index obtained by the new method and mature fibre percentage obtained by caustic soda swelling method has been rather poor, even though earlier results on a limited number of samples had shown satisfactory agreement between the two estimates. With the number of samples increased to 110, the correlation coefficient was found to be 0.45 which was too low to permit the use of this method for maturity estimation.

The optical index seems to be strongly influenced by fibre fineness (absolute wall thickness) besides fibre maturity (relative wall thickness with respect to the lumen size) as would be clear from the higher association it has with the Micronaire value ($r = -0.77$). It would appear that the new optical measure represents fibre fineness more strongly than fibre maturity. At the same time, the optical method cannot be suggested for fineness measurement because established air flow instruments, in which fibre fineness can be evaluated quickly and accurately using much larger samples, are already available.

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

The measurement of single fibre linear density and its breaking strength was being continued. A total of 300 fibres were being tested for each of the four selected cottons. The two broken segments of the fibres were also examined under polarised light to ascertain whether the breakage was in the vicinity of a reversal or away from it. Collection of the above data is in progress.

Determination of the Spiral Angle of Different Varieties of Cotton

Comparative study of the x-ray angles for the air-dried and solvent-exchanged samples was continued. A few cottons belonging to *G. arboreum* and *G. herbaceum* species were tested.

Samples belonging to the *G. arboreum* species, had, in general, very few convolutions and the x-ray angle for these samples was around 26°. There was no significant difference between the x-ray angles of the solvent-exchanged and the air-dried control samples. The *G. herbaceum* cotton tested had x-ray angle around 30° and that too was only marginally different from that of the solvent-exchanged samples, unlike the observations made earlier on *G. hirsutum* and *G. barbandense* varieties. Of course, the *G. arboreum* and *G. herbaceum* cottons had fewer convolutions to begin with and hence their removal can not be expected to bring about as significant an effect on the x-ray angles as in the case of *G. hirsutum* and *G. barbadense* cottons. Even so, the differences in x-ray angles observed between air-dried and solvent-dried samples were too little to account for the reduction in the number of convolutions in the latter. Many of the varieties tested had large number of immature fibres. Hence, it is likely that some solvent trapped in the lumen could have led to diffused x-ray scattering, thereby leading to a high apparent value of x-ray angle for the solvent-exchanged samples.

Fibres from fully mature, but unopened bolls of a few more cottons belonging to both *G. herbaceum* and *G. arboreum* species are required to be studied before arriving at some definite conclusions on the constancy or otherwise of the spiral angle in these two species.

Relationship between X-ray Orientation and Tensile Properties of Cotton Fibres

Samples belonging to *G. barbadense*, *G. hirsutum* and *G. herbaceum* species were subjected to tests for orientation parameters and tensile properties and the results have already been reported. The study was continued by determining tensile and orientation parameters of ten more samples belonging to *G. arboreum* species. The results, on analysis, confirmed the earlier finding that the highest association of fibre bundle tenacity at zero gauge length was with the 20% x-ray angle as compared with other x-ray angles, and the orientation factor, fx. However, all the correlations were highly significant at 0.1% level. In the case of tenacity at 3 mm gauge length, the correlations with 20% as well as 75% x-ray angles were almost the same, while the correlations with fx remained the poorest. When the correlation was worked out for values of all the 80 cottons for tenacity at zero gauge length, it was observed that the values of 20% x-ray angle gave the highest correlation as compared to the other x-ray angles. However, the relationship of this fibre property with fx remained almost the same as that with 20% x-ray angle.

In the case of percentage elongation, for *G. arboreum* as well as for all the 80 cottons pooled together, the same trend was noticed as in the case of other species, viz. 75% x-ray angle is the best for the assessment of elongation properties.

Studies on Inheritance of Strength and Structural Parameters in Cotton Fibres

Analysis of data on x-ray angle of the samples confirmed the tentative choice of parent materials made earlier on the basis of tenacity data. The most promising progenies of the parents have been identified for further work.

X-ray Diffraction Studies on Structural Parameters of Yarns with a View to Utilising them for Textile Yarn Characterisation

As a beginning of yarn characterization studies, Suvin cotton was spun to 40s, 60s, 80s and 100s. Each count was spun with the same set of four different twist multipliers (3.00, 3.75, 4.50, 5.25) except

100s which was spun with only the first three twist multipliers. The orientation profiles from all these yarns were obtained. Preliminary analysis indicated that the influence of twist on the orientation parameter is different for yarns of different counts. The influence of counts on orientation, however, is not so markedly different for yarns spun with different twist multipliers.

X-ray Diffraction Studies on Structural Parameters of Fibres and Yarns with a view to Utilising them for Textile Material Characterisation

During the period, efforts were made to improve the accuracy of blend analysis by using "Wiley-cut" samples, wider divergence and receiving slits and counting methods for intensity determinations. With these innovations, the maximum error was reduced to ±1.5% in the case of cotton/viscose and cotton/polynosic blends, the analysis being done by radial methods. No significant reduction of maximum error occurred in the case of cotton/polyester blends from that obtained earlier (±3%). In order to link the sample volume with accuracy of the Optical Index (OI) method, repetitive analysis was made on a cotton/viscose yarn (nominal Blend Composition (BC) 84/16), the BC of which based on two tests was +8.5% off from the chemically determined value. Examination of the results revealed that atleast ten tests would be needed to obtain an error of less than ±5%. This finding also indicates that it should be possible to obtain better results with the OI method by increasing the volume of sample involved in the analysis.

Studies on the Lustre of Cottons grown in India and its Improvement on Mercerisation in Fibre and Yarn Stages

During the period under report, about 25 samples of 1981 season were tested for lustre index. The range of lustre values determined for the same samples from 1981 season was from 1.563 to 2.072 as compared to 1.408 to 1.990 for samples from 1980 season and 1.594 to 2.174 for samples from 1979 season.

In order to study the effect of mercerisation on lustre, a procedure was standardised for mercerisation of tufts of cotton fibres held in a stainless steel device. A tuft of fibres was carefully combed and one end of the fibres was gripped in the device specially made for this purpose. The fibres that were not caught in the grip were removed. The free end of the tuft was gripped in a similar stainless steel jaw. Thus all the fibres in the tuft were made parallel and gripped at both ends. The jaws were fixed to a metal plate so as to prevent shrinkage during mercerisation. The tuft of fibres was mercerised by immersing the jaws fitted to the metal plate in 25% Sodium

Hydroxide using 'Mercerine' as wetting agent. The tuft was then washed thoroughly with water till it was free from caustic soda. It was then soured with 1% acetic acid and again washed with water and dried. About 10 to 12 such tufts of each sample were mercerised for lustre determination. During the period under report, 10 samples were mercerised and the Lustre Index (contrast ratio) was determined. The ranges of contrast ratio of these 10 samples in raw and mercerised states were from 1.702 for JKHY.11 to 2.072 for Suvin and 3.522 for Bikaneri Narma to 6.836 for Suvin, respectively.

Characterisation of Decrystallised Cottons Produced by New Methods and Assessment of Their Influence in Subsequent Crosslinking Treatments

The study of decrystallisation by partial substitution standardised at CTRL has been extended to fabrics (treatments on cotton fibres and yarns were reported earlier). A plain weave fabric specially spun from Digvijay cotton and a commercial long cloth were used in the study.

Decrystallisation by substitution consisting of partial cyanoethylation (PC) and partial acetylation (PA) was carried out after preswelling in 15% and 21% NaOH (w/w). The longcloth fabric was slack swollen and substituted while the plain weave fabric was swollen under restraint and substituted. The method of substitution followed was the same as that used for fibres and yarns discussed in the earlier reports, the only difference being that the swollen samples were padded in the present case instead of centrifuging to get the suitable NaOH pick up.

Decrystallised fabrics so obtained were crosslinked with 8% DMDHEU along with the NaOH swollen controls by the pad-dry-cure process with slight modifications. Results on strength and CRA indicated a strong dependence of these properties on the type of fabric. Results obtained for the plain weave fabric were very much in line with those obtained for fibres and yarns in the sense that the decrystallized and crosslinked fabrics showed greater strength retention than the controls crosslinked for nearly the same crease recovery level. Bursting strength was marginally higher than that for the swollen and crosslinked controls, while tearing strength remained nearly the same.

Table 14 gives some of the results obtained for both types of fabrics. Reproducibility of the results depended very much on maintaining the precise conditions, especially during crosslinking. For the same crease recovery levels, the strength loss appears to be more

for the longcloth than for the plain weave fabric. More non-uniform distribution of crosslinks due to uneven penetration of the crosslinking agent may partly be responsible for this difference.

TABLE 14 : TENSILE STRENGTH AND CREASE RECOVERY DATA ON CHEMICALLY TREATED FABRICS

Type of fabric / Treatment	Plain weave fabric			Long cloth		
	Tensile strength		CRA (W+T)	Tensile strength		CRA (W+T)
	Warp (kg)	Weft (kg)		Warp (kg)	Weft (kg)	
None (Control)	19.3	18.9	181	25.4	18.9	173
Crosslinking with 8%DMDHEU	8.3	7.0	300	8.1	6.0	297
21% NaOH swelling + crosslinking with 8% DMDHEU	9.3	9.7	281	11.2	7.8	291
21% NaOH swelling + partial acetylation + crosslinking with 8% DMDHEU	11.8	11.1	283	11.1	8.4	275
21% NaOH swelling + partial cyanoethylation + crosslinking with 8% DMDHEU	10.7	10.8	284	11.7	7.5	285
15% NaOH swelling + crosslinking with DMDHEU	7.1	7.4	288	8.4	6.7	293
15% NaOH swelling + partial acetylation + crosslinking with 8% DMDHEU	8.3	8.7	276	9.6	7.0	288
15% NaOH swelling + partial cyanoethylation + crosslinking with 8% DMDHEU	8.8	10.3	287	10.6	7.0	290

From the study on fabrics, it appears that by selecting fabrics of proper construction and crosslinking the same after decrystallising it is possible to get higher strength retention than that obtainable in NaOH swollen and crosslinked samples. However, the improvement in strength is not to the extent observed for the fibres probably owing to lack of proper penetration of the reagents and consequent non-uniform distribution of crosslinks.

Some Studies on the Swelling of Regenerated Cellulose Fibres in Sodium Hydroxide

Preliminary work for standardising the procedure for swelling and stretching treatments on viscose rayon filaments has been carried out. The continuous filament yarn (120 den., 40 fils) in the form of a skein (50 cm girth) was swollen in the slack state in sodium hydroxide solution (18% w/w) for five minutes and stretched to a chosen level with the aid of a stretching device. Immediately after stretching, the skein was immersed in an acetic acid bath (about 5% w/w) to neutralise the alkali in the filament. After ensuring complete neutralisation, the skein was washed with tap water and later dried in air.

Load-extension curves were obtained for the untreated and treated filament yarns using the Instron Tensile Tester at a gauge length of 10 cm in the standard atmosphere. The cross head speed of the Instron was adjusted to give a time-to-break within 20 ±3 sec.

Test results are given in Table 15.

TABLE 15: RESULTS OF TENSILE TESTS ON UNTREATED AND TREATED VISCOSE FILAMENT YARNS

Sample (120/40) viscose yarn	Breaking load* (g)	Linear density (d)	Tenacity (g/d)	Breaking elongation* (%)
Untreated	173.4	129.6	1.33	17.6
Slack treated	124.0	146.9	0.84	33.4
30% stretched	122.8	99.0	1.24	13.4
35% stretched	126.6	95.4	1.33	12.5
40% stretched	130.9	91.4	1.43	11.3
45% stretched	131.6	91.8	1.43	10.6

* Each value is the average of 25 breaks.

It can be seen from Table 15 that on slack treatment in the alkali, the breaking load and tenacity are considerably reduced and the extensibility greatly increased. With stretch, the breaking load and tenacity tended to recover. The original tenacity of 1.33 g/d was regained by the yarn stretched to 35%, despite the fact that the breaking load was reduced to 126.6 g from an initial value of 173.4 g. The maintenance of tenacity at the level of the control sample has been possible largely because of the reduction in linear density accompanying stretch. Breaking extension, on the other hand, decreased progressively with increasing stretch beyond 30%.

Preparation and Standardisation of Calibration Cotton Standards

As reported earlier, 15 kg each of the two Trade Variety cotton samples, viz. Varalaxmi (2.5% span length = 1.40 in.) and Gaorani (2.5% span length = 0.86 in.), were processed separately and also after blending 50:50 and 75:25 proportions. The 20 sub-lots each of the control samples, 50 : 50 and 75 : 25 blends, were tested for 2.5% span length and Micronaire value. For further study, two cottons viz. V.797 and Hybrid 4 having Micronaire values 5.0 and 3.8, respectively, were selected. These samples were processed individually and the card webs were being tested for fibre properties.

Formulation of Suitable Indices of Fibre and Yarn Quality for Assessing the Spinning Potential of Cotton

While fixing the values for Yarn Quality Index (YQI), it was observed that yarns spun at CTRL for the last two seasons (which were included in the present study) have shown improvement in the values of strength, U% and neps per 100 metres, as compared to those of corresponding counts spun during earlier seasons. It was, therefore, thought necessary to re-examine the applicability of the norms. Accordingly, data for the above mentioned yarn parameters were collected during the period for 50 yarn samples (for the years 1978-79 and 1979-80) of each of the counts, 20s, 30s, 40s, 50s, 60s, 80s and 100s, and analysed statistically. It was observed that these yarns, in general, were stronger, more uniform and less neppy. Based on the analysis, revised norms have been suggested. These will be confirmed for samples of one more season (1980-81).

Further, it was felt that in the method used earlier for calculations of YQI, weightage given to different yarn quality parameters was arbitrary. Therefore, simple correlations between Fibre Quality Index (FQI) and yarn quality parameters for 50 samples, as shown below, were worked out to fix up due and appropriate weightage for each parameter.

$rxx_1 = +0.8502^{**}$, $rxx_2 = +0.6022^{**}$, $rxx_3 = +0.6304^{**}$, $rxx_4 = 0.4460^{**}$, $rxx_5 = +0.1932$ NS; where x = FQI, x_1 = CSP, x_2 = U%, x_3 = neps per 100 metres, x_4 = CV% of count and x_5 = CV% of strength.

The multiple correlation Rx. $x_1x_2x_3$ computed was also highly significant ($+0.9035^{**}$). The corresponding regression equation was found to be $y = 0.0894x_1 - 4.2013x_2 + 0.1493x_3 - 74.8486$ which can be approximated to $y = 0.09x_1 - 4.2x_2 + 0.1x_3 - 75$. From the correlations, it was proposed to fix suitable weightage and then try to find out the

optimum weightages for YQI and establish the relationship. The multiple correlation and regression equation will also be taken into account while fixing the weightage.

Studies on Lakshmi-Rieter Drawing and Speed Frames

During the period under report, Varalaxmi cotton was processed in the blow room. The lap produced was carded on MMC Card at 8 lb/hr. The carded sliver was then given two passages on Lakshmi-Rieter draw frame using four combinations of break draft with two combinations of zonal settings, viz. 39/44 and 41/46 (Front/Back), respectively. The slivers of various combinations were spun at 80s count on Lakshmi-Rieter ring frame after a passage on Can-fed Intermediate.

The uniformity of the material was determined at all the intermediate stages for all combinations, and the results are given in Table 16.

TABLE 16 : UNIFORMITY OF MATERIAL AT DIFFERENT STAGES OF PROCESSING

Settings	I				II			
Break Draft	B. Zone-44mm — F. Zone-39mm				B. Zone-46mm — F. Zone-41mm			
Combinations	I	II	III	IV	I	II	III	IV
Passage I	1.7	1.7	1.3	1.3	1.7	1.7	1.3	1.3
Passage II	1.7	1.3	1.3	1.7	1.7	1.3	1.3	1.7
U% Card Sliver	3.2	NA	3.8	4.1	3.1	3.7	NA	3.8
U% DF. I „	3.2	3.6	3.1	3.5	2.8	3.4	3.6	3.8
U% DF. II „	3.5	3.9	2.9	3.6	3.2	3.2	3.8	3.5
U% Canfed Inter	6.7	6.8	6.5	6.8	6.4	6.7	8.5	7.6

NA — Not available.

The yarns produced from various combinations were tested for yarn characteristics, viz. lea count, lea strength, single yarn characteristics, U% and imperfection and the results are tabulated in Table 17.

Study on the Relationship Between Single Strand Strength, Lea Strength and Knotted Lea Strength

The extension at break obtained during lea test on normal skein and knotted skein as well as during single thread strength test was studied on five samples each of four counts, viz. 30s, 40s, 50s and 60s. It was observed that extension (E%) was higher for knotted skein as compared to normal skein by about 20%. Further, relationship between extension values of single thread and skein strength was considerably improved by knotting. The work on the project has been completed.

TABLE 17 : YARN CHARACTERISTICS OF VARIOUS COMBINATIONS OF BREAK DRAFTS AND ZONAL SETTINGS

Settings	I				II			
Break Draft Combinations	B. Zone 44mm-F. Zone 39mm				B. Zone 46mm-F. Zone 41mm			
	I	II	III	IV	I	II	III	IV
Count	79.57	80.53	80.93	80.04	78.51	78.67	79.65	77.56
Strength (lb)	30.23	31.39	30.83	29.83	31.29	31.20	30.83	29.92
Corrected CSP	2418	2528	2481	2387	2476	2463	2466	2281
Uster Single Thread								
Tenacity (g/t)	16.6	16.3	16.2	16.1	16.4	17.0	16.5	16.7
Elongation (%)	6.6	6.4	6.5	6.6	6.9	7.2	6.2	7.3
CV(%) of Breaking strength	10.6	12.2	10.8	11.9	13.1	11.2	16.3	13.0
U%	18.0	17.9	17.5	19.3	17.5	18.4	19.2	18.6
Thin places per 100m	41	52	30	74	33	18	29	30
Thick places per 100m	179	171	165	200	169	122	120	126
Neps/100m	251	251	220	259	226	199	205	205
CV (%) of Lea count	3.42	2.41	2.93	3.09	3.08	3.77	5.53	4.40
CV (5%, of Lea strength	6.61	4.85	4.11	4.09	3.84	4.31	5.60	6.24

Open End Spinning of Indian Cottons and Cotton Wastes

(a) *SEM Studies of Open-end and Ring Spun Yarns from Polyester Fibres*

In order to examine the structural aspect of open-end spun yarns *vis-a-vis* ring spun yarns on SEM, an indigenous polyester (38 mm) was processed and spun on open-end spintrainer using : (i) two rotor diameters, (ii) two shapes of rotors, (iii) two types of doffing tubes, and (iv) three rotor speeds. The yarns produced from various combinations were mounted on the specimen stub to examine under the scanning electron microscope. Precaution was also taken to avoid charging of the samples. The electron micrographs on the structure of

various combinations were recorded. A detailed analysis of micrographs is underway to explain the characteristics of the above combinations.

(b) The Influence of Blow Room Cleaning and Carding Variables on the Quality Characteristics of Open-end Spun Yarns

Three cottons, viz. Wagad, V.797 and Virnar, having fibre properties as shown in Table 18, were selected.

TABLE 18 : FIBRE PROPERTIES OF THE SELECTED COTTONS

Particulars	Wagad	V.797	Virnar
Store No.	810659	810656	810664
2.5% span length (mm)	20.5	22.9	24.1
Uniformity ratio (%)	49	49	48
Micronaire value	5.9	4.9	3.6
Maturity by NaOH method :			
Mature	71	74	60
Immature	29	26	40
Bundle Strength			
Zero gauge (g/t)	45.6	52.5	47.7
1/8" gauge (g/t)	22.4	26.2	27.2
Trash content (%)	10.8	7.4	7.4

The three cottons were mixed in equal proportions and processed in blow room to produce four laps using various openers to assess the cleaning efficiency. Each of the laps produced were carded both on conventional and metallic cards. Double carding was also carried out on both the types of cards to assess the quality improvement over the single card by giving an extra passage in the blow room for both the types of card slivers from the single card.

The slivers produced from the single card and double card (both types) were given two draw frame passages to produce 0.14 hk sliver. 20s yarns were spun from each of the combinations keeping the settings of the open-end spinning machine as mentioned below :

Opener speed : 5,000 rpm	TM = 5, TPI = 22.36 (TPM = 881.01)
Rotor speed : 45,000 rpm	Rotor type : 'V' shape (23)
Delivery : 51.07 M/min	Doffing tube : With serration

In addition, rovings were also prepared from single carded conventional finisher head draw frame sliver to spin on ring frame for comparison. Further tests are in progress.

Optimal Blending of Standard Varieties of Indian Cottons

The processing of Blend No. L.14 comprising 50% Varalaxmi, 30% H.4, and 20% MCU.5 was completed and all yarn tests carried out. Due to insufficient quantity of one of the constituent cottons, the processing was limited to the combination : High Speed Drawing, Canfed Inter-Spinning on L.R and SKF drafting systems. With this, the experiments on the three blends of the three finer varieties of Maharashtra cottons were concluded. The properties of 50s and 60s yarns spun from the above blends are given in Table 19.

TABLE 19 : PROPERTIES OF YARNS SPUN FROM BLENDS OF THREE FINER COTTON VARIETIES OF MAHARASHTRA (PROCESSED ON HIGH SPEED DRAFTING — CANFED INTER — SPINNING ON L.R. DRAFTING SYSTEM)

Code No. of Blend	L.12		L.13		L.14	
Blend composition (%)						
Varalaxmi	21%		30%		50%	
Hybrid 4	50%		20%		30%	
MCU.5	30%		50%		20%	
FQI	82.8		89.0		99.2	
Nominal count	60s	50s	60s	50s	60s	50s
Corrected CSP	2100	2267	2149	2296	2189	2363
Single yarn tenacity (g/t)	13.8	14.7	13.4	14.8	14.8	15.3
Breaking elongation (%)	6.0	6.5	5.6	6.4	6.5	6.8
U%	17.4	16.9	17.5	17.1	19.3	18.8
Neps/100m	228	202	212	206	187	181
End breaks/100 spindle hr	4.98	4.07	4.98	3.80	3.24	4.75

The blend L.14, with the higher Fibre Quality Index (FQI), should have produced yarns superior in all the properties to the other two blends, L.12 and L.13. But due to a mechanical problem encountered at the drawing stage, the U% of the sliver was adversely affected which has been reflected in the low CSP and high U% values of Blend L.14. This experiment could not be repeated due to non-availability of Hybrid 4.

All the same, for both the counts L.14 has shown better single yarn tenacity and breaking elongation than the other two blends, L.12 and L.13, which do not differ much from each other. While their end breakage rates for 60s count are equal, L.13 has recorded a slightly lower value for 50s count.

The study of medium staple varieties of Maharashtra cottons includes Laxmi, B.1007 and L.147. Of the three, Laxmi has been processed in 1980 and the other two were processed during the reporting year — all the three being spun to 40s and 30s counts.

The yarn properties of 40s and 30s counts spun under the short preparatory system are reproduced in Table 20.

TABLE 20 : YARN PROPERTIES OF LAXMI, B. 1007 AND L. 147

Variety	Laxmi		B.1007		L.147	
FQI	73.0		68.2		69.6	
Nominal count	40s	30s	40s	30s	40s	30s
Corrected CSP	2046	2183	1771	1962	1768	1914
Single yarn tenacity (g/t)	13.1	13.9	11.7	12.5	12.2	12.7
Breaking elongation (%)	7.1	7.5	5.6	6.0	5.5	6.0
U%	16.4	16.0	16.5	16.1	17.9	16.9
Neps/100m	142	112	162	146	170	130

The yarns spun from Laxmi were superior to those from B.1007 and L.147 for both the counts. The latter two did not differ in respect of 30s counts; but the 40s count yarn spun from both the varieties was sub-standard. Hence, it was decided to spin the blends of these two varieties to 30s and 20s counts. Accordingly the following three blends were processed :

Blend Code No.	*Laxmi*	*B.1007*	*L.147*	*FQI*
AD3. M.4	50	30	20	73.7
AD3. M.5	20	50	30	70.8
AD3. M.6	30	20	50	68.2

The processing of M.4 and M.5 has been completed, while M.6 is under process. The results are being compiled.

Blending of Cotton with Man-made Fibres

During the period under report, the study was extended to the quality of yarns spun from flat strips produced during conventional processing of different blends of polyester and viscose. The study was confined mainly to the examination of the feasibility of using blend

waste as such, for open-end spinning instead of mixing the same in the original mix, which might affect the quality.

With this in view, five samples of flat strips, varying in blend compositions, were procured from two local mills. These were processed in blow room and card at optimum conditions to produce 0.14 hk sliver. The hk carded sliver was then given two passages on draw frame to produce 0.15 hk sliver and 20s yarn was spun on open-end spintrainer. The rovings were also prepared from the finisher head draw frame sliver in the case of some samples and spun on ring frame to compare the yarn characteristics with that of open-end spun yarns. The yarn test results are given in Table 21.

TABLE 21 : YARN PROPERTIES OF OPEN-END AND RING-SPUN YARNS FROM FLAT STRIPS

Samples	1		2		3		4		5	6
Blend Composition	15%P : 85%V		15P% : 85%V		67%P : 33%V		67%P : 33%V		48%P : 52%V	15%P 85%V
Spinning System	OE	Ring	OE	Ring	OE	Ring	OE	Ring	OE	OE
Nominal count — tex	30s	30s	30s	30s	20s	20s	15s	15s	30s	30s
— Ne	20s	20s	20s	20s	30s	30s	40s	40s	20s	20s
Yarn tenacity — mN/tex	83	119	109	144	152	223	143	208	105	78
— gf/tex	8.5	12.1	11.1	14.7	15.5	22.7	14.6	21.2	10.7	7.9
Breaking elongation (%)	10.4	10.2	12.6	13.1	11.6	12.3	10.8	11.1	13.4	9.2
CV (%) of ST strength	11.1	12.5	7.8	9.4	9.8	9.8	12.3	14.4	10.3	10.9
U%	11.3	12.3	11.2	10.5	11.9	12.1	12.2	12.4	12.1	12.8
Thin places/100m	0	0	0	0	0	0	0	1	1	2
Thick places/100m	6	18	1	1	2	4	2	6	5	10
Neps/100m	36	67	11	10	10	14	18	23	29	51
YQI	6.3	8.0	10.0	14.7	12.1	18.5	10.3	15.2	9.5	4.5
Drop in tenacity (%)	29.8		24.5		31.7		31.1	—		—

P — Polyester. V — Viscose staple.

Spinning of flat strips with different proportions of polyester and viscose and different length-fineness combinations produced yarns of satisfactory regularity and extension values compared to ring spun yarns from the same material. The main advantage of OE spinning in the case of man-made fibre blends seems to be with productivity, without much advantages in terms of regularity and extension, but with a significant drop in strength.

In addition, the card slivers from the various blends were analysed for actual blend composition.

Studies on the Elastic Moduli and Elastic Recovery Properties of Cotton/Polyester Blends

The present report discusses the effect of chemical modifications on tensile recovery properties and analyses the relationship of dynamic modulus with recovery properties, such as immediate elastic recovery (IER) and work recovery (WR). Dewaxed and kier-boiled leas of L.147 cotton sample (30s) constituted the control sample (DK). This control sample was subjected to the following chemical treatments : (i) slack mercerization (DKMS), (ii) mercerized and then stretched to 92% of the original length (DKM—8%), (iii) mercerized and then stretched to original length (DKMO), (iv) mercerized and then stretched to 103% of original length (DKM+3%), (v) crosslinking treatments with HCHO of 1% (XH1%), 3% (XH3%) and 5% (XH5%) concentrations, and (vi) crosslinking treatments with DMDHEU of 1% (XD1%), 3% (XD3%) and 5% (XD5%) concentrations. Form 'W' process was employed for HCHO treatments while pad-dry cure procedure was adopted for DMDHEU treatment. Yarn geometry was maintained the same during both the crosslinking treatments by carrying out treatments on samples wound over a special frame.

Pulse propagation meter PPM-5 was used to determine the dynamic modulus under a load of tex/2 g. IER and WR were determined from the stress-strain curves of yarn obtained on the Instron Tensile Tester. Three different strain levels (20%, 40% and 60% of the breaking extensions) were studied in the case of mercerized samples, while two strain levels (40% and 60% of breaking extensions) in the case of crosslinked samples. The gauge length of 50 cm was used and the rate of extension was 5cm/mt.

Table 22 summarises the results on mercerized samples. Slack mercerization reduced the modulus considerably (from 73.2 g/d to 34.9 g/d) evidently on account of decrystallisation. However, stretch given during mercerisation enhanced the modulus value. At 3% (DKM+3%) stretch, the modulus was about 30% over that of control. A similar trend was shown by the IER and WR taken at all the three strain

levels. It was quite evident that the dynamic modulus was highly correlated with IER and WR at all strain levels.

TABLE 22 : DYNAMIC MODULUS AND ELASTIC RECOVERY DATA ON MERCERISED SAMPLES

Sample	Dynamic Modulus (g/d)	IER %			WR %		
		at 20%	at 40 %	at 60%	at 20%	at 40%	at 60%
DK (Control)	73.2	61	51	45	46	36	31
DKMS	34.9	46	33	27	30	21	16
DKM—8%	56.4	56	43	40	42	29	27
DKMD	82.0	70	62	57	60	44	41
DKM + 3%		71	64	59	59	47	44
Regression coefficient with Dynamic Modulus	—	0.98	0.98	0.98	0.96	0.99	0.98

The results on yarns crosslinked with DMDHEU and HCHO of various concentrations are given in Tables 23 and 24. There is pronounced increase in modulus as the concentration increased, showing that the treatments have led to increase in structural rigidity of the fibre. The IER and WR also show progressive increase with the severity of crosslinking. In both the cases of treatments, very high correlations exist between dynamic modulus and IER as well as dynamic modulus and WR.

TABLE 23 : DYNAMIC MODULUS AND ELASTIC RECOVERY DATA ON DMDHEU TREATED SAMPLES

Sample	Dynamic Modulus (g/d)	IER %		WR%	
		at 40%	at 60%	at 40%	at 60%
DK (Control)	73.2	51	45	36	31
XD1%	74.4	69	60	54	46
XD3%	102.6	78	76	68	59
XD5%	119.2	81	80	72	66
Regression coefficient with Dynamic Modulus	—	0.99	0.98	0.99	1.00

TABLE 24 : DYNAMIC MODULUS AND ELASTIC RECOVERY DATA ON HCHO TREATED SAMPLES

Sample	Dynamic Modulus (g/d)	IER %		WR %	
		at 40%	at 60%	at 40%	at 60%
DK (Control)	73.2	51	45	36	31
XH1%	96.5	68	56	47	36
XH2%	106.2	73	61	54	43
XH5%	111.6	77	70	61	51
Regression coefficient with Dynamic Modulus	—	0.99	0.95	0.99	0.98

Studies on Mechanical Properties of Cotton Fabrics

(a) Effect of Fabric Assistance on the Abrasion Resistance

During the period under report, five grey fabric samples from different mills were tested for various fabric properties. They were then tested for flex-abrasion (Stoll method). The test results are given in Table 25.

TABLE 25 : VALUES OF ABRASION RESISTANCE FOR DIFFERENT FABRIC SAMPLES

Sample	Fabric construction		Count		Abrasion resistance in cycles-Warp-way		Difference between col. 6 & 7 as percentage of col. 6	Abrasion resistance in cycles-Weft-way		Difference between col. 9 & 1 as percentage of col. 9
	Ends	Picks	Warp	Weft	Control	After removing crossing threads		Control	After removing crossing threads	
1	2	3	4	5	6	7	8	9	10	11
1	59	58	16.4	18.3	4352	1218	72	3152	545	83
2	63	57	21.0	20.0	2318	737	68	2264	727	68
3	61	57	18.9	22.0	2855	1511	47	2821	249	91
4	90	84	61.4	62.2	2358	879	64	2611	671	74
5	65	58	20.1	19.8	1623	466	71	1416	441	69

It was observed that the values of flex-abrasion test for the ravelled strips (from which the crossing threads were removed) were considerably less than the control sample in both the directions.

(b) *Comparative Study of Tests for Tearing Strength*

During the period, three more samples of grey fabrics (plain weave) in the count range 60s to 80s were selected and tested for tearing strength using : (i) Elmendorf Tear Tester, (ii) Ballistic Tear Tester, and (iii) Tongue Tear Tester. The test results together with those of 12 samples tested earlier are given in Table 26. The statistical analysis of the test results of these samples has since been carried out.

TABLE 26 : DATA ON COUNT, CONSTRUCTION AND TEARING STRENGTH OF COTTON FABRICS

Sample No.	Count		Construction		Thickness (mm)	Tearing Strength Test					
						Elmendorf		Ballistic		Tongue	
	Warp	Weft	Ends per inch	Picks per inch		Warp-way (kg)	Weft-way (kg)	Warp-way (kg)	Weft-way (kg)	Warp-way (kg)	Weft way (kg)
1.	15.2	15.0	59	45	0.35	3.347	2.547	2.22	1.85	5.67	4.99
2.	15.7	17.8	54	51	0.25	3.316	3.316	2.50	2.19	5.53	5.53
3.	15.9	17.5	51	51	0.29	3.622	3.098	2.33	2.02	6.12	4.94
4.	16.5	16.8	52	53	0.27	3.648	3.731	2.20	2.07	4.26	5.13
5.	19.1	22.4	60	57	0.32	2.837	2.464	2.17	1.73	5.58	4.67
6.	21.8	29.3	55	45	0.17	1.810	1.110	1.42	0.88	3.18	1.81
7.	26.1	30.0	60	63	0.27	2.485	1.760	1.73	1.64	4.76	4.40
8.	26.6	17.4	52	42	0.23	4.069	3.280	2.97	2.62	4.40	5.22
9.	26.6	30.0	60	64	0.26	2.475	1.952	1.71	1.55	4.40	4.22
10	27.0	30.3	62	66	0.28	2.688	1.555	1.60	1.69	4.85	4.67
11.	30.0	36.3	90	81	0.26	1.542	1.088	1.38	0.91	3.63	2.59
12.	34.6	41.9	73	72	0.23	1.909	1.237	1.36	0.89	3.63	2.86
13.	60.7	78.1	69	65	0.20	2.406	1.370	1.20	1.07	2.95	2.36
14.	78.6	80.6	59	52	0.11	2.125	1.766	1.35	1.31	3.17	2.95
15.	71.0	68.6	62	55	0.10	2.470	2.112	1.43	1.30	3.31	2.63

The correlation coefficients worked out between the tearing strength values obtained by the different instruments are given in Table 27.

It was observed from Table 27 that the correlation between the values obtained from the three Tear Testers have been found to be highly significant in both the directions.

The correlation between Elmendorf Tear Tester and Ballistic Tear Tester was of higher order compared to the correlation between Elmendorf and Tongue Tear Tester, and Ballistic and Tongue Tear Tester. This may be due to the different principles underlying in each of these instruments. Further, the low values of correlation coefficients in the

warp direction compared to that in the weft direction in all the three cases may be due to the influence of the cloth cover factor.

TABLE 27 : CORRELATION COEFFICIENTS OF TEST DATA FROM DIFFERENT TYPES OF TEARING STRENGTH TESTERS

S. No.	Tearing Strength Testers	Correlation Coefficient (N = 15)
1.	*Elemendorf and Ballistic*	
	Warp-way	0.9035**
	Weft-way	0.9258**
2.	*Elmendorf and Tongue*	
	Warp-way	0.6507**
	Weft-way	0.8605**
3.	*Ballistic and Tongue*	
	Warp-way	0.7185**
	Weft-way	0.9204**

** Significant at 1% level.

Studies on Absorbancy of Indian Cottons

Maturity values of 30 varieties of cotton were determined by the Sodium Hydroxide Method during the period so as to ascertain the relationship between absorbancy and fibre maturity of cottons.

The general trend was that when the percentage of immature fibres was higher, the water holding capacity of the sample was lower.

Study on Cotton and Cotton Blended Fabrics Treated with Mixtures of Resins

The resin finishing treatment on mixed catalyst system having 0.5% inorganic salt and 0.5% organic acid was carried out on scoured, bleached and mercerised cotton fabrics. The crosslinking reagent used was DMDHEU (10%), with Vasarang PE softener (2%) and non-ionic wetting agent (0.1%). The resin finished fabrics were cured at two different temperatures of 140°C and 160°C for 4 min and 3 min, respectively. Conventional treatment was also carried out using DMDHEU as crosslinking reagent, keeping curing time and temperature the same as above.

Physical and chemical properties of treated fabrics along with untreated control were determined. It was observed that the cotton fabric in the mixed catalyst system (0.5% of an inorganic salt + 0.5% of an organic acid) and cured at 140°C showed slightly lower wrinkle recovery angle (dry) and higher breaking and tearing strength retentions

compared to the sample cured at 160°C. However, the samples cured at both the temperatures (140°C and 160°C) showed higher breaking strength and tearing strength retentions than those treated by the conventional process.

Further treatment on cotton fabric was carried out using DMDHEU as crosslinking reagent and a mixture of an inorganic salt (2.5%) and an organic acid (1.0%) as catalyst. Curing was done at 140°C. Physical and chemical tests on these samples are in progress.

Work on single step poly-set process was continued during the period to confirm earlier observations. It is proposed to patent this work, shortly.

Studies on Migration of Crosslinking Resin Finishes During Durable Press Finishing Treatment of Cotton and Cotton Blended Fabrics

Work during the period was mainly confined to the study of the effect of mixed catalyst system on migration of resin during crosslinking treatment. Cotton and cotton : terene (33 : 67) blended fabric samples were padded with 10% DMDHEU solution in the presence of mixed catalysts of two different concentrations, viz. 2% and 3.5%, of an inorganic salt and an organic acid, respectively. These padded samples were dried at 60°C for different periods varying from zero to 60 minutes and cured subsequently at 140°C for 10 minutes. The crosslinked samples were analysed for moisture and nitrogen contents.

It was observed that in the case of samples crosslinked in the presence of 2% mixed catalyst, the rate of drying was much higher for cotton : terene blended fabric samples as compared to cotton fabric samples dried for the same period. Results also indicated that the migration of resin was comparatively low in the case of blended fabric samples.

Analysis of the samples treated in the presence of 3.5% mixed catalyst is in progress.

Studies on Distention Index and Distribution of Crosslinks in Mercerised and Crosslinked Cotton

Cotton yarn samples mercerised under the following conditions were received from Prof. Hebeish, Cairo, Egypt, and were crosslinked with formaldehyde in 'D' and 'W' bath :

1. Scoured
2. Slack followed by 90% stretch
3. ,, ,, 94% ,,
4. ,, ,, 96% ,,
5. ,, ,, 100% ,,
6. ,, ,, 103% ,,

Crosslinked samples were studied for various properties like strength, elongation, formaldehyde content and distention Index. The results are being analysed.

Studies on Grafting of Vinyl Monomers onto Cotton Fabric

In order to accomplish uniformity in grafting treatment, a special frame was designed to be used during further grafting treatment on cotton fabrics. The fabrication work is completed.

Electron Microscopical Investigation of Dye Diffusion and Dye Aggregation in unmodified and modified Cottons

Layer expansion and fibrillation studies were carried out on cotton dyed with Pd and Ce metallized azo dyes. The observations in respect of unmodified and modified cottons are summarised below alongwith other observations :

(a) *Unmodified Cotton*

The relatively large inter-lamellar spaces and surfaces of lamellar bundles were the places of growth of most of the bigger crystalline and non-crystalline aggregates. The ultimate localisation of dye molecules, depending upon the size of the dye molecules, takes place on the disordered regions of the elementary fibril. The inter-elementary fibrillar space being of the order of 15Å - 20Å is not accessible to the dye molecules.

(b) *Modified Cotton*

A large number of dye aggregates of different sizes, some of them crystalline in nature, were observed in the case of mercerized fibres. Cyanoethylated and benzoylated fibres with low DS also showed a similar pattern of dye aggregates. At higher DS, however, there was a reduction in the number of aggregates formed. In the case of benzylated cotton (both low and high DS), only very few dye aggregates were observed. This could be due to the very high steric hindrance of the benzyl group which may prevent the diffusion of the dye molecule.

(c) *The Single Crystals of Dyes in Cotton Fibres*

The single crystals of dyes observed under both layer expansion and fibrillation of dyed fibres were distinguished by sharp edges and regular geometric shapes. Their dimensions were of the order of 600Å - 1500Å. The ED study of these crystals gave typical diffraction patterns of the respective single crystals of the dyes.

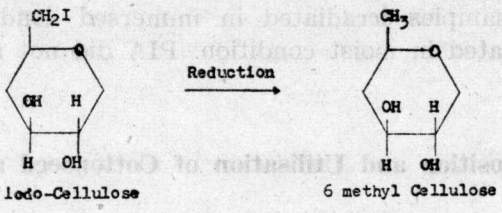
(d) *Pores in Cotton Fibres*

Although much is mentioned in literature about pores in cotton fibres, the information about their shape, size, tortuosity, etc. is scanty In the present study, a direct evidence of the existence of micropores has been obtained. Numerous bright spaces which could be ascribed to pores surrounded by dyed regions were observed in the electron micrographs of some of the macro-and micro-fibrils of Pd dyed cotton fibres. The shape of these bright areas varied from near circular to elliptical. The ellipticity was found to be in the range of 0.7 — 0.9. The size of these pores varied from 25Å — 175Å and the maximum number of pores were found to be in the range of 25Å — 50Å. These pores or capillary channels were made visible in the electron micrograph by virtue of the dyed amorphous outerlining.

Synthesis of Cellulose Derivatives with Unusual Functional Groups

Iodo-cellulose prepared from tosyl-cellulose was analysed for iodine content by Schoniger's method.

The next step was to reduce iodo-cellulose to 6 methyl cellulose.



Iodo-Cellulose 6 methyl Cellulose

Trials were carried out to achieve reduction using various methods given below :

1. Shaking with sodium borohydride for 72 hr in water and in acetone.
2. Shaking with zinc and hydrochloric acid for 24 hr and 48 hr.
3. Shaking with zinc and acetic acid for 72 hr at room temperature and 24 hr at 60°C.

The absence of iodine was tested by Sodium Fusion Method.

As the above mentioned common reducing agents, which are effective for pure organic compounds, failed in the case of reduction of iodo-cellulose, catalytic hydrogenation with Palladium Chloride will be tried.

Analysis and Grading of Cotton Linters

Linters of nine varieties, viz. Khandwa 2, G. Cot.10, L.147, Varalaxmi, J.34, Nimkar, Deviraj, Laxmi and C. Indore 1, were analysed for α- cellulose, ash and iron content.

The method for the spectrophotometric determination of iron content was standardised.

Pre-cleaning and pre-washing of raw linter samples were carried out to reduce ash and iron content. The colour developed during Bottle Acetylation Test was measured in terms of Hazen Units using Lovibond Comparator.

The ash, iron content and the colour developed during Bottle Acetylation Test were low in the case of all linter samples mentioned above.

Irradiation of Cellulose in the Presence of Various Probable Radiosensitive and Radio-protective Chemicals

Cellulose in the form of cotton yarn was soaked in water, Methanol, Ethanol, Iso-propanol, n-Butanol, Tert. Butanol and Eethylene Diamine and then irradiated in moist condition to a total dosage of 1.457×10^7 Rads. Strength and Post-Irradiation Activity (PIA) of these samples were determined. It was observed that the tenacity retained in the case of samples irradiated in immersed condition was higher than those irradiated in moist condition. PIA did not show any definite trend.

Studies on Composition and Utilisation of Cottonseed and Similar Plant Seeds

Oil was extracted from 22 glandless varieties of cottonseed using solvent extraction method and the determination of fatty acid composition by conversion to methyl esters as per AOCS Method was underway using GLC with flame ionisation detector and FFAP Stainless Steel Column.

Six cottonseed varieties grown at four different locations were collected to study the effect of environmental conditions on fatty acid composition.

Seeds of two varieties of Kapok were obtained from the Director, School of Genetics, Coimbatore, and were analysed for oil, protein, gossypol, etc. The analysis of fatty acids by GLC is proposed to be taken up, shortly.

Studies on the Release of Gossypol from Cottonseed Meal in Fermentation Medium

It has been shown earlier, that free gossypol was released during the amylase fermentation by *Bacillus subtilis* — 159 when it was grown on cottonseed meal as a nitrogen source. However, this organism produces weak protease which is responsible for the hydrolysis of protein in the meal and thereby releases bound gossypol in a free form. Since cottonseed meal is used as nitrogen source in various fermentations it is possible that free gossypol may be released in the fermentation broth. To study this possibility, two standard strains of *B. subtilis* and a strain of tetracyclin producing *Streptomyces aureofaciens* were selected. Preliminary standardisation of media, assay methods., etc. were completed.

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

Methods for the estimation of ash, lignin, cellulose, hemi-cellulose, alcohol-benzene extract and water solubles in cotton seed hull were standardized. About 20 kg cottonseed hull procured from M/s. Liberty Oil Mills was ground into particles of different mesh size and few samples of lamination boards were prepared from these particles. These samples are being tested for various physical and chemical properties.

Studies on the Biosynthesis of Cellulose by Micro-organisms and Higher Plants

As was done last year, the study on cellulose biosynthesis continued in two systems : (a) developing cotton fibres and (b) micro-organism, *Acetobacter xylinum.*

(a) Developing Cotton Fibres

Enzymatic synthesis of cellulose in developing cotton fibres of Laxmi and Suvin varieties was studied using unlabelled Uridine-diphosphoglucose (UDPG) as well as labelled UDP-C^{14}-glucose as substrates. The Laxmi and Suvin varieties of cotton were grown in pots and fresh bolls were collected 10, 15, 20, 30, 40 and 50 days from the date of flowering. Cellulose synthesizing enzyme(s) was extracted from the fibres at each stage of development and incubated with 10μl (0.5 μci) of UDP-C^{14}-glucose along with unlabelled UDPG. The incorporation of radioactivity in alkali-insoluable product (cellulose) was determined on scintillation counter; the radio-activity was expressed as counts per minute (cpm). Earlier results have shown that

the enzyme activity reached its peak at 15 days post-anthesis. This was followed by a drop in the activity after 20 days. The activity again increased around 30-40 days post-anthesis followed by a second drop in the activity. The enzymatic synthesis of cellulose using UDP-C^{14}-glucose has shown a similar trend for Laxmi variety. Studies on the Suvin variety are in progress.

Studies were also carried out simultaneously to find out the types of free amino acids present in cottonseed kernel of Laxmi variety.

(b) Acetobacter xylinum

Studies were undertaken to observe whether *A. xylinum* forms any soluble polymer(s) when grown on carbon sources other than glucose. *A. xylinum* was grown in a medium containing yeast extract, peptone and xylose or fructose as carbon source for four days and the filtrate was collected by centrifugation at 10,000 rpm. To the clear filtrate, alcohol was added to 60% final concentration and the precipitate formed was collected by centrifugation at 12,500 rpm. It was dissolved in water and dialized against water for 48 hr and finally, the material was liophilized to powder form which was preserved for further studies.

Fermentation Studies on Cellulase Production and Its Applications

Penicillium funiculosum is a well known cellulase producer, but it is extremely weak in pectinase enzyme. An application of this organism was found in the separation of pectin from the peals of some citrus fruits.

The orange or lemon peels were cut into small pieces and added to Mandels *et al* medium and inoculated with the organism. The organism grew on the cellulose in the peels and disintegrated them completely. The growth of the organism and other insoluable materials from the medium were filtered. The filtrate contained pectin which was precipitated with alcohol.

Studies were conducted on the mutation of *P. funiculosum* by UV irradiation. Three mutants isolated had higher cotton (C), CM-cellulase (CMC) and FP activity as compared to wild strain. However, the mutants produced slightly lower beta-glucosidase activity. To improve their ability in the production of beta-glucosidase the mutants were further irradiated with UV and ten secondary mutants were isolated and these mutants were tested for C, CMC, FP and beta-glucosidase activities. Out of these secondary mutants, two isolates showed extremely higher beta-glucosidase activity.

Studies on Enzymatic and Acid Hydrolysed Cotton Cellulose

Purified cotton sample was treated with cellulase enzyme of *Penicilium funiculosum* for various intervals ranging from one day to seven days, continuously. The reducing sugar and percent weight loss as a result of enzymatic hydrolysis was determined to ascertain the degree of hydrolysis of cotton cellulose. It was observed that the reducing sugar and the percent weight loss increased progressively with duration of enzymatic hydrolysis only up to three days. During this period, the reducing sugar increased from 180 μg/ml for one day hydrolysis to 390 μg/ml for three days hydrolysis with percent weight loss of 1.2 and 6.7, respectively. After three days hydrolysis, the reducing sugar remained more or less constant at 330 μg/ml with 4.2 weight loss for rest of the period (fourth to seventh day). This showed that cellulase enzyme was highly active on the substrates only for three days.

Cotton samples were also treated with the enzyme continuously for three days. After this period, the substrate was again treated repeatedly with fresh solution of the enzyme at the interval of 24 hr for a further period of three days. The reducing sugar obtained at the end of the repeated period was around 350 μg/ml, which was practically the same as that obtained at the end of three days of continuous treatment. This indicated that treatment with fresh enzyme after every 24 hr did not lead to drastic hydrolysis. Therefore, it was decided to treat cotton samples with cellulase enzyme for three days at a stretch and then replace the solution by fresh enzyme and continue the treatment for the next three days. In this way, cotton samples were treated with cellulase enzyme for 21 days. Simultaneously, a sample treated continuously for 21 days was also prepared. The reducing sugar produced as a result of repeated enzyme hydrolysis for three days at a stretch increased from 400 μg/ml at the end of the first cycle to 2890 μg/ml at the end of the seventh cycle. The corresponding increase in weight loss was from 7% to 32%, respectively. In the case of the continuous enzyme treatment for 21 days, on the other hand, the reducing sugar was only 900 μg/ml with 14% weight loss.

Enrichment of Cattlefeed by Microbiological Methods

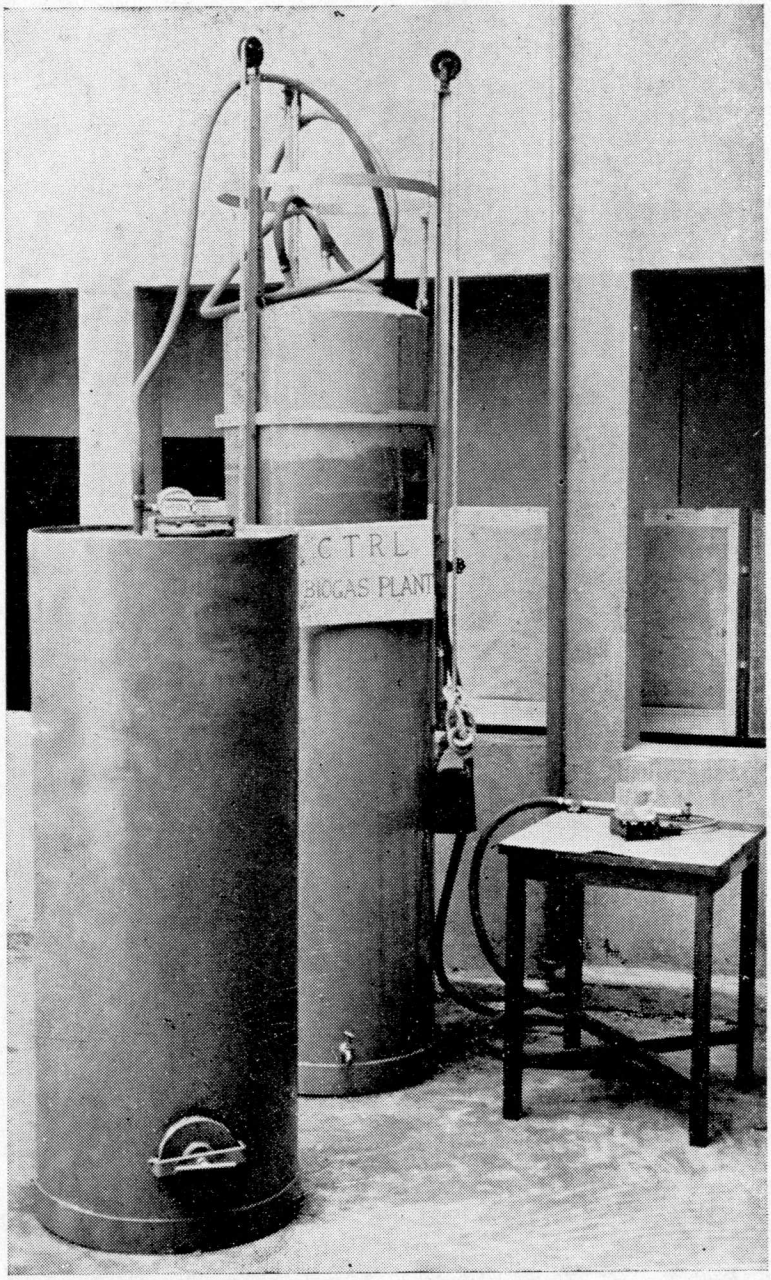
Enrichment of a few post-harvest agricultural waste materials with microbial proteins was hitherto undertaken on acid hydrolysed and ammoniated substrates. The study was continued to explore the possibilities of enriching crude protein on acid hydrolysed and alkali neutralised substrates as well, using a free living nitrogen fixing micro-

organism. Amongst several free living nitrogen fixing micro-organisms tried, *Beijerinekia mobilis* was found to be the best from the point of view of its wide adaptability to different levels of pH and accumulation of fat droplets inside the cell apart from trapping atmospheric nitrogen. Experiments were conducted in the laboratory using this organism on paddy straw, wheat straw, cotton stalks, tur stalks and groundnut hulls. All these substrates were hydrolysed with 0.5N H_2SO_4 at 121°C for 30 min and then neutralised with 5N NaOH. Actively growing culture of *B. mobilis* was added aseptically and incubated over a period of seven days. Analysis of the samples for crude protein indicated that there was a two-fold increase with paddy straw and groundnut hulls and about one-and-half times increase with other materials. Interestingly, the crude fat percentage rose to about two times in almost all cases. Experiments were also undertaken to enhance the crude protein level further by growing *Pleurotus sajor-caju* — a mushroom fungus — with and without *B. mobilis* and without acid hydrolysis. This method also helped in enhancing the crude protein percentage to almost the same level but the crude fat percentage increase was only 1.5 — 2.0 times. The *in-vitro* rumen digestibility (IVRD) undertaken on these substrates on freshly collected rumen liquor indicated that *P. sajor-caju* enhanced the digestibility to about 150% in the case of cotton stalks, paddy straw and groundnut hulls whereas with *B. mobilis*, it was about 70%.

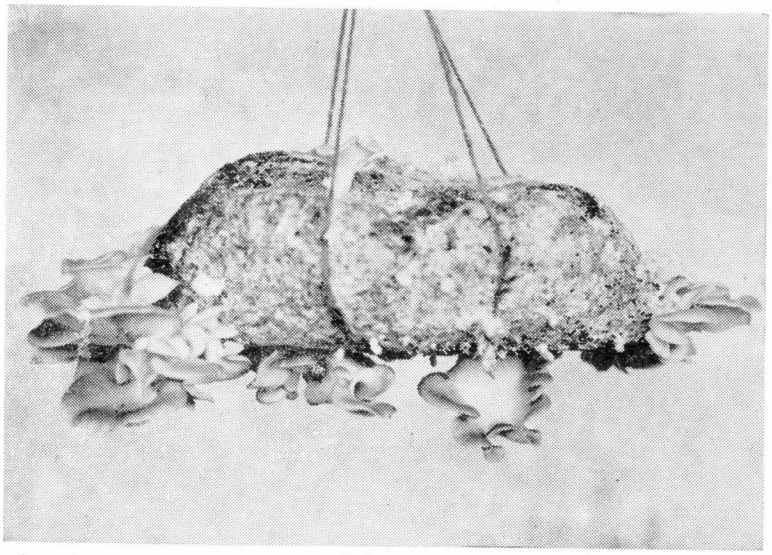
Production of Bio-gas from Cellulosic Wastes from Textile Mills

On the basis of the experience gained in the laboratory trials, an experimental plant for batch type fermentation was designed and fabricated. This has a capacity to handle 100 kg of willow-dust. The plant consists of an anaerobic fermenter and a separate gas holder constructed from galvanized iron sheets. The anaerobic fermentation tank is totally closed except for one opening of 180 mm diameter at the top to feed willow-dust and a similar opening at the bottom for removing the spent slurry. In addition, a gas outlet, a pressure gauge and two inspection windows are also fitted with the tank.

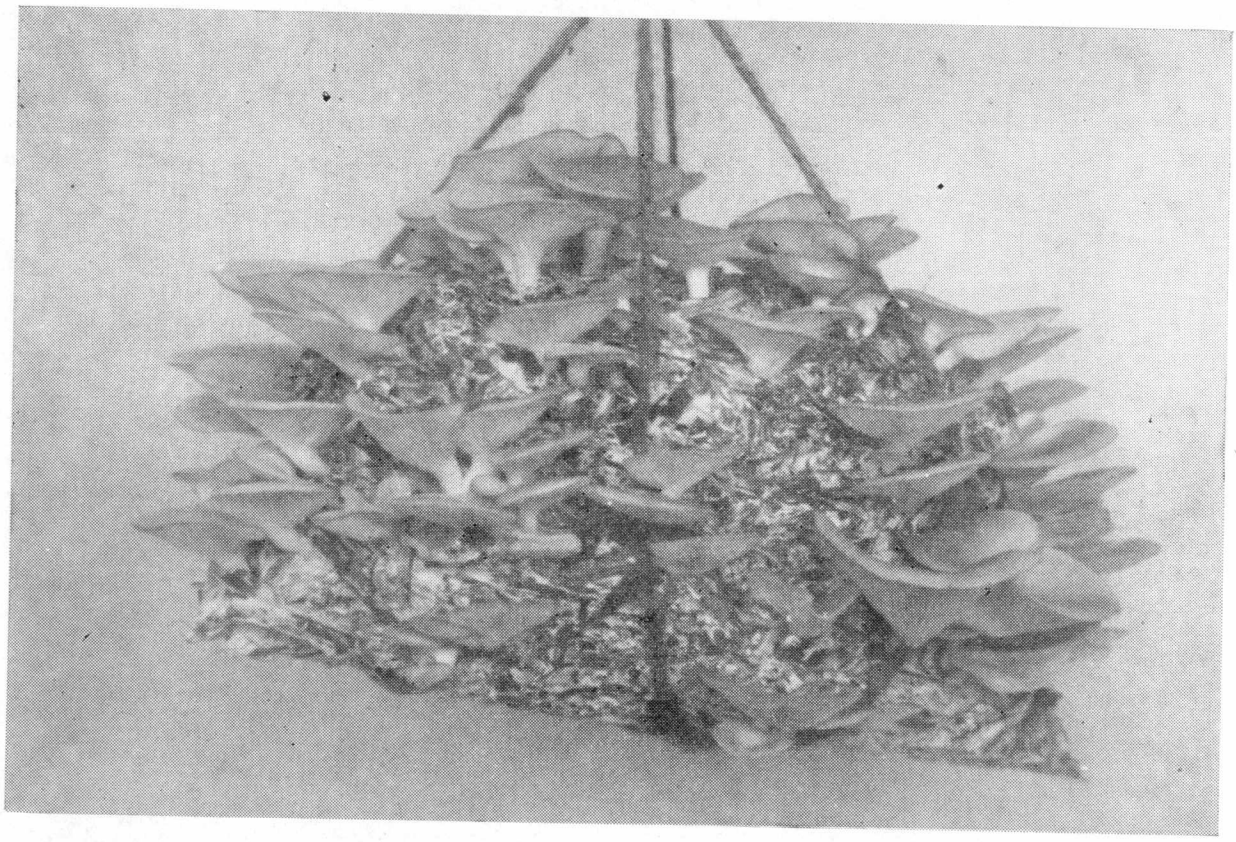
The bio-gas generated in the fermenter is led to the gas holder through flexible rubber hoses. The gas holder is of the floating type designed to store 500 litres of bio-gas over water. The plant is presently in operation producing about 600 litres of biogas daily from 100 kg of willow-dust. Further, it has been observed that there was almost three phases in bio-gas production. The first phase which lasted for 6-7 days comprised the generation of a non-combustible bio-gas rich in carbon dioxide (54%-74%). Then the second phase or the active gas producing phase commenced and continued for a period of one



CTRL Experimental Bio-Gas Plant (see page 66)



Mushroom Grown on Willow-Dust *(see page 67)*



Mushroom Crop on Cotton Stalk *(see page 67)*

month. During this phase, the gas generated was having a methane content of about 55%-60%. The third phase remained as a continuation of the second phase, where production of bio-gas decreased gradually. However, the methane content of the gas went up to 70%. Eventhough 20,000 litres of bio-gas could be produced during the first two months period comprising the second and third phases, 85% of the total gas production (17,000 litres) was confined only to the first 30 days of the second phase.

Analysis of the digested slurry showed an increase in total nitrogen content from 1.5% — 2.0% — 2.5% and in lignin content from 16% to 25%. It seems, therefore, that the slurry will serve as a good source of manure. The high percentage of lignin in the slurry will also help in improving the moistrue retaining capacity in open textured soils.

Studies on the Utilisation of Cellulosic Wastes for the Production of Mushrooms

Amongst the three well known commercially grown mushrooms, *Pleurotus sajor-caju,* commonly called *Dhingri,* is comparatively easier to cultivate and can grow very well even on unfermented materials. An effort was, therefore, made to grow this mushroom fungus on a few cellulosic wastes, viz. willow-dust (a textile mill waste), cotton stalks (available in plenty after the harvest of *kapas*), and cotton seed hulls. In each case, the material was soaked in water overnight and after draining the water, boiling water was added to the soaked material and allowed to remain for 1-2 hr. The water was completely removed thereafter and calcium carbonate (4%) was added only in the case of willow-dust to neutralise the acids produced during the spawn run period. In the other cases (cotton stalks and seed hulls), acid production was not much to lower the pH below 6.5 and hence addition of calcium carbonate was not found necessary. Later, the materials were packed compactly in layers by sprinkling the grain spawn of the mushroom fungus in polythene bags of convenient size with one or two holes at the bottom to drain off the excess water. The bags were tied and incubated at 25°C (spawn run period) for the proliferation of the fungus. When the pin heads started appearing, which took about 15-20 days, the polythene covers were cut open and the mycelial entangled blocks were hung with jute ropes. Water was sprinkled daily to keep the blocks moist. Fruiting bodies were harvested when they just started folding inwards. About 600 g of fleshy fruiting bodies were obtained per kg of willow-dust and cottonseed hulls, while 500 g of fresh mushroom was obtained per kg of cotton

stalks. Experiments are underway to enhance the yield by supplementing inorganic/organic nutrients and also to grow mushrooms on composted material.

Research work done at the Regional Quality Evaluation Units

COIMBATORE

Estimation of Fibre Maturity by Spacer Technique on Micronaire: Last year, 50 cotton samples were tested on Sheffield Micronaire by Spacer Technique and the findings were reported. During this period, 50 more samples were tested on the Keisokki Micronaire (Japan make) at two compressions using two spacers. Results indicated that 9.5 mm spacer was more suitable to predict maturity on this instrument.

Standardisation of Shirley Miniature Spinning Plant: Trials were undertaken to standardise the Shirley Miniature Plant installed, recently. About 40 cotton samples varying in staple length were spun to 30s—80s counts using 4.0 TM. The sliver hank varied from 0.26 to 0.32. Lea strength was generally, on the lower side for all the counts. It is proposed to spin all the cottons using higher TPI. After conditioning the Laboratory, comparative tests will be carried out between this plant and that installed in SITRA, which is already standardised.

DHARWAD

Effect of Soil Salinity on Fibre Quality of Cotton Genotypes: Six genotypes, viz. Bhagya, DB.3-12, JK.125-2-50, SM.88, CPD.35-41 and DS.56, were grown under the three salinity levels of 0.95 (control), 6, and 12 mmhos/cm. Salinity was created by adding NaCl and $CaCl_2$ in the proportion 4 : 1 before sowing and the same level was maintained throughout the crop growth. The analysis of the data revealed that the soil salinity levels did not have significant effect on fibre properties.

HISSAR

Effect of Synthetic Pyrethroids on Fibre quality and Yield of H.777 Cotton: During 1979 to 1981 seasons, an investigation was conducted to study the effect of synthetic pyrethroids (SP) in comparison with Carbaryl on the quality and yield of H.777. It was observed that Decamethrin (0.02 kg ai/ha) was most effective in controlling the incidence of pink bollworm and gave the highest yield. All SP treatments controlled the incidence of pink bollworm as compared to Carbaryl. Decamethrin (0.02 kg ai/ha) and Cypermethrin (0.04 kg ai/ha) treatments produced finer fibres. Other fibre properties were unaffected.

Effect of Picking Interval on Fibre Quality of H.777 and G.27 Cottons: Two varieties H.777 and G.27 were picked from August 15 to November 15, 1981, at the intervals of 15 days and fibre properties were determined for the produce from each pickings. In the case of of G. 27 variety, October-November pickings produced fibres of lower length as well as strength. September pickings proved superior in fibre quality for both the varieties.

INDORE

Fibre and Seed Characters Affecting GP: It has been observed that number of varieties belonging to *G. hirsutum* and *G. arboreum* species have seed index of the same order, but they exhibited variation in GP values. GP is influenced by wt. of lint/seed, no. of fibres/seed, fibre length, volume of seed, etc. It is proposed to examine the influence of these characters on GP, keeping the variation in seed weight at narrow limits. Five varieties each from *G. arboreum* and *G. herbaceum* species were selected and well developed and healthy bolls were collected for each variety from all replications separately for carrying out the above mentioned tests.

NANDED

Influence of Various Formulations of Synthetic Pyrethroids (SP) Treatments on Fibre quality: This trial was conducted at Nanded on Hybrid 4 during 1980-81 season. It consisted of 15 SP treatments including water spray as control. Most of the treatments showed improvement in bundle tenacity and yield. Permethrin (0.016%) produced high yield of 1983 kg/ha as compared to the yield by the control treatment (806 kg/ha).

Influence of Crop Protection Treatment on Fibre Quality: The experiment was laid out in Randomised Block Design to find out the effect of different crop protection treatments in controlling the pest attack on hybrid 4 and NHH.1 varieties. No marked difference in fibre properties was observed due to the treatments. However, maximum protection offered throughout the crop growth was more advantageous for producing higher yield.

3. PUBLICATIONS

During the year 1981, one Annual Report, two Technological Reports, 39 Research Publications and 86 Technological Circulars were issued in addition to seven papers presented at various Conferences.

A. Annual Report

The Annual Report of the Cotton Technological Research Laboratory for the calendar year 1980.

B. Technological Reports

No. 27. Technological Report on Trade Varieties of Indian Cottons, 1979-80 Season.

No. 28. Technological Report on Standard Indian Cottons, 1979-80 Season.

C. Research Publications (CTRL Publication — New Series)

No. 154. A New Method for Achieving Cellulose IV → Cellulose III Lattice Transformation — by P. K. Chidambareswaran, S. Sreenivasan, N. B. Patil and H. T. Lokhande (Reprinted from **Journal of Polymer Science,** Polymer Letters Edition, Vol. 18, 603-606, (1980).

No. 155. Study of Different Methods of Measurement of Fibre Configuration — by I. K. P. Iyer, M. S. Parthasarathy and V. Sundaram (Reprinted from **Journal of Textile Association,** January 1981).

No. 156. The Creep-Time Relationship in Textile Fibres — by G. S. Rajaraman (Reprinted from **Journal of the Textile Association,** January, 1981).

No. 157. Influence of Relative Humidity on the Bundle Tenacity of Wool Fibres — by K. R. Krishna Iyer and K. V. Ananthakrishnan (Reprinted from **Indian Journal of Textile Research,** Vol. 5, 140-142, December 1980).

No. 158. Determination of Fineness and Maturity of Cotton by Air-Flow Methods — by G. S. Rajaraman (Reprinted from **Textile Research Journal,** Vol. 50, No. 12, December 1980).

No. 159. Quantitative Analysis of Polymer Blends Using Breadths of Overlapping X-ray Diffraction Lines — by P. K. Chidambareswaran, S. Sreenivasan, N. B. Patil and V. Sundaram (Reprinted from **Journal of Applied Polymer Science,** Vol. 25, 1825-1831, 1980).

No. 160. Semi-solid Microbial Fermentation of Rice and Wheat Straw for Protein Enrichment and Increased Digestibility — by R. H. Balasubramanya and S. P. Bhatawdekar (Reprinted from **Indian Journal of Agricultural Sciences,** 50(12), 965-970, December 1980).

No. 161. Studies on Grafting of Styrene onto Cotton — by N. Thejappa and S. N. Pandey (Reprinted from **Indian Journal of Textile Research,** Vol. 5, 109-113, December 1980).

No. 162. Influence of Constructional Parameters on the Tensile Properties of Cotton Fabrics — by S. R. Ganatra and V. G. Munshi (Reprinted from **Indian Journal of Textile Research,** Vol. 5, September 1980).

No. 163. Electron Diffraction Studies on Indian silk — by N. V. Bhat, G. S. Nadigar, K. M. Paralikar and S. M. Betrabet (Reprinted from **Journal of Applied Polymer Science,** Vol. 25, 635-640, 1980).

No. 164. Dyeing of Cotton Fibres Decrystallized by Alkali Swelling and Partial Substitution — by P. Bhama Iyer, K. R. Krishna Iyer, N. B. Patil and I. G. Bhatt (Reprinted from **Journal of Applied Polymer Science,** Vol. 25, 2235-2240, 1980).

No. 165. Effect of Gamma-Ray Irradiation on Raw and Chemically Treated Cotton Cellulose — by V. Sundaram, I. G. Bhatt and P. K. Chidambareswaran (Reprinted from **Proceedings of Symposium on Industrial Polymers and Radiation,** held at Sardar Patel University, Vallabh Vidyanagar, Gujarat during February 12-14, 1979).

No. 166. Synthesis of Propargyl Cellulose — by I. G. Bhatt, V. Iyer V. Sundaram (Reprinted from **Indian Journal of Textile Research,** Vol. 6, 43-44, March 1981).

No. 167. Technological Performance of Improved Varieties of Cottons in Tamil Nadu — by M. S. Parthasarathy (Reprinted from **Journal of Indian Society for Cotton Improvement,** Vol. V, 1980).

No. 168. Quality Characteristics of New Hybrids in Karnataka — by P. G. Oka, M. S. Sitaram and B. Srinathan (Reprinted from **Journal of Indian Society for Cotton Improvement,** Vol. V, 1980).

No. 169. Technological and Economic Performance of Some Improved Varieties Developed for Rice Fallows in Tamil Nadu to Replace MCU.7 — by A. K. Antony, S. V. Nayar, C. P. Venugopalan and S. Kamalanathan (Reprinted from

Cotton Development Journal, Vol. 10, Nos. 3-4, October 1980 and January 1981 issue.)

No. 170. Particle Boards from Cotton Stalks — by S. N. Pandey and A. K. Mehta (Reprinted from **Research and Industry,** Vol. 25, 67-70, June 1980).

No. 171. Release of Gossypol from Cottonseed Meal in Fermentation Medium — by V. G. Khandeparkar (Reprinted from **Indian Journal of Experimental Biology,** Vol. 19, 574-576, June 1981).

N. 172. Production of Bio-gas from Willow-dust by a Batch Fermentation Process — by R. H. Balasubramanya, V. G. Khandeparkar, S. M. Betrabet and V. Sundaram (Reprinted from **Journal of Textile Association,** July 1981).

No. 173. Comparative Study of the Properties of Differently Decrystallized and Crosslinked Cotton Fibres — by P. Bhama Iyer, K. R. Krishna Iyer and N. B. Patil (Reprinted from **Journal of Applied Polymer Science,** Vol. 25, 2951-2959, 1980).

No. 174. Comparison of Yarn Tenacities at 500 mm and 12 in Gauge Lengths — by V. Sundaram, S. Ramanathan and K. R. Krishna Iyer (Reprinted from **ISI Bulletin,** Vol. 31, No. 4, 107, 1979).

No. 175. Improved Durable-Press Cotton by a Two-Step Poly-Set Process, Part II : Crosslinking of Cotton Cellulose with Dimethylol Dihydroxy Eethylene Urea — by S. N. Pandey and Prema Nair (Reprinted from **Textile Research Journal,** Vol. 51, No. 5, May 1981).

No. 176. Textile Properties of Styrene Grafted Cotton Yarn — by N. Thejappa and S. N. Pandey (Reprinted from **Textile Trends,** July 1981).

No. 177. Relationship between Skein Strength and Single Strand Strength and Estimation of Spinning Performance of Cotton from Single Strand Strength—by D. V. Mhadgut (Reprinted from **Journal of Textile Association,** September 1981).

No. 178. Cotton-Jute-Blending: Changes in Blend Composition During Processing — by M. S. Parthasarathy, B. Srinathan, S. Sreenivasan, P. K. Chidambareswaran and V. Sundaram (Reprinted from **Textile Research Journal,** Vol. 51, No. 2, February 1981).

No. 179. Clarification of Lime Juice by Cellulase of *Penicillium funiculosum* — by S. P. Bhatawdekar (Reprinted from

Journal of Food Science and Technology, Vol. 18, 207-208, September-October 1981).

D. Papers Presented at Conferences/Seminars

1. Some Studies on the Rieter Open-end Spintrainer — by M. S. Parthasarthy and B. Srinathan (Presented at the Twentysecond Joint Technological Conference of BTRA, ATIRA and SITRA held at ATIRA, Ahmedabad, on February 2 and 3, 1981).
2. Study on Fatty Acid Composition of Indian Cotton Seed Oil — by S. N. Pandey and N. Thejappa (Presented at Thirtysixth Annual Convention and Symposium on "Processing on Oilseeds, Oils, By-products, Derived products, Techno-Economic Aspects", held at Oil Technologists' Association of India, Hyderabad, on February 14 and 15, 1981).
3. Effect of Cellulase on the Morphology and Fine Structure of Cellulosic Substances — SEM and X-ray Diffraction Studies — by S. M. Betrabet, K. M. Paralikar and N. B. Patil (Presented at the Thirteenth Annual EMSI Conference held at Indian Institute of Science, Bangalore, on February 16-18, 1981).
4. Need for Flame-proof Textiles—by I. G. Bhatt and V. Iyer Presented at Sixth International Conference of Women Engineers and Scientists held at Indian Women Scientists' Association, Bombay, during September 7-12, 1981).
5. Spinning of Polyester-Viscose Blends on Rieter Open-end spintrainer — by B. Srinathan, T. N. Ramamurthy Rao and M. S. Parthasarathy (Presented at the Seminar on Rotor Spinning held at Department of Textile Technology, IIT, New Delhi, on September 11 and 12, 1981).
6. Studies on Blends of Indian Cottons with Polyester Fibres — by M. S. Parthasarathy, B. Srinathan and V. Sundaram (Presented at the International Textile Conference — 1981 of Textile Association, India, held at Bombay, during November 18-20, 1981).
7. Durable Flame Retardant Finishes for Cotton — by V. Iyer, I. G. Bhatt and V. Sundaram (CTRL), and S. N. Bailey, G. R. Phalgumoni and B. R. Manjunatha (Textile Committee), (Presented at the Symposium on "Flame Retardant Finishes of Textiles — State of Art in INDIA", held at BTLA, Bombay, on December 10 and 11, 1981).

E. Technological Circulars on Trade Varieties of India Cottons

T.C. No.	Variety	Place	T.C. No.	Variety	Place
		1979-80 Season			
2069	L. 147	Kinwat	2078	Jayadhar	Hubli
2070	Varalaxmi	Avanashi	2079	Laxmi	Hubli
2071	Digvijay	Banaswada	2080	Bhagya	Haveri
2072	Laxmi	Hubli	2081	Buri 147	Nagpur
2073	Varalaxmi	Raichur	2082	B. 1007	Nagpur
2074	Suvin	Guntur	2083	Nimbkar	Nagpur
2075	Digvijay	Jumbsuk	2084	Hybrid 4	Nagpur
2076	Jayadhar	Hubli	2085	Suyodhar	Jamkhandi
2077	Laxmi	Hubli			
		1980-81 Season			
2086	Bengal Desi	Sriganga-nagar	2112	SRT. 1	Jalgaon
2087	Sanjay	Botad	2113	Virnar	Udaipur
2088	Narmada	Burhanpur	2114	H. 777	Sirsa
2089	AK. 235	Akola	2115	MCU. 5	Bodwad
2090	Buri 1007	Amravati	2116	AK. 235	Washim
2091	L. 147	Nandura	2117	Bikaneri Narma	Sriganga-nagar
2092	J. 34 R/G*	Ramapura-phul	2118	Jyoti	Yawal
2093	J. 34 S/G.*	Rampura-Phul	2119	Varalaxmi	Jamner
2094	Sankar 4	Idar	2120	Hampi	Raichur
2095	Sankar 4	Manvadar	2121	Bhagya	Raichur
2096	H. 777	Hansi	2122	Westerns 1	Bellary
2097	Bengal Desi	Raman	2123	Digvijay	Banaswada
2098	J. 34 R/G*	Sriganga-nagar	2124	SRT. 1	Beed
2099	J. 34 S/G*	Sriganga-nagar	2125	Varalaxmi	Raichur
2100	Varalaxmi	Idar	2126	Raichur 51	Raichur
2101	Hybrid 4	Dhamnod	2127	Mysore 14	Arasikere
2102	Hybrid 4	Udgir	2128	Wagad	Morvi
2103	SRT. 1	Rajkot	2129	SRT. 1	Baroda
2104	G. 1422	Udgir	2130	Varalaxmi	Alur
2105	Deviraj	Gokak	2131	Ganganagar Agethi	Sriganga-nagar
2106	Y. 1	Amalner	2132	V. 797	Harij
2107	Hybrid 4	Udgir	2133	Laxmi	Dharwad
2108	Varalaxmi (Irrigated)	Pidugunalla	2134	Digvijay	Jambusar
2109	Varalaxmi (Rainfed)	Phirongi-puram	2135	JKHy. 1	Badnawar
2110	Suvin (Irrigated)	Prothipadu	2136	Dhy. 286	Washim
2111	Suvin (Rainfed)	Prothipadu	2137	Virnar	Khargone
			2138	Buri 147	Kinwat-nagar
			2139	Deviraj	Surendra-Beed
			2140	G. 1422	Khargone
			2141	Sankar 4	Khargone
			2142	Maljari	Dekar
			2143	Digvijay	

F. Technological Circulars on Standard Indian Cottons

		1980-81 Season			
212	Laxmi	Ahmednagar	218	Varalaxmi	Siruguppa
213	B. 1007	Achalpur	219	Deviraj	Arabhavi
214	Badnawar	Badnawar	220	Hampi	Siruguppa
215	Virnar	Udaipur	221	Ganganagar Desi	Sriganga-nagar
216	S.I. Andrews	Shimoga	222	Digvijay	Bharuch
217	Khandwa	Khargone			

* R/G = Roller ginned. * S/G = Saw ginned.

4. EXTENSION

This laboratory does not have the facility of a farm to undertake all field work in connection with the cotton growing research and hence the responsibility of these field trials is vested on the Central Institutes and Agricultural Universities in various parts of the country. CTRL and its Regional Quality Evaluation Units actively participate in some of these trials. Eventhough CTRL is not directly dealing with the Farm Community, extension services are indirectly rendered to cotton growers, by testing and supplying reliable and accurate data on various desired quality parameters of samples sent by them/trade/industry/Government/Civic Organisations, etc., in addition to imparting training in cotton technology which includes training in quality evaluation of cotton fibres and yarns as well as training to gin fitters. Assistance also is being rendered by continuously gearing part of the activities of CTRL in developmental work of new equipments useful for test in the fields, apart from their fabrication and supply.

Testing Work

CTRL receives regularly quite a large number of samples of fibre, yarn and cloth for special tests from Government and Semi-Government organisations and the textile industry on payment of the prescribed test fees as per a schedule of fees prepared for the purpose, in addition to the research and agricultural samples from various cotton growing states being received for different tests. The particulars of such samples received and tested during 1981 together with the number of samples tested for the quinquennium 1976 to 1980 are given in Table 28.

The total test fees realised during 1981 for carrying out paid tests on these samples amounted to Rs. 28,381.55 as against Rs. 35,310.00 during 1980.

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

1. Two cotton sliver samples received from a mill in South India were subjected to Open-End Spinning trials to find out the optimum settings during mechanical processing. The processed material was supplied to the party.
2. Five samples of absorbent cotton supplied by two private firms were tested for mean fibre length.

TABLE 28 : NUMBER OF SAMPLES RECEIVED FOR PAID TESTS

Types of test	Average of the quinquennium 1976-80	1979	1980	1981
Spinning	51	65	32	34
Fibre (EICA*)	158	116	72	130
Fibre (others)	121	138	128	48
Yarn	48	51	67	69
Cloth	76	73	76	47
Moisture	—	—	—	40
Total	471	22	10	14
Miscellaneouus	17	465	385	382

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

3. One sample of cotton linter, received from a composite mill of Bombay, was tested for cellulose content.
4. Seven viscose staple fibre samples sent by a Public Sector Organisation were tested for : (i) Single Fibre Strength and Elongation by Instron Tensile Tester, (ii) Denier, and (iii) Staple Length.
5. One polyester fibre sample received from a Gujarat mill was tested for Denier by Vibroscopy method.
6. Two synthetic fibre samples were sent by a leading composite mill in South India for qualitative analysis. Fibres from both the samples were identified as Modacrylic fibres.
7. Polyester-Viscose and Cotton-Viscose blend samples (one each) submitted by a private local mill were micro spun to 60s count yarn. The yarn parameters were tested and reported.
8. One Cotton-Rayon mixed fibre sample submitted by a local private firm was tested for mean fibre length by Baer Sorter.
9. Hairiness Index on Shirley Hairiness Tester was determined on 22 Polyester-Cotton and Polyester-Viscose blended yarn samples, received from two synthetic fibre manufacturing firms.
10. One sample of sewing thread received from a garment manufacturing firm was tested for breaking strength with elongation on Uster Single Thread Strength Tester.
11. Three Inter and seven Ring-spun Poly-Viscose yarn samples sent by a mofussil mill were tested for strength, elongation and Uster Evenness.
12. Four samples of fibreglass yarns of different deniers were received from a manufacturer for the determination of single yarn strength.

13. Two canvas samples sent by a waterproof fabric processing company, and two synthetic-cotton blend fabric samples sent by two end-users, were analysed for quantitative identification of component fibres in the warp-way and weft-way separately.
14. One hessian cloth sample received from a Public Sector Undertaking was tested for fabric parameters, as per DGS&D's relevant specifications.
15. A local Public Sector Undertaking sent four Polyester-Wool and Polyester-Viscose-Wool blend fabric samples, for quantitative identification of component fibres, together with other fabric parameters. The test results together with comments were communicated to the party.
16. Five acrylic emulsion samples, two ion-exchange resin samples, and three precipitated silica samples, received from three different manufacturers were analysed on Electron Microscope. The Electron Micrographs were supplied with comments.

Training

CTRL conducts two full time training courses lasting eight weeks each, one from July to September and the other from September to November, for personnel deputed by cotton trading organisation in Bombay and mofussil centres. During 1981, eight persons attended the above course which included lectures and practical work on methods of evaluation of cotton fibre quality and interpretation of test results based on statistics.

1. Shri D. R. Kadu,
   C/o. The Maharashtra State Co-operative
   Marketing Federation Ltd.,
   Bombay-400 009.
2. Shri Malay Kalyanji Gala,
   C/o. M/s. J. K. Cotton Co.,
   Bombay-400 077.
3. Shri Madan Krishna Nagraj,
   C/o M/s. Aravind Enterprises,
   Bombay-400 056.
4. Shri Deepak Chandra Adhikari,
   M/s. Hetanda Textile Industry Ltd.,
   Kathmandu, Nepal.
5. Shri P. Viswanathan,
   C/o National Textile Corporation (TNPP) Ltd,,
   Coimbatore-641 009.

6. Shri K. C. Maniar,
C/o Gujarat State Co-operative
Cotton Marketing Federation Ltd.,
Ahmedabad-380 006.
7. Shri H. B. Patel,
C/o P. A. Maneklal,
Indore 3.
Madhya Pradesh.
8. Shri R. V. Raghavulu,
C/o. Rama Lakshmana Cotton Traders,
Chilakaluripet,
Andhra Pradesh 522 616.

5. CONFERENCES AND SYMPOSIA

Director and Scientists of the Laboratory participated in the following Scientific and Technological Conferences and Meetings connected with the work of this Laboratory :

S. No.	Meeting/Conference	Place	Date	Name of Officers who attended the Meeting/Conference
1.	Conference of the Directors of Institutes under ICAR.	New Delhi	12-1-1981 and 13-1-1981	Dr. V. Sundaram
2.	Second Meeting of the Cotton Advisory Board of Textile Commissioner.	Bombay	20-1-1981	Dr. V. Sundaram
3.	Seminar on "Computers in Industry" organised by M/s. Blue Star Ltd., Bombay.	Bombay	30-1-1981	Dr. S. N. Pandey
4.	Twentysecond Joint Technological Conference of ATIRA, BTRA and SITRA held at ATIRA, Ahmedabad.	Ahmedabad	2-2-1981 and 3-2-1981	Shri M. S. Parthasarthy Shri B. Srinathan and Dr. K. M. Paralikar
5.	Thirtysixth Annual Convention and Symposium on "Processing of Oilseeds, Oils, By-products, Derived Products, Techno-economic Aspects", Oil Technologists' Association, India.	Hyderabad	14-2-1981 and 15-2-1981	Dr. S. N. Pandey
6.	Thirteenth Annual Conference of Electron Microscope Society of India.	Bangalore	16-2-1981 to 18-2-1981	Dr. K. M. Paralikar
7.	Technological Conference of SASMIRA.	Bombay	18-2-1981 to 20-2-1981	Dr. K. R. K. Iyer and Kum. I. G. Bhatt
8.	Meeting of Panel of Experts on Physics-Oriented Studies at ATIRA.	Ahmedabad	20-2-1981	Dr. V. Sundaram
9.	First Meeting of Reconstituted Cotton Research Advisory Sub-Committee of ICMF.	Bombay	25-2-1981	Dr. V. Sundaram
10.	Seventh Meeting of the Research Advisory Committee of SITRA.	Coimbatore	5-3-1981 and 6-3-1981	Dr. V. Sundaram
11.	Tenth Meeting of Advisory Sub-Committee for Research and Liaison (Physics, Physical Testing, Electronics and Mathematics of BTRA).	Bombay	10-3-1981	Dr. V. Sundaram

S. No.	Meeting/Conference	Place	Date	Name of Officers who attended the Meeting/Conference
12.	Seminar on "Latest Advances in Analytical Instrumentation" sponsored by M/s. Blue Star Ltd., and Perkin Elmer International, held at Tata Institute of Fundamental Research, Bombay.	Bombay	2-4-1981 and 3-4-1981	Dr. S. N. Pandey and Smt. Prema Nair
13.	North Zone Panel Meetings of AICCIP held at Punjab Agricultural University.	Ludhiana	2-4-1981 and 3-4-1981	Shri P. G. Oka and Shri M. S. Sitaram
14.	"Wissitex-81" a Symposium organised by the Instrument Association of India, Bombay.	Bombay	15-4-1981 to 18-4-1981	Dr. K. R. K. Iyer and Shri Ramesh Babu
15.	Central Zone Panel Meeting of Breeding and Technology Group under AICCIP held at Agricultural Research Station.	Indore	15-5-1981 and 16-5-1981	Shri P. G. Oka and Shri M. S. Sitaram
16.	South Zone Panel Meeting of AICCIP held at Andhra Pradesh Agricultural University.	Hyderabad	1-6-1981 to 3-6-1981	Dr. V. Sundaram Shri P. G. Oka and Shri M. S. Sitaram
17.	National Seminar on Bio-gas Technology and a Workshop on Renewable Energy Sources (ICAR), held at Punjab Agricultural University.	Ludhiana	9-7-1981 to 11-7-1981 and 13-7-1981 to 15-7-1981	Dr. V. G. Khandeparkar and Dr. R. H. Balasubramanya
18.	Fourth Meeting of Reconstituted Cotton Advisory Board of Textile Commissioner.	Bombay	29-8-1981	Dr. V. Sundaram
19.	Sixth International Conference of Women Engineers and Scientists.	Bombay	8-9-1981 to 12-9-1981	Kum. I. G. Bhatt
20.	Seminar on Rotor Spinning at IIT.	New Delhi	11-9-1981 and 12-9-1981	Shri B. Srinathan and Shri T. N. Ramamurthy Rao
21.	Fifth Meeting of Standing Committee on Cotton of ICMF.	Bombay	15-9-1981	Dr. V. Sundaram
22.	Meeting of Directors of ICAR Institutes/Project Directors/Co-ordinators of Crop Divisions of ICAR, held at IARI.	New Delhi	21-9-1981 to 23-9-1981	Dr. V. Sundaram
23.	Conference of Directors of ICAR Institutes.	New Delhi	30-9-1981 and 1-10-1981	Dr. V. Sundaram

S. No.	Meeting/Conference	Place	Date	Name of Officers who attended the Meeting Conference
24.	Meeting of the Cotton Germplasm Advisory Committee, held at Punjab Agricultural University.	Ludhiana	3-10-1981	Dr. V. Sundaram
25.	Management Committee Meeting of Central Institute for Cotton Research.	Nagpur	19-10-1981 and 20-10-1981	Dr N. B. Patil
26.	International Textile Conference on "Textile Blends", sponsored by Textile Association, (India).	Bombay	18-11-1981 to 20-11-1981	Dr. V. Sundaram Dr. N. B. Patil Shri M. S. Parthasarathy Dr. S. N. Pandey and Shri K. S. Bhyrappa
27.	Seminar on High Wet Modulus Fibres held at SASMIRA.	Bombay	3-12-1981	Dr. K. R. K. Iyer Shri P. K. Chidambarewaran and Shri T. N. Ramamurthy Rao
28.	Biennial Workshop of AICCIP at Marathwada Agricultural University.	Parbhani	7-12-1981 to 10-12-1981	Dr. V. Sundaram Shri P. G. Oka and Shri M. S. Sitaram
29.	Symposium on Flame Retardant Finish — State of Art.	Bombay	10-12-1981 to 12-12-1981	Dr. V. Sundaram Kum. I. G. Bhatt and Shri A. W. Shringarpure

In addition to the above, Director and other Scientists of the Laboratory attended meetings of several Sub-Committees of the Indian Standards Institution, pertaining to the standardisation of textile materials and test methods.

The Director also attended various meetings of the Board of Directors of Cotton Corporation of India, Management Committees of Central Institute for Cotton Research, Nagpur, and Krishi Vigyan Kendra, Kosbad, Governing Council of BTRA, and the Board of Management of VJTI, Bombay.

6. SUMMARY OF THE REPORT

This is the 58th Annual Report of the Laboratory covering the calendar year 1981. The Laboratory continued to collaborate actively with agricultural scientists and cotton breeders in their endeavour to produce more and superior quality cottons by authoritative evaluation of the quality of improved strains and norms fixed for various quality characters. The Laboratory continued to function as a co-ordinating centre for cotton technology under the AICCIP. In addition to the routine testing and evaluation of the quality of agricultural samples received from various cotton growing centres in the country, there were 49 on-going research projects on agricultural aspects, fundamental studies in fibre physics, ginning and spinning technology, textile chemistry, microbiology and biochemistry. 39 research papers were published apart from seven papers on different topics presented at various Conferences. More than 300 samples of fibre, yarn and cloth were received for paid tests and an amount of Rs. 28,381 was realised on them during the year. Eight nominees from cotton trading and allied organisations attended the full time training course lasting eight weeks being conducted by CTRL. Quinquennial Review of CTRL's activities were conducted by a team constituted by the Director General, ICAR.

Research Activities

CTRL is actively participating with the Agricultural Scientists in various Universities and Central Institutes in developing new varieties of cotton by authoritative evaluation of samples received from breeding, agronomy and several other similar trials, apart from carrying out research on physical, chemical, structural and technological aspects of textile materials. CTRL is the coordinating centre for the quality evaluation of all new strains under trial in different parts of the country under the All India Coordinated Cotton Improvement Project (AICCIP).

During the year, 2076 samples were received at CTRL, Bombay for various tests from different agricultural trials. In addition, over 20,000 samples were screened for various fibre characters at the 11 Regional Quality Evaluation Units of CTRL. Besides, tests were carried out on samples of standard cotton and samples of Trade varieties of Indian cotton representing the varieties under large scale production. As a result of this work carried out in collaboration with agricultural scientists, the following improved varieties of cotton were recommended for release at the panel meetings of the Breeding and Technology

Group of the AICCIP : (i) L.D. 23 (ii) 76IH.20 (iii) 68KH.33.1146 (Khandwa 3) (iv) JKHy.11 (v) PA.32 (vi) ABH.4208 (PKV Hy.1) (vii) AHH.468 (PKV Hy.2) and (viii) AKH.5.

In connection with the identification of varieties with different levels of nep content and study of varietal variability and inheritance of the characteristic neppiness of cotton, the 28 diallele crosses made earlier, along with the 8 parents have been sown during this season and the produce will be picked in about a month's time and examined for their nep-content.

In the study of the effects of NPK on quality of Hybrid 4 cotton it was observed that the fertiliser doses tried do not exercise any significant influence on the fibre properties of the cotton.

With a view to find out the influence of various insecticides on the quality of Cottons, data collected on fibre tests and ginning percentage (GP) on 30 samples of Hybrid 4 cotton from an entomological trial (1978-79 season) were analysed and the results indicated that Phosalone, Monocrotophos and Endosulfan treatments significantly affected length, while all the treatments improved significantly GP and yield. Similarly, data regarding yield and fibre properties of 24 samples of H.4 cotton from another trial revealed that while there was significant improvement in bundle tenacity at zero gauge length for cypermethrin treatment, all the treatments showed significant improvement in yield.

A working model of the seed-cotton cleaner fabricated with a view to assess the constraints that could be eliminated before actual fabrication and mounting revealed that for efficient operation, some more improvements in the choice of spike roller spacing, roller speed, grid oscillation and shape, etc. were necessary. A final revised design was being prepared.

Based on the principles of laws of floatation, three ginning percentage indicator devices were designed, fabricated and tested. All the three devices were found to give fairly accurate results ($\pm 0.2\%$).

The new regression equation derived from recent data (1971-72 to 1978-79 seasons) for estimating the maturity coefficient (Mc) from the difference in Micronaire value (M_D) was found to be different from the earlier equations, the reason being that the range of difference in Micronaire values, with and without spacer, in the present study is small (1.10 to 2.20 μg/in) compared to the earlier investigations (1.0 to 2.70 μg/in.) for the same spread of maturity coefficient values (0.60 to 0.90). Hence the values of maturity coefficient estimated from the new equation are found to be higher than those predicted by the equation currently in use in the Laboratory and thus highlights scope for the revision of the prediction formula currently in use.

The design and fabrication work of the Electronic Fibre Length Tester is progressing satisfactorily.

Twentyfive cottons were tested for fibre maturity by caustic soda method, IIC Fineness-Maturity Tester and by the Optical scanning Technique using Fibrograph. High correlations were obtained for maturity parameters by the different methods. The correlation between the "immaturity index" obtained by the new optical method and the mature fibre percentage (caustic soda swelling method) currently used at CTRL has been found to be poor (r=0.46). However, when the new index was compared with the micronaire difference ("spacer" method), the relationship was strong (0.75). It would appear that evaluation of the new method should be made with reference to instrumental methods rather than with the caustic soda swelling method which encompassed an element of subjectivity.

In connection with the study of cotton fibre strength and its dependence on various morphological and structural parameters, 300 single fibres were tested for linear density and breaking strength and the broken tufts were examined for ascertaining the location of break in the fibres.

A comparative study of the x-ray angles of air-dried and solvent-exchanged samples belonging to *G. arboreum* and *G. herbaceum* species showed no significant difference in x-ray angles between solvent-exchanged and air-dried samples, unlike the observations made on *G. hirsutum* and *G. barbadense* species. A few more samples were being tested for confirmation of the findings.

Correlation worked out among x-ray angles and tensile parameters for 10 *G. arboreum* cottons exhibited the same trend as that for other species, viz. 20% x-ray angle is better associated with tenacity at zero gauge length, while 75% x-ray angle gives the best correlation with elongation. Similar trend was noticed, when the values were pooled for 80 cottons and correlations worked out.

For the study on inheritance of strength and structural parameters in cotton fibres, most promising progenies of parents were identified by analysis of data on x-ray angles of samples received earlier.

For the characterisation studies of yarns, Suvin cotton was spun to 40s, 60s, 80s and 100s counts using different twist multipliers. Orientation profiles of the yarns also were obtained. A preliminary analysis of data revealed that the influence of twist on the orientation parameter is more marked than that of yarn counts. By using improved methods of specimen preparation, the error of analysis for blends of cotton with viscose or polynosic was brought down to $\pm 1.5\%$ using x-ray diffraction

technique. Possibility of obtaining more accurate results using the OI method through increasing the sample volume was demonstrated.

Study on decrystallised and crosslinked fabrics has shown that by selecting suitable fabric and decrystallising it by the limited substitution procedure (partial acetylation or partial cyanoethylation) after swelling in NaOH, it is possible to achieve better strength retention on crosslinking than that obtainable by crosslinking after swelling in NaOH alone. The improvement in strength retention is, however, less than what is achieved in similarly treated fibres and yarns. The lack of proper penetration of the reagents and consequent non-uniform distribution of crosslinks might be responsible for the lower strength retention in the case of fabrics.

Some experiments were carried out to study the changes in properties brought about by swelling and stretching of normal viscose rayon filaments. It has been found that stretch upto 45% over the initial length is possible when the filament is swollen in NaOH (18% w/w). If the stretched yarn is treated with mild acetic acid (about 5%) to neutralise the alkali, the increase in length remains permanent. The filament, after subsequent washing and drying shows changes in tensile properties. While the breaking load is significantly reduced, the tenacity is more or less maintained at the initial value, largely because of the reduction in linear density accompanying stretch. The breaking extension shows a progressive fall with the increase in stretch.

In connection with the preparation and standardisation of calibration cottons, Varalaxmi and Gaorani cottons were processed individually and also in blends of 50:50 and 75:25. Two more cottons, V.797 and Hybrid 4 were also selected and processed.

With a view to assess the applicability of the norms fixed for Yarn Quality Index being formulated, data on 50 more yarn samples were collected and statistically analysed. As the yarns were stronger, more uniform and less neppy in general, revised norms have been suggested. Simple and multiple correlations between Fibre Quality Index and Yarn Quality parameters were worked out and were found to be highly significant.

In connection with the studies on Laxmi-Rieter Drawing and Speed Frames, the influence of break draft and zonal settings for Varalaxmi cotton was studied during the year. The materials from the various combinations were spun to 80s count and the yarns produced were tested for yarn characteristics. It was observed that use of a low draft of 1.3 at the second head gave better overall yarn characteristics — combination III (1.3 — 1.3 for first and Second D.F. Passages) for the closer settings and combination II (1.7 — 1.3 for first and second

D.F. Passages) for the higher setting. The differences were, however, marginal between different settings.

Studies on five samples each of four counts for elongation at break (E%) during lea test on normal skeins and knotted skeins as well as on single thread strength tester showed that the E% values increased by 20% for knotted skeins and that the relationship between elongation values of single thread and skeins improved considerably.

Studies were conducted on the structural aspects of Open-end spun yarn *vis-a-vis* ring spun yarn on Scanning Electron Microscope (SEM). In the Open-end Spintrainer, an indigenous polyester of 38 mm was processed using (a) two rotor diameters, (b) two shapes of rotor (c) two types of doffing tubes, (d) three rotor speeds and electron micrographs were taken of yarns produced from various combinations.

The data obtained after processing Laxmi, B.1007 and L.147 to 40s and 30s counts indicated that the Laxmi cotton was far more superior to the other two cottons with respect to yarn properties. The processing of 3 blends of the above 3 varieties was also carried out. The tests on the third blend was in progress.

A study was conducted on the flat strips produced during conventional processing of different blends of polyester with a view to examine the feasibility of using blend waste on Open-end Spinning, instead of mixing the same in the original mix, that might affect the quality. Comparism was also made between the Open-end Spun yarns and Ring Frame Yarns produced from the various blends of flat strips.

The effect of chemical treatments like mercerization and crosslinking on the dynamic modulus and tensile recovery properties and their interrelationship has been studied on a sample of cotton yarn (L.147 spun to 30s count). While slack mercerization was found to reduce the modulus and recovery parameters like immediate elastic recovery and work recovery, stretch mercerization brought about considerable increase in all these characteristics. Increase in these properties with increase in the degree of crosslinking in HCHO and DMDHEU was found to occur. The dynamic modulus and recovery parameters showed high degree of association among samples subjected to crosslinking treatments.

The study of the effect of fabric assistance on abrasion resistence carried out on 5 grey fabric samples showed that the values of flex abrasion test for the revelled strips were comparatively less than the control for both warp and weft directions.

Correlation coefficients worked out between tearing strength values obtained by Elmendorf, Ballistic, and Tongue Tear Testers were found to be highly significant in both warp and weft directions. The corre-

lation between Elmendorf and Ballistic Tear Testers was comparatively higher than that of Tongue Tear Tester with either Elmendorf or Ballistic Tear Tester.

With a view to find out the relationship between absorbency and fibre maturity of cottons, 30 varieties of cottons were subjected to maturity tests by NaOH method and the trend observed was that when the percentage immature fibres was higher, the water holding capacity was poor.

Cotton fabrics were treated with DMDHEU in a mixed catalyst system of 0.5% inorganic salt and 0.5% organic acid and cured at 140°C and 160°C for 4 min and 3 min respectively with control samples. It was observed that while the treated sample cured at 140°C gave slightly lower values for dry crease recovery angle and higher breaking and tearing strength retentions compared to the sample cured at 160°C, the samples cured at both the temperatures showed higher breaking strength and tearing strength retentions compared to control.

Cotton and cotton : terene (33:67) fabrics were given resin finishing treatments with DHDHEU in the presence of an organic acid and an inorganic salt. These treated fabrics were being studied for migration of resin and rate of drying.

Cotton yarn samples mercerized under different conditions of stretch were crosslinked in 'D' and 'W' bath and were studied for tensile properties, formaldehyde content and Distention Index.

Electron microscopic study of location and aggregation of dyes in cotton cellulose reveals that the ultimate localization of dye molecules takes place on the disordered regions of the elementary fibrils separated alongside their length by crystalline regions. The inter-elementary fibrillar space, being of the order of 15Å — 20Å is not accessible to the dye molecules. Differences in the behaviour of the aggregation of dyes are noticed in mercerised, cyanoethylated, benzoylated and benzylated cotton. A direct evidence of the existence of pores in cotton cellulose has been obtained in the present study.

In connection with the synthesis of cellulose derivatives with unusual functional groups, iodo-cellulose prepared from tosyl cellulose was analysed for iodine content and for reducing iodo-cellulose to 6 methyl dioxycelluloses, various methods using common reducing agents were tried; but all of them were found to be ineffective.

Linters of nine varieties of cotton were analysed for α - celluose, ash and iron content. The determination of iron contents by spectrophotometric method also was standardised. The ash, iron content and the colour developed during bottle acetylation test, where the measurement was done in Hazen Units, were low in the case of all linter samples subjected to test.

Cotton yarn in moist condition was irradiated to a dosage of 1.457×10^7 Rads in the presence of seven chemicals. Strength and Post-Irradiation Activity of these samples irradiated in immersed condition, was higher than those irradiated in moist condition.

Oil was extracted from 22 cottonseed varieties (glandless) and the samples of oil were being analysed for fatty acid content using GLC technique. Six varieties of cottonseed grown at the four different locations were studied for their fatty acid composition.

Two samples of kapok seed were analysed for seed weight, oil content, protein, gossypol content and other characteristics.

It has been observed in a detailed study, that free possypol was released in the fermentation medium of *Bacillus Subtilis* when the organism was used for amylase production. Attempts were made to study the possibility of such release of gossypol in the protease and tetracyclin fermentations.

Methods for the analysis of cottonseed hull samples for estimation of ash, lignin, cellulose, hemicellulose, etc. were standardised. 20 kg of hull sample was obtained from M/s. Liberty Oil Mills for preparation of boards and the boards thus prepared were being tested for various characteristics.

Enzymic synthesis of cellulose in developing cotton fibres of Laxmi variety was studied using radioactive UDP — C^{14} — glucose as substrate. Two peaks of enzyme activity were observed, one at 15 days post anthesis and the other at 30 to 40 days post anthesis. Similar results were observed previous year with unlabelled UDPG. *Acetobacter-xylinum* was grown on fructose and xylose to ascertain whether any soluble polymer is formed during the biosynthesis of cellulose.

An application of *P. funiculosum* was found in the separation of pectin from the peels of citrus fruits. The organism was grown on Mandels *et al.* medium containing citrus peels. The organism utilized the cellulose in the peels and set free the pectin which could be precipitated with alcohol from the clear filtrate. The three UV mutants of the organism having higher CMCase and FP activities, but lower beta-glucosidase activity, were irradiated again when ten secondary mutants were isolated. Two of these isolates had considerable high beta-glucosidase activity.

Purified cotton fibres were treated with cellulose enzyme for different periods. The reducing sugar and weight loss were used as indices for assessing the extent of enzymic hydrolysis. It was observed that treatment with fresh enzyme solution after every 3 days resulted in maximum enzymic hydrolysis of cotton cellulose. Samples prepared

using these optimum conditions have been taken up for morphological and structural studies.

Paddy straw and groundnut shells were the best among the five substrates tried to enhance crude protein with the free living nitrogen fixing bacterium *Beijernekia mobilis* after acid hydrolysis, and alkali neutralisation. But *Pleurotus sajor-caju* grows well on all the substrates without any pre-treatment and enhances the crude protein by about 1.5 to 2.0 times.

An experimental plant for batch type fermentation of biogas was designed and fabricated to process 100 kg willow-dust. On an average, the plant produced 600 litres of gas daily for a period of 30 days. The detailed studies on biogas production on this plant showed that there are almost three phases of gas production. The first phase (6-7 days) was rich in carbondioxide, second was the active gas producing phase (30 days) and third was continuation of second phase of low gas production. The analysis of digested slurry showed that it is rich in nitrogen and lignin and could be a good source of manure.

The edible mushroom *pleurotus sajor-caju* can be grown easily on willow-dust, a textile mill waste, cotton stalks, a post-harvest agricultural waste material and cotton seed hulls. On an average 500-600 g of fleshy fruiting bodies can be obtained when cultivated on these cellulosic wastes during winter months at Bombay without any nutrient supplementation.

7. PERSONNEL

A. Appointments

Technical Staff

Shri H. U. Gangar (w.e.f. 2-11-1981) to the post of Technical Officer, Grade T-6, Smt. S. R. Kamath (w.e.f. 15-1-1981), Sarvashri S. M. Gogate, S. Venkatakrishnan, P. Sivaprakash, Kum. M. Narayani and Kum. Vishala S. Ayyer (all w.e.f. 7-12-1981) and S. Mukundan (w.e.f. 10-12-1981, to the post of Technical Assistant, Grade T-II 3 and Shri A. A. Gote (w.e.f. 1-4-1981) to the post of Electrician, Grade T-1.

B. Assessments

1. *Technical Staff*

The five yearly assessment of the eligible technical personnel of CTRL was held in June 1981, and promotions/advance increments granted as detailed below :

Promotions

No.	Name	Grade to which promoted	Effective date of promotion
1.	Smt. P. A. Dabholkar	T-4 (Rs. 550-900)	1-7-1981
2.	Shri G. D. Narkar	T-2 (Rs. 330-560)	1-7-1981
3.	Shri R. A. Dalvi	T-2 (Rs. 330-560)	1-7-1981

Advance Increments

No.	Name	Grade	No. of advance increments	Effective date of increments
1.	Shri D. L. Upadhye	T-I-3	Two	1-7-1981

2. *Scientific Staff*

The five yearly assessment of the eligible scientific personnel of CTRL for the years 1977 and 1978 was carried out by the ASRB in May 1980. As a result of the assesment, Shri S. G. Gayal, Scientist 'S', was promoted to the Grade S-1 (Rs. 700-1300) w.e.f. 1-7-1979 and Shri M. S. Parthasarathy, Sr. Scientist (Textile Manufacture), in the Grade S-3 was granted higher scale of pay of Rs. 1800-2250, w.e.f. 1-7-1979.

C. Promotion

Shri B. D. Sawant to the post of Senior Clerk w.e.f. 19-2-1981.

D. Transfers

1. Scientific Staff

Shri K. H. Sawakhande, Scientist 'S', from Q.E. Unit at Dharwad to CTRL, Bombay.

2. Technical Staff

Shri Ram Parkash, Quality Evaluation Officer from Q.E. Unit at Ludhiana to Q.E. Unit at Akola w.e.f. 22-1-1981 and again to Q.E. Unit at Sriganganagar w.e.f. 1-5-1981.

Shri S. J. Guhagarkar, Technical Assistant, from Q.E. Unit at Akola to CTRL, Bombay, w.e.f. 1-1-1981.

Shri V. K. Madan, Technical Assistant, from CTRL, Bombay, to Q.E. Unit at Ludhiana, w.e.f. 16-5-1981.

E. Retirement

Sarvashri T. P. Parameshwaran, P.A. to Director, and A. C. Kadam, Supporting Staff Grade II, retired from service w.e.f. 30-5-1981 and 30-6-1981, respectively.

F. Resignations/Termination of Services

Sarvashri J. C. Toscano and S. N. Hussain, Technical Assistants Grade T-II-3, resigned from service, w.e.f. 1.1.1981 and 25.4.1981, respectively.

Shri M. T. Itnare, Electrician Grade T-2, resigned from service w.e.f. 15-3-1981.

Shri U. K. Iyer, Administrative Officer, resigned from service w.e.f. 21-11-1981.

Shri B. Ramamurthy, Stenographer Grade I, resigned from service w.e.f. 31-3-1981.

Kum. A. K. Annamma, Junior Stenographer, resigned from service w.e.f. 29-8-1981.

The services of Sarvashri G. R. Kamble and Mahendra Kumar Beni Prasad, both supporting Staff Grade I, were terminated w.e.f. 27-2-1981 and 15-4-1981, respectively.

G. Training

1. Shri T. K. M. Das, Senior Technical Assistant (Information), has attended the training course in "Information Storage and Retrieval Systems" organised by Small Industry Extension Training Institute, Yousufguda, Hyderabad, from June 1 to June 26, 1981.

2. Shri A. V. Ukidve, Scientist S-1, has been deputed for the orientation course in Agricultural Research Management from October 14 to November 18, 1981, at National Academy of Agricultural Research Management (ICAR), Rajendra Nagar, Hyderabad..

8. APPENDICES

APPENDIX I

Financial Statement

(EXPENDITURE AND RECEIPTS OF THE LABORATORY DURING 1980-81)

	Sanctioned grant (Rs.)	Actual expenditure (Rs.)	Saving (—) Deficit (+) (Rs.)
A. EXPENDITURE			
I. Technological Research Laboratory including Regional Stations (Non-Plan)			
(a) Capital expenditure including expansion of Laboratory ..	6,47,290	6,47,261	(—)29
(b) Working expenditure	38,51,710	38,51,704	(—) 6
	44,99,000	44,98,965	(—)35
II. Scheme for modernisation and strengthening of CTRL for intensive research on cotton (Plan)	39,26,000	36,65,234	(—)2,60,766
III. Schemes financed from AP Cess funds:			
1. Investigation of the effects of high energy radiation on the induction and half life of excited free and/or ionised radicals in cotton cellulose to obtain basic information needed for the development of potentially new useful cotton products	49,600	38,063	(—)11,537
2. Optimal blending of Standard Varieties of Indian Cottons ..	1,00,000	45,015	(—)54,985
3. Regional Committee No. 7 ..	20,000	17,804	(—) 2,196

B. RECEIPTS	Rs.
Sale of vehicles, machine tools, plants, equipment and other non-consumable stores	16,462
Analytical and testing fees	33,629
Rent	58,456
Interest on loans and advances granted to Council's employees	550
Fees for training, application fees, etc.	4,950
Receipts from services rendered by the Institute	7,600
Sale of publications	3,462
Miscellaneous receipts (including sale of cotton waste, mixed cotton, etc.)	34,743
	1,59,852

APPENDIX II

Staff Working at the Cotton Technological Research Laboratory as on 31-12-81

(List does not include vacant posts)

A. At CTRL, Bombay

Director: Dr. V. Sundaram, M.Sc., Ph.D., F.T.I., C.Chem., M.R.S.C.

Scientific Staff

Designation	Grade	Name
Scientist (Physics)	S-3	Dr. N. B. Patil, M.Sc., Ph.D.
,, (Spinning Technology)	,,	Shri M. S. Parthasarathy, M.Text. (Bom.) M.Sc. Tech. (Manch), A.M.C.S.T.
,, (Testing Technology)	,,	Dr. V. G. Munshi, M.Sc., Ph.D., F.T.A.
Scientist (Chemistry)	S-2	Kum. I. G. Bhatt, M.Sc.
,, (Chemistry)	,,	Dr. S. N. Pandey, M.Sc., Ph.D.
,, (Fibre Technology)	,,	Shri T. N. Ramamurthy, B.Sc., B.Sc. (Tech.)
,, (Microbiology)	,,	Dr. V. G. Khandeparkar, M.Sc., Ph.D.
,, (Physics)	,,	Shri P. K. Chidambareswaran, M.Sc.
,, (Physics)	,,	Dr. K. R. Krishna Iyer, M.Sc., Ph.D.
,, (Physics)	,,	Shri P. G. Oka, M.Sc.
,, (Statistics)	,,	Shri G. S. Rajaraman, M.A.
,, (Textile Manufacture)	,,	Shri B. Srinathan, B.Sc. (Text.), M. Sc. (Text.)
Scientist (Biochemistry)	S-1	Smt. S. P. Bhatawdekar, M.Sc.
,, (Biochemistry)	,,	Shri S. G. Gayal, M.Sc.
,, (Biochemistry)	,,	Smt. G. Revathi, M.Sc.
,, (Biophysics)	,,	Dr. K. M. Paralikar, M.Sc., Ph.D., F.R.M.S.
,, (Chemistry)	,,	Shri S. Aravindanath, M.Sc.
,, (Chemistry)	,,	Smt. Vatsala Iyer, M. Sc.
,, (Chemistry)	,,	Smt. Prema Nair, M.Sc.
,, (Chemistry)	,,	Kum. C. R. Raje, M.Sc.
,, (Chemistry)	,,	Shri A. J. Sheikh, M.Sc.
,, (Chemistry)	,,	Shri P. V. Varadarajan, M.Sc.
,, (Electronics & Instrumentation)	,,	Shri N. Ramesh Babu, B.E., M. Tech.
,, (Farm Machinery & Power)	,,	Shri U. N. Borkar, B.Sc. (Agri.) B.Sc. (Agrl. Engg.), M. Tech.
,, (Microbiology)	,,	Dr. R. H. Balasubramanya, M.Sc., Ph.D.
,, (Microbiology)	,,	Kum. A. S. Dighe, M.Sc.
,, (Organic Chemistry)	,,	Shri L. K. Suri, M.Sc.
,, (Physics)	,,	Shri G. F. S. Hussain, M.Sc.
,, (Physics)	,,	Dr. (Smt.) P. Bhama Iyer, M.Sc., Ph.D.
,, (Physics)	,,	Shri R. P. Nachane, M.Sc.
,, (Physics)	,,	Dr. S. Sreenivasan, M.Sc., Ph.D.
,, (Physics)	,,	Shri A. V. Ukidve, M. Sc.,
,, (Physics)	,,	Dr. N. C. Vizia, M.Sc., Ph.D.

Designation	Grade	Name
Scientist (Quality Evaluation)	S-1	Shri A. K. Gupta, M.Sc., LL.B., W.P.M.M.T.
" (Quality Evaluation)		Shri B. M. Petkar, M.Sc.
" (Statistics)	"	Smt. Janaki K. Iyer, M.Sc.,
" (Textile Manufacture)	"	Shri Muntazir Ahmed, B.Sc., B.Sc. (Text.)
Scientist (Chemistry)	S	Shri R. M. Gurjar, M.Sc.
" (Chemistry)	"	Shri K. H. Sawakhande, M.Sc.
" (Quality Evaluation)	"	Shri P. Bhaskar, M.Sc.
" (Quality Evaluation)	"	Shri K. L. Datar, M.Sc.
" (Quality Evaluation)	"	Shri D. N. Makwana, M.Sc.
" (Quality Evaluation)	"	Smt. J.K.S. Warrier, M.Sc.
" (Statistics)	"	Shri D. V. Mhadgut, M.Sc.

Technical Staff

Technical Officer (Elec. Eng.)	T-7	Shri H. V. Tamhankar, L.M.E., L.E.E.
Technical Officer (Elec. Engineering)	T-6	Shri H. U. Gangar, B.E. (E.), Grad. I.E.T.E.
Technical Officer (Quality Evaluation)	T-6	Shri M. S. Sitaram, B.Sc.
Junior Quality Evaluation Officer	T-5	Shri K. S. Bhyrappa, L.T.T., A.T.A.
"	"	Shri K. Chandran, B.A.
"	"	Shri S. Chandrasekhar, L.T.M., A.T.A.
"	"	Shri S. R. Ganatra, M.Sc.
"	"	Kum. I.K.P. Iyer, B.Sc.
"	"	Shri H. R. Laxmivenkatesh, D.T.T., A.T.A.
"	"	Smt. S. D. Pai, B.Sc.
"	"	Shri A. W. Shringarpure, B.Sc.
"	"	Shri N. Thejappa, M.Sc.
Senior Technical Assistant (Information)	T-4	Shri T. K. M. Das, B.Sc., D.B.M. Dip. J, D.P.R., Cert. ISRS.
" (Instrumentation)	"	Shri G. S. Patel, M.Sc.
" (Library)	"	Kum. Rachel Verghese, B.Sc., B.Lib.
" (Photography)	"	Shri R. M. Modi, S.S.C. (Certificate in Photography)
" (Quality Evaluation)	"	Shri K. V. Ananthakrishnan, B.Sc., D.B.M.
" "	"	Smt. R. P. Bhatt, B.Sc.
" "	"	Smt. P. A. Dabholkar, B.Sc.
" "	"	Shri B. S. Ganvir, B.Sc.
" "	"	Shri C. R. Sthanu Subramony Iyer, B.Sc.
" "	"	Shri V. Jose Joseph, B.Sc.
" "	"	Smt. N. D. Nachane, B.Sc.
" "	"	Smt. Girija Radhakrishnan, B.Sc.
" "	"	Smt. S. V. Suki, B.Sc.
" "	"	Shri V. B. Suryanarayanan, B.Sc.
" "	"	Shri G. Viswanathan, B.Sc., A.T.A.
" "	"	
" "	"	Shri V. V. Kshirsagar,
" (Refrigeration)		

Designation	Grade	Name
Technical Assistant (Microbiology)	T-II-3	Smt. A. A. Kathe, B.Sc.
„ (Quality Evaluation)	„	Shri I. H. Hunsikatti, B.Sc., A.T.A.
„ „	„	Shri M. Karmakar, B.Sc.
„ „	„	Shri S. J. Guhagarkar, B.Sc.
„ „	„	Shri P. K. Mandhyan, B.Sc.
„ „	„	Shri E. A. Pachpinde, B.Sc.
„ „	„	Shri R. S. Pathare, B.Sc.
„ „	„	Shri D. Radhakrishna Murthy, M.Sc.
„ „	„	Shri R. Radhakrishnan, B.Sc.
„ „	„	Shri K. B. Rajagopal, B.Sc.
„ „	„	Shri N. Ramanathan, B.Sc.
„ „	„	Shri S. Sekar, B.Sc.
„ „	„	Shri S. Vancheswaran, B.Sc.
Senior Library Assistant	T-I-3	Smt. Rekha K. Shahani, B.Sc. B.Lib.
Draughtsman	„	Shri P. B. Gurjar
Electrician	„	Shri R. B. Pawar
Fitter (Ginning)	„	Shri A.R.S. Abdulla
Mechanic	„	Shri R. K. Landge
Operator (Refrigeration)	„	Shri S. G. Dalvi
Operator (Workshop Machinery)	„	Shri D. L. Upadhye
Turner „	„	Shri N. M. Shaikh
Fitter (Mechanical Processing)	T-2	Shri Purushottam Vira
Laboratory Assistant (Chemistry)	„	Shri N. O. Anthony
Senior Operative (Mechanical Processing)	„	Shri P. J. Ahire
„ „	„	Shri R. A. Dalvi
Plumber	„	Shri H. B. Tambe
Carpenter	T-1	Shri G. D. Narkar
Driver	„	Shri B. B. Gaykar
„	„	Shri S. S. Patekar
Driver-Cum.-Mechanic	„	Shri Premchand Rana
Fitter (Mechanical Processing)	T-2	Shri P. K. Gopalan
Electrician	„	Shri A. A. Gote
Laboratory Assistant	„	Shri S. B. Kamble
Senior Operative (Mechanical Processing)	„	Shri D. B. Gadankush
„	„	Shri Bechan Nokai
„	„	Shri H. K. Pawar
„	„	Shri S. G. Shinde
Telephone Operator	„	Smt. K. K. Kale

Administrative Staff

Asstt. Accounts Officer	Shri V. J. Antony, B.Com., F.S.A.A. (India)
Asstt. Administrative Officer	Shri V. N. Wadhwani
Superintendent	Shri D. L. Kalsekar
Assistant	Shri K. S. Deshpande
„	Smt. S. S. Dongare, B.A.
„	Shri F. C. Fernandes
„	Smt. V. V. Gore, B.A.
„	Shri M. P. Juwale
„	Shri G. Moosad, B.Com.
„	Shri D. P. Naidu
„	Shri D. J. Raut

Designation	Name
Assistant	Smt. Jayagouri Sivaramakrishnan
"	Shri P. D. Sonawane, B.A.
"	Shri K. Sudhakaran
Junior Stenographer	Smt. Chellamma Damodaran
"	Kum. R. K. Shetty, B.Com., D.B.M.
"	Shri Venu Thanikal
Senior Clerk	Shri Y. P. Belgaonkar (on deputation from NDRI)
"	Shri M. Z. Bhagat
"	Smt. M. V. Kamerkar, B.A.
"	Shri V. M. Kasabe
"	Shri K. W. Khamkar, B.A.
"	Smt. Veena Kotwani, B.A.
"	Shri B. D. Sawant
Junior Clerk	Smt. S. D. Ambre
"	Shri A. B. Dalvi
"	Smt. S. M. Desai
"	Smt. V. V. Desai
"	Shri K. N. Iyer
"	Shri H. G. Kini
"	Shri D. G. Kulkarni
"	Shri G. N. More
"	Shri A. P. Natu
"	Kum. Sujatha G. Nayar
"	Kum. V. E. Sagwekar
"	Shri S. N. Salve
"	Smt. S. S. Shanbhag

Supporting Staff

Grade IV	Shri K. K. Dalvi
"	Shri K. D. Mohite
"	Shri M. M. Rupawate
Grade III	Shri R. G. Chiplunkar
"	Shri P. G. Kadam
"	Shri D. V. Kambli
"	Shri K. K. Kasar
"	Shri M. B. Thokrul
Grade II	Shri Babu Aba Babar
"	Shri H. N. Gawde
"	Shri Ratansing Gussain
"	Shri T. R. Kadam
"	Shri R. R. Khurdekar
"	Shri Chatrapal Mhatri
"	Shri M. R. Nevrekar
"	Shri Obilal Parsuram
"	Shri S. V. Patil
"	Shri R. S. Pawar
"	Shri Ramkishan Taleram

APPENDICES

Designation	Name
Grade I	Shri G. G. Ambare
"	Shri Butnislal Balmiki
"	Shri A. R. Bane
"	Smt. Tarabai V. Bhowar
"	Shri M. Y. Chandanshive
"	Shri D. M. Chougule
"	Shri G. S. Devrukhkar
"	Shri S. L. Gawde
"	Shri M. K. Ghadage
"	Shri A. R. Gujar
"	Shri E. T. Gurav
"	Shri S. D. Gurav
"	Shri M. B. Gurve
"	Shri B. R. Jadhav
"	Shri R. B. Jadhav
"	Shri N. R. Kamble
"	Shri N. J. Kharat
"	Shri T. S. Mhaske
"	Shri S. V. Naik
"	Shri M. Z. Rathi
"	Shri B. R. Satam
"	Shri A. B. Sawant
"	Shri B. K. Sawant
"	Shri S. M. Sawant
"	Shri Kartarsingh Sivdayal Singh
"	Shri K. P. Somasekharan
"	Shri O. T. Thapa
"	Shri T. B. Thapa
"	Shri V. Y. Unhalekar
"	Shri Shamji Waghela.

B. Regional Quality Evaluation Units of CTRL

Station	Technial Officer (Quality Evaluation) Grade T-7	Technical Officer (Quality Evaluation) Grade T-6	Junior Quality Evaluation Officer Grade T-5	Senior Technical Assistant (Quality Evaluation) Grade T-4	Scientist Grade S
1	2	3	4	5	6
Akola	—	—	—	—	—
Coimbatore	—	—	Sluri A. K. Antony, B.Sc.	Smt. Santa V. Nair, B.Sc., Shri C. P. Venugopalan, B.Sc.	—
Dharwad	—	—	Shri E. S. Abraham, B.Sc.	—	—
Guntur	—	—	Shri R. Dwarakanath, B.Sc.	—	—
Hissar	—	—	Shri S. N. Nagwekar, B.Sc.	—	—
Indore	—	—	—	—	Shri S. B. Jadhav, M.Sc.
Ludhiana	—	—	—	—	—
Nagpur	—	—	—	—	—
Nanded	—	—	—	—	Shri L. D. Deshmukh, M.Sc.
Sriganganagar	—	Shri Ram Parkash, B.Sc.	—	—	—
Surat	Shri L. R. Jambunathan, BSc., A.M.I.C.T. L.T.I.	—	—	Shri M. C. Bhalod, B.Sc.	Shri Y. Subramanyam M.Sc.

Technical Assistant (Quality Evaluation) Grade T-II-3	Senior Operative/ Laboratory Assistant Grade T-1	Assistant	Supporting Staff Grade III	Supporting Staff Grade II	Supporting Staff Grade I
7	8	9	10	11	12
Shri V. M. Kulmethe, B.Sc.	—	—	—	Shri V. M. Subramaniam	—
—	Shri K. V. Nair	—	Shri N. Arumugham	—	—
Shri M. T. Danolli, B.Sc.	—	—	Shri R. P. Belamaddi	Shri V. R. Sone	—
—	—	—	Shri Ch. Timmanna	—	Shri V.Y.H. Suvarchala Rao
—	—	—	—	Shri Gian Singh	—
—	Shri Sunil Sharma, B.Sc.	—	—	Shri Harisingh Babar Shri John Robert	—
Shri V. K. Madan, B.Sc.	—	—	—	Shri Kamikar Singh	—
Shri R. S. Darade, B.Sc.	—	—	—	—	—
Shri N. V. Bhansode, B.Sc.	—	—	—	Shri L. R. Indurkar	—
Shri Tula Ram Gupta, B.Sc.	—	—	Shri Vijendra Singh	—	Shri S. M. Saini
Shri J. K. Gohel, B.Sc. Shri G. G. Mistry, B.Sc.	—	Shri G. Sasidharan	Shri J. B. Dhodia	—	Shri K. M. Rathod

APPENDIX III

Statement showing the total of Employees and the number of scheduled castes-scheduled tribes amongst them as on 31st December, 1981

Class	Permanent/ Temporary	Total Number of employees	Number of Scheduled Caste employees	Percentage of Scheduled Caste employees with reference to Col. 3	Number of Scheduled Tribe employees	Percentage of Scheduled Tribe employees with reference to Col. 3	Remarks
1	2	3	4	5	6	7	8
Class I	Permanent	28	—	5	—	—	—
	Temporary	15	2	—	—	—	—
Class II (Gazetted rank)	Permanent	15	—	7	—	—	—
	Temporary	31	3	—	—	—	—
Class III (Non-Gazetted rank)	Permanent	25	3	12	—	2	—
	Temporary	64	8	—	2	—	—
Class IV (Excluding Safaiwala)	Permanent	31	6	23	1	3	—
	Temporary	28	6	—	1	—	—
Class IV (Safaiwala)	Permanent	2	2	100	—	—	—
	Temporary	5	5	—	—	—	—

Note :
1. The Statement is prepared with reference to persons and not with reference to posts. Therefore, vacant posts, etc. have not been taken into account.
2. Persons on deputation have been included in the above Statement.
3. Persons working at Quality Evaluation Units of CTRL outside Bombay have also been included in the above Statement.
4. Persons permanent in one grade but officiating or holding temporary appointments in the higher grades, have been shown in the figures relating to such higher grade.
5. Persons in the categories of Scientific and Technical Cadre are appointed to the next higher grade on the basis of assessment as per Agricultural Research Service and Technical Service Rules of ICAR.

APPENDIX IV

Statement showing the number of reserved vacancies filled by members of scheduled castes — scheduled tribes during the year, 1981

Class of Post	Total No. of vacancies		Scheduled Castes					Scheduled Tribes					Remarks
	Notified	Filled	No. of vacancies reserved		No. of SC candidates appointed	No. of ST candidates appointed against vacancies reserved for SCs in the 3rd year of carry forward	No. of reservations lapsed after carrying forward for three years	No. of vacancies reserved		No. of ST candidates appointed	No. of SC candidates appointed against vacancies reserved for STs in the 3rd year of carry forward	No. of reservations lapsed after carrying forward for three years	
			Out of col. 2	Out of col. 3				Out of col 2	Out of col 3				
1	2	3	4	5	6	7	8	9	10	11	12	13	14
I. Posts filled by direct recruitment													
Class I	1 [A]	1 [A]	—	—	—	—	—	—	—	—	—	—	—
Class II	—	—	—	—	—	—	—	—	—	—	—	—	—
Class III	8	8	—	—	—	—	—	—	—	—	—	—	—
Class IV (Safaiwala)	—	—	—	—	—	—	—	—	—	—	—	—	—
Class IV (excluding Safaiwala)	—	—	—	—	—	—	—	—	—	—	—	—	—

1	2	3	4	5	6	7	8	9	10	11	12	13	14
II. Posts filled by promotion													
Class I	—	—	—	—	—	—	—	—	—	—	—	—	—
Class II	1	1	—	—	—	—	—	—	—	—	—	—	—
Class III	1	1(C)	—	—	—	—	—	—	—	—	—	—	—
Class IV	2	2(B)	—	—	—	—	—	—	—	—	—	—	—
(excluding Safaiwala)	—	—	—	—	—	—	—	—	—	—	—	—	—
Class IV Safaiwala)	—	—	—	—	—	—	—	—	—	—	—	—	—

A. Scientific posts are filled up by ICAR through ASRB.

B. The Posts have been filled up on the basis of the results of the assessment of the Technical Personnel.

C. The posts have been filled up on the basis of Seniority — Cum — Servitability

9. ANNEXURES

ANNEXURE I

New Equipments Purchased During 1981.

1. Polarisation Microscope
2. Projection Microscope
3. Electronic Tensiometer
4. Sputter Coater Unit
5. Oscilloscope
6. Systronics Digital pH Meter
7. Spectronics Digital Flame Photometer
8. Stelometer
9. Sliver Trash Analyser
10. Semi Automatic Twist Tester (SITRA-VPF)
11. Lea Strength Tester
12. Crimp Tester (SASMIRA)
13. Fabric Strength Tester (KMI)
14. Single Pen Potentiometric Strip Chart Recorder
15. Deioniser
16. Slide Projector

ANNEXURE II

Distinguished Visitors to CTRL During 1981

1. Dr. SH. Ibragimov,
   Zaitzev All Union Research Institute of Cotton
   Selection and Seed Production,
   Tashkent. USSR.

2. Dr. Yuldash Uzakov,
   Zaitzev All Union Research Institute of Cotton
   Selection and Seed Production,
   Tashkent, USSR.

3. Mr. Shigemi Wakamatsu,
   Deputy Director,
   Ministry of International Trade and Industry,
   Japan.

4. Dr. Sato Masahito,
   Deputy Director,
   International Affairs Division,
   Science and Technology Agency,
   Japan.

5. Dr. Muneyuki Yokoo,
   Director,
   Equipment and Facilities Division,
   Agriculture, Forests and Fisheries Research Council
   Secretariat,
   MAFF., Government of Japan.

6. Dr. Fumio Nakamura,
   Planning Bureau,
   Science and Technology Agency,
   Japan.

7. Mr. V. K. Misra,
   Counsellor (Science),
   Embassy of India at Tokyo,
   Kudanminami,
   2, Chone, Chiyoda. Ku,
   Tokyo.

8. Dr. S. Suzuki,
South-West Asia Division,
Ministry of Foreign Affairs,
Japan.

9. Dr. R. V. Bhagwat,
Chairman, Board of Studies in
Chemistry and Member of
Executive Council,
University of Bombay.

10. Dr. K. S. Korgaonkar,
Professor Emeritus, Physics Department,
Poona University.

11. Prof. W. B. Achwal,
Professor of Textiles,
University Department of Chemical Technology,
Bombay-400 019.

12. Dr. Roger Burley,
Dept. Chemical and Process Engineering,
Hoist-Watt University,
Edenburgh, UK.

13. Dr. Wilfred C. Ingamells,
Dept. of Polymer & Fibre Science,
UMIST, Manchester, England.

14. Prof. (Dr.) B. R. Nagar,
Consultant, Planning Commission,
New Delhi.

15. Dr. Manoon Pumklom,
Scientist,
Thailand.

16. Dr. S. R. Das,
Director-General,
National Test House,
Alipore,
Calcutta.

17. Dr. Satpal,
Assistant Programme Officer,
UNDP, New Delhi.

18. Dr. H. Steffer Peiser,
National Bureau of Standards,
Washington D.C., USA.,

19. Mr. U Sann Aung,
Project Co-ordinator,
Agricultural Co-operation,
Rangoon, Burma.

20. Mr. U Hla Shwe,
Deputy General Manager,
Agricultural Co-operation, Rangoon, Burma.

21. Mr. U Tin Myint,
Deputy Divisional Manager,
Agricultural Co-operation,
Rangoon, Burma.

22. Dr. Roberto Ibarguren,
Agricultural Minister and Counsellor
in-charge of Agriculture, Argentina Embassy,
Canberra, Australia.

23. Mr. Alexandri Akil,
Production Manager,
Central Industrielle du Cotton,
Rumania.

24. Dr. Ian Holme,
Lecturer in Textile Industries,
Dept. of Textile Industries,
Leeds University, UK.

25. Dr. B. C. Goswami,
Professor, University of Tennessee,
Knoxville, USA.

26. Dr. M. El. Homossani,
Lecturer, Textile Department,
Helwan University,
Orman, Giza, Cairo.

27. Shri K. H. Patil,
Ex-Minister for Agriculture,
Karnataka, Dharwad.