Cotton Technological Research Laboratory

Indian Council of Agricultural Research

Annual Report
1980

BOMBAY

Cotton Technological Research Laboratory

Indian Council of Agricultural Research

Annual Report
1980

BOMBAY

Contents

Printed : November, 1981

Published by Dr. V. Sundaram, M.Sc., Ph.D., F.T.I., Director, Cotton Technological Research Laboratory, Bombay 400 019, and Printed by Girish F. Shah, PRINTRITE, 24-B, Hamam Street, R.B. Compound, Bombay 400 023.

1. INTRODUCTION

This is the fifty-seventh Annual Report of the Cotton Technological Research Laboratory (CTRL) and covers the calendar year 1980.

CTRL was founded in the year 1924 by the Indian Central Cotton Committee (ICCC) mainly with a view to : (*i*) undertake spinning tests on various strains of cotton received from the Agricultural Departments situated in various parts of the country and (*ii*) carry out tests on the fibre properties of the cottons so as to relate these properties with the spinning value of cotton. In order to accomplish these functions, CTRL was actively collaborating with the Departments of Agriculture in different parts of the country in their endeavour for the development of new improved varieties 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). Keeping in view the responsibility of coordination of research and education vested in ICAR, the research activities of the Laboratory also have been reoriented and intensified. As in the past, concerted efforts were made to help the breeders and agricultural scientists to produce more and better quality cottons as also to increase the utilisation of cotton lint as well as cotton plant by-products which ultimately improve the economy of the country.

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 carry out research on physical, structural and chemical properties of cotton in relation to quality and processing performance.
3. To carry out research investigations on the ginning problems of cotton.
4. To investigate the greater and better utilization of cotton, cotton waste, linters, cottonseed, 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.
7. To collect and disseminate technical information on cotton.

Library

CTRL has an up-to-date library of books on cotton, cotton technology and allied subjects. The total number of books by the end of 1980 was 3,849, with the addition of 165 books during the year. Apart from this, the total number of bound volumes of journals was 3,656, as against 3,426 last year. The library received regularly about 220 journals covering a wide range of subjects in the textile and related fields, of which 97 were being subscribed and the remaining received on exchange basis or as complementary.

New Equipments Purchased

No major purchases of equipments were made during 1980. However, some of the equipments purchased during the year have been listed out in Annexure I.

Distinguished Visitors

Dr. O. P. Gautam, Director General, Dr. C. Kempanna, Assistant Director General, Shri. T.H. Nirmal, Assistant Director General and Shri Philomen Dos, Director (Finance) from ICAR Headquarters visited CTRL on official work. A list of other distinguished visitors to the Laboratory during 1980 is given in Annexure II.

Management Committee

In all, three meetings of the Management Committee were held during 1980, on March 6, July 22, and December 19, respectively.

The transactions during the first meeting included subjects like the question of formation of Research Advisory Committee for assistance in the evaluation of research projects. The deliberations of the meeting also comprised consideration of Revised Budget (1979-80) and Budget Estimates (1980-81) both plan and Non-plan, actions taken on the recommendations of the Staff Joint Council, Golden Jubilee Celebrations of the Quality Evaluation Units at Coimbatore and Dharwad and redelegation of powers to Heads of Divisions and Administrative Officer.

Some of the major recommendations made in the second meeting were purchase of a slide projector (involving foreign exchange), and decision to keep in abeyance the formation of Research Advisory Committee, pending recommendations of the Quinquennial Review Team which has to have its meeting shortly. The Sixth Plan Proposal (1980-85) and budget allocation for 1980-81 (Plan and Non-Plan), action plan for

achieving freedom from hunger to be adopted by ICAR, progress of research during the half year, January to June, 1980 and new research project proposals, were some of the other items discussed during the meeting.

In the third meeting, discussions took place on the final accounts of 1979-80, revised estimates for 1980-81, budget estimates for 1981-82, revised Sixth Plan Proposals (1980-85), action taken on the recommendations of the Management Committee at its earlier meeting and the reports of the Grievance Cell and Institute Joint Council. A new member was proposed to be nominated to the Grievance Cell for Officers belonging to Class I and above as one sitting member retired voluntarily from the service of CTRL. The progress of research during the period from July 1980 to December 1980 was also discussed during the deliberations.

Staff Research Council

A meeting of the Staff Research Council (SRC) was held from February 29 to March 5 in four preliminary sessions, and a final session on March 6 jointly with the Management Committee. All Divisional Heads and Scientist Members of the Management Committee from CTRL participated in all the sessions, while Scientists (S-1, S-2 and S-3) and Technical Officers (T-5 and T-6) attended only the sessions pertaining to their respective disciplines. In the joint session with the Management Committee, all Scientists S-2 and above as well as Technical Officers (T-6) including those in-charge of Regional Quality Evaluation Units were present. An appraisal of the various existing projects was done and the work proposed to be carried out during 1980 on the existing as well as new projects taken up, were considered. Eight projects were given extension while 18 projects were deleted from the programme of work as the work on them was completed/dropped/postponed. Out of the nine new project proposals for the year 1980, eight were approved with certain modifications and suggestions. Thus, finally the programme of work for the year 1980 was approved.

Apart from these, consideration of the progress of research had been one of the items in the agenda for all the subsequent Management Committee Meetings during 1980 and the SRC members presented the work done in their sections.

Inter-Institutional Projects

The following six Inter-Institutional Projects were operating at CTRL during the period.

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. Blending of cotton with wool, jute and other natural fibres (in collaboration with CSWRI, Avikanagar and Jute Technological Research Laboratory (JTRAL), Calcutt)o
4. Studies on the utilisation of Chitin and other allied products from prawn shell waste (in collaboration with Central Institute of Fisheries Technology (CIFT), Cochin and Regional Station of the Central Institute for Cotton Research (CICR), Coimbatore).
5. Enrichment of cattle feed by microbiological methods (in collaboration with Punjabrao Krishi Vidyapeeth (PKV) Akola).
6. Studies on the bio-synthesis of cellulose by microorganisms and higher plants (in collaboration with Mahatma Phule Krishi Vidyapeeth (MPKV), Rahuri).

As in last year, the progress of the first project above was impeded by non-receipt of adquate quantity of scoured wool samples required for testing the efficiency of the new device.

Integrated Cotton Development Project

With a view to improve the cotton production in the country, an Integrated Cotton Development Project (ICDP) sponsored by the World Bank, was launched by ICAR and the Government of India in the states of Maharashtra, Punjab and Haryana for a period of five years from November 30, 1976. Under this project, CTRL has been entrusted with the responsibility of organising a Ginning Training Centre at Nagpur.

Construction Work:

Initially the major constraint was lack of building at Nagpur for starting the Ginning Training Centre. The PKV has placed at the disposal of ICAR, some land on the Nagpur-Amravati road for construction of buildings for ICAR Institutes. Taking into consideration the volume of *Kapas* which is likely to be received and the need for storing lint, seed and pressed lint before it is disposed off, plans for various types of buildings have been drawn up. As the preliminary estimate was very high, the initial phase of construction was restricted to the following buildings:

1. One storage shed for cotton.
2. One building to house the ginning and pressing machinery.
3. One building to house spinning and testing machinery, workshop, lecture halls, administration unit, etc.
4. Trainees' hostel.

In addition to the cost of the above construction of buildings, considerable amount of money would also be required for developing the site. Hence, an additional provision of about Rs. 29 lakhs has been made in the Sixth Plan Budget (1980-85) of CTRL.

The construction of one godown for storing *kapas,* lint, etc., has been completed and the possession given by CPWD. The construction of the building for housing the ginning machinery, bale press, etc., is nearing completion. As the baling press requires special type of foundation, details of the same are being obtained from the foreign suppliers.

Since the outlay for the Sixth Plan of CTRL has been reduced considerably and also since the Nagpur Municipal Corporation has recently imposed a limit on the built-up area in the plot, it is not possible to construct a separate building for housing spinning and testing machinery, workshop, lecture halls, etc., as originally proposed. In view of this, it is now proposed to house these in the ginning building itself after making suitable modifications in the building. CPWD, which was approached in this connection, has also agreed for the modifications. The detailed estimates are awaited. Estimates for the construction of the Trainees' Hostel prepared by CPWD, have been forwarded to ICAR for approval.

In addition to the above, provision has also been made towards the cost of development of land which includes compound wall, internal roads, provision of water tanks, installation of a transformer, etc. From the estimate submitted by CPWD for the development of the plot, the share of CTRL has been worked out to be Rs. 10.70 lakhs, while the balance will be borne by National Bureau of Soil Survey and Land Use Planning which will also have its building at the same site. The amount has been sanctioned by ICAR and the work is likely to commence shortly.

Equipment: An order for procurement of a modern saw gin with bale press from the USA was placed with the Director General of Supplies and Disposals (DGS&D) in January, 1979. However, DGS&D subsequently intimated that the foreign exchange release obtained from the Government lapsed and a fresh release had to be obtained. Fresh foreign exchange release was obtained and the same communicated to DGS&D who have now floated tender for procurement of the equipment. The machinery is awaited.

A Double Roller Gin has been purchased locally. Action for purchase of other equipments will be taken up after the construction of the building reaches the completion stage.

Staff: It has not been possible to get staff having suitable qualification for conducting the training course. Hence, the Ginning Engineer attached to CTRL was looking after this work till his retirement in September, 1979. Meanwhile, two Scientists (S-1) with agriculture machinery background have been recruited and trained in ginning and they form the nucleus of the training staff. Action is being taken to recruit a Scientist (S-2) also.

One post of Assistant Administrative Officer (Stores) and two posts of Junior Clerks under the Project were filled up as these were considered necessary to process action relating to construction of building and purchase of machinery and equipment needed for the project. However, the post of the Assistant Administrative Officer (Stores) has again fallen vacant due to retirement. Other posts have not been filled up since the buildings are not yet ready.

Regional Committee

The fourth meeting of the ICAR Regional Committee No. 7 for the Semi-arid Lava Plateaus of Maharashtra, Western and Central Madhya Pradesh and Union Territory of Goa, Daman and Diu, was held on November 22 and 23, 1980 at the Conference Hall of the Goa Chamber of Commerce and Industry, Panaji. As the Director, CTRL was the nominated Member-Secretary of the Committee, the entire responsibility of organising the meeting was on CTRL. The meeting was inaugurated by Shri Pratapsingh Raoji Rane, Chief Minister and Minister-in-Charge of Agriculture and Forests of the Union Territory of Goa, Daman and Diu. Some of the Ministers and Vice-Chancellors from the three States of Maharashtra, Madhya Pradesh and Union Territory of Goa, Daman and Diu, Directors of various ICAR Institutes, various scientists and senior officials of ICAR and of the three states comprising Regional Committee No. 7 also attended the meeting.

The agenda items which figured in the discussions prominently included status papers on Agriculture/Animal Husbandry/Fisheries/Forestry, etc. from various states as well as status paper on various crops, apart from certain specific problems confined to particular regions.

As a result of discussions that took place on more than 30 items on the agenda, the existing problems with respect to agriculture, animal husbandry, fisheries, forestry, etc., in the various states under the

Regional Committee No. 7 have been identified and several recommendations made for follow-up action.

Post-Graduate Training

The recognition of CTRL as a post-graduate institution by the University of Bombay has been continued during the year 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.

Dr. V. Sundaram (Director), Dr. S. M. Betrabet (Senior Scientist, Microscopy), Dr. N. B. Patil (Senior Scientist, Physics), Dr. V. G. Munshi (Senior Scientist, Quality Evaluation), Shri M. S. Parthasarathy (Senoir Scientist, Mechanical Processing), Dr. S. N. Pandey (Scientist, Chemical Studies), Dr. K. R. Krishna Iyer (Scientist, Physics) and Kum. I. G. Bhatt (Scientist, Chemistry) continued as research guides for various degrees recognised by the University of Bombay. Shri P. K. Chidambareswaran, (Scientist, Physics) has been recognised as research guide for M.Sc. during the year.

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. degree in Spinning Technology.

The following student from the Laboratory was awarded degree as indicated :

Shri G. S. Patel — M.Sc. in Physics (Textiles).

Golden Jubilee Celebrations of Quality Evaluation Units at Coimbatore and Dharwad

The Quality Evaluation Units of CTRL at Coimbatore and Dharwad completed 50 years in 1978 and in order to celebrate the occasion, a wide spectrum of programmes was chalked out. But the celebrations were postponed in view of the Golden Jubilee Celebrations of ICAR itself in 1979. Subsequently, two seminars of topical interest were held at Coimbatore and Dharwad in January, 1980 as part of the celebration. Six papers on "Status and Development of Long Staple Cottons in Tamil Nadu" were presented at the Seminar in Coimbatore on January 17, 1980. At the Seminar on "Recent Developments on Hybrid Cottons in Karnataka State" organised at Dharwad on January 28, 1980, six papers were contributed. At both the Seminars, it was emphasised that the number of varieties grown in each agro-climatic area should be reduced. The celebrations provided a proper forum for the participants

to recapitulate the methods by which the various problems in cotton research were overcome in the past in Tamil Nadu and Karnataka and, at the same time, created an awareness of the existing problems for which solutions have to be found out.

Membership on Other Organisations

The Director and other Scientists of CTRL continued to represent CTRL and ICAR on various Committees and Institutions as in the past.

In addition, the Director was nominated as a member of the following Committees/bodies during the year :

1. The Cotton Advisory Board — nominated by Ministry of Commerce, Government of India.
2. The Committee on Textile Technology — nominated by Department of Science and Technology, Government of India.
3. Editorial Board of Indian Journal of Textile Research (Council of Scientific and Industrial Research, New Delhi).

The Assistant Accounts Officer was nominated by ICAR as a member of the Visiting Team to inspect the research set-up of the Land Research Institute, Bombay, for the purpose of recognition of the same under Section 35 (I) (ii) of the Income Tax Act, 1961.

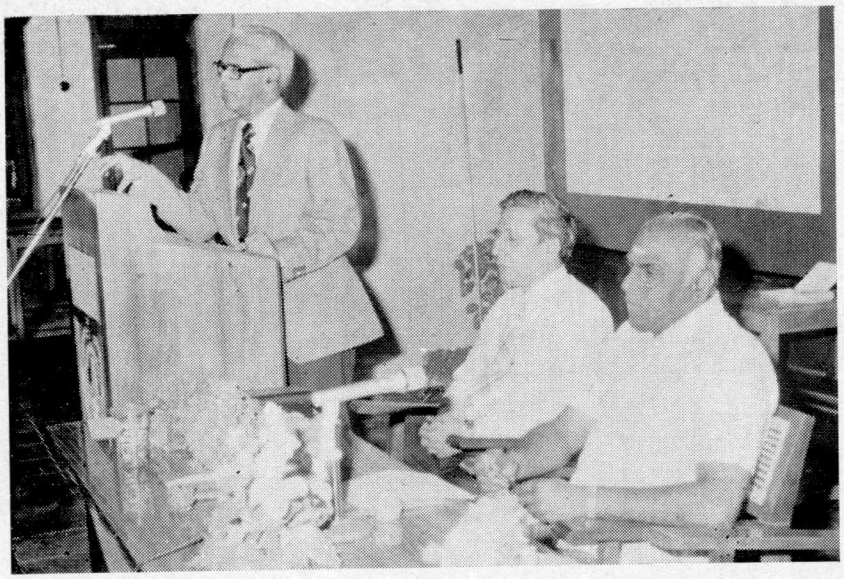
Expansion and Modernisation

The work on the multi-storeyed building which was to be constructed as the first phase of construction programme under the modernisation and expansion of the Laboratory was progressing satisfactorily. However, the installation work of lifts, etc., is expected to be done only in the beginning of 1982. Action has also been taken for installation of an automatic telephone exchange comprising 50 lines in the new building through the Indian Telephone Industries Ltd. Efforts were also being made to obtain electrical power connections for the new building. The construction work is expected to be completed by the end of 1981.

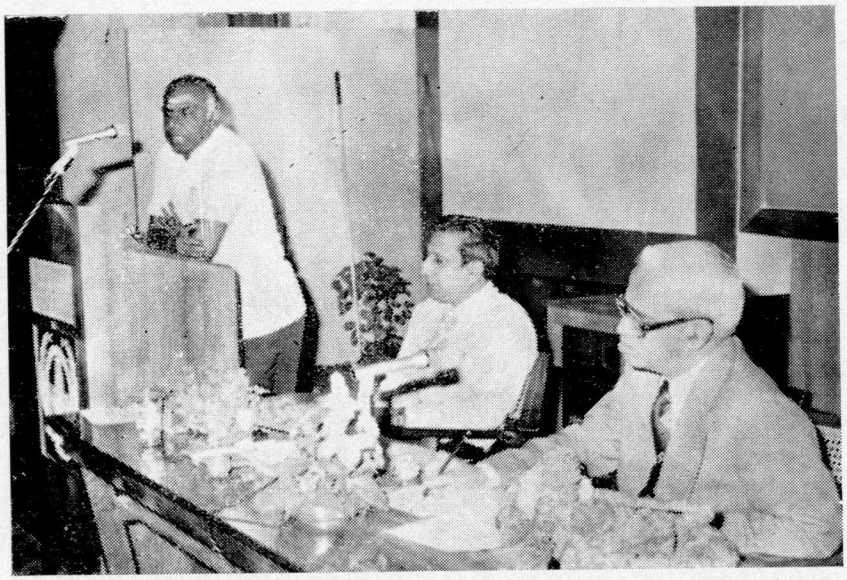
Staff Amenities

Accommodation has been provided for 16 staff members in Grade D and 22 in Grades C and B, in the existing staff quarters of the Laboratory. Ten employees in Grade A have also been provided accommodation by purchasing a building of 10 tenements for High Income Group (HIG) from Maharashtra Housing Board (MHB). Another building of 20 tenements for the Middle Income Group (MIG) was being purchased

GOLDEN JUBILEE CELEBRATIONS OF CTRL REGIONAL UNIT AT COIMBATORE

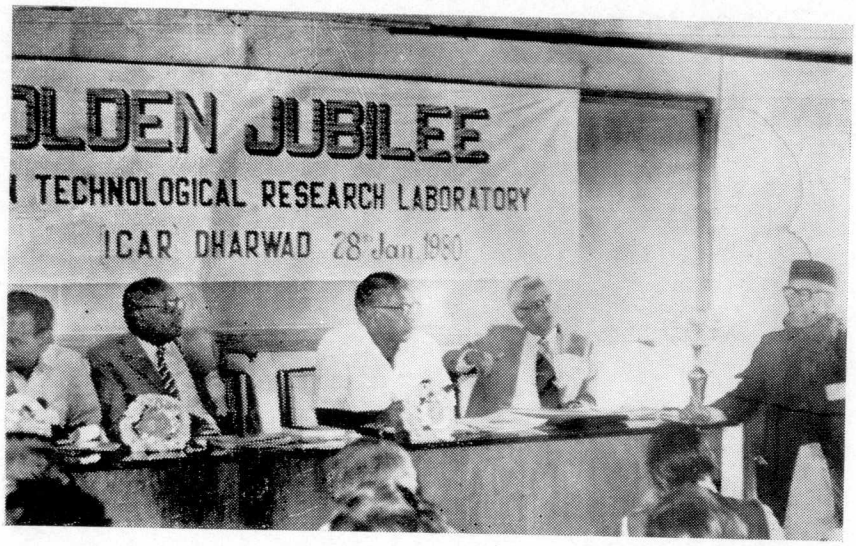


Dr. V. Sundaram (Director, CTRL) Welcomes the Guests



Shri A. Venkataraman, IAS (Vice Chancellor, TAU) Inaugurates the Seminar

GOLDEN JUBILEE CELEBRATIONS OF CTRL REGIONAL UNIT AT DHARWAD



(L to R) Dr. R. B. Patil (Director of Instructions), Dr. C. Kempanna (DDG, ICAR), Dr. S. V. Patil (Director of PG Instructions, UAS, Dharwad), Dr. V. Sundaram (Director, CTRL) and Rao Bahadur S. H. Prayag (Cotton Research Worker)

REGIONAL COMMITTEE MEETING AT GOA

Shri Pratapsingh Raoji Rane (Chief Minister, Goa, Daman and Diu) Inaugurating the Meeting of Regional Committee No. 7. On his right is Shaikh Hassan (Minister of Health, Goa, Daman and Diu) and on his left is Dr. O. P. Gautam (Director General, ICAR)

from MHB for providing accommodation to employees in Grades A and B. The possession of the building is expected by April 1981.

Departmental Canteen

A newly elected Managing Committee consisting of the following members has taken over charge on March 1, 1980 :

Chairman	:	Shri S. R. Ganatra
Members	:	Shri N. Thejappa
		Kum. R. Verghese
		Shri G. Viswanathan
		Shri R. K. Landge

At the First meeting of the Committee, Sarvashri N. Thejappa and G. Viswanathan were unanimously elected as Hon. Secretary and Hon. Treasurer, respectively.

Finance

A statement showing the sanctioned budget grant of CTRL and the actual expenditure for the financial year 1979-80 is furnished in Appendix I. It will be seen from the statement that the actual expenditure under Non-Plan was Rs. 39,41,987 as against sanctioned grant of Rs. 39.42 lakhs. An expenditure amounting to Rs. 30,15,312 was incurred under the scheme for modernisation and strengthening of CTRL for intensive research on cotton against the sanctioned grant of Rs. 30.15 lakhs. Further, (*i*) a sum of Rs. 0.88 lakh was incurred 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. 0.90 lakh, (*ii*) a sum of Rs. 0.55 lakh was incurred on scheme for 'Optimal Blending of Standard Varieties of Indian Cottons' as against the sanctioned amount of Rs. 3.01 lakhs and (*iii*) a sum of Rs. 0.06 lakh was incurred on Regional Committee No. 7 against the sanctioned grant of Rs. 0.19 lakh. The savings during the year, in all the cases, were mainly due to non-filling up of the posts and also non-materialisation of certain purchases, etc.

Significant Findings

The following two varieties of cotton were released through the Tamil Nadu State Department of Agriculture :

Variety		*Traits*
KCH.2	..	Short duration variety, recommended for cultivation in rice fallows areas of Tamil Nadu, having 30.7 mm mean length and spinnable up to 60s count; superior to MCU.7 in yield and spinnability.
KC.1	..	Short duration variety, recommended for cultivation in rainfed areas of Tamil Nadu, having 23.5 mm mean length and spinnable up to 40s count. High yield potential compared to MCU.6, and better spinnability compared to varieties like Bharati and Laxmi.

The Panel meetings of the Breeding and Technology Group of North Zone, Central Zone and South Zone under AICCIP identified the following promising strains :

Strain/hybrid		*Special features*
		NORTH ZONE
LH.357	..	A long staple *hirsutum* variety from Punjab Agricultural University (PAU) having high ginning out-turn (37%) and yield potential.
FP.286	..	Another *hirsutum* variety from PAU, which has shown good spinning performance at 40s count.
LD.230	..	A short staple coarse *desi* variety from PAU which has potential for further improvement as the strain was amenable to closer spacings. It recorded higher yields than G.27 and because of its superior performance, it has been recommended by the Variety Evaluation Committee of PAU for adaptive trials in the farmers' fields in the Punjab State.
		CENTRAL ZONE
AKH.604	..	An *arboreum* strain identified at Punjabrao Krishi Vidyapeeth, (PKV), Akola, which recorded more than 15% increase in yield over AKH.4 and more than 18% over AK.235. The technological characteristics are on par with those of AKH.4. Spinning potential — over 20s.

SOUTH ZONE

H.64 and H.134 .. These hybrids involving *hirsutum* x *barbadense* crosses were identified at CICR Regional Station, Coimbatore. *Kapas* yields were 24.74 q/ha and 22.33 q/ha, respectively, against 19.89 q/ha of Varalaxmi. H.64 is earlier maturing than Varalaxmi by 2-3 weeks. In addition to having higher ginning out-turn, these hybrids recorded 2.5% span length over 35 mm and PSI over 9.0 lb/mg. Spinning potential — around 80s.

A new instrument for the determination of fibre length was being fabricated using, to a large extent, indigenously available electronic, optical and mechanical components.

X-ray methods have been developed for analysis of blends of cotton with polyester, viscose and polynosic fibres. The results of radial diffraction analysis and orientation analysis for each of the blend systems indicated that the accuracy of results lie within ± 3% and ± 7%, for the two methods, respectively.

Studies on decrystallised yarns obtained by the limited substitution procedure standardised at CTRL showed that these samples recorded higher strength and work of rupture after crosslinking than the undecrystallised control for nearly equal levels of CRA.

Of the four different break draft combinations, viz. 1.7-1.7(A), 1.7-1.3(B), 1.3-1.3(C), 1.3-1.7(D), for first and second draw frame passages respectively, tried out for their comparative performance during processing on Lakshmi-Rieter high speed drawframe, using Varalaxmi cotton, the combination A recorded the lowest U% (2.8) for the finisher drawframe sliver. The yarn quality was superior with combination C. In general, the yarn quality from high speed drawframe slivers was better than that from the conventional drawframe.

Open-end spinning was found to be successful in the production of yarns from cotton wastes, where ring spinning failed.

When mixed catalyst system was used in the single step poly-set process for crosslinking cotton fabric samples, the strength retention was found to be better with good Durable Press (DP) rating.

A study in connection with the absorbancy of Indian cottons showed that generally cotton varieties having higher Micronaire value showed good water holding capacity and low sinking time, while the crystallite size did not show any definite relationship.

During electron microscopical investigation of dye diffusion and dye aggregation in unmodified and modified cottons, it was observed that

the electron diffraction patterns of some of the dye aggregates were a mixture arising out of two different crystalline structures, one due to cotton cellulose I and the other due to metallized dye crystallites, confirming the crystalline nature of the dye aggregates. However, the aggregates formed at the microfibrillar level posessed a poor crystalline structure or had no crystalline structure.

Preliminary experiment undertaken to enrich the acid hydrolysed and alkali neutralised straws with *Beijernineckia mobilis* (a nitrogen fixing bacterium) resulted in an increase in the crude protein content by 2-3 folds in enriched straws.

Pot culture studies undertaken to utilise prawn shell waste for the control of root rot disease of cotton revealed that the prawn shell waste, apart from having the property of controlling root rot caused by *Rhizoctonia solani,* can be a good source of nutrients especially nitrogen.

Studies undertaken on cotton seed meal in fermentation medium revealed that free gossypol was released during fermentation in the medium and that clear inhibitory zones were developed on the plates after incubation. However, since the gossypol release during fermentation was very slow, it had very little effect on the organism.

Initial trials undertaken to explore the possibility of producing bio-gas from willow dust revealed that about 160 litre of bio-gas could be produced from 1 kg of willow dust in a period of 60 days.

2. PROGRESS OF RESEARCH

Considerable progress has been made on various research projects during the year and a brief account of the same is given below :

Evaluation of the Quality of Cotton Samples

CTRL is imparting technological assistance to the Agricultural Scientists 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. Besides, 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 Co-ordinated Cotton Improvement Project (AICCIP). Accordingly, a large number of samples are being received every year for various tests, which also include samples from trials conducted by Agricultural Universities and State Departments of Agriculture and samples being obtained for different on-going research investigations.

Table 1(a) summarises the number of samples received during the years 1978, 1979 and 1980 as well as the average number of samples for the quinquennium 1971 to 1975.

Table 1(b) gives the number of samples tested at different regional units during 1980.

The samples received from agricultural trials are tested in the order of receipt and test reports issued as soon as possible. The test results on samples of Trade Varieties and Standard Indian Cottons are reported as Technological Circulars as and when the tests are over and later on compiled for the whole season and published as two Technological Reports — one for Trade Varieties and the other for Standard Indian Cottons. Besides these, test reports are also issued on samples received for certain miscellaneous tests such as determination of quality of ginning, neppiness, oil content in cottonseed, etc.

The statewise figures for the number of samples tested for fibre characteristics and spinning performance have been given in Table 2 under the two heads : (i) AICCIP 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 1971-75	1978	1979	1980
Fibre and Full Spinning	403	120	247	178
Fibre and Microspinning	2,562	1,922	1,933	2,041
Microspinning alone	—	—	—	—
Fibre tests alone	86	435	193	338
Mill test	12	16	6	27
Standard cottons	21	22	24	26
Trade Varieties				
Lint	24	35	19	33
Kapas	49	41	42	79
Technological Research	81	170	77	63
Miscellaneous	—	16	40	53
Total	3,238	2,777	2,581	2,538

Table 1 (b): Number of Samples Tested at the Quality Evaluation Units

Unit	Total number of samples tested			
	Length	Fineness	Strength	Maturity
*Akola	149	—	—	69
Coimbatore	1,031	1,081	1,031	1,099
Dharwad	1,136	1,106	1,106	1,106
Guntur	298	264	275	289
Hissar	315	3,707	315	3,331
Indore	644	644	644	644
Ludhiana	1,806	1,500	592	1,500
Nagpur	559	529	584	553
Nanded	1,020	1,211	1,211	1,233
Sriganganagar	553	553	40	559
Surat	9,417	7,178	6,205	7,210

* Number of samples tested at Akola is comparatively less because this Unit was set up only in May 1980 and it was not fully equipped to carry out all the tests.

Table 2: Number of Samples Tested and Reports sent during 1980

State	Fibre and Full spinning	Fibre and Micro-spinning	Micro-spinning	Fibre Tests	Total
(i) AICCIP					
Punjab	31 (5)	46 (7)	—	8 (1)	85 (13)
Haryana	16 (4)	40 (7)	—	16 (3)	72 (14)
Rajasthan	4 (1)	—	—	—	4 (1)
New Delhi	—	29 (2)	—	—	29 (2)
Madhya Pradesh	6 (2)	237 (16)	—	—	243 (18)
Gujarat	66 (12)	—	—	—	66 (12)
Maharashtra	17 (4)	117 (21)	—	—	134 (25)
Andhra Pradesh	3 (1)	72 (5)	—	—	75 (6)
Karnataka	41 (9)	449 (34)	—	—	490 (43)
Tamil Nadu	—	257 (24)	—	—	257 (24)
Total	184 (38)	1,247(116)	—	24 (4)	1,455(158)
(ii) Other State Schemes					
Punjab	—	—	—	—	—
Haryana	—	—	—	—	—
Rajasthan	—	—	—	—	—
New Delhi	—	—	—	—	—
Madhya Pradesh	—	—	—	—	—
Gujarat	—	—	—	—	—
Maharashtra	9 (3)	28 (2)	—	—	37 (5)
Andhra Pradesh	10 (4)	24 (3)	—	—	34 (7)
Karnataka	5 (1)	80 (12)	—	—	85 (13)
Tamil Nadu	7 (2)	12 (2)	—	—	19 (4)
Total	31 (10)	144 (19)	—	—	175 (29)
Grand Total					1,630(187)

Note : Figures in brackets indicate number of reports issued.

ALL INDIA COORDINATED COTTON IMPROVEMENT PROJECT

In order to intensify the research programmes on cotton, the Indian Council of Agricultural Research sponsored the All India Coordinated Cotton Improvement Project (AICCIP) with effect from 1967. The work on this project is carried out on an all India basis with the 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 demarcated according to the agro-climatic conditions. The North zone comprises the States of Punjab, Haryana, Rajasthan and Uttar Pradesh, and the Central zone includes the States of Madhya Pradesh, Gujarat and Maharashtra, while the South zone consists of 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 *hirsutum* and short staple *desi 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 types. 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 Coordinated Varietal Trials of *G. hirsutum* for normal plant type as well as for early maturing (short duration) type were conducted at Faridkot, Hissar, Ludhiana, Muktsar, Saradhana and Sirsa. Table 3 gives the data on the ranges of 2.5% span length, fineness and bundle strength along with the maturity for the samples tried out in the above two trials.

PROGRESS OF RESEARCH

The following strains tried out at different locations under this trial gave encouraging spinning performance :

Location	*Count*	*Promising Strains*
Faridkot	40s	FP.286 and F.414
	30s	F.605, RS.488, LH.357, FP.233, B.N. and LH.371
Hissar	40s	FP.286, RS.481, RS.488, B.N. and H.777
	30s	H.854 and LH.371
Ludhiana	40s	F.605, LH.318, LH.357, FP.286 and B.N.
	30s	LH.372, H.854, LH.299, LH.371 and F.414
Muktsar	30s	B.N., LH.357, F.414 and H.854
Saradhana	30s	FP.286, RS.481, SH.175, LH.318, LH.372, 468-10, H.854, FP.277, FP.233, RS.485, RS.490 and B.N.
Sirsa	30s	F.605, FP.286, RS.481, PL.470, H.842, FP.233, BS.211, RS.485, B.N., PL.500 and H.777

Samples pertaining to Preliminary Varietal Trial were received from Faridkot, Hissar, Ludhiana, Muktsar, Saradhana and Sirsa under normal plant type and from Hissar and Ludhiana 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*
Faridkot	30s	HS.6, LH.518, J.329 and F.414
Hissar	30s	RS.489 and H.777
Ludhiana	30s	B.N., H.841, FP.236, RS.489 and F.414
Muktsar	30s	F.414
Saradhana	30s	H.841, H.844, H.845, H.518 and FP.241
Sirsa	30s	FP.132, FP.236 and RS.487

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

Location	*Count*	*Promising Strains*
Faridkot	30s	RS.514, LH.705, RS.513 and F.414
Hissar	30s	LH.704, RS.518 and H.777
Saradhana	30s	RS.511, H.815 and LH.704
Sirsa	30s	H.843, RS.513, RS.510 and RS.515

Table 3 : Summary of Test Results of Strains Tried in Coordinated Varietal Trials (CVT) of *G. hirsutum* in North Zone

Location	No. of samples	Range				Count	Spinning performance		Control
		2.5% span length (mm)	Micronaire value (μ g|in.)	Maturity	Bundle strength (g|t)		A	B	
		Normal Plant Type — Code No. Br04(a)							
Faridkot	6	23.1—25.7 (24.7)	3.9—4.3 (4.1)	average to good	46.1—51.5 (48.8)	40s	2	Nil	F.414
Hissar	5	24.3—25.5 (24.6)	3.8—4.2 (4.1)	average to good	46.6—48.8 (47.5)	40s	5	3	H.777
Ludhiana	7	24.7—27.7 (26.3)	4.1—4.9 (4.5)	average to good	46.6—51.5 (48.7)	40s	5	6	F.414
Muktsar	7	24.7—26.1 (25.2)	3.8—4.4 (4.2)	average to godo	47.2—48.2 (47.8)	30s	1	1	F.414
Saradhana	15	22.4—29.7 (26.3)	3.3—4.6 (3.9)	average to good	37.0—45.6 (42.1)	30s	6	13	B.N.
Sirsa*	6	24.2—29.1 (26.6)	4.2—4.8 (4.4)	average to good	47.2—52.5 (49.7)	30s	4		

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

Table 3: Summary of Test Results of Strains Tried in Coordinated Varietal Trials (CVT) of *G. hirsutum* in North Zone *(Contd.)*

Location	No. of samples	Range				Count	Spinning performance		Control
		2.5% span length (mm)	Micronaire value (μ g/in.)	Maturity	Bundle strength (g/t)		A	B	
Short Duration Type — Code No. Br04(c)									
Faridkot	6	23.4—26.4 (24.5)	3.8—4.8 (4.4)	average	44.0—49.3 (46.3)	30s	4	Nil	F.414
Hissar	7	23.6—26.1 (25.1)	3.9—5.0 (4.3)	average to good	44.5—48.2 (46.9)	30s	3	1	H.777
Ludhiana	6	23.1—26.6 (24.5)	4.6—5.0 (4.8)	good	46.1—50.4 (48.0)	40s	1	4	F.414
Muktsar	5	24.4—26.0 (25.1)	3.8—4.4 (4.1)	average to good	44.5—48.8 (46.4)	30s	2	1	F.414
Saradhana	16	23.0—27.4 (24.5)	3.4—4.2 (3.9)	low to good	39.1—47.2 (43.0)	30s	6	5	B.N.
Sirsa	8	22.7—27.1 (24.8)	3.8—4.8 (4.4)	average to good	45.0—51.5 (48.5)	30s	7	2	H.777

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 (μ g/in.)	Maturity	Bundle strength (g/t)		A	B	
		Normal Plant Type — Code No. Br03(a)							
Faridkot	6	23.6—25.9 (24.6)	4.1—5.0 (4.5)	average to good	44.0—48.2 (47.0)	30s	4	Nil	F.414
Hissar	5	24.2—26.5 (25.5)	3.8—4.4 (4.1)	good	46.6—49.8 (48.1)	30s	2	Nil	H.777
Ludhiana	6	23.8—28.5 (25.4)	4.6—4.8 (4.7)	good	47.2—52.0 (49.0)	30s	5	3	F.414
Muktsar	7	23.9—27.0 (25.3)	4.0—4.8 (4.4)	average to good	45.6—49.3 (47.3)	30s	1	Nil	F.414
Saradhana	23	23.1—27.9 (25.6)	3.2—4.1 (3.7)	low to good	40.2—46.6 (42.9)	30s	5	17	B.N.
Sirsa *	5	23.7—28.3 (25.8)	4.6—5.2 (4.8)	average to good	44.0—48.2 (46.1)	30s	3		
		Compact Plant Type — Code No. Br03(b)							
Hissar	5	25.2—30.6 (27.0)	3.6—4.3 (4.0)	average to good	45.6—50.9 (47.6)	30s	1	Nil	H.777
Ludhiana	5	24.0—26.2 (25.3)	4.4—4.8 (4.6)	average to good	43.4—47.2 (45.2)	30s	1	Nil	F.414

A — No. of samples spinnable to the count selected.

B — No. of samples better than or on par with the Control.

* Control variety not received.

Values in brackets indicate averages.

G. arboreum Trial

Samples pertaining to *G. arboreum* trial was 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 the place of existing varieties, viz. G.27 and HD.11. Mean fibre length of the strains tried under this trial ranged between 16.0 mm and 22.6 mm. Micronaire values for the following samples only were higher than that of G.27 (7.2) :

LD.202 (7.8), HD.5 (7.7), LD.31 (7.6), HD.36 (7.6), RG.2 (7.6), LD.205 (7.6).

Miscellaneous Trials

Pilot Project Demonstration Trial was conducted at Hissar and Sirsa. At Hissar, the performance of the new strain, H.842 was inferior to the local control, H.777. The performance of strain 4-1-1 was compared with that of the local control, Bikaneri Narma, at Sirsa. It was observed that even though both the strains recorded identical performance in respect of mean length, uniformity in length, fineness, maturity and bundle strength at zero gauge length, the strain 4-1-1 did not record desired yarn strength at 40s count.

In another miscellaneous trial conducted at Faridkot, progenies FP.286, FP.236, FP.233, FP.605, FP.332 and FP.167 recorded encouraging CSP at 30s count.

Central Zone

This Zone comprises the States of Madhya Pradesh, Gujarat and Maharashtra, where varieties pertaining to *G. hirsutum*, *G. herbaeeum* and *G. arboreum* species are under commercial cultivation. However, during recent years, emphasis has been given to 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. As mentioned earlier, trials using North Zone entries are conducted at Gwalior in Madhya Pradesh and Rahuri in Maharashtra under irrigated conditions.

G. hirsutum Trials

In the Coordinated Varietal Trial, samples were received from Nanded and Surat under irrigated conditions and from Achalpur, Indore, Khandwa and Nanded under rainfed conditions. Samples, spe-

Table 5: Summary of Test Results of Strains Tried in Coordinated Varietal Trial (CVT) of *G. hirsutum* in Central Zone

Location	No. of samples	Range				Count	Spinning performance		Control
		2.5% span length (mm)	Micronaire value (μ g|in.)	Maturity	Bundle strength (g|t)		A	B	
Irrigated Trial — Code No. Br04(a)									
Nanded *	3	26.3—27.7 (26.9)	3.0—4.4 (3.5)	low to good	45.0—477 (46.3)	40s	3		
Surat	6	25.5—32.3 (27.8)	3.5—4.4 (3.9)	average to good	40.7—47.2 (43.8)	50s	3	Nil	G.Cot.100
Rainfed Trial — Code No. Br04(b)									
Achalpur	6	25.4—30.1 (27.6)	4.1—4.6 (4.3)	good	45.0—48.8 (46.7)	40s	4	2	DHy.286
Indore	16	21.4—27.5 (25.3)	3.3—4.4 (3.7)	low to average	42.3—52.0 (47.4)	40s	2	Nil	Khandwa 2
Khandwa	18	21.5—27.9 (25.8)	3.3—4.6 (4.2)	average to good	44.5—57.0 (48.5)	40s	5	14	Khandwa 2
Nanded *	5	24.6—30.1 (27.2)	4.0—4.2 (4.2)	average	40.2—44.5 (42.8)	40s	5		

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

Table 5: Summary of Test Results of Strains Tried in Coordinated Varietal Trial (CVT) of *G. hirsutum* in Central Zone (Contd.)

Location	No. of samples	Range				Count	Spinning performance		Control
		2.5% span length (mm)	Micronaire value (μ g|in.)	Maturity	Bundle strength (g|t)		A	B	
High Ginning Type Trial — Code No. Br04(c)									
Achalpur	6	25.2—28.6 (27.1)	4.2—4.5 (4.3)	average to good	41.8—49.8 (46.5)	40s	3	1	DHy.286
Indore	13	23.3—26.1 (24.3)	3.3—4.6 (4.0)	average to good	38.1—48.2 (44.0)	30s	1	7	Khandwa 2
Junagadh *	13	23.2—28.2 (24.9)	3.1—4.0 (3.6)	low to average	38.6—46.1 (43.1)	30s	1		
Khandwa	16	22.4—25.4 (24.1)	3.3—4.3 (4.0)	average to good	41.3—49.3 (46.4)	40s	5	10	Khandwa 2
Nanded *	3	25.9—26.6 (26.3)	4.2—4.4 (4.3)	average	41.8—44.5 (42.7)	40s	3		
Surat	6	25.5—30.3 (27.0)	3.5—4.6 (4.1)	average to good	41.3—44.5 (42.7)	40s	1	Nil	G.Cot.100
Gwalior	20	23.3—30.0 (25.2)	3.8—5.0 (4.5)	average to good	47.7—54.7 (51.2)	30s	19	9	C.59.228

* Control variety not received.

cially identified for high ginning outturn were also received from Achalpur, Indore, Junagadh, Khandwa, Nanded and Surat. Further, samples from trials containing North Zone entries were received from Gwalior.

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*
Achalpur	40s	DHY.286, NH.124, PKV.0732, NH.183 and BA.26
Gwalior	30s	H.807, H.849, H.854, SH.2374, FP.277, FP.233, LH.299, LH.336, LH.371, BC.131-2, CPD.8-1-1, BS.211, RS.285, RS.490, B.N., F.414, SH.131 and C.59-228
Indore	40s	Badnawar 1, BSTD.35 and 76IH.20
Junagadh	30s	ACH.101 and 73IH.3
Khandwa	40s	JLH.19, PKV.0732, NH.124, ACH.344, BSTD.35, G.Cot. 10, KOP.236, CPH.2888, 73IH.3 and 68KH.33/1146
Nanded	40s	IAN.4795, CPH.4373, G.Cot. 10, JLH.19, F.414, PKV.0011, 76IH.23 and 72IH.2
Surat	50s	NH.124, G.925 and 76IH.20
	40s	G.Cot. 10 and CPD.8-1

Samples pertaining to Preliminary Varietal Trial under irrigated conditions were received from Junagadh and under rainfed conditions from Achalpur, Amravati and Khandwa. In the irrigated tract of Madhya Pradesh sowing is normally done prior to monsoon. Therefore, the entries approved for Preliminary Varietal Trial in North Zone were also tried at Gwalior.

Table 6 contains the fibre and spinning test results of the samples pertaining to the above trial. The promising strains from the spinning point of view are indicated below :

Location	*Count*	*Promising Strains*
Achalpur	40s	IC.1225, JLH.72 and ISTD.34
Amravati	40s	G.Cot.10, PKV.015, 71KH.82/1845 and B.72-2888

Gwalior	30s	B.N., J.329, H.806, H.841, H.844, H.845, H.846, H.847, F.518, FP.235, FP.132, FP.236, LH.338, LH.604, LH.580, LH.613, RS.489, RS.521, RS.487, 4-1-1, SH.179 and HS.6.
Junagadh	40s	BSTD.35, IAN.27-47 and Santher 13442
Khandwa	30s	JLH.79, 74.KH83/1888, ISTD.34, PKV.015, G.Cot.10, RHR.393, IC.1225, DS.56, JLH.84, JLH.72, B.72-2888, RHR.401, NH.195, PKV.0012-14, NHH.126 and SH.175

G. barbadense Trials

Samples pertaining to Coordinated Varietal Trial were received from Junagadh for microspinning test and from Surat for full spinning test. Range of 2.5% span length was between 29.1 mm and 34.5 mm. Maturity was satisfactory only in the case of a few strains. Bundle strength values were good, ranging between 44.5 g/t and 54.7 g/t. The following strains fared well at 60s count :

Location	*Promising Strains*
Junagadh :	SILS.9, IBSI.5356, ERB.4600 and ERB.13727
Surat :	ERB.13758

G. arboreum Trials

The Coordinated Varietal Trial was conducted at Badnapur, Indore, Khandwa, Nanded and Nagpur. The following strains recorded desired yarn strength at 20s count :

Location	*Promising Strains*
Badnapur	NA.8
Khandwa	JLA.2, AK.4, AKH.605, SC.97, AKH.487, JLA.26, Local Check, NA.8, AKH.607, NA.10, AKH.597 and AKH.496
Nanded	AKH.605, AKH.597, CJ.73, AKH.615, PA.32 and 78IA.1
Nagpur	AKH.592, AKH.606, AKH.590 and AKH.604

Table 6: Summary of Test Results of Strains Tried in 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 (μ g|in.)	Maturity	Bundle strength (g|t)		A	B	
Irrigated Trial, Trial Code No. Br04(a)									
Junagadh	19	24.5—30.0 (25.7)	3.3—4.7 (3.9)	average to good	39.1—46.1 (40.2)	40s	4	3	G.Cot.100
Gwalior*	22	23.7—27.7 (25.7)	4.1—5.2 (4.6)	average to good	47.2—54.7 (50.9)	30s	22		
Rainfed Trial, Trial Code No. Br04(b)									
Achalpur	6	26.9—32.2 (28.8)	3.8—4.8 (4.1)	average to good	44.0—50.4 (47.1)	40s	4	2	DHy.286
Amravati	6	23.5—30.2 (26.4)	3.4—4.6 (3.9)	average to good	43.4—47.2 (45.0)	40s	5	3	DHy.286 L.147
Khandwa	20	22.7—30.3 (25.4)	3.1—4.6 (3.9)	average to good	42.9—52.0 (47.0)	30s	18	9	Khandwa 2

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

G. herbaceum Trials

Coordinated Varietal Trial was conducted at Bharuch and Surat under irrigated conditions and at Viramgam under rainfed conditions. Although 2.5% span length for most of the samples was around 23-24 mm, the uniformity in staple was excellent. The bundle strength also was high. Apart from Digvijay, the strains numbered as 5497, 5814, 6117 and 1449 at Bharuch, showed promising performance when spun to 30s count while strains Sujay, 6117 and 5497 fared well when raised at Surat. So far as the samples from Viramgam were concerned, the strains 1522, 1501, 6130, 1432, 914, 1449, 6023 and 53-3-1 fared well at 20s count.

In the Preliminary Varietal Trial conducted at Bharuch and Surat, the strains numbered as 1449, 3518 and 5495 raised at Bharuch fared well at 20s count, while at Surat the strains 3518, 5495 and 3549 fared well at 30s 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 Madhya Pradesh, Gujarat and Maharashtra, either under irrigated or rainfed conditions. The performance of the following hybrids was promising at the counts and locations indicated below :

Location	*Count*	*Promising Hybrids*
Achalpur (I) ..	50s	Godavari, JKHy.1 and Hybrid 4
Achalpur (R) ..	40s	JKHy.1, ACHH.468, ACHH.7186 and Godavari
Amravati ..	50s	ACHHy.3, Godavari, JKHy.1 and Hybrid 4
Bharuch (R) ..	50s	GHH.15, ACHH.468 and Hybrid 4
Nanded (I) ..	50s	NHH.1, GHH.3, JKHy.1 and Hybrid 4
Nanded (R) ..	50s	GHH.3, NHH.44 and NHH.67
Nagpur (R) ..	40s	JKHy.1

(I — Irrigated; R — Rainfed)

Inter-specific Hybrids : The object of this trial was to identify superior hybrids in respect of yield and quality to replace Varalaxmi, which is the existing inter-specific hybrid, cultivated in various cotton growing states.

The promising hybrids at the various counts and locations are listed overleaf :

Location	*Count*	*Promising Hybrids*
Achalpur (I) ..	50s	IBH.4208, and Varalaxmi
Achalpur (R) ..	50s	IBH.4208, Am. Hy. 5 and Varalaxmi
Amravati ..	50s	Varalaxmi
Surat ..	60s	Varalaxmi, GHB.14, GHB.10, JK.Hy.11 and DCH.32

Although many of the above hybrids recorded desired yarn strength at the respective counts, the yarns were very neppy.

Demonstration Trials : These trials were conducted at the various agricultural research stations to demonstrate the performance of new promising strains or hybrids.

Three promising strains, viz. 72IH.2, 76IH.20 and 68KH.33/1146 with Khandwa 2 as control, were raised at Indore. From the technological point of view, only one strain, viz. 68KH.33/1146, fared well at 30s count.

In the case of samples raised at Khandwa under rainfed conditions, the strains 68KH.33/1146 and 76IH.20 along with Khandwa 2 recorded desired yarn strength at 30s count.

In the trial conducted at Gwalior with entries approved for northern zone, the strains J.34, B.N. and F.414 along with local control C.59-228 fared well at 30s count.

Miscellaneous Trials

Trials with different objectives were conducted at Indore, Parbhani and Surat. The performance of a new *G. hirsutum* strain, viz. 76IH.20 was compared with that of Khandwa 2 at Indore and it was found to be on par with that of Khandwa 2 in respect of mean length, fineness, strength and spinning performance.

A promising *G. arboreum* strain, viz. PA.32, raised at Parbhani recorded 2.5% span length of 22.1 mm with a Micronaire value of 4.9 and bundle strength value of 46.6 g/t. The strain recorded satisfactory performance at 20s count.

Suitable hybrid cotton budded scion on compatible perennial root stock can be of use for exploiting hybrid vigour. Such experiments on 'budding of cotton' were in progress at Surat. One sample from this trial, designated as G.Cot.101 was received for full spinning test. It has recorded mean fibre length as high as 30.0 mm. The fibre length uniformity and maturity were low. Bundle strength value at zero gauge was satisfactory. Although CSP at 90s count was satisfactory, the yarns were very neppy.

In the Maximization Plot Trial conducted at Surat, performances of new and old varieties/hybrids were compared. The data are summarised in Table 7.

Table 7: Performance of Varieties|Hybrids in 'Maximization Trial' at Surat

Variety| hybrid	Species	2.5% span length (mm)	Micron-aire value (μ g|in.)	Matu-rity	Bundle stren-gth (g|t)	Spinn-ing poten-tial (count)
GHH.3)	*hirsutum* x	27.2	3.8	0.71	44.5	50s
Hybrid)	*hirsutum*	27.4	4.1	0.74	40.7	40s
G.Cot.10)	*hirsutum*	26.9	4.7	0.73	45.0	40s
G.Cot.100)		30.5	3.5	0.67	42.3	50s
DH.22)	*arboreum* x	23.6	5.6	0.74	47.2	20s
DH.2)	*arbereum*	23.6	5.6	0.74	52.0	20s
1449)	*herbaceum*	24.4	4.3	0.75	45.0	20s
3943)		24.6	3.9	0.72	49.8	20s
HB.14)	*hirsutum* x	31.5	3.3	0.66	46.1	50s
Varalaxmi)	*barbadense*	34.9	3.4	0.66	46.1	60s

South Zone

Cottons belonging to *G. hirsutum* species cover a large area in this zone comprising the States of Andhra Pradesh, Karnataka and Tamil Nadu. 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 Coordinated Varietal Trial was conducted at Siruguppa, and Srivilliputtur under irrigated conditions and at Dharwad and Raichur under rainfed conditions. The trial was also conducted in the rice-fallows at Aduthurai and Srivilliputtur. The Preliminary Varietal Trial was conducted at Arabhavi, Siruguppa and Srivilliputttur under irrigated conditions and at Dharwad under rainfed conditions.

The test results of these two trials are compiled in Tables 8 and 9.

The following strains recorded satisfactory spinning performance at the counts and locations indicated on page 32.

Table 8 : Summary of Test Results on Strains Tried in Coordinated 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 (μ g|in.)	Maturity	Bundle strength (g|t)		A	B	
				Irrigated Trial, Code No. Br04 (a)					
Siruguppa	18	25.9—33.2 (30.5)	3.1—4.5 (3.7)	average to good	39.7—47.2 (43.5)	40s	13	15	Hampi
Siruguppa	18	24.4—30.0 (26.4)	3.5—4.8 (4.2)	average to good	36.4—46.6 (42.9)	40s	8	13	Hampi
Srivilliputtur ..	18	27.2—33.5 (30.5)	3.3—4.3 (3.8)	average to good	47.7—54.7 (50.2)	50s	10	6	MCU.8
				Rainfed Trial, Code No. Br04 (b)					
Dharwad	20	25.4—32.5 (29.1)	3.4—5.1 (4.1)	low to good	37.0—47.2 (43.3)	40s	19	1	Laxmi
Dharwad	12	27.1—32.1 (30.6)	3.5—4.7 (4.1)	average to good	37.5—43.4 (39.7)	40s	9	1	Bhagya
Raichur	20	23.4—29.8 (27.0)	3.5—4.7 (4.0)	low to average	36.4—46.6 (42.7)	40s	6	10	Bhagya
				Short Duration Type, Trial Code No. Br04(c)					
Aduthurai	10	27.1—30.0 (28.1)	3.8—4.6 (4.3)	average to good	47.7—53.1 (50.3)	50s	Nil	4	Krishna
Srivilliputtur	10	27.3—32.0 (28.4)	3.2—4.1 (3.7)	low to good	47.7—52.5 (50.7)	50s	4	5	Krishna

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

Table 9: 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)	Micronaire value (μ g|in.)	Maturity	Bundle strength (g|t)		A	B	
Industrial Trial, Code No. Br03(a)									
Arabhavi	20	26.5—33.1 (29.4)	3.1—4.8 (3.7)	low to average	39.1—48.8 (44.1)	30s	7	17	Bhagya
Siruguppa	20	27.0—34.5 (30.2)	3.4—5.0 (3.9)	average to good	41.8—47.2 (44.5)	40s	12	16	Hampi
Srivilliputtur	27	27.2—33.8 (30.2)	3.3—4.8 (4.1)	average to good	43.4—53.1 (48.9)	50s	9	6	MCU.8
Rainfed Trial, Code No. Br03(b)									
Dharwad	20	26.5—31.7 (29.0)	3.6—4.4 (3.9)	low to good	37.5—44.0 (41.5)	40s	17	16	Bhagya
Dharwad	22	26.5—30.7 (28.7)	3.7—4.6 (4.3)	average to good	35.9—47.7 (40.0)	40s	16	Nil	Bhagya
Dharwad	12	28.9—31.7 (30.0)	3.7—4.5 (4.1)	low to good	35.4—45.0 (40.0)	40s	11	5	Bhagya

A — No. of samples spinnable to the count selected.
B — No. of samples better or on par with control.
Values in brackets indicate averages.

Location	*Count*	*Promising Strains*
Siruguppa	40s	MCU.5, CP.2/1, AV.2775-11/1, ELS.501, ELS.271-A-1, MCU.5 WT, CP.25/1, ELS.391, AV.3373-4, NLS.10, UAS.70-480-2, ELS.579, NLS.13, AV.2709, LRA.5166, JK.97-82, DS.56-36, AHO.61-38-2, JC.1245, AHO.80-187, PPD.1049, AV.3391, ELS.668-D, NMF.175, ELS.527, ELS.577, SRG.101, ELS.524, ELS.500, CPD-8-1LL, ELS.503, ELS.525, AHO.66-113 and AV.3500
Srivilliputtur ..	50s	DS.56, AV.2709, AV.2775-II/1, NLS.13, NLS.10, DS.59, MCU.5, ELS.271-A-1, MCU.5 WT, CP.25/1, MCU.8, 5019, 756, SVPR.124, 4992, RF.22, ADB.10050, EL.575, AV.3373-4, DS.56-16, ELS.500, ELS.501 and ELS.294-2-6
Dharwad	40s	B.N., DS.35, CPD.11-1-2, CPD.17-B-12, CPD.7-B-2, SRT.1, UAS.48-4, CPD.11-4, C.50, NA.247, CPM.25, CPD.34-B.7, CPD.35-41, DS.44, NA.332, CRH.71, CPD.8-1, Bhagya, JK.79-418, DP.1602, DP.336, DP.342, JK.78-162, DP.1266, DP.437, JK.97-603, IC.45-C-VI-9, NA.548, DS.43, JK.212, JK.125-2-50, HG.18, CPD.4-68-13, LRA.5766, DP.445, DP.197, Jgl.14575, DP.490, RARD.1163, DP.443, DP.415, DP.427, DS.55, JK.79-6-114, DP.225, DP.446, RBK.18575, SK.202, JK.97-JCB.50, JK.211, JK.97-LAC-60-1, DP.224, DP.352, DS.22, CPD.103-2 JK.79.299, CPD.34-25, CPD.35-19, 2028-4, CRH.65, NMF.06, DS.67, DS.14, JK.152-1, JK.98-167, CPD.4-68-12, JK.67-P-65, CPD.15-57 and IC.473
Raichur	40s	CPD.35-41, CPD.7-B-2, NA.247, CPM.25, CPD.17-B-12 and SRT.1
Arabhavi	40s	MCU.5, NMF.175, ELS.525, ELS.524, AV.3391, AV.3500 and AHO.66-113

G. barbadense Trials

Coordinated and Preliminary Varietal Trials were conducted at Shimoga. Ranges of 2.5% span length were between 31.2 mm and 38.6 mm for the strains tried in Coordinated Varietal Trial and between 31.5 mm and 39.3 mm for the strains tried in Preliminary Varietal Trial. Fibre maturity in the case of many strains from both the trials was poor. However, bundle strength values were satisfactory. The following strains fared well at the counts indicated below.

Trial	*Count*	*Promising Strains*
CVT	60s	CPH.202, CBS.34, SBS.(YF), Menoufi, PSH., CBS.200, Marrad, Suvin, CBS.203, BCS.9-70, SB(A) and Giza 47-27
PVT	80s	TCB.15, BCS.10.25, TCB.15, BCS.23-24, TCB-73, TCB.7, Suvin, TCB.14 and BCS.9-96

G. herbaceum Trials

In the Coordinated Varietal Trial conducted at Raichur under rainfed conditions the following strains fared well at 20s count :

MDS.56, SM.88, MDS.42, SM.80, 6435, SM.28 and 5497.

Hybrid Trials

Intra-hirsutum Hybrids : This trial was conducted at Dharwad under rainfed conditions. The following hybrids fared well at 40s count :

DCH.295, T.1 x M.7, CPD.H.1, DCH.337, Lam H.1, T.6 x M.7, Lam H.2, CPH.4 and NHH.39.

Desi Hybrids : Three hybrids, viz. AH.11, AH.21 and AH.71 with Jayadhar as control were raised at Coimbatore. 2.5% span length ranged between 24.7 mm and 26.9 mm with low uniformity in staple. Micronaire value ranged between 4.4 and 5.3. Bundle strength values were satisfactory. All the hybrids recorded satisfactory yarn strength at 20s count.

The technological performance of a new promising hybrid, viz. NHH.39 raised at Adilabad was compared with that of Hybrid 4 and JKHy.1. All the three hybrids recorded 2.5% span length between 26.5 mm

and 27.5 mm. Micronaire values ranged beween 4.0 and 4.6. Fibre maturity was average, bundle strength values were good and all of them fared well at 40s count.

Inter-specific Hybrids : Nine hybrids involving *hirsutum-barbadense* crosses were raised at Siruguppa and tested for technological performance along with Varalaxmi as control. Their 2.5% span length values ranged between 30.4 mm and 36.3 mm. Maturity was rather low for all the hybrids; however, bundle strength values were satisfactory. The hybrids DCH.65, NHB.55, TNHB.123 and TNHB.124 recorded encouraging spinning performance as compared to Varalaxmi.

The performance of a newly identified hybrid, DCH.32 raised at Dharwad was found to be very good in respect of staple length, fineness, bundle strength and yarn strength at 80s and 100s counts. The yarns, however, recorded high nep content.

Pilot Project Demonstration Trial

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

Location	*Count*	*Promising Strains*
Arabhavi	40s	MCU.5
Dharwad	80s	Varalaxmi
	40s	DP.225, DS.44, NA.247, CPD.8-1, JK.195, C.500, CP.1998F and DP.197
Shimoga	80s	Suvin
Shimoga	40s	DP.225 and CP.1198F
Siruguppa	50s	MCU.5
Srivilliputtur ..	50s	SVPR.124 and SVPR.134

A new strain identified as LRA.5166 raised at Coimbatore was found to be suitable for 50s count.

EXTRA-LONG STAPLE (27 MM AND ABOVE) COTTONS

The results of the detailed tests carried out during 1980 on extra-long staple cotton samples received and tested at CTRL are shown in Table 10.

Table 10 : Results of Extra-long Staple (27 mm and above) Cottons Tested During 1980

Variety	Place	Mean fibre length		Fineness		Maturity coefficient	Bundle strength		
		mm	in.	Millitex	Micronaire value		Tenacity (zero gauge) g/t	P.S.I. (zero gauge) lb/mg	Tenacity (1/8" gauge) g/t
Andhra Pradesh									
1. MCU.5	Chirala	28.2	1.11	142	3.6	0.70	43.4	8.1	24.7
2. Varalaxmi	,,	31.4	1.24	118	3.0	0.63	46.1	8.6	27.6
3. MCU.5	Guntur	29.6	1.17	130	3.3	—	46.1	8.6	24.8
4. Suvin	,,	36.1	1.42	134	3.4	0.67	56.8	10.6	43.1
Gujarat									
5. Varalaxmi	Idar	30.7	1.21	126	3.2	0.64	45.6	8.8	27.2
6. Hybrid 4	Modassa	28.2	1.11	157	4.0	0.72	42.9	8.0	24.9
7. Varalaxmi	Palej	32.3	1.27	138	3.5	0.67	44.0	8.2	—
8. Hybrid 4	Palej	27.9	1.10	157	4.0	0.72	40.7	7.6	—
9. G.Cot.101	Surat	30.8	1.18	114	2.9	0.61	47.7	8.9	—
10. GHB.14	,,	31.2	1.23	142	3.6	0.68	46.1	8.6	28.3
11. GHB.10	,,	30.5	1.20	134	3.4	0.67	47.2	8.8	30.0
12. JKHy.11	,,	30.5	1.20	130	3.3	0.66	44.5	8.3	29.2
13. DCH.32	,,	33.8	1.33	134	3.4	0.66	47.2	8.8	31.4
14. ERB.13758	,,	27.9	1.10	165	4.2	0.86	45.6	8.5	31.2
15. Giza 7	,,	27.9	1.10	154	3.9	0.78	44.5	8.3	29.9
16. Gu.76	,,	27.2	1.07	165	4.2	0.82	45.0	8.4	30.3
17. Mu.4512	,,	27.1	1.10	165	4.2	0.82	46.6	8.7	28.1
18. Vishnu	,,	27.4	1.08	138	3.5	0.67	42.3	7.9	25.1
19. HB.14	,,	28.2	1.11	130	3.3	0.66	46.1	8.6	27.8
20. Varalaxmi	,,	31.8	1.25	122	3.1	0.63	48.8	9.1	32.4
Karnataka									
21. DCH.32	Bellary	32.1	1.26	118	3.0	0.63	48.8	9.1	27.8
22. Varalaxmi	Dharwad	31.8	1.25	122	3.1	0.63	48.8	9.1	32.4
23. DCH.32	,,	34.8	1.37	122	3.1	0.65	47.7	8.9	31.6
24. Varalaxmi	Raichur	32.0	1.26	138	3.5	0.67	40.7	7.6	—
25. DCH.32	,,	31.5	1.24	118	3.0	0.63	43.6	8.5	—
Madhya Pradesh									
26. Varalaxmi	Sendhwa	31.8	1.25	134	3.4	0.67	46.6	8.7	—

— Con'd.

Table 10: Results of Extra-long Staple (27 mm and above) Cottons Tested During 1980 (Contd.)

Variety	Place	Mean fibre length		Fineness		Maturity coefficient	Bundle Strength		
		mm	in.	Millitex	Micronaire value		Tenacity (zero gauge) g/t	P.S.I. (zero gauge) lb/mg	Tenacity (1/8" gauge) g/t
Maharashtra									
27. Varalaxmi	Ahmednagar	32.4	1.28	118	3.0	0.63	47.7	8.9	29.0
28. Hybrid 4	Nanded	27.4	1.08	157	4.0	0.74	41.3	7.7	21.8
29. Hybrid 4	Majalgaon	27.2	1.07	154	3.9	0.72	44.5	8.3	25.5
30. Hybrid 4	Pachora	27.4	1.08	165	4.2	0.72	41.3	7.7	25.1
31. Varalaxmi	Phalton	29.8	1.17	118	3.0	0.62	45.6	8.5	27.2
Tamil Nadu									
32. Suvin	Annur	34.5	1.36	126	3.2	0.65	56.8	10.6	38.5
33. MCU.5-WT	Coimbatore	30.0	1.18	134	3.4	0.67	45.6	8.5	26.4
34. MCU.5	,,	29.2	1.15	130	3.3	0.65	42.9	8.0	25.9
35. MCU.8	Periakulam	29.6	1.17	134	3.4	0.86	50.4	9.4	26.1
36. MCU.9	,,	28.5	1.12	134	3.4	0.85	49.3	9.2	28.4
37. SVPR.124	Srivilliputtur	28.2	1.11	146	3.7	0.70	47.7	8.9	28.3
38. SVPR.134	,,	28.7	1.13	157	4.0	0.72	48.2	9.0	28.7
39. MCU.5	Tirupur	27.9	1.10	134	3.4	0.66	47.7	8.9	

MILL TESTS

Taking into consideration the results of field trials and the tests for quality and spinning performance carried out at CTRL, selected improved varieties of cotton are being subjected to actual mill tests 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 cooperation of a few textile mills in the country.

During the year such mill tests were carried out on a few improved strains pertaining to 1979-80 season along with their respective controls. Their comparative performances at the Mill and CTRL are given in Table 11.

The following observations may be made from Table 11.

Gujarat: The yarn strength of SC.97 received from Amreli was lower than that of Sanjay at 20s count at the Mill.

Table 11: Comparative Spinning Test Results at Mill and CTRL

Place	Variety	Mill Test Results				CTRL Results			
		Waste (%)	Count	Stre-ngth (lb)	t.m.	Waste (%)	Count	Stre-ngth (lb)	t.m.
Gujarat									
Amreli	SC.97	2.80	20s	87.2	NA	3.00	20s	94.7	4.25
	Sanjay*	2.40	20s	95.8	NA	2.90	30s	65.3	4.00
Karnataka									
Siruguppa	CPD.8-1	1.50@	40s	40.2	4.00	2.90	40s	52.0	4.00
	Laxmi*	2.85@	40s	45.8	4.00	4.90	40s	50.0	4.00
Siruguppa	DS.56	3.90	30s	64.5	4.61	2.60	30s	66.6	4.00
	DS.56	NA	30s	66.3	4.61	2.60	30s	67.4	4.00
	Hampi*	4.00	30s	63.1	4.61	3.20	30s	58.5	4.00
Siruguppa	DCH.32	6.47@	66s	42.8	4.24	—	66s	44.7	3.75
	Varalaxmi*	7.92@	66s	43.5	4.24	—	66s	43.5	3.75
Gangavati	DCH.32	7.69@	66s	41.1	4.24	—	66s	44.2	3.75
	Varalaxmi*	6.32@	66s	41.6	4.24	—	66s	44.3	3.75
Raichur	DCH.32	7.60	66s	45.0	4.20	—	66s	44.9	3.75
	Varalaxmi*	6.40	66s	46.1	4.24	—	66s	45.6	3.75
Madhya Pradesh									
Badnawar	JKHy.11	4.86	60s (CMB)	46.1	4.30	NA	NA	NA	NA
Maharashtra									
Akola	IHH.468	2.60	30s (CMB)	70.3	4.56	5.60	40s	53.2	4.00
	Hybrid 4*	3.80	40s (CMB)	59.6	4.45	7.20	40s	53.6	4.00
Akola	IBH.4208	5.60	40s (CMB)	75.4	4.45	7.90	60s	41.8	3.75
Akola	AKH.605	5.60	30s	57.4	4.66	6.20	30s	55.2	4.00
	AKH.4*	NA	NA	NA	NA	6.50	30s	59.2	4.00
Rahuri	KOP.203	2.20	30s	55.2	4.00	2.30	30s	60.6	4.00
	Laxmi *	3.52	30s	59.7	4.00	3.00	30s	62.4	4.00
Parbhani	PA.32	1.70	20s	94.4	4.64	1.40	20s	101.7	4.25
	CJ.73 *	2.20	20s	108.8	4.64	1.70	20s	105.7	4.25

@ — Blow-room loss

* — Control Variety

CMB — Combed

Note: 1. Waste % determined by Shirley Analyser.

2. The spinning system and machinery used by the mills are in many respects different from those adopted at CTRL and hence the strength values are not strictly comparable.

3. NA — Not available.

Karnataka : The strains DS.56 and DS.59 from Siruguppa recorded higher yarn strength than that of Hampi both at the Mill and the Laboratory. The spinning performance of the new hybrid DCH.32 was on par with that of Varalaxmi at the Mill as well as at the Laboratory. But CPD.8-1 recorded lower yarn strength than Laxmi at the Mill while at the Laboratory both the strains gave almost identical results.

The spinning performance of DCH.32 received from Gangavati and Raichur was on par with that of the control variety Varalaxmi both at the Mill and the Laboratory.

Madhya Pradesh : JKHy.11 has the potential to spin to 60s count (combed).

Maharashtra : From Akola, the new hybrid IHH.468 recorded the same yarn strength as Hybrid 4 for 40s count at the Laboratory while the *arboreum* strain AKH.605 was inferior to AKH.4 in respect of yarn strength at the Laboratory.

Kop.203 from Rahuri showed lower yarn strength than Laxmi at the Mill as well as the Laboratory.

The strain PA.32 from Parbhani had much lower yarn strength than CJ.73 at the Mill whereas at the Laboratory the yarn strength for both the strains were more or less the same.

NEW COTTON VARIETIES RELEASED

The following varieties of cotton were released through the Tamil Nadu State Department of Agriculture :

Variety		*Traits*
KCH.2	..	An inter-specific hybrid from a *G. hirsutum* strain MCU.7 and a *G. barbadense* strain SB.289E, a short duration cotton, recommended for cultivation in rice fallows areas of Tamil Nadu: having 30.7 mm mean length and spinnable up to 60s count; superior to MCU.7 in yield and spinnability.
KC.1	..	A short duration *G. hirsutum* variety which is a selection from SRT.1; recommended for cultivation in rainfed areas of Tamil Nadu; having 23.5 mm mean length and spinnable up to 40s count. High yield potential compared to MCU.6 and better spinnability compared to varieties like Bharati and Laxmi.

PROMISING STRAINS

The panel meetings of the Breeding and Technology Group of North Zone, Central Zone and South Zone under AICCIP identified the following promising strains :

Strain/hybrid	*Special features*
	North Zone
LH.357 ..	A long staple *G. hirsutum* variety from Punjab Agricultural University (PAU) having high ginning out-turn (37%) and high yield potential.
FP.286 ..	Another *G. hirsutum* variety from PAU, which has shown good spinning performance at 40s count.
LD.230 ..	A short staple coarse *desi* variety from PAU which has potential for further improvement as the strain was amenable to closer spacings. It recorded higher yields than G.27 and because of its superior performance, it has been recommended by the Variety Evaluation Committee of PAU for adaptive trials in the farmer's fields in the Punjab State.
	Central Zone
AKH.604 ..	An *arboreum* strain identified at Punjabrao Krishi Vidyapeeth (PKV), Akola which recorded more than 15% increase in yield over AKH.4 and more than 18% over AK.235. The technological characteristics are on par with those of AKH.4. Spinning potential — over 20s.
	South Zone
H.64 and H.134 ..	These hybrids involving *hirsutum* x *barbadense* crosses were identified at CICR Regional Station, Coimbatore. *Kapas* yield was 24.74 q/ha and 22.33 q/ha, respectively against 19.89 q/ha of Varalaxmi. H.64 is earlier maturing than Varalaxmi by 2-3 weeks. In addition to having higher ginning out-turn, these hybrids recorded 2.5% span length over 35 mm and PSI over 9.0 lb/mg. Spinning potential — around 80s.

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 Trade Varieties of Indian Cottons are being obtained for each season through the East India Cotton Association (EICA) Ltd., Bombay, and some regional cotton associations. Representative *kapas* samples of these varieties are also procured from the State Departments of Agriculture for determination of ginning percentage. The fibre and spinning test results, ginning percentage and other test results on each variety of cotton are being published as Technological Circulars as early in the season as possible for information of the cotton trade and industry. Such Circulars were issued during 1980 on 59 varieties covering most of the 1979-80 season samples. The test results on all the Trade Varieties of 1978-79 season were compiled together and published as "Technological Report on Trade Varieties of Indian Cottons, 1978-79 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 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 the Cotton Breeders and other research workers as early in the season as possible. During 1980, such circulars were issued on 17 varieties and thus most of the samples of Standard Indian Cottons of the 1979-80 season received and tested, have been covered.

The results on all the samples pertaining to 1978-79 season were consolidated and published as "Technological Report on Standard Indian Cottons, 1978-79 Season".

Studies on the Variation in Fibre Characteristics of Newly Released Varieties

During the period under report, two samples each of four varieties, viz. JKHy.11, MCU.5, Varalaxmi and Suvin, picked at three intervals, at Badnawar (M.P.) and Amravathi (A.P.) were tested for seed index, lint index, ginning out-turn, 2.5% span length, Micronaire value, bundle

strength at zero gauge length and maturity by caustic soda method. The test results are given in Table 12.

Table 12: Fibre Characteristics of Samples from Different Pickings

Variety	Picking	Seed index	Lint index	Ginning out-turn (%)	2.5% span length (in.)	Micronaire value (μ g/in.)	Bundle strength at zero gauge (g/t)	Maturity (M-H-I)
JKHY.11	I	8.13	4.06	30.3	1.34	2.9	46.9	68-4-28
„	II	11.08	4.80	30.4	1.39	3.2	43.9	65-5-30
„	III	8.64	3.82	31.4	1.37	2.7	42.4	58-5-37
Varalaxmi	I	10.15	4.04	27.9	1.55	2.9	59.0	68-4-28
„	II	10.23	3.95	28.2	1.46	2.9	44.9	62-4-34
„	III	11.27	4.19	27.6	1.51	2.9	49.1	65-5-30
MCU.5	I	11.27	6.12	22.3	1.43	3.6	46.0	84-3-13
„	II	10.30	5.84	33.4	1.42	3.4	46.9	73-4-23
„	III	11.27	6.06	33.8	1.39	3.4	45.1	77-4-19
Suvin	I	11.31	3.77	23.9	1.69	3.1	57.0	76-4-18
„	II	10.51	3.84	25.3	1.66	3.1	61.6	75-3-22
„	III	8.83	3.62	25.4	1.52	2.6	53.9	62-4-34

It was observed that: (*i*) the seed index and the lint index at the second stage of picking of JKHy.11 were higher than those at the other pickings, (*ii*) the fibre properties of Suvin at the last picking were poor as compared to those at the other pickings, and (*iii*) Varalaxmi and MCU.5 cottons from different pickings did not show significant change in the fibre properties.

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 Characteristic of Neppiness in Cotton

About 30 varieties of cotton for which pure lines were available, were critically examined for nep-content (number of neps per 100 sq. cm of card web) and classified into the four nep grades: low (up to 2.3), average (2.4 to 4.6), high (4.7 to 7.0) and very high (above 7.0). From among these, the following varieties were selected from each group for the crossing programme.

Nep grade	*Cotton*
Low	Laxmi and American Nectariless
Average	IAN.4903 and IAN.5131
High	G.67 and GU.76
Very High	Suvin and SB.289E

Diallele crosses have been made and the material will be collected for further study.

Study of the Effects of Nitrogen, Phosporus and Potash on the Quality of Hybrid 4 Cotton

The materials from the different treatments were examined for yield and tested for their fibre and yarn properties. The results were statistically analysed by appropriate methods and the observations made were as follows :

The yield differences were significant for nitrogen levels, the increase in yield being in direct proportion to the applied dose. The highest yield of 1,541 kg/ha resulted from the dose, 320 kg/ha. The yield differences due to phosphorus and potash as well as the interaction factors were all non-significant.

The doses of different fertilizers and their interaction effects had no significant impact on fibre length and fibre fineness.

The interaction NP showed marginal effect on the length uniformity ratio (LUR) as well as maturity coefficient (Mq).

Fibre bundle strength at zero gauge length displayed a significant effect for both nitrogen and phosphorus levels, the higher doses giving better bundle strength. The potash levels made no noticeable impact.

The samples were all spun to 44s count on the Shirley Miniature Spinning Plant and their count strength product (CSP) data were statistically analysed for discerning trends. The nitrogen and the potash treatments produced negligible effect, but the phosphorus doses led to significant trends confirming the observations made earlier that higher doses gave significantly better results in the case of fibre bundle strength.

As it was the first year of experiment, the observations need to be confirmed before valid inferences can be drawn.

Influence of Insecticide Treatments on the Quality of Cotton and Cottonseed

During the period under review, cottonseed samples of G.Cot.100 (1977-78 season) and Hybrid 4 (1978-79 and 1979-80 seasons) belonging to the entomological trial "Chemical Control of the Pest Complex" laid out at the Cotton Research Station, Gujarat Agricultural University, Surat, were analysed for the crude protein and oil percentages. The trial consisted of 10 insecticide treatments in 1977-78 and 1978-79 seasons and eight insecticide treatments in 1979-80 season, including the control. The analysis carried out with respect to oil percentage in all the three seasons and crude protein percentage in 1977-78 season indicated that

generally the treatments showed increase in both the characters over the control. The results are given in Tables 13 to 15.

Table 13: Effect of Insecticides on Oil Content and Crude Protein Percentage of G.Cot.100 for the Season 1977-78

Treatments	Crude protein (%)	Rise in crude protein (%) as compared to control	Percent increase over the control	Oil content (%)	Rise in oil content (%) with respect to control
Phosalone 4% dust	27.80	8.32	43	22.14	4.78
Phosalone 35 EC	25.07	5.59	29	21.22	3.86
Monocrotophos 40 EC	25.66	6.18	32	21.63	4.27
Endosulfan 35 EC	23.18	3.70	19	20.63	3.27
Leptophos 34 EC	25.64	6.16	32	21.24	3.88
Quinalphos 25 EC	21.02	1.54	8	18.66	1.30
Fenitrothion	22.55	3.07	16	20.40	3.04
Old Schedule	24.07	4.59	24	21.16	3.80
New Schedule	23.00	3.52	18	19.42	2.06
Control (Untreated)	19.48	—	—	17.36	—

Table 14: Effect of Insecticide on Oil Content of Hybrid 4 Cotton for the Season 1978-79

Treatment	Oil content (%)	Rise in oil content (%)	Rise (%) over the control
Phosalone 4% dust	19.30	0.22	1.2
Phosalone 35 EC	19.85	0.77	4.0
Monocrotophos	19.66	0.58	3.0
Endosulfan	19.44	0.36	1.9
Quinalphos	20.09	1.01	5.3
Fenitrothion	18.55	—	—
Sumicidine	20.83	1.75	9.2
Old Schedule	18.70	—	—
New Schedule	18.83	—	—
Control (Untreated)	19.08	—	—

Table 15: Effect of Inscticide on Oil Content of Hybrid 4 Cotton for the Season 1979-80

Treatment	Oil content (%)	Rise in oil content (%)	Rise (%) over the control
Permethrin (Permesect)	21.30	1.93	9.96
Permethrin (Ambush)	20.82	1.45	7.5
Cypermethrin (Ripcord)	20.52	1.15	5.9
Cypermethrin (Cymbush)	20.00	0.63	3.3
Decomethrin (Decis)	20.20	0.83	4.3
Fenvalerate (Sumicidine)	20.96	1.59	8.2
Carbaryl (Sevin 50 wp)	19.90	0.53	2.7
Control	19.37	—	—

Design and Fabrication of an Electronic Fibre Length Tester

A new instrument is being designed and developed for determination of length of cotton fibres, by using optical scanning techniques. As far as possible, indigenously available electronic, optical and mechanical components will be used. The imported parts will be restricted to the minimum. The work is in the development stage.

Optical Scanning Technique for Determination of Fibre Fineness and Maturity

The project work relating to the determination of fibre fineness by employing Model 430 Fibrograph has been completed last year. The work on the determination of maturity was continued on 12 more cotton samples in the more immature group, since the data on 60 cotton samples on which tests were done last year did not have sufficient representation for very immature cottons. The statistical analysis of the data on all the 72 cottons revealed that the Optical Index of Maturity determined using Model 430 Fibrograph and the Maturity Coefficient by the caustic soda method showed high association (r = —0.817). On analysing the relationship between these two attributes separately for each botanical species, it was observed that the simple correlation coefficients were higher for *G. arboreum* and *G. herbaceum* species (r = —0.824 and

r = —0.858 respectively) than for the *G. hirsutum* and *G. barbadense* species (r = —0.683 and r = —0.512 respectively).

Fabrication of a New Instrument for Evaluating Cotton Fibre Maturity

The work during the year comprised further attempts to improve the performance of the new maturity measuring device. It was reported earlier that maturity indices obtained by the new method and by the alkali swelling method show a linear relationship and that cottons belonging to different cultivated species, however, fall on different lines.

An attempt was made to explore the possibility of bringing the different cultivated species together by applying corrections for the fineness differences inherent in the four species. This was possible from a knowledge of the number of fibres in the test slide, obtained by counting them with the aid of a microscope. This procedure did not, however, lead to any improvement of correlation between the two indices of maturity as shown by results on 30 cottons selected from the 40 samples tested earlier.

Tests were also carried out on some samples by the alkali swelling method in order to get maturity indices from the same test slide. This could be done by making some changes in the optical set-up to ensure that all the fibres in the test slide were illuminated and the entire transmitted light reached the photomultiplier. By comparison of the results with earlier data, it was observed that this procedure also did not lead to any better relationship between the two indices.

Trials were made by using a green selenite plate, instead of the red plate, in conjunction with a green filter (550 millimicron wave length). This combination has been found to give better results in terms of reproducibility. Further, the cottons belonging to *G. barbadense* species alone were found to remain separate when the two maturity indices were plotted. It has, therefore, been decided to use the above combination of filter and selenite plate for all future work.

Determination of Spiral Angle of Different Varieties of Cotton

The standardised solvent exchange procedure to get cotton fibres in the never-dried state was applied to seven cottons last year and the study was extended to two more cottons this year. The 50% X-ray angle, convolution/mm and convolution angle were measured on the solvent-exchanged samples as well as the air-dried controls. The results were in conformity with the earlier observation that convolutions account for a large part of differences in the measured spiral angle usually encountered in nature-dried fibre. The study will be extended to cottons belonging to *G. arboreum* and *G. herbaceum* species also. Unopened, but mature bolls of cotton from these two species are being collected.

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

The orientation parameters such as 20%, 40%, 50% and 75% X-ray angles and fx for 20 samples of *G. hirsutum* species, when correlated with tensile properties such as tenacity at zero and 3 mm gauge lengths and percentage elongation at 3 mm gauge length, confirmed the earlier findings on an equal number of *G. barbadense* samples that the 20% X-ray angle correlated best with the tenacity at zero gauge length, while the 75% X-ray angle showed the highest correlation with percentage elongation.

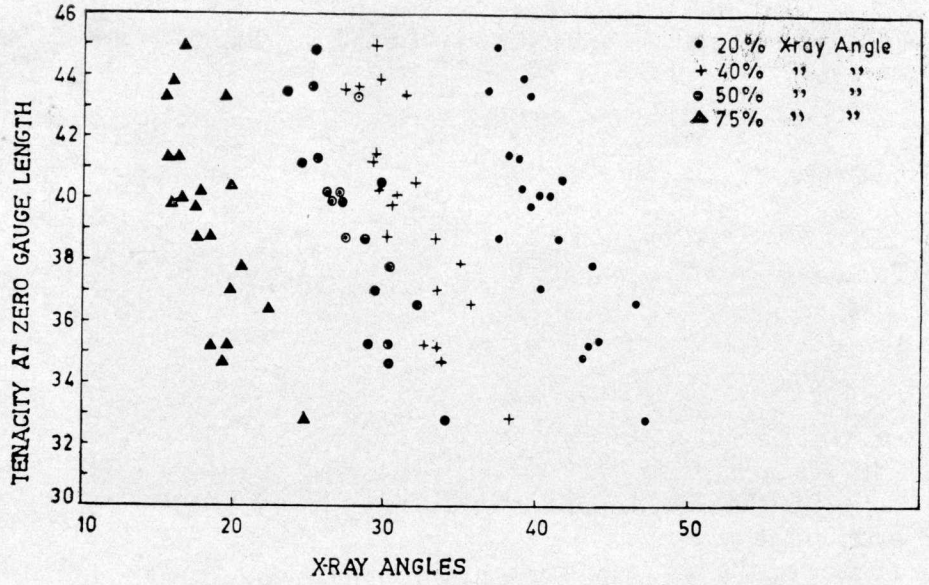
When the results obtained from an equal number of *G. herbaceum* samples were analysed, the 75% X-ray angle gave the highest correlation with the percentage elongation which is well in agreement with the trend noticed in the case of both *G. barbadense* and *G. hirsutum* species. However, in the case of tenacity at both zero as well as 3 mm gauge lengths, fx showed the highest correlation for the *G. herbaceum* samples. Although the correlation of the 20% X-ray angle was better than that of the 75% X-ray angle, the correlations of 40% and 50% X-ray angles were also of the same level as that of the 20% X-ray angle.

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

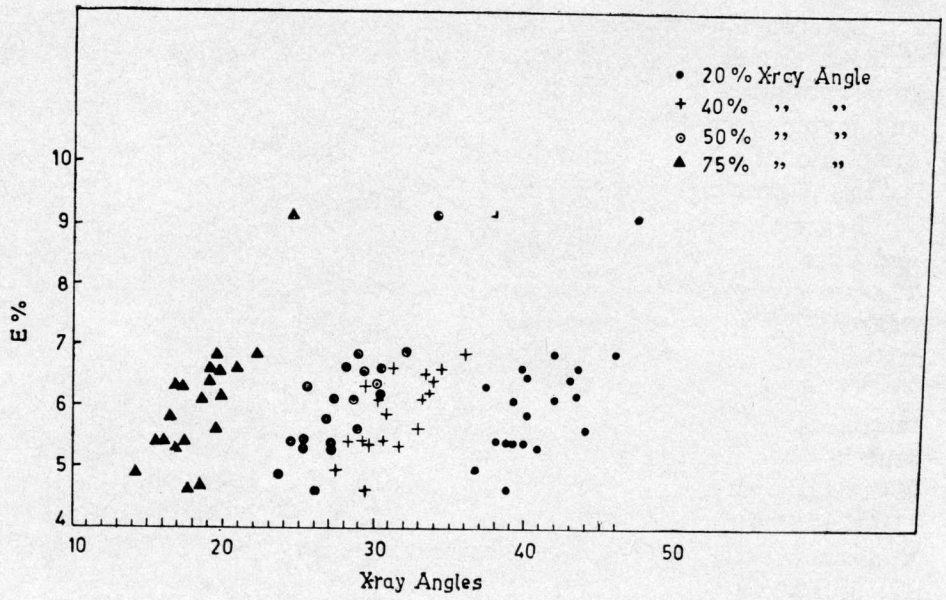
Data on fibre properties such as mean fibre length by Balls Sorter and Baer Sorter, 2.5% span length and uniformity ratio by Digital Fibrograph, gravimetric fineness, Micronaire value (with and without spacer) and maturity coefficient by caustic soda method were collected on 710 samples of the Trade Varieties and the Standard Indian Cottons pertaining to the past eight years.

Regression equations connecting mean fibre length by Balls Sorter and Baer Sorter with 2.5% span length were derived for the pooled data. These equations were compared with the equations derived by the earlier workers. The regression equations predicting mean length from 2.5% span length values are given in Table 16.

The equation (2) is now in use in the Laboratory for predicting mean length from 2.5% span length. As the Baer Sorter alone is used at present in the Laboratory for determining mean fibre length, the equation (4) was compared with the equation (2). It is evident that they are almost identical and the predicted values of mean length from these two equations show little difference. Hence it can be concluded that the equation (2) still holds good.

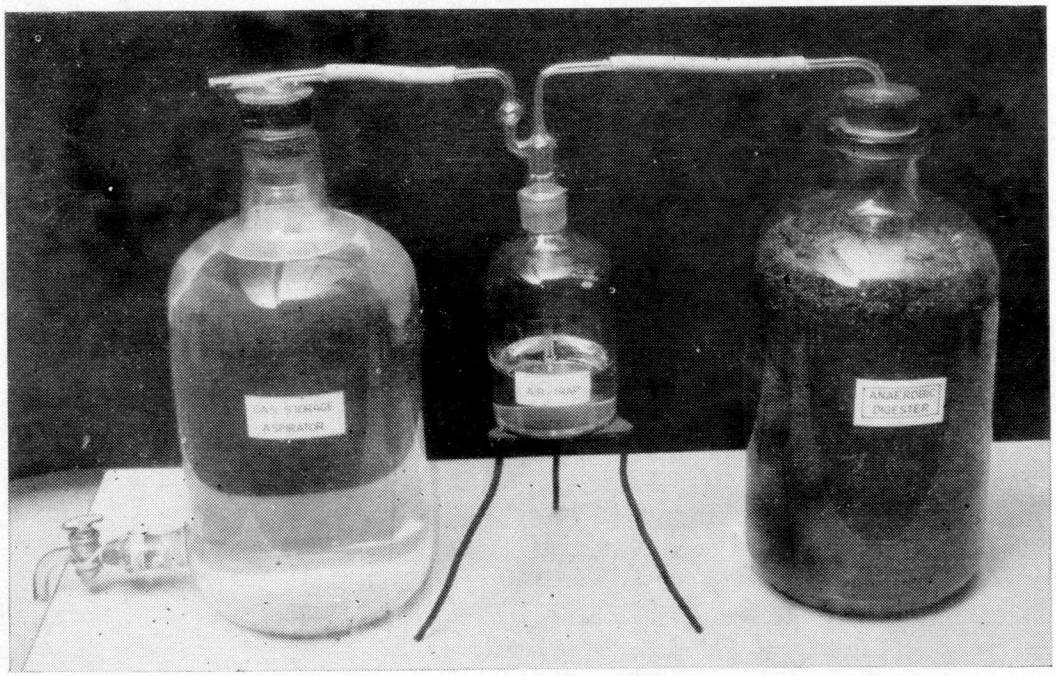


Relationship Between Tenacity at Zero Gauge Length and Various X-Ray Angles (*See page* 46)



Relationship Between Elongation at 3 mm Gauge Length and Various X-Ray Angles (*See page* 46)

Visit of Dr. O. P. Gautam, Director General, ICAR, on April 8, 1980



Laboratory Assembly for the Production of Biogas from Willow-dust
(*See page* 66)

Table 16: Simple Correlation Coefficients and Regression Equations Between Mean Fibre Length and 2.5% Span Length (in inches)

Author (Year)	Number of cottons	Correlation coefficient	Regression equation
Jai Prakash (1965)	115	+0.980**	B = 0.898 D +0.0565— (1)
C.A.S. Aiyar *et al.* (1971)	4,025	+0.980**	B = 0.821 D +0.095 — (2)
Present study (1980)	460	+0.986**	B = 0.809 D +0.1064— (3)
„ „	710	+0.985**	Br = 0.819 D +0.098 — (4)

**Highly significant (0.01 level).
B — mean length by Balls Sorter.
Br — mean length by Baer Sorter.
D — 2.5% span length by Digital Filbrograph.

Further, the regression equation connecting gravimetric fineness in micrograms per inch and Micronaire value was derived and compared with the earlier equations given in Table 17.

Table 17: Simple Correlation Coefficients and Regression Equations Connecting Gravimetric Fineness (μ) and Micronaire Value (M)

Author (Year)	Number of cottons	Correlation coefficient	Regression equation
Harirao Navkal (1958)	100	+0.931**	μ = 0.8675 M + 0.5443
Jai Prakash and R.L.N. Iyengar (1965)	140	+0.81 **	μ = 0.8249 M + 0.7907
Present study (1980)	186	+0.878**	μ = 0.9221 M + 0.3535

** Highly significant (0.01 level).

The regression equation in the present study, viz. μ = 0.9221 M + 0.3535—(5) covers a wide range of fineness values varying from 2.47 to 6.68 micrograms/inch and will enable one to estimate the values of fibre weight per unit length from the Micronaire readings whenever necessary.

The earlier equation used for predicting gravimetric fineness from Micronaire values was found to be not satisfactory as fibre maturity had

not been taken into account while deriving that equation. After grouping the cottons into two groups, viz. (*i*) those having a maturity coefficient less than 0.8 and (*ii*) those having a maturity coefficient higher than 0.8, two separate equations have been worked out in the present study.

For Mc $<$ 0.8; r (Correlation Coefficient) = 0.8754**,

$\mu = 1.03\ M + 0.0471$ ..... (6)

and for Mc $>$ 0.8, r = 0.9008**

and $\mu = 0.9747\ M + 0.0036$ ..... (7)

It was observed that there was better agreement between actual gravimetric fineness value and that estimated from Micronaire tests, if the appropriate equation based on fibre maturity of the sample is used for prediction purpose.

Studies on Inheritance of Strength and Structural Parameters in Cotton Fibres

During the year, the tenacity values of 54 samples from the two high strength and one low strength parents were determined. The results showed that the parents had stabilized. Samples from the more promising high strength parent as well as the low strength parent were identified for effecting crosses and raising the F_1 generation.

Studies on Lustre of Cottons Grown in India and Its Improvement on Mercerisation in Fibre and Yarn Stages

The method for the determination of lustre index (contrast ratio) was standardised. Over 160 samples of different Trade Varieties and Standard Cottons belonging to 1979 and 1980 seasons were tested for lustre index, which ranged between 1.594 and 2.174 for 1979 season and between 1.408 and 1.990 for 1980 season. It was observed that there was significant difference in lustre index between the varieties. Samples of the same varieties grown at different places did not show any change in contrast ratio indicating that location had no effect on lustre.

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

Eight varieties of Standard Indian Cottons were selected for the investigation. Measurements for the convolution angle and frequency distribution of reversals are in progress for some of the varieties.

A gadget has been fabricated to facilitate mounting of single fibres for breaking strength measurements at 10 mm, 5 mm or 3 mm gauge lengths on the Instron.

The measurements of morphological, structural and tensile properties of fibres are in progress.

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

Using the method based on the half breadth of (002) reflection, a detailed study was completed on the composition of cotton-jute blends at various stages of processing from blow room to ring frame. The study revealed that the reduction in the jute content observed in the ring yarn is due to preferential losses of jute content under the licker-in region during carding.

Further, X-ray methods were developed for analysis of blends of cotton with polyester, viscose and polynosic fibres. For each of the blend systems, radial diffraction analysis (for which the sample has to be in the form of a finely cut powder) as well as orientation analysis (for which the sample can be in fibre or yarn form) procedures were evolved. The results indicated that the accuracy of the results lie within $\pm 3\%$ and $\pm 7\%$ for radial and orientation methods, respectively, when two tests were carried out per sample. Further experiments were in progress to standardise the methods to achieve better accuracy.

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

Study on the differently pre-swollen and decrystallised yarns has been completed.

Yarns pre-swollen with NaOH of three concentrations, viz. 21% (w/w), 15% (w/w), and 12% (w/w), and then decrystallised by Partial Acetylation (PA) and Partial Cyanoethylation (PC) were prepared both in the slack state and with a small known amount of stretch over the slack length. Later on, portions from the decrystallised yarns along with the swollen controls were crosslinked with 8% DMDHEU. Breaking strength, extension, work of rupture, crease recovery angle (CRA) and the percentage nitrogen due to crosslinking were determined for all the samples. It was found that in general, decrystallised and subsequently crosslinked samples had higher strength, extension and work of rupture than the swollen and crosslinked control for nearly the same percentage of nitrogen content, though the CRA was slightly lower.

Stretch given during decrystallisation was found to help in better tenacity retention after crosslinking as compared to the non-stretched samples. However, the advantage was not quite evident in the retention of work of rupture probably due to fall in the extensibility brought about by stretch.

Preparation and Standardization 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 6 (2.5% span length = 0.86 in.), were processed separately to prepare card-web samples, and sub-lots of these samples were tested for 2.5% span length and Micronaire value. During the period under review, the two varieties were blended in two proportions (50 : 50 and 75 : 25). Forty sub-samples of the 50 : 50 blend were tested for 2.5% span length and Micronaire value by two operators separately. For span length and Micronaire tests, two and three observations, respectively, were made by each operator. The analysis of the test data indicated that the variations observed for the individual test results between operators and within operators were within tolerance limits. The fibre tests on 75 : 25 blend samples were in progress.

Studies on Lakshmi-Rieter Drawing and Speed Frames

A long staple cotton Varalaxmi, having 2.5% span length of 32.8 mm, Micronaire value of 3.0 and tenacity of 31.6 g/t at 3 mm gauge length was processed through blowroom, card and two passages of Lakshmi-Rieter high speed drawframe (D.F.) using the following four break draft combinations, and settings of 37 mm and 42 mm in the front and back zones, respectively.

Break Draft Combination	*A*	*B*	*C*	*D*
First D.F. Passage	1.7	1.7	1.3	1.3
Second D.F. Passage	1.7	1.3	1.3	1.7

For comparison, a corresponding sample was processed on a conventional T&S drawframe with a break draft of 1.2 and settings of 37 mm, 40 mm and 45 mm, respectively, in the three roller zones, front to back.

The results indicated that while the U% of the finisher drawframe sliver was lowest at 2.8 for combination A, the U% values of finisher slivers for the other combinations were the same at 3.7 to 3.8. The

yarn quality was best with combination C employing 1.3 break draft in both drawframe passages. As observed earlier, the yarn quality from highspeed drawframe slivers was better than from conventional drawframe.

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

It was proposed in the earlier report that the results obtained will be confirmed by carrying out work on more number of samples of each count to cover a wide range. Accordingly, 10 samples from each of the four counts, viz. 40s, 50s, 60s and 80s were taken up for the purpose of comparison of skein strength, knotted skein strength and Uster single thread strength. During the period, yarn strengths by these three methods were determined on all the above samples and the data were analysed. In general, single thread strength parameters did not give significantly better correlation with knotted lea strength as compared to usual lea strength, though the knotted lea strength was about 10% higher than the conventional lea strength. Further, use of metric skein instead of standard lea for the tests, so as to get a test length of 500 mm between the grips as in the case of single strand strength tests, did not result in any improvement in the relationship between single strand and skein strength.

Further, it was proposed to study the extension (E%) at break, when lea tests were carried out on the normal lea and the knotted lea. The work was completed on 5 samples of each of the two counts, 30s and 60s. The extension (E%) was observed to be on the increase by about 20%.

Open-End Spinning of Indian Cottons and Cotton Wastes

A number of trials employing cotton wastes and pure cottons were carried out on the Open-End (OE) Spintrainer during the year under review. The materials used for the study were as follows :

1. Three types of willowed cotton wastes of 30s mixing comprising (a) licker-in droppings, (b) blow-room droppings and (c) mixture containing 80% pneumafil waste and 20% flat strips.
2. Four varieties of Indian cottons, viz. G.22, V.797, Sanjay and Digvijay, with their 2.5% span length in the range of 22 mm to 24 mm.

The above materials were individually processed through blowroom, card and two passages of drawframe and the finisher drawframe sliver

was spun on the OE machine to produce 6s to 14s yarn in the case of wastes and 20s in the case of cotton samples. Influence of various machine and processing factors like type of rotor groove (rounded or V-type), withdrawal tube (fluted or smooth), rotor speed and twist multipliers were examined. Comparative spinnings were also done on conventional ring frame for the four cottons.

The influence of draft on spinning and yarn count was studied by spinning American Elpaso cotton to 16s, 20s and 24s from 0.12, 0.13 and 0.14 hank slivers respectively.

OE spinning was found to be successful in the production of yarns from cotton wastes, where ring spinning failed. The V-shaped groove design (Rotor 23) produced better yarns than the rounded groove design (Rotor 11). In general, the smooth withdrawal tube gave better performance than the fluted tube. These results are given in Table 18.

Table 18 : Properties of Yarns Produced from Different Cottons by Open-End Spinning (20s count)

Quality Parameters	Cotton			
	G.22	V.797	Sanjay	Digvijay
Lea CSP				
Ring Yarn	2136	2012	2228	2124
Rotor 23 F	1546	1592	2030	1600
Rotor 23 S	1640	1600	2002	1630
Single Yarn Tenacity (g/t)				
Ring yarn	12.8	12.6	13.5	14.1
Rotor 23 F	8.6	9.2	11.0	10.5
Rotor 23 S	10.8	9.0	11.5	10.6
Breaking Elongation (%)				
Ring Yarn	7.1	7.5	7.1	6.8
Rotor 23 F	8.1	8.3	8.7	7.6
Rotor 23 S	9.3	8.5	8.8	7.8
Uster Unevenness (%)				
Ring Yarn	16.5	16.4	15.6	15.1
Rotor 23 F	11.6	12.6	12.3	13.1
Rotor 23 S	10.7	11.5	12.9	12.4
Yarn Quality Index				
Ring Yarn	4.4	4.6	4.8	5.1
Rotor 23 F	4.8	4.8	6.2	4.9
Rotor 23 S	7.5	5.3	6.3	5.3

Increase in twist during open-end spinning improved yarn strength but resulted in poorer yarn regularity. Increase in rotor speed from 35,000 to 45,000 rpm improved yarn strength, but resulted in lower extension and poorer regularity. The hairiness of OE yarns was lower than that of ring spun yarns.

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

During last year, the Fibre Quality Indices were compared with CSP values, where only the strength and the count of the yarn were taken into account. Although yarn strength plays a predominant role in the yarn quality, other characteristics such as variation in strength and count, yarn irregularity, appearance, imperfections, etc., are also known to influence the ultimate quality of yarn. It was, therefore, proposed to work out a consolidated Yarn Quality Index (YQI), giving due weightage for different properties in a similar way as that formulated at BTRA and also a modified index taking neps in yarn into consideration in place of the appearance grade. This would also be a more useful approach as regards the newly evolved varieties, some of which pose serious problems of neps. The two indices have been worked out as follows :

$$YQI = \frac{s}{S} \times 50 + \frac{P}{p} \times 10 + \frac{T}{t} \times 10 + \frac{U}{u} \times 20 + \frac{a}{A} \times 10),$$

where s, p, t, u and a are the observed values for the yarn and S, P, T, U and A are the corresponding 'good' grade norm values for yarn of the same count for lea strength, CV of lea strength, CV of count, evenness and appearance index, respectively. In the modified formula, neps per 100 m have been introduced instead of apparance grade and YQI calculated in the similar way. During the period, 25 cotton samples were tested for fibre length, fineness, maturity and bundle strength using Digital Fibrograph and Stelometer and from these FQI (SITRA and CTRL) was determined. The yarns spun from the above cottons were tested for various properties and YQI values were also determined. It was observed that YQI by both the methods and CSP are significantly related and have similar association with $\sqrt{FQI}$ values.

The study was further extended to 50 cotton samples covering all the four cultivated species and hybrids. The yarn spun from these

cottons ranged from 20s to 100s. Fibre and yarn tests have been completed. The calculations of FQI and YQI and further analysis were in progress.

Optimal Blending of Standard Varieties of Indian Cottons

During the year, studies on the following blends from long staple cottons received from Maharashtra State were completed :

Grade No.	*Cotton and Percentage Composition*
L.11	50% MCU.5, 30% Nimbkar and 20% H.4
L.12	20% Varalaxmi, 30% MCU.5 and 50% H.4
L.13	30% Varalaxmi, 50% MCU.5 and 20% H.4
L.14	50% Varalaxmi, 20% MCU.5 and 30% H.4

Trials on medium staple cottons from the same State were then started and Laxmi cotton was first taken up for the study individually.

Comparing the three blends of MCU.5, H.4 and Nimbkar (L.9, L.10 and L.11) wherein the first two were reported last year, it was seen that L.11 containing higher percentage of MCU.5 gave the best yarn regularity and lower neps as well as end-breaks in spinning. Between L.9 and L.10, there was no appreciable difference in regularity and end-breaks. All the three blends were similar in yarn lea strength (Table 19).

Table 19 : Yarn Quality Data of Blended Yarns (50s)

Blend No.	L.9	L.10	L.11
Composition (%)			
H.4	20	30	50
MCU.5	30	50	20
Nimbkar	50	20	30
Corrected Lea CSP	1,934	1,973	1,950
Single Yarn Tenacity (g/t)	13.3	13.9	13.1
Elongation (%)	6.8	6.9	6.8
U%	18.1	18.3	17.5
Neps/100 m	213	268	179
End-Breaks/100 Spindle hours	7.3	7.2	4.9

Table 20: Fibre Quality Data of Mixings

	L.12	L.13	L.14
2.5% Span length (m.m.)	31.0	31.5	32.0
Uniformity Ratio (%)	42	41	42
Maturity Coefficient	0.78	0.80	0.81
Micronaire Value	3.6	3.3	3.3
Bundle Strength — 3 m.m. gauge (g/t)	24.3	25.3	29.8
Fibre Quality Index (FQI) as per SITRA method	68.6	79.2	96.3

The fibre properties of the other three blends studied are given in Table 20. Testing of fibre hooks on card and drawframe slivers as well as of yarns spun on both SKF and LR Drafting from conventional slubber-inter and canfed-inter materials and on OM drafting were completed on L.12 and L.13 The results indicated clearly that use of high speed drawing, can-intermediate and L.R. drafting produced the best quality yarns, while use of OM drafting after 2 passages of high speed drawing and one passage of OM drawing, as well as use of SKF after three passages of conventional T & S drawing and slubber-inter process produced poorer quality yarns. Similar results were also noticed for Laxmi cotton.

Blending of Cotton with Wool, Jute and Other Natural Fibres

The yarn (6s) produced from the blend of 75% cotton flat strips and 25% jute caddies was woven at the All India Handloom Weavers' Service Centre, Bombay, to produce furnishing fabrics using 2/10s cotton warp and 2 ply 6s blended cotton-jute yarn in weft along with 2/10s cotton weft, employing 24s reed and 36 picks per inch. Similarly, the blend of 75% cotton and 25% wool noils, spun to 6s yarn was used for production of durrie fabric employing 2 ply, 6s blended yarn in warp with 20s reed and 6s blended yarn weft with 52 picks per inch. The fabrics have been produced after dyeing the yarns into attractive colourful shades.

Blending of Cotton with Man-Made Fibres

No studies could be carried out during the year on blends of cotton with man-made fibres, due to pressure of work from other projects. How-

ever some studies were carried out on a blend of 67% polyester and 33% viscose staple fibre, both of 51 mm and 2 denier, employing the Open-end Spintrainer for spinning of 14s yarn. Various combinations of rotor design, diameter, type of withdrawal tube, stage of blending, etc., were studied to examine their influence on open-end yarn quality. It was observed that the range in yarn tenacity over the various combinations was between 12.8 g/t and 13.8 g/t, lea CSP was from 1,900 to 2,100, breaking elongation from 14.0 to 16.4 and yarn U% from 11.6 to 13.7. The type of rotor used had a major influence on yarn quality, especially U%, type 25 proving better than type 14. Surprisingly, even the smaller rotor diameter of 45 mm produced better quality yarn than the bigger rotor of 55 mm. Smooth withdrawal tube gave better performance, than a fluted tube.

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

The work carried out during the year under report comprised a study of the effect of crosslinking treatments on the dynamic and static moduli of cotton yarn. Kier boiled and dewaxed yarn spun from Digvijay (30s count) was initially subjected to slack mercerization so as to increase its response to crosslinking. The slack mercerized yarn formed the control sample for the formaldehyde (HCHO) and dimethylol dihydroxy ethylene urea (DMDHEU) treatments. In the former treatment, Form W process was employed with 3 alternative concentrations, viz. 8%, 16% and 22% while for the DMDHEU treatment, which was carried out by the conventional pad-dry-cure method, the solution concentrations chosen were 5%, 10% and 20%. The yarn was kept at constant length during resin treatments.

The dynamic modulus (E′) was calculated from the pulse velocity determined by using the Pulse Propagation Meter (PPM-5). The static modulus (E) was obtained from the load-extension curves of the yarn samples tested on the Instron Tensile Tester. The results of tests are given in Table 21 for the control as well as treated samples.

It is evident from Table 21 that both the static and dynamic moduli increased with the degree of crosslinking, the latter being indicated by the bound HCHO% or N% as the case may be. The effect on the moduli was more phenomenal in the case of DMDHEU treatment. At the highest level of N%, the dynamic modulus E′ was doubled while the static modulus E recorded a four-fold increase, with respect to the control. On account of the more pronounced change in E than E′ with both HCHO and DMDHEU treatments, the ratio E′/E showed a decrease as the degree of crosslinking increased.

Table 21: Results of Elastic Modulus Measurements of Crosslinked Yarn

Sample	N% or bound HCHO%	Modulus (g|d)		Ratio E'|E	Ratio with respect to control	
		Dynamic (E')	Static (E)		(E')	(E)
Slack mercerised yarn (control)	—	39.60	7.20	5.50	—	—
Control crosslinked with DMDHEU						
(a) 5%	1.20	50.40	11.60	4.34	1.27	1.61
(b) 10%	2.10	55.80	14.50	3.85	1.41	2.01
(c) 15%	2.54	66.10	21.30	3.10	1.67	2.96
(d) 20%	3.04	75.60	30.00	2.52	1.91	4.17
Control crosslinked with HCHO						
(a) 8%	0.62	59.30	16.50	3.59	1.50	2.30
(b) 16%	1.30	57.90	19.00	3.40	1.46	2.65
(c) 22%	2.20	62.80	23.30	2.70	1.59	3.24

As the treatments were carried out at constant yarn length, those aspects of yarn geometry which might influence the modulus may be considered as remaining constant. The changes in moduli actually observed in the yarn could, therefore, be attributed to structural changes in the fibre resulting from the crosslinking reactions. It would appear from the trend in the modulus values that the fibre structure becomes more rigid with the introduction of inter-molecular links. The ratio E'/E that characterises the time effects found in visco-elastic materials showed a progressive fall with the severity of crosslinking, indicating that with inhibited segmental mobility, the fibre structure tends to be more "elastic" than before treatment.

Studies on Mechanical Properties of Cotton Fabrics

During the period under report, seven more samples of grey fabrics of plain weave varying in count and number of threads per unit length were selected for studying the tearing strength by different test methods, viz. Elmendorf, Ballistic and Tongue tear. The test results of these samples have been given in Table 22.

Based on the results of 12 samples of grey fabric tested so far (including five samples tested last year), it was observed that there was good association between the results of tests carried out on Elmendorf, Ballistic and Tongue Tear Tester.

Table 22: Data on Constructional and Tearing Strength Parameters of Selected Cotton Fabrics

Sample No.	Count		Ends per in.	Picks per in.	Thickness (mm)	Tearing strength (kg)					
	Warp	Weft				Elmendorf Tester		Ballistic Tester		Tongue Tester	
						Warp	Weft	Warp	Weft	Warp	Weft
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	2.155	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

*These are the samples belonging to Lab to Land Programme. Since the yarns are spun from different varieties of cotton, these were selected irrespective of the same count and construction.

Response of Cottons to Preswelling and Crosslinking Treatment and Influence of Ultra and Fine Structure on Mechanical Properties of Treated Cottons

Fabric Treatment: Fabrics processed out of four Indian cottons, viz. Hybrid 4, Laxmi, Digvijay and Sanjay, were treated with 8% DMDHEU and the treated samples were evaluated for fabric strength, elongation, toughness and CRA. The toughness retention was found to be high in the fabric made from Digvijay (59.8%) followed by that from Sanjay (53.8%). The CRA was highest in fabric from Digvijay (300°) followed by fabrics made from Hybrid 4 (294°) and Sanjay (291°).

Samples of the above four fabrics were bleached and given crosslinking treatment in a reputed mill in Bombay. The treatments were (i) fabrics mercerised and crosslinked and (ii) fabrics crosslinked without any pre-treatment. The treated fabrics were then subjected to test for breaking strength, tearing strength and CRA in the mill and at the laboratory. The results were being analysed.

Fibre Treatment : The following cottons, viz. 320F, Sea Island, G.1422 and V.797, were crosslinked and were evaluated for single fibre tenacity, elongation and toughness. The X-ray orientation parameters of these samples are also being determined.

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

Samples of plain cotton fabric of construction 38s x 36s with 524 ends/dm and 80 picks/dm (131 ends/in. and 70 picks/in.), treated earlier by the Single Step-Poly Set Process, along with untreated control, were tested for nitrogen content, formaldehyde content and various physical properties. The results indicated that fabric treated by the Poly-Set Process had higher strength and elongation retention and abrasion resistance as compared to fabrics treated by the conventional process.

The above treatment on mixed catalyst system was carried out during the period under report. Mixed catalysts containing inorganic salt (A) and/or organic acid (B) were used in the crosslinking treatment of cotton fabrics keeping other conditions of treatment the same as in earlier treatments. The catalysts were mixed in the proportion 1.0%A : 1.0%B. The properties of treated samples were studied along with those of untreated control. From the test results, it was observed that cotton fabric samples treated in mixed catalyst system performed better, as there was 68% strength retention and 4.0 D.P. rating.

Studies on (i) Migration of Crosslinking Resin Finishes during Durable Press Finishing Treatments of Cotton and Cotton Blended Fabrics and (ii) Distention Index and Distribution of Crosslinks in Mercerised and Crosslinked Cotton

(i) In order to study the effect of mixed catalyst on migration of resin, cotton fabric samples were padded with 10% solution of DMDHEU in the presence of a mixed catalyst, polyethylene emulsion 'Vasrang PE' as softner and a wetting agent. The padded fabric samples were subjected to drying for different periods (5 min, 10 min, 20 min, 30 min, 45 min and 60 min) and curing was done at 140°C for 10 min. Moisture content and nitrogen content of the above samples were determined and migration of resin and rate of water drying were worked out. The results showed that the total amount of water removal increased with increase in drying periods and migration of resin increased up to 10 min of drying followed by a decrease thereafter.

(ii) Cotton yarn samples which were crosslinked with formaldehyde by Form 'W' process were tested for various properties like break-

ing strength, elongation, formaldehyde content and distention index and the results thus obtained were being analysed.

Studies on Grafting of Vinyl Monomers onto Cotton

During the period under report, grafting of mixtures of acrylonitrile and methyl methacrylate onto cotton fabric in different compositions (100:0, 75:25, 60:40, 50:50, 40:60, 25:75 and 0:100) was carried out using ceric ammonium nitrate as initiator at room temperature. The values of percent graft obtained were lower than that obtained with single monomer. When grafting onto cotton fabric with the above mixtures of two monomers was carried out at 65°C, the percent graft obtained was higher than that obtained at room temperature.

Similarly, mixtures of styrene and methylmethacrylate also were grafted onto cotton fabric at 65°C. The grafted samples showed gradual decrease in percent graft with increase in the styrene component in the mixture. These samples along with controls were being studied for various other properties.

Synthesis of Cellulose Derivatives with Unusual Functional Groups

In order to prepare cellulose derivatives with substituents on secondary hydroxyl groups, it was necessary to block primary hydroxyl groups at C-6 position.

Theoretically, the steps involved are as follows :

$$\text{Cellulose} \xrightarrow{\text{Tosylation}} \text{Tosyl Cellulose} \xrightarrow{\text{Iodination}} \text{6 iodo-cellulose} \xrightarrow{\text{reduction}} \text{6 methyl cellulose.}$$

Hence, cellulose was tosylated with tosyl chloride in pyridine to a Degree of Substitution (DS) of 1.0 and iodination of tosyl cellulose was attempted with sodium iodide in acetone. Trials were undertaken to iodinate tosyl chloride by (i) refluxing for 72 hrs in water bath, (ii) autoclaving at 20 lb pressure for 8 hrs in sealed glass ampules and (iii) end to end stirring at 20 lb pressure in Beaker Dyeing Machine.

Sodium fusion test was carried out on all these treated samples. In the case of samples treated in Beaker Dyeing Machine, the sodium fusion test showed presence of iodine and absence of sulphur indicating that the reaction was complete.

An 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 Development of Potentially New Useful Products

Both two-step process and single bath treatment to introduce crease resistance in flame proofing cotton fabrics failed to yield any promising results. Again, the flame proofing properties were found to be lost on repeated wash. Hence, with a view to trap the flame proofing agents, a water proofing treatment with hydro-epoxy resin was attempted. The results were evaluated on the basis of Limiting Oxygen Index (LOI). The water proofing treatment did not improve the wash fastness of flame proofing properties to any appreciable extent.

Raw and purified *bhoor bhendi* yarn samples were irradiated and tested for tensile strength, lignin (%) and copper number. The *bhoor bhendi* yarn was very uneven and showed wide variation in the tensile strength. The lignin percent in raw *bhoor bhendi* yarn slightly decreased with radiation, while the copper number showed slight increase.

Studies on Absorbancy of Indian Cottons

Micronaire values of about 20 varieties of cotton were determined with a view to establish whether any relationship exists between Micronaire value and absorbancy. Again, in order to find out whether crystallite size has any relationship with absorbancy, four varieties of cotton, viz. G.1, Digvijay, SRT.1 and Deviraj, were analysed for crystallite size by X-ray technique.

The results showed that the varieties having very high Micronaire values (around 7.0) showed good water holding capacity and low sinking time. No definite relationship could be established between the crystallite size and absorbancy.

Electron Microscopical Investigation of Dye Diffusion and Dye Aggregation in Unmodified and Modified Cotton

Crystalline aggregates of metallized azo dyes were detected by electron diffraction technique inside layered cross sections of dyed cotton fibres. These aggregates might have grown between the inter-lamellar space. Some single crystals with dimensions to the order of 600Å-1000Å were also observed. The most developed faces of these crystals while growing might have been parallel to the macro fibrillar surface. However, most of the aggregates were non crystalline as they failed to give any electron diffraction patterns.

Fibrillated cotton fibres dyed with both Pd and Ce metallized azo dyes showed aggregates of the respective dye molecular of sizes in the range 200Å-2500Å adhehring to the surface of the macro and microfibrils. Electron diffraction patterns of some of the dye aggregates were found to be a mixture arising out of two different crystalline structures, one due to cotton cellulose I and the other due to metallized dye crystallites, confirming the crystalline nature of the dye aggregates. More critical examination of thin fragments of macrofibrils showed that dye penetration in some areas was more than others, while some areas had practically no dye penetration. Evidently, the non-dyed regions are crystalline regions or regions without inter-connecting pores and the dyed regions are less ordered regions. Dye aggregates were also found in some isolated microfibrils along their length indicating the penetration of dye molecules even to the microfibrillar level.

Most of the aggregates inside a macrofibril were not crystalline as they did not produce electron diffraction patterns. However, some of them produced electron diffraction patterns with less number of reflections. This drastic reduction in the number of reflections was caused by the preferential alignment of the dye crystallites with a certain crystallographic axis parallel to the microfibrillar axis. This can be well understood only in terms of smallness of the empty spaces available for growth of crystallites in all, but one or two directions. These empty spaces must, therefore, be the inter-microfibrillar spaces or spaces inside pores in the microfibrils.

The very fact that, more often than not, selected micro areas containing dye molecules did not show any dye crystal diffraction patterns clearly indicated that most of the metallized dye molecules involved in the dyeing of cellulose fibres were not aggregated in a crystalline lattice and if so, the crystallites must be too small for detection by electron diffraction. A possibility is that they are bound to the cellulose chains at the —OH sites by hydrogen bonding and the hydrogen bonded molecules form nuclei for non-detectable crystalline growth.

Studies on the Biosynthesis of Cellulose by Microorganisms and Higher Plants

Biosynthesis of cellulose was studied in (i) developing cotton fibres and (ii) in a microorganism, *Acetobacter xylinum*.

Developing cotton fibres : Two varieties of cotton, viz. Laxmi and Suvin, were grown in pots and fresh cotton bolls from both the varieties were collected at different stages of development. Cellulose synthesizing enzyme was extracted from cotton fibres and the enzyme activity was

assayed immediately. The results were in good agreement with last year's findings.

The fibres from fresh bolls of both the varieties at each stage of development were collected and the degree of cell-wall thickening was estimated. In both the varieties, the degree of thickening increased after 20 days post anthesis. However, this increase was more rapid in Laxmi variety as compared to Suvin.

Acetobacter xylinum : The growth of the organism was centrifuged and a soluble polymer (SP) isolated from the supernatant by precipitation with alcohol. Attempts were made to characterize the SP by (i) treatment with cellulase enzyme, (ii) electron microscopy and (iii) infra-red study. It was found that the SP was hydrolyzed by cellulase enzyme, and a reducing sugar was formed. The transmission electron microscopy study showed branched fibrillar structure of SP. The infra-red spectrum of the polymer resembled more mercerized bacterial cellulose than native bacterial cellulose.

It appears from the above results that the polymer contains β, 1→4 linkages and it may be cellulose II.

Earlier work on cellulose synthesis by *A. xylinum* from different carbon sources, viz. xylose, mannose, fructose and glucose, was extended and studies were carried out on electron microscope, both in transmission and diffraction modes. It was observed that the formation of the microfibrils was accompanied with the crystallization of cellulose. The crystals appear fibrous with lamellar structure. The electron diffraction studies revealed two types of patterns, one showed single crystal pattern where the *d* spacings of its most intense reflections are well in agreement with those of cellulose I. The second ED pattern perhaps represents an earlier stage of crystallization and revealed weak reflections corresponding to 002 and 021 planes with splitting effect.

Fermentation Studies on Cellulase Production and Its Applications

Beta-glucosidase or cellobiase is one of the few important enzymes that take part in the process of hydrolysis of cellulose in which it converts cellobiose into glucose. The enzyme occurs extracellularly in the cell-free filtrate and intra-cellularly on an organism. Studies were, therefore, undertaken to get a better insight into the formation of this enzyme by *Penicillium funiculosum*.

The organism was grown at different time intervals and the growth medium was filtered to get the filtrate containing extra-cellular enzyme. The mycelia collected were washed and treated with cold acetone to get mycelied dry powder. The powder was then ground in buffer and cen-

trifuged to get intra-cellular enzyme. The samples collected at different intervals of growth of the organism were analysed for both extra- and intra-cellular beta-glucosidases. It was found that the enzyme occurred both intra- and extra-cellularly after 18 hr incubation. Assessment of the occurrence of the enzyme within a period less than 18 hr is in progress.

It was reported earlier that *Candida utilis* grow better on the hydrolysates of cellulosic materials. Attempts were also made to find out whether any breakdown products of cellulosic substrates, like xylose, glucose and cellobiose and alcohol — one of the metabolite produced by the organism from sugars —, are the inducers of beta-glucosidase of *C. utilis*. It was confirmed that xylose acted as a potent inducer of beta-glucosidase and elaborated the enzyme almost 10-fold.

All the modules, viz. pH meter, aerator, stirrer, defoaming pump unit, cooling system and oxygen meter of the Gallenkamp Modular Fermenter were set into operation. The aerator and stirrer were operated at different settings to study the effect of dissolved oxygen in the medium. *Candida utilis* was grown in a synthetic medium on fermenter for a trial.

Attempts were made to mutate *P. funiculosum* for higher cellulase production by UV irradiation. The conidia were exposed to various doses of UV and a survival curve for the organism was prepared by plotting time of irradiation against percentage of survival. It was found that 45 sec were required for 10% survival. The conidia were further treated as described above at 1% survival level, and several fast growing mutants were isolated. Three such mutants sporulated within half of the time taken by the mother culture. The cellulase production by the above mutants showed that they were marginally (10%) higher in activity. Further work on mutation was in progress.

Enrichment of Cattle Feed by Microbiological Methods

Straws of paddy and wheat which were acid hydrolyzed, ammoniated and fermented with *Penicillium funiculosum* and *Candida utilis* indicated a fairly high amount of ammoniacal nitrogen at the end of fermentation period. An effort was, therefore, made to find out the factors responsible for the non-utilization of ammoniacal nitrogen by the above organisms. The results indicated that when the elements, phosphorus and magnesium, the presence of which were very low in those straws, were supplemented with sugars in the form of glucose, sucrose or mollases, the level of inorganic nitrogen was brought down with a concomitant increase in the crude protein. There was a four-fold increase in crude protein with *P. funiculosum* and *C. utilis* by supplementing with inorganic nutrients as against 2-3 folds with unsupplemented products.

Preliminary experiments were undertaken to enrich the acid hydrolysed and alkali neutralized straws with *Beijerinekia mobilis,* a free living nitrogen fixing bacterium that can grow in the pH range of 3.0 to 9.0 and utilize a variety of carbohydrates. The results indicated that there was increase in the crude protein content by 2-3 folds. Experiments are underway to grow this bacterium along with a mushroom fungus, *Pleurotus sajor caju* which is known to have cellulase, ligninase and nitrogen fixing ability.

Studies on the Utilisation of Chitin and Other Allied Products from Prawn Shell Waste

Cellulase filtrates from the efficient culture collections of CTRL were tested for their ability to break down chitin. The organisms included in this category were *Penicillium funiculosum* F_4, *P. funiculosum* 844, *Trichoderma viride* QM 6a, 9123 and 9414. The results indicated that the production of glucosamine was maximum with *T. viride* 9123 filtrate, closely followed by *P. funiculosum* F_4 and *T. viride* QM 6a filtrates. The strain 9414, despite having very high cellulase activity, showed the least chitinase activity. Cross streak assay against the three soil-borne fungal phytopathogens indicated that *T. viride* 9123 inhibited *Fusarium oxysporum f. vasinfectum* and *Rhizoctonia solani.* This study gave a clue that cellulose degraders can also be made to establish on added cellulosic substrates and thereby act as suppressors for the proliferation of pathogenic fungi in the soil environment.

Pot culture studies were undertaken to control the root rot of cotton caused by *R. solani* on Laxmi cotton by amending the soil with prawn shell waste, with and without chitinoclastic microorganisms. The prawn shell waste was applied in two different doses. Manures and fertilizers were totally eliminated but appropriate plant protection measures were undertaken excluding fungicides. The results indicated that the crop in the prawn shell waste amended soils were healthy, robust and dark green as compared to plants raised in unamended soils. The plants were sick or stunted in the pathogen inoculated controls. Hence, it can be concluded that prawn shell waste apart from having the property of disease control can act as a good source of nutrients, particularly nitrogen.

Analysis and Grading of Cotton Linters

M/s. Mysore Acetate and Chemicals, Mandya, was visited by personnel from CTRL to ascertain the suitability of Clark's Classifier for the determination of fibre length groups in linters. As this instrument was found useful for the purpose in view, it was proposed to approach the above firm for permission to test some of the samples.

Further, it was observed that certain varieties of linters develop colour during acetylation treatment and thereby become unsuitable for manufacture of cellulose acetate. Hence, "Bottle Acetylation" test was standardised to study this effect in the Laboratory.

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

Cottonseed meal is a cheap nitrogen source and therefore, used in certain fermentions. It is possible that 'gossypol', a toxin, bound in the meal is released during such fermentations. In order to confirm this, a good amylase and low protease producing strain *Bacillus subtilis*-159 was grown in Tendlers' non-synthetic medium containing cottonseed meal as a source of nitrogen. The organism was also grown in the above medium on peptone. After completion of growth, the cells were separated by centrifugation and the clear supernatant obtained was assayed for amylase activity and the presence of free gossypol. It was found that the amylase production in the medium containing cottonseed meal was about twice the value as compared to that obtained on peptone. The estimation of gossypol showed that there was no free gossypol in the beginning of fermentation in the medium. However, after growth of the organism, the cell-free filtrate showed the presence of gossypol. This was a clear evidence that gossypol is released during fermentation. Further, studies were conducted to see whether gossypol itself has got any inhibitory effect on the organism. Nutrient agar plates were seeded with *B. subtilis*. Cups of 1 cm diameter were bored and pure gossypol solution was added to them. It was found that clear inhibitory zones were developed on the plates after incubation. This showed that the gossypol has inhibitory effect on the growth of organisms. However, the concentration of gossypol released during fermentation was very low, and therefore, had very little effect on the organism.

Production of Bio-gas from Cellulosic Textile Mill Wastes

Experiments were undertaken to explore the possibility of producing bio-gas from willow-dust, a textile mill waste, which closely resembles cow dung in chemical composition. Initial trials were undertaken in the laboratory by a batch fermentation process in 5 litre and 10 litre capacity corning bottles. Bio-gas generated was collected in the aspirator by water displacement. The gas production was found to be starting after 15 days and and it continued up to 60 days. The results indicated that about 160 litres of bio-gas could be produced from 1 kg of willow-dust in a period of 60 days. Analysis of the gas indicated that it contains about

55% methane similar to that of gobar gas. When willow-dust was treated with 1% sodium hydroxide and aerobically fermented for 3 days, the production of bio-gas initiated after 5 days and 160 litres of the gas was obtained in 30 days, when water-substrate ratio was kept at 6:1.

Large scale experiments will be undertaken on a pilot plant scale shortly.

Studies on Composition and Utilisation of Cottonseed and Similar Plant Seeds

During the period under report, fatty acid composition of cottonseed oil in different varieties was analysed using Gas Chromatograph. Out of 43 cottonseed oil samples studied, 11 samples were belonging to *G. arboreum*, 7 to *G. herbaceum*, 22 to *G. hirsutum* and 3 to *G. barbadense*.

The data obtained revealed that there was marked variation in fatty acid content of different varieties. The mean values and ranges for fatty acid content of different varieties were as follows :

Name of fatty acids	*Average values (%)*	*Range (%)*	
		Minimum	*Maximum*
Myristic	0.73	0.35	— 1.16
Palmitic	24.35	20.53	— 28.01
Palmitoleic	1.16	0.59	— 3.45
Stearic	3.00	2.30	— 4.35
Oleic	50.62	14.71	— 26.79
Linoleic	20.15	41.13	— 55.39

Attempts were also being made to standardise the "Halphen Test Method" for estimation of cyclopropenoid fatty acids in cottonseed oil.

Utilisation of Cotton Stalks

Several enquiries requesting for the technical know-how of the preparation of particle board from cotton stalk have been received from various parties and all relevant details were supplied to them. One of the consultancy firms in Gujarat was supplied with samples of the particle boards of different sizes prepared from cotton stalk at the Laboratory for ascertaining the marketability of the product before setting up a factory for the same at Gujarat. Further communication was awaited from them.

Evaluation of Mechanical Device for De-burring of Raw Wool

The alignment of the device was completed and some trials undertaken.

Rambouillet scoured wool was received from the Central Sheep and Wool Research Institute, Avikanagar. Orders for burry wools with 10%, 20% and 30%, respectively, of cookle burrs have been placed with the Rajasthan Sheep and Wool Marketing Federation, Jaipur.

Research Work Done at the Quality Evaluation Units

COIMBATORE

Fifty samples of cotton belonging to the four cultivated species were tested for fibre maturity using the 9.5 mm and 12 mm spacers with the Micronaire. The results obtained were compared with the standard values obtained by caustic soda method. It was observed that 12 mm spacer could be used for cottons having Micronaire value of 5.0 and below to get more accurate results of maturity. For the Micronaire value ranging from 5.5 to 6.0, 9.5 mm spacer was found to be suitable.

HISSAR

The effect of defoliant treatments was studied on H.655 variety during 1979-80 season. The defoliants had non-significant effect on fibre characters and *kapas* yield of H.655 as compared to 320F (control).

Effect of insecticides was assessed by their efficacy against pink boll-worm on H.777 variety. Dimethiate was also sprayed to check jassid attack. All the nine insecticide treatments produced significantly higher yield than the control. Significantly low incidence of boll-worm attack was observed with Permethrin treatment. Length, maturity and strength were unaffected by the insecticide treatments. However, Permethrin treatment resulted in coarseness of the fibres.

INDORE

An investigation was undertaken at College of Agriculture, Indore to minimise the cost of hybrid seed production (which is the main obstacle in spreading the hybrid varieties although they are superior in yield and fibre quality). For this purpose, cheaper and easier methods for hydrid seed production by introducing a suitable male sterile restored source, has been adopted. The qualitywise performance of the Cytoplasmic Male Sterile (CMS) hybrids was compared with the normal hybrids like JKHy.1, JKHy.11 and Hybrid 4. It was observed that GP and bundle strength of the CMS hybrids were better than that of the

normal hybrids, while length, fineness and maturity had not shown any significant difference.

To study the differences in physical properties of fibres from different positions of a cotton boll, a trial was laid in randomised block under irrigated conditions during 1978-79 season. Hybrid 4 and JKHy.1 were included in the experiment. Selected bolls of three varieties were divided into four portions viz. Base, Middle 1, Middle 2, and Tip. The fibres from these portions were tested for fibre properties. It was observed that G.P. and bundle strength values were higher for fibres obtained from the base portions and, in addition, these fibres were coarser. These properties gradually decreased from base to tip portions. Maturity and fibre length did not show significant differences amongst the different portions.

3. PUBLICATIONS

During the year 1980, one Annual Report, two Technological Reports, 11 Research Publications and 76 Technological Circulars, were issued in addition to six papers presented at various Conferences.

A. Annual Report

Annual Report of the Cotton Technological Research Laboratory for the calendar year 1979.

B. Technological Reports

No. 25. Technological Report on Trade Varieties of Indian Cottons, 1978-79 season.

No. 26. Technological Report on Standard Indian Cottons, 1978-79 season.

C. Research Publications (CTRL Publication — New Series)

No. 143. Comparative Performance of Conventional and High Speed Draw Frames — M. S. Parthasarathy, B. Srinathan and K. S. Bhyrappa (Reprinted from Indian Journal of Textile Research, Vol. 4, March 1979).

No. 144. Contribution of CTRL to the Improvement of Cotton Ginning in India — by V. Sundaram.

No. 145. Crystallinity of Polyethylene Terephthalate Fibres — by V. B. Gupta and Satish Kumar of I.I.T., New Delhi and N. B. Patil and P. K. Chidambareswaran (Reprinted from Indian Journal of Textile Research, Vol. 4, March 1979).

No. 146. Know Your Cotton: (6) SRT.1 (G. Cot.10) — by V. Sundaram, C. T. Patel and N. P. Mehta (Reprinted from Journal of the Indian Society for Cotton Improvement Vol. 2, September 1979).

No. 147. Isolation of Chitinoclastic Microorganisms and their Application with Chitin in the Biological Control of Verticillium Wilt of Cotton — by S. M. Betrabet and R. H. Balasubramanya (Reprinted from the Journal of Indian Society for Cotton Improvement, Vol. 4, September 1979).

No. 148. Production of Amylase by *Bacillus subtilis*-159—by S. G. Gayal and V. G. Khandeparkar (Reprinted from Indian Journal of Microbiology, Vol. 19, October-December, 1979).

No. 149. Migration of Crosslinking Reagents in Cotton Fabric during Resin Finishing Treatments — by S. N. Pandey and C. R. Raje (Reprinted from the Textile Research Journal, Vol. 50, September, 1980).

No. 150. The Cross-sectional Shapes of a Cotton Fibre Along its Length — by B. M. Petkar, P. G. Oka and V. Sundaram (Reprinted from the Textile Research Journal, Vol. 50, September, 1980).

No. 151. Prediction of Bundle Strength from Single Fibre Test Data — by R. P. Nachane and K. R. Krishna Iyer (Reprinted from the Textile Research Journal, Vol. 50, October, 1980).

No. 152. Role of TEM in Cotton Finishing Research and Study of other Textile Materials — by S. M. Betrabet (Reprinted from Colourage, Vol. XXVII, March, 1980).

No. 153. Performance of Different Flat Tops in the Processing of Immature Cottons — by B. Srinathan, T. N. Ramamurthy, H. V. Sreenivasa Murthy and A. A. Gupte (Reprinted from the Textile Industry and Trade Journal, Vol. XVII, September/October, 1979).

D. Papers Presented at Conferences/Seminars

1. Technological Performance of Imporved Varieties of Cottons in Tamil Nadu — by M. S. Parthasarathy (Presented at the Golden Jubilee Symposium of CTRL Regional Unit, Coimbatore in January, 1980).
2. Quality Characteristics of New Hybrids in Karnataka—by P. G. Oka, M. S. Seetharam and B. Srinathan (Presented at the Golden Jubilee Symposium of Quality Evaluation Unit, Dharwad in January, 1980).
3. Resin Finishing of Polynosic/Cotton Blended Fabric by Polyset Process — by S. N. Pandey and (Smt.) Prema Nair (Presented at the Twentyfirst Joint Technological Conference of BTRA, SITRA and ATIRA held at Bombay in February, 1980).
4. Study on Different Methods of Measuring Fibre Configuration — by (Kum.) I. K. P. Iyer, M. S. Parthasarathy and V. Sundaram (Presented at the Twentyfirst Joint Technological Conference of BTRA, SITRA and ATIRA held at Bombay in February, 1980).
5. Cotton Quality and End Uses — by M. S. Parthasarathy and V. Sundaram (Presented at the National Seminar on Cotton in Eighties, at Tamil Nadu Agricultural University, Coimbatore, in December, 1980).

6. Cottonseed Oil and Its Role in Indian Vanaspathi Industry — by S. N. Pandey (Presented at the Seminar on 'New Dimensions in the Utilisation of Fats and Oils organised by Oil Technologists Association of India at H. B. Technological Institute, Kanpur in December, 1980).

E. Technological Circulars on Trade Varieties of Indian Cottons

T.C. No.	*Variety*	*T.C. No.*	*Variety*
2010	Desi (Dhuri)	2039	Narmada (Burnpur)
2011	Desi (Ganganagar)	2040	Hybrid 4 (Karanjan)
2012	J.34 (Adampur)	2041	Hybrid 4 (Palej)
2013	Gaorani 6 (Sailu)	2042	AK.235/277 (Buldana)
2014	J.34 (Bhatinda)	2043	Laxmi (Gadag)
2015	SRT.1 (Jamner)	2044	C. Indore 1 (Kankroli)
2016	Laxmi (Phaltan)	2045	Narmada (Khandwa)
2017	L.147 (Adilabad)	2046	My.14 (Arasikere)
2018	Deviraj (Gokak)	2047	C. Indore 1 (Bilwar)
2019	Varalaxmi (Phalton)	2048	Khandwa 2 (Khandwa)
2020	Hybrid 4 (Umerkhed)	2049	JKHy.1 (Khandwa)
2021	Sanjay (Bhotad)	2050	J.34 (Khandwa)
2022	AK.277 (Shegaon)	2051	J.34 (Haryana)
2023	Buri 147 (Malkapur)	2052	Varalaxmi (Palej)
2024	B.1007 (Umerkhed)	2053	Varalaxmi (Guntur)
2025	Nimbkar (Baramati)	2054	Wagad (Saurashtra)
2026	Varalaxmi (Raichur)	2055	MCU.5 (Guntur)
2027	Laxmi (Sattur)	2056	Virnar (Jalna)
2028	MCU.7 (Manapparai)	2057	Varalaxmi (Sendhwa)
2029	Hybrid 4 (Modasa)	2058	Digvijay (Kapadvanj)
2030	Bikaneri Narma (Sriganganagar)	2059	Y.1 (Pachora)
		2060	B.1007 (Adilabad)
2031	SRT.1 (Baroda)	2061	L.147 (Dhamond)
2032	Maljari (Khargone)	2062	414F (Malout)
2033	Virnar (Khargone)	2063	Suvin (Guntur)
2034	Suvin (Annur)	2064	Jayadhar (Adoni)
2035	Sujay (Surat)	2065	Jayadhar (Hubli)
2036	MCU.5 (Tirupur)	2066	320F (Haryana)
2037	V.797 (Mahasada)	2067	G.27 (Haryana)
2038	Digvijay (Palej)	2068	Westerns (Bellary)

F. Technological Circulars on Standard Indian Cottons

S. C. No.	*Variety*	*S. C. No.*	*Variety*
195	MCU.7 (Aduthurai)	203	Varalaxmi (Siruguppa)
196	L.147 (Adilabad)	204	Buri 147 (Akola)
197	Sanjay (Amreli)	205	Hampi (Siruguppa)
198	LSS (Abohar)	206	V.797 (Viramgam)
199	Sea Island Andrews (Karnataka)	207	Hybrid 4 (Surat)
		208	Digvijay (Bharuch)
200	Gujarat 67 (Talod)	209	Jayadhar (Dharwad)
201	Khandwa 2 (Khandwa)	210	Sujay (Surat)
202	Narmada (Khandwa)	211	Westerns (Hagari)

4. EXTENSION

Since Cotton Technological Research Laboratory has no farm attached to it, all field work is carried out at various Central Institutes, Agricultural Universities and Regional units in different cotton growing states of the country. As such, though CTRL does not directly deal with the farm community, valuable assistance is being indirectly rendered to cotton growers, by undertaking various tests for quality of cotton samples sent by them/trade/industry/Government/Civic organisations, etc., besides imparting training in cotton technology and supplying various testing instruments for assessing quality of cotton.

Testing Work

Apart from the research samples received from various agricultural stations, CTRL continued to receive a number of samples of fibre, yarn and cloth for special tests from Government and semi-Government organisations as well as from trade and textile industry, on payment of the prescribed test fees. The number of such samples received and tested during the year 1980 together with the corresponding figure for 1978 and 1979 and for the quinquennium 1971-75 are given in Table 22.

Table 22: Number of Samples Received for Paid Tests

Type of test	Average for the quinquennium 1971-75	1978	1979	1980
Spinning	10	67	65	32
Fibre (EICA)*	16	163	116	72
Fibre (Others)	193	126	138	128
Yarn	37	20	51	67
Cloth	48	110	73	76
Moisture	73	—	—	—
Miscellaneous	8	26	22	10
Total	385	512	465	385

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

EXTENSION

The total fees realised during 1980 for carrying out paid tests on samples received amounted to Rs. 35,310.00 against Rs. 24,349.20, during 1979.

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. One sample of Zambian cotton was received from the trade, for determination of fibre quality and spinning potential using microspinning technique.
2. Five samples of absorbant cotton supplied by two private firms were tested for mean fibre length.
3. Three samples of polyester fibre received from two Indian manufacturers were subjected to tests for determination of tensile strength, elongation and modulus, by Instron Tensile Tester and also for denier by the "whole fibre method" followed at CTRL for cotton fibres.
4. Two samples of polynosic fibre were sent by two National Textile Corporation mills, and they were tested for (i) single fibre strength and elongation, by Instron Tensile Tester, (ii) denier and (iii) staple length.
5. Twentyseven samples of card sliver received from three textile mills were subjected to Open-End Spinning trials to find out the optimum settings during mechanical processing.
6. A composite mill from Bombay, sought opinion regarding the type of cottons used in the two different fabrics submitted by them. The fibres were taken out of the warp and weft yarns of the two fabric samples received from them and they were tested for maturity, fineness, convolutions and reversals. The observations were reported to the party.
7. A cotton yarn sample spun on cycle charkha, using A-600 system of drafting received from the President, The Textile Association (India), Bombay, was tested for yarn characteristics.
8. Fifteen samples of fibreglass yarns of different deniers were received from a firm for the determination of single yarn strength.
9. Three samples of polyester texturised yarn received from an indigenous producer were tested for denier and breaking strength as well as elongation using Instron Tensile Tester.
10. Hairiness Index on Shirley Hairiness Tester was determined on four polyester/cotton blended yarn samples received from a local manufacturer.
11. One fabric sample was received from a garment dealer for the determination of bursting strength.

12. One polyester/viscose rayon blended fabric sample received from a trader was analysed for constructional parameters and quantitative identification of component fibres in fabric. The findings were reported.
13. Three 'Magalotrate' samples were received from a pharmaceutical firm, for X-ray diffraction analysis. The observations and comments were communicated to the party.
14. Four polymeric emulsion samples received from a local firm were analysed on Electron Microscope. The photomicrographs were supplied.

In addition to the above, assistance was also rendered to other sister institutions by testing the samples received from them free of charge. Special mention may be made of a sample of *Calotropis* floss fibre received from Central Arid Zone Research Institute, Jodhpur, which was tested for bundle strength, tenacity and toughness.

Training

Two full time training courses lasting eight weeks each, one from July to September and the other from September to November, for those deputed by cotton trading organisations in Bombay and mofussil centres are being conducted regularly by this Laboratory. During the year, the following nine persons attended the training course which consisted of lectures and practical work on methods of evaluation of cotton fibre quality and interpretation of test results based on statistical analysis.

1. Shri Yogendra Anandji Nagda
   M/s. Arjun Khimji & Co.
   Bombay 400 021.
2. Shri Vikram Mulraj Sampat
   C/o. M/s. Mulraj Dayal
   31, V.B. Gandhi Marg
   Bombay 400 001.
3. Shri Krishna Dulaji Sawant
   Dy. Controller of Stores
   Western Railway,
   Bombay 400 011.
4. Shri Samir Pravinlal Shroff
   M/s. Shroff Cooper & Co.
   225, Nariman Point
   Bombay 400 021.

5. Shri Virendra Mutha
M/s. Ganesh Cotton Co.
Nanded.
6. Shri Bhaskar Kumar Govindji Pawani
M/s. Sree Jalaram Trading Co.
130, Balasundaram Chettiar Road
Coimbatore 641 018.
7. Shri Jitendra Govindji Nagda
M/s. Arjan Khimji & Co.
Bombay 400 021.
8. Shri Babaji Ramraju
Andhra Pradesh Cotton Association
Guntur 522 007.
9. Shri G. Parmesh
M/s. Rayalseema Mills Ltd.
Adoni 518 301.

In addition, Shri Madhukar A. Amboday of India United Mills No. 5, Bombay underwent a short refresher course during March 1980.

5. CONFERENCES AND SYMPOSIA

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

Sr. No.	Meeting|Conference	Place	Date	Names of Officers who attended the Meeting|Conference
1	Golden Jubilee Symposium entitled "Status and Development of Long Staple Cottons in Tamil Nadu" at CTRL Regional Unit at Coimbatore.	Coimbatore	17-1-1980 and 18-1-1980	Dr. V. Sundaram, Shri M. S. Parthasarathy and Dr. V. G. Munshi
2.	Workshop on Management Practices in ICAR.	Hyderabad	17-1-1980 to 19-1-1980	Shri P. G. Oka
3.	Seminar on Cotton Ginning organised by Textile Students' Association held at VJTI.	Bombay	21-1-9180	Shri B. Srinathan
4.	Seminar on Future of Viscose.	Bombay	26-1-1980	Shri M. S. Parthasarathy, Shri B. Srinathan and Shri T. N. Ramamurthy
5.	Seminar held in connection with the Golden Jubilee Symposium of CTRL Regional Unit at Dharwad on "Recent Developments on Hybrid Cottons in Karnataka State".	Dharwad	28-1-1980 and 29-1-1980	Dr. V. Sundaram, Dr. V. G. Munshi, Shri P. G. Oka, Shri B. Srinathan and Shri M. S. Sitaram
6.	Twentyfirst Joint Technological Conference sponsored by ATIRA, BTRA and SITRA held at BTRA.	Bombay	14-2-1980 and 15-2-1980	Dr. V. Sundaram, Dr. S. M. Betrabet, Dr. N. B. Patil, Shri M. S. Parthasarathy, Dr. S. N. Pandey, Shri B. Srinathan, Shri T. N. Ramamurthy, Kum. I. G. Bhatt, Shri P. K. Chidambareswaran, Smt. V. Iyer, Smt. Prema Nair and Kum. I. K. P. Iyer
7.	Annual Convention of Oil Technologists Association of India.	Bombay	16-2-1980 and 17-2-1980	Dr. S. N. Pandey
8.	Symposium on Chemical Treatment and Textile Coatings.	Kanpur	25-2-1980	Kum. I. G. Bhatt and Smt. V. Iyer

CONFERENCES AND SYMPOSIA

Sr. No.	Meeting/Conference	Place	Date	Names of Officers who attended the Meeting/Conference
9.	Meeting of the Research Advisory Committee of SITRA.	Coimbatore	12-3-1980 and 13-3-1980	Dr. V. Sundaram
10.	National Symposium on Recycling of Residues of Agriculture and Industry held at Punjab Agricultural University.	Ludhiana	28-3-1980 and 29-3-1980	Dr. V. G. Khandeparkar and Dr. R. H. Balasubramanya
11.	Regional Meeting on Agricultural Development Programme for 1980-81 for Gujarat, Maharashtra, M.P., Rajasthan and Goa.	Bombay	7-4-1980 and 8-4-1980	Dr. V. Sundaram
12.	North Zone Panel Meeting of Breeders and Technologists of AICCIP.	Ludhiana	7-4-1980 and 8-4-1980	Shri P. G. Oka
13.	Tenth Conference of SASMIRA.	Bombay	17-4-1980 and 18-4-1980	Kum. I. G. Bhatt
14.	Central Zone Panel Meeting of Breeders and Technologists of AICCIP.	Pune	14-5-1980 and 15-5-1980	Shri P. G. Oka
15.	South Zone Panel Meeting of Breeders and Technologists of AICCIP.	Coimbatore	5-6-1980 and 6-6-1980	Shri P. G. Oka
16.	Technological Conference on "Fibre of the Eighties — Super Lon Bell" organised by Paramount Cotton Co.	Bombay	20-6-1980	Dr. V. Sundaram, Dr. N. B. Pail, Shri M. S. Parthasarathy, Dr. V. G. Munshi, Shri B. Srinathan and Shri T. N. Ramamurthy
17.	Meeting of the Local Management Committee of Krishi Vigyan Kendra, Kosbad Hill.	Kosbad	4-7-1980	Dr. V. Sundaram
18.	Seminar organised by Textile Association, Bombay on 'Rings and Travellers'.	Bombay	24-7-1980	Shri M. S. Parthasarathy, Shri B. Srinathan, Shri T. N. Ramamurthy, Shri Muntazir Ahmed, Shri K. S. Byrappa, Shri S. Chandrasekhar and Shri H. R. Laxmi venkatesh
19.	Symposium on Scanning Electron Microscopy and Related Techniques.	Bombay	11-8-1980 and 12-8-1980	Dr. K. M. Paralikar
20.	Twentyfirst Annual Conference of Association of Microbiologists of India, held at Bhavan's College.	Bombay	31-10-1980 to 2-11-1980	Dr. V. G. Khandeparkar and Dr. R. H. Balasubramanya

Sr. No.	Meeting/Conference	Place	Date	Names of Officers who attended the Meeting/Conference
21.	Fourth Meeting of Regional Committee No. 7 held at Conference Hall of Goa Chamber of Commerce and Industry, Panaji.	Goa	22-11-1980 and 23-11-1980	Dr. V. Sundaram and Dr. V. G. Khandeparkar
22.	International Textile Machinery Exhibition Symposium.	Bombay	27-11-1980 to 29-11-1980	Dr. V. Sundaram, Shri M. S. Parthasarathy and Shri T. N. Ramamurthy
23.	Convention of Chemists.	Bombay	9-12-1980 to 13-12-1980	Kum. I. G. Bhatt and Smt. V. Iyer
24.	"National Seminar on Cotton in the Eighties", organised by Directorate of Cotton Development and Tamil Nadu Agricultural University.	Coimbatore	22-12-1980 to 24-12-1980	Dr. V. Sundaram, Dr. N. B. Patil, Shri M. S. Parthasarathy and Shri P. K. Chidambareswaran
25.	Seminar sponsored by Oil Technologists Association of India on "New Dimensions in the Utilisation of Fats and Oils" held at H. B. Technological Institute.	Kanpur	27-12-1980	Dr. S. N. Pandey

In addition, the Director and other Scientists of CTRL 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 Committee of Central Institute for Cotton Research, Nagpur, Governing Council of BTRA and the Board of Management of VJTI, Bombay.

6. SUMMARY OF THE REPORT

This is the 57th Annual Report of the Laboratory covering the calendar year 1980. The Laboratory continued to collaborate actively with cotton breeders and agricultural scientists in their endeavour to evolve new improved cotton strains by authoritative evaluation of their quality characteristics. CTRL continued its function as the co-ordinating centre on cotton technology under AICCIP in which a multi-disciplinary approach to cotton research is envisaged. Several samples of cotton, yarn and fabric received from the trade and industry for paid tests were evaluated for desired characteristics. In all, 48 research projects on agricultural aspects, fundamental studies in fibre physics, ginning and spinning technology, textile chemistry, microscopy and microbiology were undertaken during 1980, in addition to regular testing and evaluation work on quality of cottons received from agricultural research scientists and cotton breeders in various parts of the country. Several papers were published on the research findings in various scientific journals in India as well as abroad.

Research Activities

Under AICCIP and various state schemes, samples were tested for fibre quality and spinning performance.

The following two varieties of cotton were released through the Tamil Nadu State Department of Agriculture :

Variety	*Traits*
KCH.2	A short duration variety, recommended for cultivation in rice fallows areas of Tamil Nadu, having 30.7 mm mean length and spinnable up to 60s count; superior to MCU.7 in yield and spinnability.
KC.1	Short duration variety, recommended for cultivation in rainfed areas of Tamil Nadu, having 23.5 mm mean length and spinnable up to 40s count. High yield potential compared to MCU.6 and better spinnability compared to varieties like Bharati and Lakshmi.

Tests for seed index, lint index, ginning out-turn, 2.5% span length, Micronaire value and bundle strength at zero gauge length carried out on

JKHy.11, MCU.5, Varalaxmi and Suvin picked at three intervals revealed that (i) the seed index and the lint index at the second stage of picking of JKHy.11 were higher than those at the other pickings (ii) the fibre properties of Suvin at the last picking were lower as compared to those at the other pickings and (iii) Varalaxmi and MCU.5 cottons from different pickings did not show significant change in the fibre properties.

With a view to study the varietal variability and inheritance of the characteristic of neppiness in cottons, about 30 varieties for which pure lines were available at the Cotton Research Station, Surat, were critically examined for nep content and some varieties were selected for diallel crossing programme.

The effect of nitrogenous, phosphatic and potash fertilizers on the yield and quality of Hybrid 4 cotton was examined by testing the material from different treatments and statistical analysis of the data. The yield differences were significant for nitrogen levels, whereas those due to phosphorus and potash as well as their interaction factors were non-significant. Different fertiliser doses and their interaction effects exhibited no significant impact on fibre length and fibre fineness. The bundle strength at zero gauge length displayed significant effect for nitrogen and phosphorus levels, while the potash levels made no noticeable impact.

As part of the study on the impact of insecticide treatments on the quality of cotton and cottonseed, samples of seeds of G.Cot.100 and Hybrid 4 belonging to an entomological trial at Surat were analysed for crude protein and oil percentage. The analysis of the data indicated that by and large, there was marked increase in the crude protein and oil percentage levels as compared to the control.

The designing and fabrication work of an electronic fibre length tester using mostly indigenous components was in progress.

The work on optical scanning technique for the determination of maturity employing Model 430 Fibrograph was continued by scanning some more samples in the more immature group. Statistical analysis of the data indicated high association between the Optical Index of Maturity determined using Model 430 Digital Fibrograph and the Maturity Coefficient determined by the caustic soda method.

Attempts were made to improve the performance of the new maturity measuring device fabricated last year. Trials made using a green selenite plate, instead of the red plate earlier tried, in conjunction with a green filter (550 m μ wave length) was found to give better reproducible results.

The results for 50% X-ray angle, convolution/mm and convolution

angle on the standardised solvent exchanged samples and air-dried controls were in conformity with the earlier observation that the convolutions account for a large part of differences in the measured spiral angle usually encountered in nature-dried fibre.

When the results of orientation parameters, viz. 20%, 40%, 50% and 75% X-ray angles as well as fx, obtained from 20 cotton samples of *G. herbaceum* species were analysed, the 75% X-ray angle recorded highest correlation with the percentage elongation as in the case of *G. barbadense* and *G. hirsutum* species. As far as tenacity values at zero and 3 mm gauge lengths were concerned, fx showed highest correlation for *G. herbaceum* cottons.

Tests on over 700 samples confirmed that the earlier equation, B1 = 0.821 D + 0.095, where B1 is the mean fibre length by Balls Sorter and D is the 2.5% span length by Digital Fibrograph, still holds good for prediction of B1 values from D values. On the other hand, the earlier equation used for predicting gravimetric fineness from Micronaire values was found to be not satisfactory as fibre maturity had not been taken into account while deriving that equation. After dividing the cottons into two groups viz., (i) those having a maturity coefficient less than 0.8 and (ii) those having a maturity coefficient higher than 0.8, two separate equations have been worked out in the present study. It was observed that there was better agreement between actual gravimetric fineness value and that estimated from Micronaire tests, when the appropriate equation based on fibre maturity of the sample was used for prediction purpose.

The method for the determination of Lustre Index was standardised. It was observed on testing more than 160 samples for Lustre Index that there was significant difference in Lustre Index between varieties, even though the same varieties grown at different places did not show any change.

A detailed study completed on the composition of cotton-jute blends at various stages of processing from blow room to ring frame revealed that reduction in the nominal jute content observed in the ring yarn might be due to preferential losses of jute fibre under the licker-in region during carding. The results of analysis of blends of cotton with polyester, viscose and polynosic fibres using X-ray methods developed, indicated that the accuracy of the results lie between $\pm$ 3% and $\pm$7% respectively, for radial diffraction analysis and orientation analysis.

Yarn samples preswollen with NaOH, decrystallised by partial acetylation (PA) and partial cyanoethylation (PC) and crosslinked with 8% DMDHEU along with the swollen controls indicated that in general, decrystallised and subsequently crosslinked samples had higher strength,

extension and work of rupture, than the swollen and crosslinked control for nearly the same percentage of nitrogen content. Stretch given during decrystallisation also was found to produce better tenacity retention.

In connection with the preparation of calibration cotton standards, two cottons, viz. Varalaxmi and Gaorani 6, were blended in two proportions (50:50 and 75:25) and 40 sub-samples of the 50:50 blend were tested for 2.5% span length and Micronaire value by two operators separately. The results indicated that the variations of the individual values between operators and within operators lie within tolerance limits.

Varalaxmi cotton was processed through blow room, card and two passages of Laxmi-Rieter high speed draw frame using the four break draft combinations of 1.7—1.7 (A) 1.7—1.3 (B), 1.3—1.3 (C) and 1.3—1.7 (D) for first and second D.F. passages respectively and the properties of the material were compared with those of a similar sample processed on conventional T & S draw frame with a break draft of 1.2. The results indicated that the U% of the finished draw frame sliver was lowest at 2.8 for the combination A. The yarn quality was best with combination C. Generally, the slivers from high speed draw frame had better yarn quality than those from conventional draw frame.

As part of the study on the relationship between single strand strength, lea strength and knotted lea strength, yarn strengths were determined on 10 more samples in the count range 40s, 50s, 60s and 80s by the above three methods and analysis of the data carried out. It was observed that in general, single thread strength parameters did not show any better correlation with knotted lea strength as compared to that with lea strength, though the knotted lea strength was about 10% higher than the conventional lea strength.

A large number of trials employing cotton wastes — three types of willowed cotton wastes of 30s mixing as licker in drippings, blow room droppings and mixture containing pneumafil waste and flat strips — and four cotton varieties, viz. G.22, V.797, Sanjay and Digvijay, were undertaken on the newly installed Open-End (OE) Spintrainer. Influence of various machine and processing factors and comparative spinnings with conventional ring frame also were studied. The OE spinning was found to be successful in the production of yarns from cotton wastes, where ring spinning failed. Several other observations regarding shape of groove, use of certain type of withdrawal tube, rotor speed etc. also were made during the study.

Values of Fibre Quality Index (FQI) were worked out from tests for fibre characteristics carried out on 25 cotton samples, using the methods followed at SITRA and CTRL. The samples were spun to 50s count and, in addition to the Count-Strength Product (CSP), the values of

Yarn Quality Index (YQI) were calculated according to the methods of BTRA and CTRL. It was observed that both CSP and YQI values showed significant correlation with values of $\sqrt{FQI}$.

Spinning trials and yarns tests on trinary blends of three long staple cottons, viz. MCU.5, Hybrid 4 and Nimbkar, were completed and spinning of trinary blends of Varalaxmi, MCU.5 and Hybrid 4 were taken up during the year. In addition, trials on medium staple cottons were started with tests on Laxmi cotton. Among the three blends from the first set mentioned above, it was seen that the best quality of yarn was accrued from blend of 50% MCU.5, 30% Nimkar and 20% Hybrid 4. In general, between various systems of processing studied, use of high speed drawing, can-fed intermediate and Lakshmi Rieter drawing produced the best quality yarn.

The yarn produced from the blends of cotton flat strips and jute caddies was successfully woven into furnishing fabrics of attractive shades Similarly, yarns produced from the blends of cotton and wool noils were woven into *durrie* fabrics after dyeing the yarns into colourful shades.

The effect of rotor type, diameter, type of withdrawal tube, etc. on the quality of yarn spun from the blend of 67% polyester and 33% viscose using the Open End Spintrainer was assessed. From the evenness (U%) point of view, yarn from rotor type 25 was better than that from type 14. Further, the small rotor of diameter 45 mm produced better quality yarn as compared to bigger rotor of 55 mm although the staple length of both the component fibres was long (51 mm).

The effect of crosslinking treatments on the dynamic and static moduli of cotton yarn was studied. The dynamic modulus (E') was determined by using pulse propagation meter and static modulus (E) from the load extension curves of the yarn samples tested on Instron Tensile Tester. It was observed that both static and dynamic moduli increased with the degree of crosslinking and that at the highest level of N%, E' was doubled, while E recorded a four fold increase, with respect to control. Further, the ratio E'/E decreased as the degree of crosslinking increased. Hence, it may be assumed that with inhibited segmental mobility, the fibre structure tended to be more elastic than before crosslinking treatment.

A comparative study of tests for tearing strength using both warp way and weft way strips from 12 samples of grey fabrics has shown that there was good association between the corresponding test results obtained with all the three instruments, viz., (i) Elmendorf, (ii) Tongue Tear and (iii) Ballistic Tear Testers.

Four Indian cottons viz. Hybrid 4, Laxmi, Digvijay and Sanjay were processed individually into fabrics and the fabric samples were treated with 8% DMDHEU and evaluated for fabric strength, elongation,

toughness and CRA. The toughness retention and CRA was highest in fabrics made from Digvijay cotton followed by Hybrid 4 and Sanjay.

Cotton fabrics were treated by single step poly-set process using mixed catalysts containing different inorganic salt and/or organic acid in the proportion 1:1 and it was observed that the properties of the cotton fabric samples treated in the mixed catalyst system were better than those of the control.

When the migration of resin was studied in a mixed catalyst system during treatment, there was an increase in the total amount of water removal with increase in the drying periods and migration of resin increased up to 10 min of drying followed by a decrease thereafter.

Grafting of mixtures of acrylonitrile and methylmethacrylate onto cotton fabric in different compositions was carried out using ceric ammonium nitrate as initiator at room temperature. The values of percent graft obtained were lower than that obtained with single monomer. When monomer mixtures were grafted at 65°C, the percent graft obtained was higher than that obtained at room temperature. Similarly when mixtures of styrene and methylmethacrylate were used in grafting, there was gradual decrease in percent graft with increase in the styrene component in the mixtures.

In order to synthesise cellulose derivatives with substituents on secondary hydroxyl groups, cellulose was tosylated with tosyl chloride in pyridine to a DS of 1.0 and iodination of tosyl cellulose was tried with sodium iodide in acetone by (a) refluxing for 72 hr in water bath, (b) autoclaving at 20 lb for 8 hr in sealed glass ampules and (c) end to end stirring at 20 lb, in beaker dyeing machine. In the case of test in beaker dyeing machine, the sodium fusion test showed the presence of iodine and absence of sulphur indicating that the reaction was complete.

Two step process as well as single bath treatment to introduce crease resistance in flame proofing cotton fabrics failed to yield any promising results. Attempts to trap flame proofing agents (to prevent loss due to repeated washings), using hydro-epoxy resin as water proofing agent was also not successful. Further work was in progress.

Raw and purified *bhoor bhendi* yarn samples were irradiated with gamma rays and tested for tensile strength, lignin (%) and copper number. The yarns were uneven and showed wide variation in the tensile strength. The lignin percent in raw *bhoor bhendi* yarn decreased with radiation, while the copper number increased.

With a view to establish relationship between absorbancy of Indian cottons with Micronaire value and crystallite size, 20 cottons were tested for fineness by Micronaire and four cottons, viz. G.1, Digvijay, SRT.1 and Deviraj, for crystallite size by X-ray technique. The results showed

that varieties having higher Micronaire value had good water holding capacity and low sinking time, while crystallite size did not exhibit any definite relationship.

Electron microscope examination of fibres dyed with metallised azo dyes showed extensive penetration and aggregation of the dye molecules between inter-lamellar space and even between some of the inter-microfibrillar space. The ED patterns of larger aggregates formed at the inter-lamellar space confirmed them to be crystalline aggregates, whereas most of the smaller aggregates located between microfibrils were either non-crystalline or crystallised along the direction of the microfibrils.

Biosynthesis of cellulose was studied in developing fibres of Laxmi and Suvin varieties as well as in a micro-organism *Acetobacter Xylinum*. Cellulose synthesizing enzymes were extracted from both the varieties at different stages of growth and the enzyme activity analysed. The results were in good agreement with those reported earlier. A soluble polymer (SP) synthesized by *A. Xylinum* was characterised by cellulase enzyme treatment and electron microscope and infrared studies. The polymer possessed a branched fibrillar structure and resembled the structure of bacterial cellulose II.

Beta-glucosidase is one of the important enzymes for complete hydrolysis of cellulose. The extra- and intra-cellular beta-glucosidase of *Penicillium funiculosum* studied at different intervals of growth showed that the enzyme occured after 18-hr incubation. Studies on extracellular beta-glucosidase of *Candida utilis* showed that xylose was a potent inducer and elaborated the enzyme 10-fold. Three UV mutants of *P. funiculosum* were obtained by UV irradiation and they had 10% more activity than the mother culture.

A fairly high amount of ammonical nitrogen at the end of the fermentation period was brought down in the acid hydrolysed, ammoniated and fermented straws of paddy and wheat with *P. funiculosum* and *C. utilis* by supplementing the hydrolysed straws with phosphorus, magnesium and sugars in the form of mollasses. Experiments were underway to enrich the straws with *Beijerinekia* sp., a nitrogen fixing bacterium and *Pleurotus* sp., a mushroom fungus which is also known to fix nitrogen.

The efficient cellulolytic cultures, viz. *Trichoderma viride* and *P. funiculosum* did not utilise chitin as exclusive source of carbon and energy, but enzymes elaborated from these on cellulose could bring about efficient chitinolysis. This indicated the possibility of chitinolysis by efficient cellulose degraders also in the presence of chitin in the soil enrichment. Experiments were undertaken in pot cultures to explore the possibility of controlling *Rhizoctonia* root rot of cotton on Laxmi variety by

amending the soil with prawn shell waste. The results showed that the stand of the crop was much better in prawn shell waste amended soils as compared to stunted growth in controls.

Cottonseed meal is being used as a nitrogen source in some fermentations. As it was possible that bound gossypol might be released free during fermentation, *Bacillus subtilis,* a good amylase and weak protease producing culture was grown on a medium containing either cottonseed meal or peptone. It was found that after fermentation, the amylase production in the medium was twice on cottonseed meal as compared to that on peptone. Estimation of gossypol showed that free gossypol was released in the medium. Even though the free gossypol was found to be harmful to the growth of the organism, as the gossypol release was low, it exhibited little effect on the organism.

Attempts were made to use willow dust, a textile mill waste closely resembling cowdung in chemical composition, for the production of biogas by a batch fermentation process. Laboratory trials have indicated that about 160 litres of bio-gas could be produced from 1 kg willowdust in 30 days with water substrate ratio 6:1 when the material was treated with 1% NaOH followed by aerobic fermentation for 3 days.

The data obtained on the fatty acid composition of cottonseed oil of different varieties of cotton determined using Gas chromatograph revealed that there was marked variation in the ranges of fatty acid content of various varieties.

Particle Boards of different sizes prepared from cotton plant stalk was supplied to a consulting firm in Gujarat for ascertaining the marketability of the product and further communication was awaited from them.

The alignment of the mechanical device for deburring raw wool was completed and trials were proposed to be undertaken using different types of wool.

7. PERSONNEL

A list encompassing the staff position in the Scientific, Technical, Administrative and Supporting Staff categories as on December 31, 1980, is given in Appendix II. Major changes in the personnel matters during 1980 are summarised below :

A. Appointments

1. *Technical Staff*

Sarvashri G. G. Mistry (with effect from 21-1-1980), P. K. Mandhyan, V. K. Madan, M. T. Danolli, N. Ramanathan, R. Radhakrishnan, V. M. Kulmethe (all with effect from 10-3-1980), N. V. Bansode (with effect from 11-3-1980), D. S. Saxena (with effect from 21-7-1980), to the posts of Technical Assistant Grade T-II-3.

Shri Sunil Sharma to the post of Laboratory Assistant (with effect from 16-6-1980).

2. *Administrative Staff*

Kum. Sujatha G. Nayar to the post of Junior Clerk (with effect from 22-9-1980).

3. *Supporting Staff*

Sr. No.	*Name*	*Grade*	*Effective date of appointment*
1.	Smt. T. V. Bhowar	Grade I	22- 4-1980
2.	Shri Chob Singh	„	6- 5-1980
3.	Shri S. D. Gurav	„	19- 5-1980
4.	Shri R. A. Bugade	„	19- 5-1980
5.	Shri M. K. Ghadage	„	24- 5-1980
6.	Shri P. B. Chhatri	„	2- 6-1980
7.	Shri M. K. Prasad	„	1-11-1980
8.	Shri M. Z. Rathi	„	10-12-1980
9.	Shri G. R. Kamble	„	16-12-1980

B. Assessment

1. *Technical Staff*

The Five Yearly Assessment of the eligible technical personnel of CTRL was held in June, 1980, and promotions/advance increments granted as detailed below :

Promotions

Sr. No.	*Name*	*Grade to which promoted*	*Effective date of promotion*
1.	Shri K. Chandran	T-5 (Rs. 650-1200)	1-7-1980
2.	Shri S. Chandrasekhar	T-5 (Rs. 650-1200)	1-7-1980
3.	Kum. I. K. P. Iyer	T-5 (Rs. 650-1200)	1-7-1980
4.	Shri H. R. Laxmi-venkatesh	T-5 (Rs. 650-1200)	1-7-1980
5.	Smt. S. D. Pai	T-5 (Rs. 650-1200)	1-7-1980
6.	Shri Tula Ram Gupta	T-4 (Rs. 550-900)	1-7-1980
7.	Shri V. V. Kshirsagar	T-4 (Rs. 550-900)	1-7-1980
8.	Smt. N. D. Nachane	T-4 (Rs. 550-900)	1-7-1980
9.	Smt. Girija Radha-krishnan	T-4 (Rs. 550-900)	1-7-1980
10.	Shri P. J. Ahire	T-2 (Rs. 330-560)	1-7-1980
11.	Shri H. B. Tambe	T-2 (Rs. 330-560)	1-7-1980

Advance Increments

Sr. No.	*Name*	*Grade*	*Number of advance increments*	*Effective date of increments*
1.	Smt. Santa V. Nayar	T-4 (Rs. 550-900)	Two	1-7-1980
2.	Shri A. R. S. Abdulla	T-I-3 (Rs. 425-700)	Two	1-7-1980

2. *Scientific Staff*

The results of Assessment for Scientific Staff are awaited.

C. Promotion

1. *Technical Staff*

Sarvashri D. B. Gadankush and S. G. Shinde, to the posts of Senior Operative (T-1) with effect from 6-2-1980.

2. *Administrative Staff*

Sarvashri V. J. Antony and D. L. Kalsekar, to the posts of Assistant Accounts Officer and Superintendent with effect from 29-4-1980 and 5-3-1980, respectively.

Smt. Jayagouri Sivaramakrishnan and Shri K. W. Khamkar, to the posts of Assistant and Senior Clerk with effect from 6-3-1980 and 22-2-1980, respectively.

D. Transfers

1. *Scientific Staff*

Dr. R. N. Adsule, Scientist S-1, to Central Tobacco Research Institute, Rajahmundry, as Scientist S-2 with effect from 28-7-1980.

Shri A. J. Q. Shaikh, Scientist S-1 from CTRL Quality Evaluation Unit, Nanded, to Headquarters at Bombay with effect from 14-7-1980.

2. *Technical Staff*

Shri Ram Parkash, Quality Evaluation Officer, from Quality Evaluation Unit, Akola to that at Ludhiana with effect from 23-6-1980.

Shri M. C. Bhalod, Senior Technical Assistant, from Quality Evaluation Unit, Ludhiana to that at Surat, with effect from 8-7-1980.

Shri R. S. Darade, Technical Assistant, from Quality Evaluation Unit, Surat to that at Nagpur with effect from 14-4-1980.

Shri S. J. Guhagarkar, Technical Assistant, from CTRL, Bombay to Quality Evaluation Unit at Akola with effect from 26-5-1980.

Shri G. G. Mistry, Technical Assistant, from CTRL, Bombay to Quality Evaluation Unit, Surat, with effect from 26-5-1980.

Shri N. V. Bansode, Technical Assistant, from CTRL, Bombay to Quality Evaluation Unit, Nanded, with effect from 14-7-1980.

Shri M. T. Danolli, Technical Assistant, from CTRL, Bombay, to Quality Evaluation Unit, Dharwad, with effect from 14-7-1980.

Shri V. M. Kulmethe, Technical Assistant, from CTRL, Bombay to Quality Evaluation Unit, Akola, with effect from 14-7-1980.

Shri K. V. Nair, Senior Operator (Mechanical Processing), from CTRL, Bombay to Quality Evaluation Unit, Coimbatore, with effect from 9-7-1980.

3. *Administrative Staff*

Shri G. Sasidharan, Assistant, from CTRL, Bombay, to Quality Evaluation Unit, Surat, with effect from 19-6-1980.

E. Retirements

1. *Scientific Staff*

Dr. S. M. Betrabet, Senior Scientist (Microscopy), Grade S-3, retired voluntarily from service with effect from 1-6-1980.

2. *Technical Staff*

Smt. S. B. Pai, Junior Quality Evaluation Officer, Grade T-5, retired voluntarily from service, with effect from 15-10-1980.

Shri S. N. Salvi, Boiler Attendant, Grade T-I-3, retired from service with effect from 30-6-1980.

3. *Administrative Staff*

Shri K. S. Ram Narayan, Assistant Administrative Officer, retired from service with effect from 31-1-1980.

Shri F. X. Meyers, Superintendent, retired from service with effect from 29-2-1980.

F. Resignations/Termination of Service

Sarvashri N. R. Tare, D. S. Saxena and A. L. Muthu, Technical Assistants Grade T-II-3, resigned from service with effect from 7-6-1980, 4-10-1980 and 10-12-1980, respectively.

Shri K. R. Chavan, Wireman, Grade T-1, resigned from service with effect from 23-2-1980.

Shri M. P. B. Nair, Junior Stenographer, resigned from service with effect from 29-10-1980.

Shri K. M. Shejwal, Junior Clerk, resigned from service with effect from 21-7-1980.

Shri P. S. Dalvi, Supporting Staff Grade I, resigned from service with effect from 19-1-1980.

G. Obituary

Shri S. G. Nayar, Junior Quality Evaluation Officer, Grade T-5, expired on 16-7-1980, while in service.

Shri K. R. Kamath, Senior Technical Assistant, Grade T-4, expired on 15-9-1980, while in service.

Shri V. S. Bhowar, Supporting Staff Grade I, expired on 11-2-1980, while in service.

H. Deputations/Foreign Assignments

Shri P. G. Oka, Scientist S-2, visited various textile research institutes, as well as research centres, in UK, USA and Egypt from 28-11-1980 to 28-12-1980, to study the methods of tests and instruments used to evaluate quality of cotton, under the study tour programme of the Integrated Cotton Development Project operating with the assistance of the World Bank.

I. Training

Dr. N. B. Patil, Scientist S-3 and Shri P. K. Chidambareswaran, Scientist S-2 participated in the International Winter School on Crystallographic Computing held at Indian Institute of Science, Bangalore, from 4-1-1980 to 14-1-1980.

The training programme during the period from 7-12-1980 to 31-12-1980 on 'Land Reforms and Rural Development', organised by Asian Institute for Rural Development, Basvangudi, Bangalore, in cooperation with Lincoln Institute of Land Policy, USA, was attended by Smt. G. Revathi, Scientist S-1.

8. APPENDICES

APPENDIX I

Financial Statement

EXPENDITURE AND RECEIPTS OF THE LABORATORY DURING 1979-80

	Sanctioned grant (Rs.)	Actual Expenditure (Rs.)	Savings (—) Deficit (+) (Rs.)
A. Expenditure			
I. Technological Research Laboratory including Regional Stations (Non-Plan).			
(a) Capital expenditure including expansion of Laboratory	3,26,650	3,26,643	(—) 7
(b) Working expenditure	36,15,350	36,15,344	(—) 6
	39,42,000	39,41,987	(—) 13
II. Scheme for modernisation and strengthening of CTRL for intensive research on cotton (Plan)	30,15,000	30,15,312	(+)312
III. Schemes financed from AP Cess funds :			
1. Investigation of the effects of 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 ..	89,820	87,801	(—) 2,019
2. Optimal blending of Standard Varieties of Indian Cottons ..	3,01,100	54,699	(—)2,46,401
3. Regional Committee No. 7 ..	19,000	6,025	(—) 12,975

B. Receipts

	Rs.
Sale of vehicles, machine tools, plants, equipments, and other non-consumable stores	5,855
Analytical and testing fees	31,962
Rent	58,525
Fees for training, application fees, etc.	7,360
Receipts from services rendered by the Institute	1,500
Sale of publications	4,960
Interest on loans and advances granted to Council's employees	390
Miscellaneous receipts (including sale of cotton waste, mixed cotton, etc.)	25,529
	1,36,081

APPENDIX II

Staff Working at the Cotton Technological Research Laboratory as on 31-12-1980

(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., F.M.A.S.

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.).
„ (Biochemistry)	S-1	Smt. S. P. Bhatawdekar, M.Sc.
„ (Biochemistry)	„	Smt. G. Revathi, M.Sc.
„ (Biophysics)	„	Dr. K. M. Paralikar, M.Sc., Ph.D., F.R.M.S.
Scientist (Chemistry)	S-1	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 and Instrumentation)	„	Shri N. Ramesh Babu, B.E., M. Tech.
„ (Farm Machinery and Power)	„	Shri U. N. Borkar, B.Sc. (Agri.), B.Sc. (Agri. Engg.), M. Tech.
„ (Farm Machinery and Power)	„	Shri S. Ganesan, B.E. (Agri. Engg.)
„ (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)	„	Shri S. Sreenivasan, M.Sc., Ph.D.
„ (Physics)	„	Shri A. V. Ukidwe, M.Sc.
„ (Physics)	„	Dr. N. C. Vizia, M.Sc., Ph.D.
„ (Quality Evaluation)	„	Shri A. K. Gupta, M.Sc., LL.B., W.P.M.M.T.
„ (Quality Evaluation)	„	Shri B. M. Petkar, M.Sc.

Designation	Grade	Name
Scientist (Statistics)	S-1	Smt. Janaki K. Iyer, M.Sc.
„ (Textile Manufacture)	„	Shri Muntazir Ahmed, B.Sc. B.Sc. (Text.)
„ (Bio-Chemistry)	S	Shri S. G. Gayal, M.Sc.
„ (Chemistry)	„	Shri R. M. Gurjar, M.Sc.
„ (Quality Evalutaion)	„	Shri P. Bhaskar, M.Sc.
„ (Quality Evalutaion)	„	Smt. K. L. Datar, M.Sc.
„ (Quality Evalutaion)	„	Shri D. N. Makwana, M.Sc.
„ (Statistics)	„	Shri D. V. Mhadgut, M.Sc.
	Technical Staff	
Technical Officer (Electrical Engineering) ..	T-7	Shri H. V. Tamhankar, L.M.E., L.E.E.
Quality Evaluation Officer ..	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 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.
„ (Statistics) ..	„	Shri K. Chandran, B.A.
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. Bhat, 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. Sukhi, B.Sc.
„ „ ..	„	Shri V. B. Suryanarayanan, B.Sc.
„ „ ..	„	Shri G. Viswanathan, B.Sc., A.T.A.
„ „ ..	„	Smt. J. K. S. Warrier, M.Sc.
Senior Technical Assistant (Regrigeration)	T-4	Shri V. V. Kshirasagar.
Technical Assistant (Microbiology)	T-II-3	Smt. A. A. Kathe, B.Sc.
„ (Quality Evaluation) ..	„	Smt. P. A. Dabholkar, B.Sc.
„ „ ..	„	Shri I. H. Hunsikatti, B.Sc.
„ „ ..	„	Shri S. N. Hussain, B.Sc. A.M.I. E.T.E.
„ „ ..	„	Shri M. Karmakar, B.Sc.
„ „ ..	„	Shri V. K. Madan, 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 K. B. Rajagopal, B.Sc.
„ „ ..	„	Shri N. Ramanathan, B.Sc.

Designation	Grade	Name
Technical Assistant		
„ (Quality Evaluation)	T-II-3	Shri S. Sekar, B.Sc.
„ „ ..	„	Shri J. C. Toscano, M.Sc.
„ „ ..	„	Shri S. Vancheswaran, B.Sc.
Senior Library Assistant ..	„	Smt. Rekha K. Shahani, B.Sc., B.Lib.
Boiler Attendant	T-I-3	Shri S. N. Salvi
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
„ (Workshop Machinery) ..	„	Shri D. L. Upadhye
Turner	„	Shri M. M. Shaikh
Electrician	T-2	Shri M. T. Itnare
Fitter (Mechanical Processing) ..	„	Shri Purushottam Vira
Laboratory Assistant (Chemistry) ..	„	Shri N. O. Anthony
Senior Operative (Mechanical Processing)	T-2	Shri P. J. Ahire
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) ..	„	Shri P. K. Gopalan
Laboratory Assistant	„	Shri S. B. Kamble
Senior Operative (Mechanical Processing)	„	Shri R. A. Dalvi
„	„	Shri D. B. Gadankush
„	„	Shri Bechan Nokai
„	„	Shri H. K. Pawar
„	„	Shri S. G. Shinde
Telephone Operator	„	Smt. K. K. Kale

Administrative Staff

Administrative Officer	Shri U. K. Iyer
Assistant Administrative Officer ..	Shri V. N. Wadhwani
Assistant Accounts Officer	Shri V. J. Antony, B.Com., F.S.A.A. (India)
Superintendent	Shri D. L. Kalsekar
P. A. to Director	Shri T. P. Parameswaran
Assistant	Shri M. P. Juwale
„	Shri F. C. Fernandes
„	Shri K. S. Deshpande
Accountant	Shri D. P. Naidu
Assistant	Shri K. Sudhakaran
„	Shri D. J. Raut
„	Smt. V. V. Gore, B.A.
„	Shri G. Moosad, B.Com.
„	Smt. S. S. Dongare, B.A.
„	Shri P. D. Sonawane, B.A.
„	Smt. Jayagouri Sivaramakrishnan
„	Shri M. Z. Bhagat
Stenographer Grade I	Shri B. Ramamurthy, B.Sc.
Junior Stenographer	Smt. Chellamma Damodaran
„	Kum. A. K. Annamma
„	Kum. R. K. Shetty, B.Com.
„	Shri Venu Thanikal

Designation	Grade	Name
Cashier	.. .. ..	Shri V. M. Kasabe
Senior Clerk	.. .. ..	Smt. M. V. Kamerkar, B.A.
,,	.. .. ..	Smt. Veena Kotwani, B.A.
,,	.. .. ..	Shri Y. P. Belgaonkar
,,	.. .. ..	Shri K. W. Khamkar, B.A.
,,	.. .. ..	Shri B. D. Sawant
Junior Clerk	.. .. ..	Shri A. B. Dalvi
,,	.. .. ..	Smt. S. S. Shanbhag
,,	.. .. ..	Shri K. N. Iyer
,,	.. .. ..	Shri H. G. Kini
,,	.. .. ..	Shri D. G. Kulkarni
,,	.. .. ..	Shri G. N. More
,,	.. .. ..	Shri S. N. Salve
,,	.. .. ..	Smt. V. V. Desai
,,	.. .. ..	Smt. S. D. Ambare
,,	.. .. ..	Smt. S. M. Desai
,,	.. .. ..	Kum. V. E. Sagwekar
,,	.. .. ..	Shri A. P. Natu
,,	.. .. ..	Kum. Sujatha G. Nayar
	Supporting Staff	
Grade IV	.. .. ..	Shri K. D. Mohite
,,	.. .. ..	Shri M. M. Rupawate
,,	.. .. ..	Shri K. K. Dalvi
Grade III	.. .. ..	Shri R. G. Chiplunkar
,,	.. .. ..	Shri P. G. Kadam
,,	.. .. ..	Shri M. B. Thokrul
,,	.. .. ..	Shri D. V. Kambli
,,	.. .. ..	Shri K. K. Kasar
,,	.. .. ..	Shri T. R. Kadam
,,	.. .. ..	Shri Babu Aba Babar
,,	.. .. ..	Shri R. R. Khurdekar
,,	.. .. ..	Shri H. N. Gawde
,,	.. .. ..	Shri Obilal Parsuram
,,	.. .. ..	Shri A. C. Kadam
,,	.. .. ..	Shri S. V. Patil
,,	.. .. ..	Shri Ratansingh Gussain
,,	.. .. ..	Shri R. S. Pawar
Grade II	.. .. ..	Shri Ramkrishna Taleram
,,	.. .. ..	Shri Chatrapal Mhatri
,,	.. .. ..	Shri M. R. Nevrekar
Grade I	.. .. ..	Shri R. B. Jadhav
,,	.. .. ..	Shri T. S. Mhaske
,,	.. .. ..	Shri Butnislal Balmiki
,,	.. .. ..	Shri N. J. Kharat
,,	.. .. ..	Shri T. B. Thapa
,,	.. .. ..	Shri Kartarsingh Sivdayal Singh
,,	.. .. ..	Shri Shamji Waghela
,,	.. .. ..	Shri G. G. Ambare
,,	.. .. ..	Shri Y. A. Asaldekar
,,	.. .. ..	Shri A. R. Bane
,,	.. .. ..	Shri G. S. Devrukhkar
,,	.. .. ..	Shri S. L. Gawde
,,	.. .. ..	Shri A. B. Sawant
,,	.. .. ..	Shri B. K. Sawant
,,	.. .. ..	Shri V. Y. Unhalekar

Designation	Grade	Name
Grade I	.. .. ..	Shri M. B. Chandanshive
,,	.. .. ..	Shri B. R. Satam
,,	.. .. ..	Shri D. M. Chougule
,,	.. .. ..	Shri M. V. Bhowar
,,	.. .. ..	Shri S. Y. Deshmukh
,,	.. .. ..	Shri S. V. Naik
,,	.. .. ..	Shri S. D. Gurav
,,	.. .. ..	Smt. Tarabai V. Bhowar
,,	.. .. ..	Shri M. B. Gurve
,,	.. .. ..	Shri S. M. Sawant
,,	.. .. ..	Shri M. Y. Chandanshive
,,	.. .. ..	Shri B. R. Jadhav
,,	.. .. ..	Shri N. R. Kamble
,,	.. .. ..	Shri E. T. Gurav
,,	.. .. ..	Shri A. R. Gujar
,,	.. .. ..	Shri K. P. Somasekharan
,,	.. .. ..	Shri O. T. Thapa
,,	.. .. ..	Shri M. K. Ghadage
,,	.. .. ..	Shri R. A. Bugade
,,	.. .. ..	Shri Mahendra Kumar Beni Prasad
,,	.. .. ..	Shri M. Z. Rathi
		Shri G. R. Kamble

B. Regional Quality

Station	Technical Officer (Quality Evaluation) Grade T-7	Technical Officer (Quality Evaluation) Grade T-6	Jnior 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	—	—	Shri A. K. Antony, B.Sc.	Smt. Santa V. Nair, B.Sc. Shri C. P. Venugopalan, B.Sc.	—
Dharwad	—	—	Shri E. S. Abraham, B.Sc.	—	Shri K. H. Sawakhande, M.Sc.
Guntur	—	—	Shri R. Dwarkanath, B.Sc.	—	—
Hissar	—	—	Shri S. N. Nagwekar, B.Sc.	—	—
Indore	—	—	—	—	Shri S. B. Jadhav, M.Sc.
Ludhiana	—	Shri Ram Parkash, B.Sc.	—	—	—
Nagpur	—	—	—	—	—
Nanded	—	—	—	—	Shri L. D. Deshmukh, M.Sc.
Sriganganagar	—	—	—	—	—
Surat	Shri L. R. Jambunathan, B.Sc., A.M.I.C.T. L.T.I.	—	—	Shri M. C. Bhalod, B.Sc.	Shri Y. Subra-manyam, M.Sc.

Evaluation Units of CTRL

Technical Assistant (Quality Evalution) 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 S. J. Guhagarkar, B.Sc. Shri V. M. Kulmethe, B.Sc.	—	—	—	—	—
—	Shri K. V. Nair	—	Shri N. Arumugham	Shri V. M. Subramaniam	—
Shri M. T. Danolli, B.Sc.	—	—	Shri R. P. Belamaddi	Shri Y. R. Sone	—
—	—	—	Shri Ch. Timmanna	—	Shri V. Y. H. Suvarchala Rao
—	—	—	—	Shri Gian Singh	—
—	Shri Sunil Sharma, B.Sc.	—	—	Shri John Robert Shri Harisingh Babar	—
—	—	—	—	Shri Kamikkar Singh	
Shri R. S. Darade, B.Sc.	—	—	—	—	—
Shri N. V. Bansode, B.Sc.	—	—	—	Shri L. R. Inderkar	—
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, B.A.	Shri J. B. Dhodia	—	Shri K. M. Rathod

APPENDIX III

Statement Showing the Total Number of Employees and the Number of Scheduled Castes/Scheduled Tribes Amongst Them as on December 31, 1980

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	29	—	—	—	—	—
	Temporary	14	2	5	—	—	—
Class II (Gazetted rank) ..	Permanent	9	—		—	—	—
	Temporary	6	—	—	—	—	—
Class II (Non-Gazetted rank)	Permanent	25	3	9	—	—	—
	Temporary	7			—	—	—
Class III	Permanent	55	8	13	—	2	—
	Temporary	32	3		2		—
Class IV (excluding Safaiwala)	Permanent	39	9	24	1	3	—
	Temporary	27	7		1		—
Class IV (Safaiwala)	Permanent	2	2	100	—	—	—
	Temporary	3	3		—	—	—

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 Rules 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 1980

Class of post	Total No. of vacancies		Scheduled Castes					Scheduled Tribes					Remarks
			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	
	Notified	Filled	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 ..	—	(A)	—	—	—	—	—	—	—	—	—	—	—
Class II .. (Gazetted rank)	—	—	—	—	—	—	—	—	—	—	—	—	—
Class II .. (Non-Gazetted rank)	—	—	—	—	—	—	—	—	—	—	—	—	—
Class III ..	10	10	2	2	2	—	—	1	1	1	—	—	—
Class IV .. (excluding Safaiwala)	6	6	1	1	1	—	—	—	—	—	—	—	—
Class IV .. (Safaiwala)	3	3	3	3	3	—	—	—	—	—	—	—	—

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

(A) Since the posts are filled up by ICAR Headquarters, they are not shown in the statement.
(B) The posts have been filled up on the basis of the result of the assessment of the Technical Personnel.
(C) The posts have been filled up on basis of seniority-cum-suitability.

9. ANNEXURES

ANNEXURE I

New Equipments Purchased During 1980

1. Bursting Strength Tester.
2. Shaker Incubator Bath (Thermolab)
3. Reciprocal Water Bath Shaker (Thermolab)
4. Rotary Flash Evaporator (Perfil)
5. Hydraulic Hack-Saw (TUKUT 8" cutting capacity)
6. Dokumator Microfilm Reader (Zeiss)

ANNEXURE II

Distinguished Visitors to CTRL During 1980

1. Dr. C. V. Narasimhan,
   Organising Executive Secretary,
   Cotton Development International, UNDP,
   New York, USA.

2. Dr. Jean Massat,
   Institute de Richerches due Cotton et des Textiles Exotiques,
   (IRCT), Paris 17, France.

3. John H. Lind, Jr.,
   World Bank,
   Washington, USA.

4. Prof. P. Grosberg,
   University of Leeds,
   UK.

5. Keith A. Merrick,
   Manager, Yield Analysis,
   Cotton Incorporated,
   Raleigh, NC 27612, USA.

6. Dr. C. Nanjundayya,
   UN Expert Consultant,
   UAE.

7. Dr. G. V. Ramana Murthy,
   Additional Agricultural Commissioner,
   Government of India, New Delhi.

8. Dr. Nandwa Stephan Makuku,
   Senior Cotton Research Officer,
   Ministry of Agriculture,
   P.O. 298, Kerugoya, Kenya.

9. Manoon Pumklom,
   Scientist,
   Thailand.