Cotton Technological Research Laboratory

Indian Council of Agricultural Research

Annual Report
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Contents

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INTRODUCTION

This fiftyninth Annual Report of the Cotton Technological Research Laboratory (CTRL) covers the calendar year, 1982.

CTRL, formerly known as the Technological Laboratory, was established in the year 1924 by the Indian Central Cotton Committee (ICCC) mainly with the following two objectives :

(i) To undertake spinning tests on various strains of cotton received from the Agricultural Department situated in various parts of the country.

(ii) To carry out tests on the fibre properties of the cottons with a view to relate the fibre properties with the spinning value of cottons.

Accordingly the Laboratory was actively collaborating with the Agricultural Departments in various cotton growing tracts of the country in their endeavour to develop new and improved varieties of cotton required by the textile industry. Several new sections were added subsequently, when the scope of the Laboratory was increased on account of the emergence of the general awareness in trade and industry about the usefulness of the work carried out by the Laboratory. 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) and the name of the Laboratory was charged to Cotton Technological Research Laboratory. The research activities were subsequently reoriented and intensified and concerted efforts were being continuously directed to help the agricultural scientists and cotton breeders to evolve cotton varieties which are superior in qualitative and/or quantitative terms as also to increase better utilisation of cotton as well as cotton plant by product so as to make the cotton cultivation more economical and thereby, contribute to improve the economy of the country.

The main functions of the Laboratory 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 investigation on the ginning problems of cotton.
4. To investigate the greater and better utilisation 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 uptodate library of books on cotton, cotton technology and related subjects. In 1982, classification and indexing of books were made according to Universal Decimal System. Before classification some of the very old books and bound volumes which were not of much use and were in a very bad condition were weeded out. The total number of remaining books together with books added during the year was 3,424 and of bound volumes of important journals stood at 4,233. The library received regularly 292 journals covering a wide spectrum of subjects; 100 journals were subscribed and the remaining 192 received on exchange basis or as complimentary.

New Equipments Purchased

A list of some of the major equipments acquired during 1982 are given in Annexure I.

Distinguished Visitors

The distinguished visitors to CTRL during 1982 is listed out in Annexure II.

Management Committee

In 1982, only one meeting of the Management Committee was held on March, 5 and 6, 1982, in which apart from regular items such as Progress of Expenditure under Plan and Non-Plan, action taken on the recommendations of Grievance Cell and Institute Joint Council, Progress of Research Work and New Project Proposals etc. the project on biogas was reviewed in the light of the adoption of the know-how by the Planning Commission to ascertion the Commercial feasibility of the technology through NTC Mills and the supply of technological cir-

culars for publishing the results of quality characteristics by two private organisations was considered and appropriate recommendations made. Recommendation was also made for purchase of certain items of machinery on single quotation.

Subsequent meetings were not held for want of communication from the Council regarding finalisation of the names of members for the reconstituted Management Committee.

Staff Research Council

A meeting of the Staff Research Council (SRC) was held in five preliminary sessions on February 16, 17, 18, 22 and March 3, 1982 and a final session with the Management Committee on March 5 and 6, 1982.

The Divisional Heads and Members of the Management Committee from CTRL attended all the preliminary sessions, while scientists S, S-1, S-2 as well as Technical Officers, T-5 and T-6 attended sessions pertaining to their respective disciplines. In the joint session with the Management Committee, Scientists S-2 and above attended.

Discussions took place at length on various on-going research projects in various disciplines and comments/recommendations were made, whereever necessary. Five new Project Proposals submitted for consideration were approved, while extension was granted to 19 projects.

In all the preliminary sessions as well as at the final session Dr. Sundaram, Director read out the relevant recommendations of the Quinquennial Review Team and suggested that follow-up action especially with respect to recommendations on research programme, should be started as soon as the report is ready and new project proposal, if any, should be submitted at the next SRC meetings.

There was also some discussion regarding celebration of Golden Jubilee of Regional Quality Evaluation Unit of CTRL at Surat and delay caused in the present procedure of patenting inventions.

Inter Institutional Projects

Two Inter-Institutional Projects were in operation in 1982, as follows :

1. Studies on deburring of raw-wool using mechanical device (in collaboration with Central Sheep and Wool Research Institute (CSWRI), Avikanagar, Rajasthan).
2. Durable Flame Retardant (FR) finishes for textiles (in collaboration with the Textile Committee Bombay).

While considerable progress has been made in the latter project, no headway has been made in the collection of scoured wool samples from

CSWRI, Rajasthan, which impeded the progress of the first mentioned project.

Integrated Cotton Development Project

An Integrated Cotton Development Project (ICDP) was sanctioned for a period of five years with effect from November 30, 1976 funded by the World Bank. In this project, the responsibility vested on CTRL was to organise a Ginning Training Centre at Nagpur. The progress made in the various facets of this project are summarised below :

Construction work : The construction of building for installation of Ginning Machinery also is nearing complition. The imported Ginning and Pressing Machinery to be installed in the above building was cleared from Bombay and despatched to Nagpur. CPWD has submitted estimates for preparing foundation for erection of the machines on the basis of the drawing received from the manufacturers. The payment for the building of the proposed Ginning Training Centre has been made in full to CPWD, Nagpur. However, some extra provision was required to be made for meeting the expenditure in connection with the proposed additions and alterations for accommodating the machinery required for Spinning, Workshop and the Testing Laboratory.

Development of Infra-Structure : Two instalments each of Rs. 2.68 lakhs have been paid to the CPWD, Nagpur. The construction of roads and compound wall was in progress. The Executive Engineer submitted estimates for the electrical work to be taken up in view of the fact that machinery to be installed had arrived.

Equipments : Out of the equipments provided, action has been taken to procure one saw-gin and bale press through the D.G.S. & D. at a cost of over Rs. 7.00 lakhs. The equipment has now been cleared and transported to Nagpur. In addition, the double roller gin has been procured at an approximate cost of Rs. 11,000.00. Action has also been taken to procure other equipments like Fibrograph, Micronaire, Stelometer, etc.

Staff : It has not been possible to get properly qualified staff 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 Scientist (S-1) with agricultural machinery background were recruited and trained in ginning, though one of them has since left. The requisition for recruiting a Scientist (S-2) has been sent to ICAR in March, 1981 and the matter is still under correspondence.

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 and difficulty was experienced in the filling up of this post as the vacancy has fallen at a reserved point. Other administrative posts as well as junior level technical posts have not been filled up since the buildings were not ready.

Post Graduate Training

The extension of recognition granted from July 2, 1980 for CTRL as a post graduate institution for five years 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. Two more seats for Ph.D (Tech) in Textile Technology (Spinning) have been granted for a period of four years from June 16, 1981.

Eleven members of the staff were being guided for M.Sc., out of which three were for Physical Chemistry and the rest for Physics (Textiles). While guidance was given for Ph.D. to one member in Physics (Textiles), another member received guidance in M. Text. (Spinning).

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

Golden Jubilee Celebration of Quality Evaluation Unit at Surat

The Regional Unit of CTRL has completed 50 years in 1982 and to commemorate the occassion, a seminar 'Focus on Development of Medium Staple Cottons with Special Reference to Gujarat State' was organised in collaboration with the Gujarat Agricultural University (GAU) at their Surat Campus. The function which was presided over by Dr. C. Kempanna, Assistant Director General, ICAR was attended by several dignitaries including Shri R. B. Shukla, Vice Chancellor, GAU Dantiwada and Shri B. V. Patel, Campus Director, GAU, Navsari, as well as present and past cotton research workers.

This was followed by two technical sessions of the seminar, one devoted to Agricultural Research and Development and the other on Fibre Processing and Technology. The function was inaugurated by Shri R. B. Shukla, Vice Chancellor, GAU, Dantiwada and the Inaugural

Session was chaired by Dr. C. Kempanna. While in the first and second sessions 11 papers were presented on various aspects of agricultural research on cotton, fibre processing and technology, the Inaugural Session was mainly devoted to highlight the research accomplishments of the Quality Evaluation Unit of CTRL at Surat, the glorious history it possessed and the reminiscences of the past research workers who were intimately associated with the station's work. The major recommendations made at the seminar were as follows :

1. While formulating research programmes, Cotton Breeders may take note of the need for introducing genes for stability of fibre quality parameters apart from yield potential in improved varieties of cotton and hybrids.
2. The reports received on the deterioration in fibre quality and spinning potential of Varalaxmi and other hybrids grown in rainfed conditions particularly in Maharashtra need critical examination. The CICR and CTRL may design suitable experiments on multilocation evaluation of Varalaxmi and undertake studies to determine the causes and remedies for the same.
3. The differential behaviour of cotton varieties belonging to **G. herbaceum** species with respect to quality and heritability characters may be studied in detail.
4. The CICR may take necessary action to import new lines of **G. herbaceum** from USSR, etc. since the variability in the local germplasm material is rather narrow.
5. Breeding trials may be undertaken to evolve varieties most suitable for Open-End Spinning.
6. A balance should be maintained in the matter of production of all categories of cotton and research efforts are to be concentrated in the development of new medium staple varieties in the country, having qualitative and quantitative superiority.
7. Greater attention needs be paid to the development of **desi** hybrid cottons.
8. White-fly menace and its impact on cotton economy is a potential subject worthy of urgent studies.
9. Efforts are to be made to introduce practicable quality grading systems at Market Centres.
10. Quality based pricing and trading policy need orientation to stabilise production.
11. A modified function, involving fibre length, length uniformity fineness, maturity and strength has been developed at the CTRL to serve as the Fibre Quality Index (FQI). Attempts may be made to

use such integrated indices to grade varieties on the basis of various quality characters.

Member hip on Other Organisations

As in the past, the Director and other scientists of CTRL represented CTRL and ICAR on various committees of the Indian Standards Institution. Besides, the Director continued to be a member of the Research Advisory Committee of ATIRA and chairman on the Panel of Experts of 'Physics Oriented Studies of ATIRA.

In addition, the Director continued as member of the following Committees Bodies during 1982 also.

1. Cotton Advisory Board of Textile Commissioner, Government of India, Ministry of Commerce, Bombay.
2. Board of Directors of Cotton Corporation of India, Bombay.
3. Research Advisory Committee of SITRA, Coimbatore.
4. Governing Council and General Advisory Committee on Research and Liaison of BTRA, Bombay.
5. Cotton Research Advisory Sub-Committee of ICMF Cotton Development and Research Association, Bombay.
6. Board of Management of Victoria Jubilee Technical Institute, Bombay.
7. Editorial Boards of Journal of Textile Association and Indian Journal of Textile Research.

Expansion and Modernisation

The new multi-storyed building being constructed was nearing completion as minor items of work such as plumbing, electrical connections, etc. only remained to be completed. It was expected that the possession of the building would be taken within a few months.

Staff Amenities

Residential quarters had already been provided for 16 staff members in Grade D, 22 in Grade C, 10 in Grade A and another 20 in Grade A and B. Estimates have been received for the construction of ten Type II-A quarters at the CTRL quarter's premises at Mahim at an approximate cost of Rs. 10.00 lakhs. Administrative approval and financial sanctions were availed of from the Council.

Finance

A statement showing the sanctioned budget grant of CTRL and the actual expenditure for the financial year 1981-82 is furnished in Appendix-I. It will be seen from the statement that the actual Non-Plan expenditure was Rs. 46.72 lakhs as against sanctioned grant of Rs. 46.72 lakhs. An expenditure of Rs. 16.54 lakhs was incurred under the Sixth Five Year Plan Scheme for 'Modernisation and Strengthening of CTRL for Intensive Research on Cotton' against the sanctioned grant of Rs. 25.65 lakhs. This included expenditure on Integrated Cotton Development Project which was funded by World Bank.

Further, a sum of Rs. 0.51 lakhs was incurred on scheme for 'Optimal Blending of Standard Varieties of Indian Cottons' as against sanctioned grant of Rs. 0.96 lakhs.

The savings during the year in all cases, were mainly due to non-filling up of the posts and also non-materialisation of certain purchases. etc.

Departmental Canteen

The details of the reconstituted Managing Committee for Departmental Canteen are given below :

Chairman : Shri M. S. Parthasarathy

Hon. Secretary : Shri P. Ramamurthy

Members : Shri A. W. Shringarpure (Nominated by Chairman)
Kum. Rachael Verghese (Nominated by Chairman)
Shri R. S. Pathare (Nominated by the Institute Joint Council)
Shri K. K. Kasar (Nominated by the Institute Joint Council)

Shri A. W. Shringarpure continued to be the Treasurer for 1982 also.

Significant Findings

The Panel meeting of the Breeding and Technology group of South Zone under AICCIP recommended a variety, LRA.5166 for release in irrigated and rainfed tracks in the zone, where MCU.5 is grown at present.

Further, in the North Zone the variety LH.580 was identified as a very promising strain for Punjab area.

Two new models of ginning percentage balances, based on Quadrant-Balance Principle have been designed. While one of them employs two

counterpoises, the other has only one. Being direct reading types both give ginning percentages directly, by placing the lint and seed in the respective pans, without any calculations.

To overcome the problem of the presence of higher trash content in some Indian cottons during processing by suitably optimising opening and cleaning conditions, experiments conducted on a mixing containing about 10% trash showed that use of double carding (with metallic clothing) after blow-room could bring down the trash content in the sliver to about 0.3% as compared to 1.1% for the card sliver from single carding (with conventional clothing) with significant improvement in yarn quality as well as considerable reduction in the end breakages.

Experiments conducted at CTRL on spinning of flat strips obtained during carding of polyester-viscose blends, on the open-end spinning machine showed that these could be successfully spun by themselves to counts lower than the conventional blends with satisfactory regularity and extension characteristics and at far higher speeds than on conventional ring spinning machine.

Polyester/viscose blended yarns (15/85) blended at the blow-room stage and prepared from both the original material and the flat strips did not show any significant variation in the blend composition, either in the medium or in the long range irrespective of whether the blend is spun in the Open-end Spintrainer or in the conventional ring-frame.

Formulated FQI standards and equation, $CSP = 12 (\sqrt{FQI} + 120)$ could be successfully used for ranking and predicting cottons for spinability under CTRL spinning conditions.

Cotton yarns in the form of skeins, conditioned in a box with a humidity of 65% rh when tested for strength at prevailing atmospheric humidity gave satisfactory results, indicating that this procedure could be adopted by testing laboratories devoid of conditioned atmosphere, provided the prevailing atmospheric humidity is within the range of 45% rh to 95% rh.

A study conducted on commercially available sewing threads revealed scope for improvement of its quality by proper selection of cottons, suitable mixing proportions and optimising twist. Improvement in strength also was found to be possible by standardising conditions of chemical treatment such as 3% stretch during mercerisation, etc.

By birefringence studies, clear experimental evidence has been obtained for the existence of biaxial orientation of cellulose molecules in stretched cellophane films. The (101) crystallographic plane in crystalline cellulose as well as the plane of the glucose rings in amorphous cellulose show a tendency for orientation parallel to the film surface with

a simultanous alignment of the molecular chain axis towards the direction of the stretch making the film biaxially oriented.

Fabrics treated by limited substitution method which comprises swelling in alkali followed by partial acetylation or partial cyanoethylation, when cross-linked with resins for dimensional stability lose much less strength than an untreated fabric when subjected to cross-linking to the same level. The advantages derived from the limited substitutions are however, strongly influenced by the type of fabric geometry.

By repeated enzyme treatment, it has been proved feasible to obtain hydrocellulose with particles of the size 300Å (which is about the same size as cellulose crystals in cotton fibres).

An efficient flame retardant (FR) finish for textiles has been developed by CTRL through collaborative research work with Textile Committee (Ministry of Commerce, Govt. of India). The fabric is phosphorylated with Diammonium Phosphate (DAP), urea and crosslinked with a reactive polymer resin, Hydrosyn in a single step process. The chemicals used are cheap, indigenously available and easy for application using conventional equipments. The FR treated fabric showed certain permanency in FR characteristics even after severe washes, along with better retention of strength.

From the resin migration study of DMDHEU on cotton fabrics in the presence of mixed catalyst, it was found that the higher the percentage of catalyst, lower will be the resin migration.

Fabric sample grafted with acrylonitrile using ceric ammonium nitrate as initiater showed slight improvement in tensile strength with graft percentage reaching upto 10.

Studies conducted on amylase fermentation using **Bacillus subtilis** showed that the gossypol got released when cotton meal was used in growth medium and that free gossypol exerted an inhibitory effect on the organism.

An experimental Bio-gas plant using willow-dust in a continuous fermentation process for generation of bio-energy was designed and fabricated out of high density polyethylene (HDPE). By charging about 10 Kg willow-dust every week, about 500-600 litres of Bio-gas was produced. An operational research project for the utilisation of willow-dust for the production of bio-energy to meet partially the energy requirement in textile industry has been sanctioned by CASE for undertaking pilot plant trials in one of the NTC mills at Bombay.

Good quality particle boards have been prepared from cottonseed hull using a suitable binder and a catalyst.

2. PROGRESS OF RESEARCH

A summary of the progress of research work and related activities at CTRL during the year 1982 is given below :

Evaluation of Quality of Cotton Samples Received from Agricultural Trials

CTRL is rendering technological assistance to cotton breeders and agricultural scientists in their endeavour to improve the yield and quality of cotton developed from time to time, by authoritative evaluation of samples received from several cotton breeding, agronomy and similar trials, in addition to those received under AICCIP and other state schemes. Therefore, quite a large number of cotton samples are received every year for various tests, which include samples from trials conducted by Agricultural Universities, State Departments of Agriculture and samples obtained for specific on-going research investigations.

The number of such samples received for test during the years 1980, 1981, 1982 together with the average number of samples for the quinquennium 1976-80 are given in Table 1 (a). Table 1 (b) summarises the number of samples tested at the Regional Quality Evaluation Units of CTRL during 1982.

The samples received from Agricultural trials are tested in the order of receipt and test reports on them are issued as soon as possible. Test reports on samples of Trade Varieties and Standard Indian Cottons are issued as Technological Circulars as and when the tests are over and later on, published in the form of two separate Technological Reports one for Trade Varieties of Indian Cotton and the other for Standard Indian Cottons.

Some samples are also received for miscellaneous tests such as quality of ginning, identification of component fibres in yarns, oil content in cotton seed, etc.

The results of samples subjected to different tests exclusively under research projects are not generally reported as the test results will appear in the relevant research publications.

The State-wise figures for the number of samples which were tested for fibre characteristics and spinning performance have been given in Table 2 under two sub-head — (i) AICCIP (ii) Other State Schemes.

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

Type of test	Average for the quinquennium 1976-80	1980	1981	1982
1	2	3	4	5
Fibre and Full spinning	175	178	137	216
Fibre and Microspinning	2093	2041	1570	1794
Microspinning alone	—	—	—	—
Fibre tests alone	225	338	131	78
Mill Tests	14	27	14	2
Standard Cottons	24	26	18	32
Trade Varieties — Lint	27	33	25	1
Trade Varieties — *Kapas*	50	79	75	42
Technological Research	96	63	104	196
Miscellaneous	22	53	2	—
Total	2729	2538	2076	2261

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

QE Unit	Length	Finences	Quality maturity	Parameter Strength	Microspining
Akola	1039	200	200	300	—
Coimbatore	1058	1318	1428	1318	296
Dharwad	1270	1208	1220	1208	—
Guntur	282	476	292	295	—
Hissar	376	1092	1104	251	—
Indore	597	597	517	517	—
Ludhiana	44	706	573	706	—
Nagpur	615	542	529	539	—
Nanded	876	767	779	711	—
Sriganganagar	579	244	244	239	—
Surat	10887*	8364	8395	5648‡	543

10309 samples were tested on Fibragraph out of this 6247 samples were evaluated on the basis of one pair of combs only.

‡ For 875 samples, only 3 breaks were made.

TABLE 2: NUMBER OF SAMPLES TESTED AND REPORTS SENT IN 1982

State	Fibre and Full Spining	Fibre and Micro-spinning	Micro-spinning	Fibre Tests	Total
		(i) AICCIP			
Punjab	30 (5)	85 (14)	—	—	115 (19)
Haryana	—	133 (18)	—	5 (1)	138 (19)
Uttar Pradesh	—	20 (5)	—	3 (1)	23 (6)
New Delhi	2 (1)	52 (4)	—	—	54 (5)
Rajasthan	—	60 (3)	—	—	60 (3)
Madhya Pradesh					17 (3)
Gujarat	51 (7)	26 (4)	—	—	77 (11)
Maharashtra	6 (2)	508 (59)	—	—	514 (61)
Andhra Pradesh	—	9 (1)	—	—	9 (1)
Karnataka	—	330 (31)	—	—	330 (31)
Tamil Nadu	3 (1)	14 (2)	—	—	17 (3)
Total	92 (16)	1268 (144)	—	8 (2)	1368 (162)
		(ii) Other State Schemes			
Punjab	1 (1)	—	—	—	1 (1)
Haryana	3 (3)	—	—	—	3 (3)
Uttar Pradesh	—	—	—	—	—
New Delhi	—	20 (2)	—	—	20 (2)
Rajasthan	8 (8)	—	—	—	8 (8)
Madhya Pradesh	7 (6)	—	—	—	7 (6)
Gujarat	27 (24)	10 (1)	—	—	37 (25)
Maharashtra	13 (13)	82 (4)	—	—	95 (17)
Andhra Pradesh	5 (5)	—	—	—	5 (5)
Karnataka	15 (15)	—	—	—	15 (15)
Tamil Nadu	7 (7)	2 (1)	—	—	9 (8)
Total	86 (82)	114 (8)	—	—	200 (90)

Note : Figures in brackets indicate number of reports issued.

All India Co-ordinated Cotton Improvement Project

In order to intensify the research programmes on cotton, the Indian Council of Agricultural Research sponsored the All India Co-ordinated Cotton Improvement Project (AICCIP) with effect from 1967. The work on this project is being 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 tests are screened through various trials, such as Initial Evaluation Trial, Preliminary 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 agro-climatic conditions. The North Zone comprises the states of Punjab, Haryana, Rajasthan and Uttar Pradesh, the Central Zone, the states of Madhya Pradesh, Gujarat and Maharashtra and the south Zone, 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 existing 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 area of Maharashtra, where cotton is grown under irrigation and the crop is sown in April without waiting for the onset of monsoon.

G. hirsutum Trials

The Co-ordinated Varietal Trials of **G. hirsutum** for Normal Plant Type as well as Early Maturing Type (short duration) were conducted at Faridkot, Hissar, Ludhiana, Mathura, Muktsar, Sirsa and Sriganganagar. Tables 3 and 4 comprise the data on ranges of 2.5% span length, fineness, bundle strength and maturity for the samples from the above two trials.

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

Location	Sample No.	Range				Count	Spinning Performance		Control
		2.5% Span Length (mm)	Micronaire Value (μg/in)	Maturity	Bundle Strength (g/t)		A	B	
Faridkot	6F	23.8 — 25.2 (24.3)	4.2 — 5.0 (4.6)	Good	47.2 — 49.3 (48.3)	40s	2	2	F.414
Hissar	7M	22.4 — 26.0 (24.0)	4.1 — 5.0 (4.5)	Average to Good	42.3 — 51.5 (46.3)	30s	4	Nil	H.777
Ludhiana	6F	25.1 — 26.3 (25.5)	4.0 — 4.9 (4.4)	Good	45.6 — 50.9 (47.2)	40s	2	1	F.414
Mathura	5M	23.2 — 24.1 (23.8)	4.2 — 5.0 (4.6)	Good	46.6 — 54.7 (50.0)	30s	1	3	SH.131
Muktsar	6F	22.5 — 25.0 (24.2)	4.2 — 5.0 (4.6)	Average to Good	46.1 — 53.6 (48.9)	30s	3	Nil	F.414
Sirsa (H.A.U.)	6M	22.1 — 24.1 (23.3)	3.9 — 5.2 (4.4)	Good	43.4 — 50.4 (47.8)	30s	4	2	H.777
Sriganganagar	18M	21.9 — 26.7 (23.6)	2.4 — 3.2	Poor	42.9 — 49.8 (45.7)	20s	12	16	G. Agethi

M — Micro Spinning
F — Full Spinning
Note : Values in brackets indicate averages

A — Number of samples spinnable to the count selected.
B — Number of samples better than or on par with the Control.

TABLE 4 : SUMMARY OF TEST RESULTS OF STRAINS TRIED IN CO-ORDINATED VARIETAL TRIAL OF **G. HIRSUTUM** (IRRIGATED) 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	
Faridkot	6M	23.4 — 25.2 (24.2)	4.2 — 4.9 (4.6)	Average to good	46.1 — 49.9 (47.7)	30s	3	1	F.414
Hissar	7M	24.7 — 25.2 (24.5)	3.5 — 4.3 (4.1)	Good	44.0 — 52.5 (48.6)	30s	3	1	H.777
Ludhiana	6F	24.5 — 26.6 (25.3)	4.1 — 4.6 (4.4)	Average	42.9 — 50.9 (47.5)	40s	3	2	F.414
Mathura	4M	23.0 — 26.1 (24.5)	4.3 — 4.7 (4.5)	Average	46.6 — 48.2 (47.8)	30s	2	3	SH.131
Muktsar	6F	23.8 — 25.0 (24.4)	4.4 — 5.1 (4.7)	Average to good	44.0 — 51.5 (46.4)	40s	2	1	F.414
New Delhi (IARI)	5M	24.1 — 26.6 (25.3)	4.5 — 4.9 (4.7)	Average to good	44.0 — 48.8 (46.3)	30s	4	No Control	
Sirsa (H. A. U.)	5M	22.9 — 23.7 (23.3)	4.2 — 4.7 (4.4)	Average to good	45.6 — 53.1 (48.8)	30s	4	2	H.777
Sirsa (IARI)	8M	22.3 — 25.1 (23.7)	4.0 — 4.9 (4.3)	Average	42.3 — 48.8 (46.2)	30s	1	4	H.777
Sriganganagar	18M	21.2 — 25.3 (23.2)	2.9 — 3.9 (3.3)	Low to Average	41.3 — 48.8 (45.6)	20s	18	4	G. Agethi.

PROGRESS OF RESEARCH

The following strains tried out at different locations under this trial gave encouraging spinning performance, for the counts indicated :

Location	*Count*	*Promising Strains*
Faridkot	40s	LH.886 and FP.286
	30s	H.871, RS.514, F.414, FP.123, and FP.235
Hissar	30s	B.N., LH.580, FP.286, H.777, H.854 and H.862
Ludhiana	40s	LH. 886, F.414, 4-1-1and FP. 277
	30s	LH.410, LH.580, FP.233, LH.660, BC.761 and H.842
Mathura	30s	H.777, FP.235 and RS.485
Muktsar	40s	B.N. and G.414
New Delhi	30s	LH.886, H.874, H.888, LH.315 and FP.277
Sirsa (HAU)	30s	BC.761, H.842, H.862 and 4-1-1
Sirsa (IARI)	30s	H.874, LH.886, FP.286, H. 777, LH.315 and H.888
		B.N.
Srigaganagar	20s	B.N., H.871, H.874, H.689-1, LH.580, LH.886, FP.286, RS.488, RS.513, RS.514 RS.642, RS.643, RS.485, HS.6, BS.761, BH.315, LH.660, FP.277, FP.235, FP.123, H.842, H.854, H.862, H.878, H.888, 4-1-1 G. Ageti, RS.621 and RS.486

Samples pertaining to Preliminary Varietal Trials were received from Faridkot, Hissar, Ludhiana, Muktsar, Sirsa (HAU), and Sriganganagar under Normal Plant Type and from Faridkot, Hissar, Ludhiana, Muktsar and New Delhi under Compact Plant Type. The ranges of 2.5% span length, Micronaire value, bundles strength and maturity are compiled in Table 5. The following strains fared well at the locations indicated :

Location	*Count*	*Promising Strains*
Faridkot	30s	H.939, RS.610, F.414, and SH.178
Hissar	30s	B.N., H.777, FP.52 and SH.178
Ludhiana	30s	LH.604, H.894, SH.180, F.414, B.N. and SH.178
Muktsar	30s	LH.808, RS.510, SH.180, RS.610, B.N., F.414, F.438, SH.178, and DS.66-4

TABLE 5 : SUMMARY OF TEST RESULTS OF STRAINS TRIED IN PRELIMINARY VARIETAL TRIAL OF **G. HIRSUTUM** IN NORTH ZONE

Location	No. of Samples	Range				Count	Spinning Performance		Control
		2.5% Span Length (mm)	Micronaire Value (µg/in)	Maturity	Bundle Strength (g/t)		A	B	
1	2	3	4	5	6	7	8	9	10
Normal Plant Type									
Faridkot	6M	22.6 — 26.6 (23.9)	4.4 — 5.2 (4.6)	Good	47.7 — 49.8 (48.8)	30s	4	Nil	F.414
Hissar	8M	23.2 — 25.7 (24.5)	3.7 — 4.4 (4.0)	Average	44.5 — 52.5 (47.7)	30s	2	Nil	H.777
Ludhiana	6M	22.9 — 27.0 (24.6)	4.0 — 5.3 (4.6)	Average	47.2 — 49.8 (47.8)	30s	5	Nil	F.414
Muktsar	6M	23.3 — 27.0 (25.5)	3.7 — 4.5 (4.2)	Average	47.2 — 50.4 (48.2)	30s	6	1	F.414
Sirsa (H. A. U.)	5M	22.8 — 25.5 (24.5)	4.3 — 5.0 (4.6)	Average	44.5 — 49.3 (47.6)	30s	3	1	H.777
Sriganganagar	24M	20.3 — 28.0 (24.3)	2.4 — 3.9	Low	42.9 — 48.8 (46.2)	30s	5	13	G. Agethi.

— Contd.

1	2	3	4	5	6	7	8	9	10
				Compact Plant Type					
Faridkot	5M	22.0 — 25.3 (24.0)	3.6 — 4.9 (4.2)	Average	44.0 — 52.5 (48.9)	30s	3	1	F.414
Hissar	7M	23.7 — 27.4 (25.4)	4.2 — 5.0 (4.5)	Good	45.0 — 47.7 (46.7)	30s	3	1	H.777
Ludhiana	7M	23.6 — 27.0 (24.5)	3.4 — 4.8 (4.0)	Average	44.5 — 49.8 ((47.3)	30s	3	1	F.414
Muktsar	6M	24.1 — 28.9 (26.9)	3.9 — 5.2 (4.4)	Good	43.4 — 49.3 (47.1)	30s	5	3	F.414
New Delhi	5M	23.1 — 25.6 (25.4)	4.5 — 4.8 (4.6)	Good	40.8 — 49.3 (45.4)	30s	2		No Control

M — Micro Spinning

Note : Values in brackets indicate averages

A — Number of samp'es spinnable to the count selected.

B — Number of samples better than or on par with the Control

New Delhi	30s	DH.85 and DH.66-4
Sirsa	30s	B.N., HS.2 and H.777
Sriganganagar	30s	FP.236, H.843, H.912, SH.180 and SH.2978

Initial Evaluation Trial was conducted at Faridkot, Hissar, Sirsa (IARI). The following strains recorded satisfactory yarn strength for the counts indicating below :

Location	*Count*	*Promising Strains*
Faridkot	30s	FP.401, FP-338, FP.341, RS.620 and F.414
Hissar	30s	LH.323, LH.839, FP.401, LH.728, H.941 and H.777
Sirsa (IARI)	30s	H.941, FP.410, RS. 620, and H.777

G. arboreum Trials

Samples pertaining to **G. arboreum** trials were received from Ludhiana, Mathura, and Sirsa. One of the objects of these trials was to identify coarser and short staple variety suitable for blending purposes in the place of existing varieties, viz. G.27 and HD.11 . The following varieties from Mathura have shown mean fibre length below 17 mm with a Micronaire value more than 7.5.

D.S.1, DS.2, RG.5 and Lohit

Miscellaneous Trials

A set of 27 samples of Pusa selections was received from IARI New Delhi. They had recorded 2.5% span length ranging between 24.1 mm to 28.7 mm. They had a trend of having higher Micronaire value ranging between 4.2 to 5.6. Bundle Strength values were good. As many as 23 selections fared well at 30s count. Only two selections viz. Pusa 79/1 and Pusa 10-7 recorded higher CSP than the control variety, H.777.

CENTRAL ZONE

The Zone comprises the States of Madhya Pradesh, Gujarat and Maharashtra where varieties pertaining to **G. hirsutum, G. herbaceum** and **G. arboreum** species are under commercial cultivation. However, during recent years, emphasis has been given to development of high yielding hybrids. As more and more irrigation facilities became available, trials under irrigated and rainfed conditions are being conducted in this zone. As mentioned earlier, trials using North Zone entries were

conducted at Morena in Madhya Pradesh and Padegaon and Rahuri in Maharashtra under irrigated conditions.

G. hirsutum Trials

In the co-ordinated varietal trial, samples were received from Nagpur, Rahuri, Surat and Talod under irrigated conditions and from Achalpur, Akola, Badnawar, Bharuch, Jalgaon, Nagpur under rainfed conditions. Samples specially identified for high ginning outturn were also received from Achalpur, Akola and Nagpur. Further, samples containing North Zone entries were received from Morena, Padegaon and Rahuri.

The summary of the fibre test results and spinning performance has been compiled in Table 6, 7 and 8 for irrigated, rainfed and high ginning type trials.

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

Location	*Count*	*Promising Strains*
Nagpur (I)	40s	76 IH.20, G.925, Santher 13442 and 66 BSTD
Rahuri (I)	30s	KOP.495 and G. 2637
Surat (I)	50s	G.925, G. Cot., 100 and G.3080
Talod	50s	G.949, G.2627, G.Cot.100 and 76 IH.20
Achalpur (R)	40s	76 IH.23, G.Cot.10 and BSTD.35
Akola (R)	40s	BSTD.35, L.147, G.Cot.10, 76 IH.23 and PKV.0011.7
Badnawar (R)	40s	PKV.0011.7
Bharuch (R)	50s	BSTD.35 and G.Cot.100
	40s	76 IH.23, G.Cot.10 and PKV.0011.7
Jalgaon (R)	40s	BSTD.35, Local Control and JLH.79
Achalpur (HG)	40s	G.Cot.10 and PKV.0802
Akola (HG)	40s	L.147, PKV.0803, G.Cot.10, PKV.0802 and NH.232
Morena (HG)	30s	RS.485, HS.6, BC.761, BN., LH.315, FP.277 FP.235, FP.123, H.842, H.854, H.862, H.878, H.888, 4-1-1, C.59-228, F.414, J.207 x BN.3 and J.207 x BN.4
Padegaon (HG)	50s	RS.488, RS.487, H.874, H.879, LH.573, F.605, FP.286, FP.132, BN., BC.761 and SH.175

I — Irrigated R — Rainfed HG — High Ginning Type

TABLE 6 : SUMMARY OF TEST RESULTS OF STRAINS TRIED IN CO-ORDINATED VARIETAL TRIAL OF **G. HIRSUTUM** (IRRIGATED) IN CENTRAL ZONE

Location	No. of Samples	Ranges				Count	Spinning		Control
		2.5% Span Length (mm)	Micronaire Value (μg/ing)	Maturity	Bundle Strength		A	B	
Nagpur	11M	23.3-30.0 (26.3)	3.0-3.8 (3.5)	Good	37.0-46.1 (41.6)	40s	4	6	L. 147
Rahuri	5M	23.7-27.3 (25.8)	3.0-4.4 (3.6)	Good	41.3-47.2 (44.3)	30s	2	Nil	Control
Surat	12F	25.2-30.9 (27.0)	3.3-4.3 (3.7)	Low to average	35.9-45.6 (41.6)	50s	5	Nil	G. Cot. 100
Talod	7M	26.4-30.5 (28.4)	4.2-5.1 (4.8)	Good	42.3-52.5 (47.4)	50s	4	6	G. Cot. 10

M – Microspinning

F – Full spinning

A – No. of samples spinnable to the count selected

B – Number of samples better than or on par with the Control

Values in brackets indicate averages

TABLE 7 : SUMMARY OF TEST RESULTS OF STRAINS TRIED IN CO-ORDINATED VARIETAL TRIAL OF **G. HIRSUTUM** (RAINFED) IN CENTRAL ZONE

Location	No. of Samples	Range				Count	Spinning		Control
		2.5% Span Length (mm)	Micronaire Value (µg/in)	Maturity	Bundle Strength (g/t)		A	B	
Achalpur	6M	25.3 — 28.3 (26.7)	3.2 — 4.5 (4.2)	Good	38.1 — 40.7 (39.9	40s	3	4	—
Akola	6M	25.1 — 27.5 (26.2)	3.2 — 4.5 (4.1)	Good	37.5 — 45.0 (42.5)	40s	5	1	L.147
Badnawar	6M	23.6 — 27.9 (25.6)	3.0 — 4.4 (3.8)	Good	41.8 — 47.7 (44.0)	40s	1	2	Badnawar.1
Bharuch	6F	23.6 — 31.5 (27.1)	3.2 — 4.3 (3.8)	Average to good	36.4 — 45.0 (42.5)	40s	4	2	G. Cot.10
Jalgaon	8M	24.9 — 28.8 (26.9)	3.4 — 4.2 (4.1)	Average to good	39.7 — 47.7 (44.2)	40s	3	2	—
Nagpur	7M	23.2 — 28.1 (26.6)	3.3 — 4.1 (3.6)	Average to good	37.0 — 45.0 (42.1)	40s	Nil	4	L.147

M — Micro Spinning F — Full Spinning

Note : Values in brackets indicate averages

A — Number of samples spinnable to the count selected

B — Number of samples better than or on par with the Control.

TABLE 8 : SUMMARY OF TEST RESULTS OF STRAINS TRIED IN CO-ORDINATED VARIETAL TRIAL OF **G. HIRSUTUM** (HIGH G.P) IN CENTRAL ZONE

Location	No. of Samples	Range				Count	Spinning		Control
		2.5% Span Length (mm)	Micronaire Value (μg/in)	Maturity	Bundle Strength (g/t)		A	B	
Achalpur	6M	25.1 — 27.8 (26.3)	4.0 — 4.8 (4.4)	Good	39.1 — 45.0 (42.4)	40s	2	4	—
Akola	6M	26.0 — 28.2 (26.6)	3.3 — 4.2 (3.8)	Average to good	41.8 — 46.1 (43.7)	40s	5	3	L.147
Nagpur	8M	24.4 — 27.1 (25.6)	3.4 — 4.4 (3.9)	Average to good	40.7 — 46.1 (43.0)	40s	Nil	2	L.147

M — Micro Spinning F — Full Spinning

Note : Values in brackets indicate averages

A — Number of samples spinnable to the count selected

B — Number of samples better than or on par with the Control.

Samples pertaining to Preliminary Varietal Trial were received from Rahuri under irrigated conditions, and from Achalpur, Akola and Amaravati under rainfed conditions. The summary of the fibre test results and spinning performance has been compiled in Table 9. This trial was also conducted at Padegaon and Rahuri with North Zone entries. The following samples fared well at the location and count indicated below :

Location	*Count*	*Promising Strains*
Rahuri (I)	30s	LRA.5166 and NH.126
Achalpur (R)	40s	CPH.4938, NH.200 and G.13426
Akola (R)	40s	LRA.5166, NH.231, G. 13426, 68 KH, 33-1916, MG.10 and G.Cot. 10
Amaravati (R)	40s	NH.210, PKV.0151, 68 KH.33-1916, G.Cot.10, G.13426, NH.200, KH.33-1916, G.Coo. NH.205 and PKV.0012.
Padegaon (North Zone Entries)	40s	H.866, H.858, H.876, H.806-1, RS.489, RS.514, RS.515, RS.520, HS.8, HS.17, MS.18, B.N., LH.704, FP.336, FP.367 and FP.370
Rahuri (North Zone entries)	30s	RS.610

In the Initial Evaluation Trial, the following samples recorded desired CSP for the counts indicated below :

Location	*Count*	*Promising Strains*
Padegaon (I)	40s	Vishnu x CP.1998F (28/1/55) Vishnu x BJA.30-4-54, PDN.43 and PDN.54
Talod (I)	50s	G.2482, G.3154, G.Cot.10 and G.Cot.100
Akola (R)	40s	G.IAN.7515 and DA.225
Badnawar (R)	40s	G.1226. G.3000, G.3159, DP.226, PKV.0724, PKV.0126, WH.202, WH.236, WH.245, 77-IH.27 and Badnawar-1
Bharuch (R)	40s	G.464, PKV.0726, NH.194, NH.80-IH-1, G.Cot.10 and G.Cot.100

TABLE 9 : 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 (µg/in)	Maturity	Bundle Strength (g/t)		A	B	
Rahuri	5 M	23.8 — 26.5 (25.3)	3.2 — 4.0 (3.6)	Good	41.3 — 45.6 (44.0)	30s	2		No Control
Achalpur	7M	25.2 — 31.6 (27.9)	3.7 — 4.4 (4.1)	Average to good	40.7 — 47.7 (44.6)	40s	3	All	
Akola	6M	25.9 — 31.3 (28.4)	3.8 — 4.8 (4.3)	Good	40.7 — 46.6 (43.7)	40s	6	4	G. Cot.10
Amaravati	12M	24.7 — (26.8)	3.6 — 5.0 (4.1)	Good	39.7 — 48.8 (45.0)	40s	11	10	

M — Micro Spinning

Note : Values in brackets indicate averages

A — Number of samples spinnable to the count selected

B — Number of samples better than or on par with the Control

G. barbadense Trials

Samples pertaining to Co-ordinated Varietal Trial were received from Surat for full spinning test and from Talod for microspinning test. Range of 2.5% span length was between 29.4 mm and 39.8 mm. Maturity was average to good and bundle strength values were good ranging from 423 g/t to 54.7 g/t. Suvin raised at Surat recorded CSP as high as 2640 at 100s count. Two strains, viz. SILS.53-568 and Suvin raised at Talod fared well at 80s count.

G. arboreum Trials

Co-oridnated Varietal Trial was conducted at Akola, Amaravati, Buldana, Jalgaon, Parbhani and Yavatmal. The promising strains are indicated below :

Location	*Count*	*Promising Strains*
Akola	30s	NA.39 and AKH.607. AKH.28, NA.39, AKH.4, AKH.607
Amaravati	30s	AKH.593, NA.40, AKH.597, AKH.606, and AKH.590
Buldana	30s	NA-39, 78-IA.1 and NA.40
Parbhani	20s	AKH.580, NA.39, NA.40 and local Control
Yavatmal	20s	AKH.593, 78-IA.1, AKH.606, AKH.607, NA.40, and Local Control

Under Preliminary Varietal Trial, samples were received from Akola and Jalgaon. Samples which were recommended for North Zone, were received from Morena for microspinning test. The strain, AK.235 at Akola and strains AKH.4 and Jyoti raised at Jalgaon were suitable for 30s count. The strain LD.193 at Morena was also found suitable for 30s count.

G. herbaceum Trials

Co-ordinated Varietal Trials were conducted at Bharuch under irrigated conditions and at Viramgam under rainfed conditions. Range of 2.5% span length was between 24.1 mm and 27.5 mm with excellent uniformity in staple. Maturity was however, low to average and bundle strength values were good. Only one strain, viz. 5497 from Bharuch and three strains viz. 40-2-2X Digvijay, 3200 X P2 and selection of K2-66-2096 from Viramgam recorded desired yarn strength at 40s count.

Hybrid Trials

1. Inter-hirsutum Hybrid Trials : Samples pertaining to this trial under irrigated conditions were received from Badnawar, Nagpur Padegaon and Rahuri. The following hybrids fared well at the counts indicated :

Location	*Count*	*Promising Strains*
Badnawar	40s	ACHH.4, JKHH.3, JKHH.2, ACHH.16, Hybrid.4, RHH.401, ACHH.3 and JKHY.1 (Control)
Nagpur	40s	RHH.401, NHH.67, and Hybrid 4
Padegaon	50s	SRT.1 x MCU.5, Laxmi x MCU.5, SRT.1 X Reba B-50, Vishnu X MCU.5, Vishnu 7 Reba B-50, Savitri and JKHY.1
	40s	Mu.2 X Reba B-50, SVM X Nect, Kop-211 X 064, C-1412 X G.67, Laxmi X Kop 495. and Laxmi X Russain hirsutum, MCU.5 X EC.110605 and SVM XEC-110-602
Rahuri	50s	RHH.371
	40s	RHH.353, RHH.352, RHH.346, RHH.354, RHH.131, RHH.358, RHH.359 and RHH.360
	30s	ACHH.16, JKHH.3, RHH.401 and Hybrid 4

PROGRESS OF RESEARCH

Inter hirsutum hybrids raised under rained conditions were received from Achalpur, Badnawar, Bharuch, Jalgaon and Nagpur. The following hybrids fared well at the counts indicated :

Location	*Count*	*Promising Strains*
Achalpur	50s	ACHH.16, RHH.451, ACHH.3, Hybrid 4 and CPHH.4994
Badnawar	40s	GHH.15, ACHH.16, G Cot. Hybrid 6, Hybrid 4, ACHH.4 and JKHY.1
Bharuch	50s	GHH.15, G.Cot. Hybrid 6, ACHH.3 ACHH.4 and ACHH.16
Jalgaon	40s	GHH.15, G.Cot. Hybrid 6, ACHH.4, and Hybrid 4
Nagpur	40s	Hybrid 4, ACHH.16, GHH.15

2. Inter species Hybrid Trials : Samples pertaining to this trials were received from Nagpur, Padegaon Rahuri and Talod. The following Hybrids fared well at the counts indicated below :

Location	*Count*	*Promising Strains*
Nagpur	50s	RHB.503, RHB, 50, Varalaxmi, JCHB 12, RHB.504 and GHB.10
Padegaon	60s	Vishnu X ERB.4492, 101-102 BXSB.1085-6 and KOP 203XERB.4492
Rahuri	50s	RHB.406, RHB.408, RHB.409, RHB.410, RHB.411, RHB.412, RHB.413, RHB.218, Savitri and Varalaxmi.
Talod	80s	RHB.502

SOUTH ZONE

Cotton 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 of the tracts of this zone.

G. hirsutum Trials

The Co-ordinated Varietal Trials (CVT) & (PVT) under irrigated conditions was conducted at Siruguppa and under rainfed conditions at Dharwad. The Preliminary Varietal Trial (PVT) under irrigated conditions conducted at Arbhavi and Siruguppa and under rainfed conditions at Dharwad. The test results are compiled in Table 10.

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

Location	*Count*	*Promising Strains*
Siruguppa (I)	40s	DS.28, JK.119-25-54, SRJ-629, MCU.5, DS.70-480-2, DS.54-32, ELS-527, ADB.10050, AV.3373.IV Hampy, CPD-8-1-LL, RRD.12-30, SRG.641, JGL.14515, DS.56, MCP.7 and SRG.584.
Dharwad (R)	40s	DP.338, DP.490, DS.35, JGL.14515, JK.78-162, Laxmi, UAS.48.4, DP.498, DP.342, DP.415, NA.606, DP.336, LRA.5166, DP.984, DP.452, and Sharada
Arabhavi (I)	40s	MCU.5, TSH.124, LS.149, AV.3526, Lam.56, ELS.525, LS.133-1, EL.0687-13 No.999 and Lam. 65
Siruguppa (I)	40s	SRG.574, E10668-D, MCU.5, TSH.124, Lam.56, DIC.13, AV.3326, Lam.65, ELS.525, TSH.127, DIC.14, LS.133-1 and EL.0687
Dharwad (R)	40s	NA.977, CPD.34-25, NA.988, DP.640, Laxmi, DS.67, DP-1293, DP.1291, CPD.35, 19, DP.1773, JK.285, BWR.116, 5, Sharda, DRC.1, DRC.6, DRC.3, NA.896, DRC.2, DRC.8, NA.920, TKH.27, DRC.4, JK.258, and L.52

The Initial Evaluation Trial was conducted at Arabhavi and Siruguppa. The following 7 strains, viz. ACP.44-15-26, ACP-71-59-1, ACP.56-

TABLE 10 : SUMMARY OF TEST RESULTS OF STRAINS TRIAL IN CO-ORDINATED VARIETAL TRIAL AND PRELIMINARY VARIETAL TRIAL OF **G. HIRSUTUM** IN SOUTH ZONE

Location	No. of Samples	Range				Count	Spinning Performance		Control
		2.5% Span Length (mm)	Micronaire Value (µg/in)	Maturity	Bundle Strength (g/t)		A	B	
Siruguppa (I)	20M	27.0 — 33.4 (30.4)	3.2 — 4.7 (3.9)	Good	38.1 — 47.2 (42.2)	40s	18	16	Hampy
Dharwad (R)	18M	26.0 — 30.9 (28.9)	3.2 — 4.3 (3.6)	Average to good	39.1 — 45.6 (42.3)	40s	16		No Control
Arabhavi (I)	20M	21.4 — 35.1 (29.6)	2.8 — 5.2 (4.1)	Average to good	35.4 — 43.4 (39.0)	40s	9		No Control
Siruguppa (I)	20M	22.8 — 33.6 (29.2)	3.4 — 5.1 (4.2)	Good	(36.4 — 47.2 (41.3)	40s	13	13	Hampy
Dardwad (R)	28M	26.2 — 31.3 (28.7)	3.0 — 4.3 (3.6)	Average to good	36.4 — 45.0 (41.6)	40s	24	16	Sharada

M — Micro Spinning
I — Irrigated
R — Rainfed

A — Number of samples spinnable to the count selected
B — Number of samples better than or on par with the Control.

199-1. DP.1560, RRD.233-3, ACP.71-14-1 and MCU.5 raised at Arabhavi recorded satisfactory yarn strength at 40s count.

G. barbadense Trials

The Co-ordinated Varietal Trial and Preliminary Varietal Trial of G. barbadense tried under these trials showed satisfactory yarn strength at 80s count :

TCB.15, TCB.54-36, TCB.50, BCS.6-48, TCB.14, BCS.22-73, BCS-10-25 and Suvin.

G. arboreum Trials

The Preliminary Varietal Trial was conducted at Bijapur. Only two strains viz., AKH.5 and NA.39 recorded desired yarn strength at 30s count.

G. herbaceum Trials

Three sets of samples each one from Co-ordinated Varietal Trial, Preliminary Varietal Trial and Initial Evaluation Trial were received from Dharwad. Range of 2.5% Span Length for 38 samples was between 22.6 mm and 28.1 mm. Uniformity in staple was excellent. Micronaire value ranged from 4.3 to 6.0 and the bundle strength values showed considerable variation ranging between 44.5 g/t and 53.6 g/t. Following strains fared well at 30s count 736, 738, 739, 741, 743, 745, 747, 750, 725, 727, 728, 731, 701, 702, 707, 708, 710, 711, 713, 714, 715, 717, 718, 719, 721, 722, 723, 724 and Jayadhar.

Hybrid Trials

On the interspecific hybrid trial conducted under irrigated conditions at Siruguppa, eight hybrids recorded variation in 2.5% span length between 33.5 mm to 36.5 mm. They had narrow range of Micronaire value between 2.9 and 3.6. Maturity was low to average and bundle strength values ranged between 43.4 g/t to 50.9 g/t. Three hybrids, viz., NHB.80, TNHB.124 and Jayalaxmi fared well at 80s count.

Pilot Project Demonstration Trial

This trial with **hirsutum** entries was conducted at Siruguppa under irrigated conditions and at Dharwad under rainfed conditions. The trial

with entries of **barbadense** species was conducted at Shimoga under irrigated conditions and with **herbaceum** species at Dharwad under rainfed conditions. The following strains fared well at the counts indicated :

Location	*Count*	*Promising Strains*
Siruguppa (I) *G. hirsutum Trials*	40s	JGL.14515, MCU.7, DS.28, DS.70-480, MCU.5, AV.3374, IV, and Hampi
Dharwad (R) *G. hirsutum Trials*	40s	JK.97-54, DP.225, DP.44, CPD.11-1-2, LRA.5166 Laxmi and Sharda.
Shimoga (I) *G. barbadense Trials*	80s	Suvin
Dharwad (R) *G. herbaceum Trials*	30s	751 and 754

Promising Strains

The panel meetings of the breeding and technology groups identified the following strains as promising.

LH.580 This strain has been tested at Ludhiana, Jullunder, Kheri, Faridkot, Muktsar and Abohar locations in Punjab for a period of four years. It has given 5% higher yield than F.414 and its ginning out-turn is higher than that of F.414. The lint production, therefore, would be 12.7% higher than that of F.414. As regards technological characteristics, this new strain is on par with F.414 and Bikaneri Narme.

New Varieties recommended for release

LRA.5166 This variety was identified at the Regional Research Station, Central Institute for Cotton Research, Coimbatore as a promising strain during last year and now has been recommended for release at the panel meetings held at Raichur in June, 1982. LRA.5166 is a derivative of cross involving Laxmi, Reha B.50 and Krishna (AC.122). It recorded higher yields than MCU.5 and, therefore, were found suitable for cultivation in irrigated and rainfed tracts where MCU.5

is grown at present. Its ginning percentage is also higher and it is suitable for spinning 50s count.

LRA-5166 is reported to have recorded more than 25% higher yield over SRT.1 in Central Zone.

Extra-Long Staple (27 mm and above) Cottons

The test results of extra-long staple cotton samples received during 1982 at CTRL are reported in Table 11.

Mill Tests

Mill tests are usually arranged on newly evolved varieties/hybrids which have shown consistently better performance than the existing ones controls for a few seasons, for assessing their performance under Mill conditions. Only after ensuring satisfactory performance of the new variety in the mill, it is recommended for release for general cultivation. Generally, no new variety/ hybrid is recommended for release until it performs better than the control, It should be at least either equal in quality with higher yield or better in quality with at least the same yield as the control.

This year however no mill tests could be arranged as the Textile Mills in Bombay were on strike.

Evaluation of the Major Trade Varieties of Cotton Grown in different parts of the Country

Lint samples of fair average quality of the Major Trade Varieties of Indian Cotton are being obtained for each season through East India Cotton Association. Representative **Kapas** samples of these varieties are also procured from State Departments of Agriculture for determination of ginning percentage. The fibre and spinning test results, the ginning percentage and other test results on each variety of cotton being published as Technological Circulars as early in the Season as possible for information of the Cottnon Trade and Industry. During 1982, 20 such circulars were issued on cottons of 1980-81 season and 49 circulars were issued on cottons belonging to 1980 to 1982 season. The test results of all Trade Varieties of 1980-81 season were compiled together and published as 'Technological Report on Trade Varieties of Indian Cottons, 1980-81 season'.

Table 11 : EXTRA – LONG STAPLE (27 MM AND ABOVE) COTTONS TESTED DURING, 1982

Variety	Place	Mean Fibre Length		Fineness		Maturity Coeffient.	Mature fibre percent	Bundle Strength		
								Tenacity (g|t)		P. S. I.
		mm	in	Millitex	Micronaire value			O" gauge (g|t)	1|8" gauge (g|t)	O" gauge (1b|mg)
1	2	3	4	5	6	7	8	9	10	11
Andhra Pradesh										
1. MCU. 5	Guntur	30.0	1.18	150	3.8	–	80	45.6	29.0	8.5
Gujarat										
2. 6437	Bharuch	27.0	1.06	157	4.0	0.72	–	45.0	23.4	8.4
3. G. Cot. 100	,,	28.7	1.13	150	3.8	0.68	–	42.9	–	8.0
4. CPB. 5008	Surat	28.7	1.13	142	3.6	–	71	49.3	28.9	9.2
5. CPB. 5011	,,	29.0	1.14	150	3.8	–	80	49.3	29.6	9.2
6. CPB. 5012	,,	27.9	1.10	150	3.8	–	81	49.3	33.7	9.2
7. CPB. 5006	,,	35.1	1.38	122	3.1	–	53	51.5	34.1	9.6
8. CPB. 5014	,,	27.9	1.10	169	4.3	–	78	42.3	27.6	7.9
9. G. Cot. 100	,,	27.9	1.10	138	3.5	–	66	40.2	24.4	7.5
10. Hybrid 4	,,	27.2	1.07	157	4.0	0.74	–	37.0	23.1	6.9
11. DH .149	,,	27.0	1.07	154	3.9	–	62	48.2	22.3	9.0
12. Varalaxmi	,,	29.2	1.15	130	3.3	–	67	42.3	27.2	7.9
13. Varalaxmi	Idar	34.0	1.34	138	3.5	–	64	48.8	31.3	9.1
14. Varalaxmi	Amod	31.1	1.22	134	3.4	–	66	43.4	28.7	8.1
15. Hybrid 6	Sabarkantha	28.7	1.13	146	3.7	–	67	44.5	25.2	8.3
16. Sankar 4	Palej	28.0	1.10	169	4.3	–	70	43.4	28.2	8.1
17. Hybrid 4	Baroda	28.6	1.13	154	3.9	–	74	39.1	23.5	7.3
Karnataka										
18. S. I. Andrews	Shimoga	30.2	1.19	146	3.7	0.70	–	46.6	28.3	8.7
19. BCS. 9–70	,,	29.2	1.15	150	3.8	0.68	–	45.6	29.3	8.5
20. Menoufi	,,	29.7	1.17	157	4.0	0.72	–	47.7	29.4	8.9
21. Varalaxmi	,,	30.7	1.21	110	2.8	–	67	45.0	28.9	8.4
22. Varalaxmi	Raichur	31.0	1.22	134	3.4	–	72	46.6	29.1	8.7
23. Suvin	,,	35.5	1.40	130	3.3	–	70	55.7	37.5	10.4
Madhya Pradesh										
24. JKHY. 1	Pamawa	27.8	1.09	142	3.6	–	60	45.0	23.7	8.4
Maharashtra										
25. Varalaxmi	Sirku Road	33.2	1.31	138	3.5	–	67	49.3	30.9	9.2
26. MCU. 5	Khamgaon	27.4	1.08	130	3.3	–	69	46.6	26.3	8.7
Tamil Nadu										
27. Suvin	Kovilpatti	31.5	1.24	130	3.3	0.66	–	42.9	26.2	8.0
28. MCU. 5	,,	30.2	1.19	130	3.3	0.65	–	44.5	25.2	8.3
29. MCU. 9	,,	30.5	1.20	114	2.9	0.63	–	40.7	24.3	7.6

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 varities are grown in Government farms or Research Farms of Agricultural Universities every year under identical conditions and careful supervision of breeders. Extensive fibre and spinning tests are regularly being done on such samples and test results are published as Technological Circulars for information of the Cotton Breeders and Research workers as early in the season as possible. During 1982, such circulars were issued on 11 varieties.

The results of all the samples pertaining to 1980-81 season were consolidated and published as 'Technological Report on Standard Indian Cottons, 1980-81 Season'.

Identification of Cotton varieties (grown at the Cotton Research Station at Surat for experimental purposes) with Different Levels of Nep-content and Study of Varietal Variability and Inheritance of the Characteristics of Neppiness in Cotton.

540 samples were tested for nep content by the template method on the card web of Shirley Minitaure Spinning Plant. The complete diallele analysis was also carried out. It was observed that the genotypes were significantly different and the neppiness was governed by dominant genes, the effect of dominance being significant. The material can be improved for reduced nep content by recurrent selection.

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

The trial has been conducted on indentical lines, as last year. The material collected was evaluated for important economic and quality characteristics, as in the previous two seasons and the data statistically analysed. In the season 1981-82, the differences in seed cotton yield due to Nitrogen levels were significant, each additional dose giving significantly higher yields. Phosphorus and Potash levels as well as their interaction factors, turned out non-significant. The ginning percentage, seed-index, lint-index, fibre length, fibre maturity and CSP at 40s count, were observed to remain

completely unaffected by the treatments tried. The effect of the Phosphorus levels on length uniformity and bundle strength and the Nitrogen levels on fineness, were just marginal. Thus, it can be inferred that the application of Nitrogen exercises a very strong influence on the yield of seed cotton, progressively increasing with the dosage applied up to the level tried, but the treatments have no impact on the quality characteristics.

Since the trends obtained during the three seasons of trial were more or less similar, the results of the three seasons were analysed after pooling the values for different seasons.

It is observed that the application of Nitrogenous fertilisers to the cotton crop is quite beneficial in enhancing seed cotton yield, while the other two fertilisers, apparently do not benefit the crop and that the application of all the three fertilisers has absolutely no impact on the quality characteristics of cotton.

Influence of Insecticide Treatments on the Quality of Cotton and Cottonseed

It was reported earlier that 24 samples of Hybrid 4 cotton for the season 1980-81, pertaining to the Entomological Trial "Chemical Control of Bollworms" consisting of eight insecticide treatments including control were tested for 2.5% span length, length uniformity ratio, bundle tenacity at zero and 3 mm gauge lengths, maturity coefficient and Micronaire value. The data on GP and yield were obtained from Surat. The statistical analysis of the data revealed that Permethrin and Carbaryl treatments significantly improved bundle tenacity at 3 mm gauge length. Cypermethrin improved fineness and yield by all the treatments in comparsion with the values for the untreated control.

Design, Fabrication and Testing of Seed-Cotton Cleaner

Design of the seed-cotton cleaner and the necessary drawings were completed. Guidance and assistance were being given in the fabrication work of the equipment.

Fabrication of Ginning Percentage Indicators

During the period, two quadrant balances were fabricated and tested for their performance using a number of *kapas* samples. Their performances were found to be quite satisfactory. However, it was realised that their performances can be improved, if the alignments of the circular discs and the fulcrum with respect to the beam are meliorated; in fact a better fulcrum employing agate edges for minimising the friction of the balances would improve their functioning to a large extent. This work is at present being attempted. The components needed for fabricating the newly designed quadrant balances have been ordered and they are awaited.

Regarding the improvement of hydrostatic balances, new designs have been made and the necessary components were being procured. It is expected that given the well machined components, the precision of these balances can be brought to a very high level and thus making them more suitable for estimating the ginning percentage of cotton samples.

It was planned to compare the performances of the above five types of balances to assess their relative merits.

Action was also being taken for patenting the three earlier types.

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

A new predicted formula for estimating the Maturity Coefficient (Mc) from the difference in Micronaire values with and without spacer M^D derived on the basis of data on recent samples, viz. $Mc = 0.2335\ M_D + 0.3712$ ..... (1) was already reported in the last Annual Report. This formula was found to be notably different from the one currently being used at CTRL for predicting Mc from M_D, viz $Mc = 0.1753\ M_D + 0.3934$ ..... (2).

For confirming the better suitability of the equation (1), it was considered necessary to apply this formula to a fresh set of samples.

Data were collected of 1980-81 season samples that were tested for maturity coefficient by caustic soda method and by using the Micronaire spacer technique. The values of Mc were estimated from those of Mc using the above two equations. The predicted values were compared with the actual Mc values obtained by the caustic soda method (Tabel 12).

TABLE 12: **COMPARISION OF THE PREDICTED VALUES OF MATURITY COEFFICIENT BY THE TWO EQUATIONS WITH THE VALUES OBTAINED BY THE CAUSTIC SODA METHOD**

Caustic Soda Method	Average of the Values Predicted by	
	Equation (1)	Equation (2)
0.62	0.67	0.61
0.64	0.66	0.61
0.66	0.71	0.65
0.68	0.70	0.64
0.69	0.70	0.64
0.72	0.75	0.68
0.73	0.78	0.70
0.74	0.79	0.71
0.75	0.79	0.71
0.76	0.79	0.71
0.77	0.82	0.73
0.78	0.82	0.73
0.79	0.83	0.74
0.80	0.83	0.74
0.81	0.83	0.74
0.82	0.84	0.74
0.83	0.82	0.74
0.84	0.84	0.74
0.85	0.83	0.74

It was discernible that all the values predicted by equation (2) were lower than the actual values and the mean difference between the two was found to be high (0.06) for the 125 cottons taken up for the study. On the other hand the values estimated by the new formula (1) were found to be either equal to or slightly greater than the actual values, the mean difference being low (0.02.)

This shows that the new equation is more precise for preditcion purposes.

Determination of the spiral angle of different Varieties of Cotton.

The standardised solvent exchange procedure for desiccating cotton fibres without allowing them to convolute, has been applied to a few more varieties of cotton belonging to the **G. arboreum** and **G. herbaceum** species. The values of X-ray angle and number of convolutions/mm of the solvent dried as well as the air-dried samples determined during the current year, are given in Table 13.

TABLE 13 : VALUES OF 50% X-RAY ANGLE AND CONVOLUTION PER MM OF AIR DRIED AND SOLVENT DRIED SAMPLES

Name of Cotton	50% X-ray Angle		Convolution/mm	
	Air Dried (A. D.)	Solvent Dried (S. D)	Air Dried (A. D.)	Solvent Dried ((S. D.)
V. 797	29.8	26.1	2.98	0.44
Sanjay	25.7	23.6	3.45	1.20
Sujay	27.9	24.3	3.50	0.86
Wagad	30.3	25.5	3.24	1.10
Jayadhar	28.7	23.6	3.87	0.67
AKH. 4	28.5	25.6	3.01	0.49
Suyodhar	28.5	25.1	4.03	0.85
K-9	27.5	25.2	3.49	1.17

Unlike the samples tested in the previous years, a near compelte absence of convolutions (i.e. less than 1/mm) could not be achieved for some samples in the present batch even after repeated solvent exchange trials undertaken to ensure complete desiccation. While the reasons for the partial formation of convolutions was not quite evident, it was surmised that immaturity which has been found to characterise these fibre samples might have enhanced their moisture affinity and thererby, lead to the formation of convolutions.

The X-ray angle for the air-dried controls for most of the samples was around 28° (Table 13). Absence of convolutions in the solvent dried samples produced a difference of only $3° - 4°$, unlike the case of **G. hirsutum** and **G. barbadense** cottons where the differences have been much higher. The main reason for the smaller differences might be the fewer number of convolutions characteristic of the present samples (3–4/mm).

Design and Fabrication of an Electronic Fibre Length Scanner

The work of mechanical fabrication has been completed and final assembly of the various components are in progress.

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

The measurement of single fibre linear density and tensile properties was completed for Suvin, AK.235 and Varalaxmi cottons. The broken ends of fibres were also examined under optical microscope and the distonces of the first reversal from the broken end were measured. Tensile breaks occuring

at a distance of 0.10 mm from a reversal point were classified as breaks occuring in the vicinity of reverseal.

It was observed that the percentage of fibre breakage in the vicinity of reversal was 34, 56 and 78, respectively for Suvin, AK.235 and Varalaxmi cottons. In this connection, it is worth noting that the reversal density per cm for the three cottons taken in the order mentioned above is 29, 23 and 27, respectively. It may, therefore, be inferred that fibres with a high reversal density need not exhibit a high probability of breaks occuring in the vicinity of reversals and **vice versa**.

Data on the tensile properties were analysed after segregating them according to whether the fibre broke around a reversal or away from it. It was observed that the averages of breaking tenacity, extension and linear density for the two sets of data did not show any difference in the case of the three cottons studied. This observation is consistent with the inference made in above para and also confirms the earlier reports that the observed drop in bundle tenacity at higher gauge lengths is not correlated with reversal density in cottons.

The most significant aspect of the present results was that the values of 50% X-ray angle for the solvent dried samples were nearly equal and that they were colse to the values observed for the **G. hirsutum** and **G. barbadense** cottons (range 23° – 26°). The results lead to the conclusion that value of original spiral angle in different varieties of cottons are nearly equal and that the pronounced spread in the X-ray angles in the air-dried state is largely attributable to the differences in the number of convolutions.

Studies on Enzymatic and Acid Hydrolysed Cotton Samples

Cotton samples treated continuously with the cellulase enzyme for 1, 3, 6 and 18 days as well as those treated repeatedly with the enzyme for 6, 12, 15 and 18 days (changing enzyme system after every 3 days), were examined for moisture regain and in transmission electron microscope (TEM).

The residual cellulosic material showed marked fall in moisture regain in the initial stage of enzymatic hydrolysis. The moisture regain value reduced from 6.5% in the control sample to 3.7% at the end of first cycle of enzyme treatment. However, the second and the thired cycle of cellulase enzyme treatment brought about only a marginal decrease in moisture regain indicating no change in percent crystallinity (which was also supported by X-ray studies) eventhough large amount of sugar with significant weight loss

had been produced. Further, repeated cellulase treatment for fourth, fifth and sixth cycles, caused progressive decrease in moisture regain.

The TEM study of cellulase treated samples revealed secondary cell wall with formation of open spaces in a fibrillar sheet and erosion of fibrillar surface at the end of first cycle of enzyme treatment. After continuous enzyme treatment for 18 days, considerable fragmentation of cell wall and sharper fibrillar image were observed.

Continuous enzyme treatment for 18 days also caused eventual formation of discrete needle shaped particles of 900 A° to 1100 A° length akin to hydrocellulose like particles. In the case of repeated cellulase treatment, the hydrocellulose like particles were obtained at the end of fourth cycle of cellulase treatment. The particle length progressively reduced with repeated enzyme action giving rise to maximum number of particles of length 500 A° to 700 A° after fifth cycle of treatment and 300 A° at the end of the sixth cycle of treatment. Even the drastic acid hydrolysis could not yield particles of 300 A° length.

The electron diffraction patterns of both sets of cellulase treated samples were recorded.

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

The strength uniformity ratio (USR), stiffness and toughness for all the 80 cottons were calculated and their simple correlations with crystallte orientation parameters were determined (Table 14).

TABLE 14 : SIMPLE CORRELATION CONEFFICIENTS BETWEEN CRYSTALLITE ORIENTATION PARAMETERS AND STRENGTH UNIFORMITY RATIO, STIFFNESS AND TOUGHNESS

Tensile Properties	Orientation Parameters				
	X-Ray Angles				fx
	20%	40%	50%	75%	
SUR	+ 0.2530*	+ 0.3911**	+ 0.4224***	+ 0.5305***	– 0.1942 +
Stiffness	– 0.7354***	– 0.8126***	– 0.8206***	– 0.7938***	+ 0.7975***
Toughness	+ 0.4010***	+ 0.6130***	+ 0.6634***	+ 0.7975***	– 0.3000**

Note : * Significant at 0.1% level ** Significant at 1% level**
*** Significant at 5% level + Significant at 10% level**

It is obvious from the Table that correlation with SUR increased with increase in X-ray angles and the correlation was highest with 75% X-ray angle and poorest with fx. Thus SUR showed a similar trend as that shown by elongation percent.

Correlations with stiffness were good for all the orientation parameters, 75% X-ray angle and fx. recording more or less the same correlation and 50% X-ray angle registering the highest.

Toughness also exhibited nearly the same trend as SUR and E%, viz., closer association with 75% X-ray angle and poor association with fx.

Among the factors other than orientation that could significantly affect the strength and elongation properties of the samples taken up for the study, it was decided to examine the role of maturity first. However, no significant correlation was obtained between this fibre property and strength – elongation characteristics.

Studies on Inheritance of Strength and Structural Parameters in Cotton Fibres

The samples selected earlier have been sown and the population were being raisd.

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

The orientation profiles of yarns of Suvin spun to 20s and 30s counts were recorded and analysed. The results confirmed that the effect of twist on the orientation profile is stronger in yarns of coarse counts. The orientation profiles of yarns spun to 20s, 40s, and 80s counts from Sudan cotton were similarly analysed. The conclusions were similar to those made for Suvin yarns. However, it was noticed that for yarns of comparable counts, the effect of twist was more evident in yarns of Suvin than in those of Sudan.

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

Seventy samples belonging to 1980 and 1981 seasons were tested for lustre index (contrast ratio). It was observed that the contrast ratio varied from 1.660 to 2.010 for **G. hirsutum** species, from 1.861 to 2.072 for **G. barbadense** species, from 1.408 to 2.010 for **G. arboreum** species, from 1.460 to 1.802 for **G. herbaceum** species and from 1.681 to 2.051 for hybrids. As one of the objectives of the study was to investigate whether locations, seasons and conditions of growth (irrigated/rainfed), etc. have any effect on

the lustre index of various cottons, the contrast ratio values of several samples of 17 varieties were determined and the results are summarised below :

Cotton	No. of Samples	Seasons	Range of Contrast Ratio	
1	2	3	4	
			Min.	Max.
Suvin	10	3	1.923	2.174
Buri 1007	7	2	1.667	1.961
AK. 235	6	3	1.739	1.905
Virnar	6	2	1.538	1.905
Jayadhar	8	3	1.550	1.724
Digvijay	11	3	1.613	1.802
Khandwa 2	12	3	1.754	1.923
Narmada	8	3	1.717	1.914
V. 797	6	3	1.556	1.724
J. 34	9	4	1.739	1.951
SRT. 1	10	2	1.818	1.923
C. Indore 1	8	3	1.667	1.870
L. 147	12	3	1.613	1.971
Hybrid 4	21	3	1.544	1.878
MCU. 5	24	5	1.835	2.041
Varalaxmi	26	3	1.810	2.051
Laxmi	23	4	1.606	1.990

It may be seen from the above table that the same variety exhibits different levels of lustre. Long staple cottons like Suvin, Varalaxmi, MCU.5 have higher contrast ratio as compared to short staple cottons like Virnar, Jayadhar, V. 797, etc.

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

The swelling and stretching treatments standardised earlier, have been carried out on a few more samples of normal viscose rayon. The treatment, as discussed in earlier reports, comprised swelling of the rayon yarn in alkali, stretching it to desired levels upto rupture and neutralising the alkali in the yarn while the latter was still under tension.

Different commercially available normal viscose rayon samples were treated in the above manner. The progressive changes in the tensile properties brought about by stretch were found to be quantitatively similar to what have been already reported on an earlier sample of rayon.

Table 15 gives representative test data on one of the many samples treated during the current year. For tensile tests the Instron was used. Twentyfive speciments were tested from each sample and the test length used was 10 cm.

TABLE 15 : TEST DATA ON NORMAL VISCOSE RAYON FILAMENT YARN SUBJECTED TO SWELLING AND STRETCHING TREATMENTS (SAMPLE 450/90 FROM NRC)

Sample	Linear density (denier)	Effective stretch $(\frac{D}{d}-1)100$	Tenacity (g/d) Cond. (Wet)	Br. Ext. (%) Cond. (Wet)	Stress at 5% ext. Cond. (Wet)	Yield stress (g/d)	Yield strain (%)	X-ray Orientation index $(\frac{1}{002})$
Control (Untreated Viscose)	444.6	—	1.96(0.83)	20.0(29.4)	1.00(0.15)	0.81	1.8	0.079
Slack	519.8	−14.5	1.12(0.50)	40.4(44.5)	0.50(0.05)	0.45	2.1	0.039
0% str.	477.0	− 0.1	1.17(0.50)	27.5(30.2)	0.61(0.10)	—	—	—
10% str.	407.5	− 9.1	1.49(0.67)	21.7(24.0)	0.71(0.15)	0.57	1.6	0.052
20% str.	366.1	21.4	1.79(0.87)	11.3(18.2)	0.89(0.25)	0.62	1.5	0.062
30% str.	337.3	31.8	2.03(0.98)	14.1(15.4)	1.08(0.47)	0.72	1.3	0.064
40% str.	315.0	41.1	2.22(1.19)	12.2(11.6)	1.22(0.50)	0.74	1.3	0.073
50% str.	294.8	50.8	2.44(1.29)	10.2(9.8)	1.51(0.62)	0.89	1.2	0.080
55% str.	287.6	54.6	2.41(1.30)	9.3(8.6)	1.57(0.72)	0.86	1.2	0.091

Tests were carried out in both conditioned (65% RH) and wet states. The reciprocal (1ϕ) of the 50% X-ray angel (ϕ) of 002 arc has been used as the orientation index.

The values of effective stretch S(%) calculated from the formula $S\% = \left(\frac{D}{d} - 1\right) 100$, where D and d are the linear densities before and after treatment, clearly shows that slack treatment leads to a longitudinal contraction of about 15%. A maximum stretch of 55% has been possible for the sample before it started breaking.

Yarn tenacity which showed reduction on slack treatment recorded progressive rise with stretch eventually reaching a value significantly above that of the untreated yarn. Similar increase is also found to occur in the stress at 5% extension (generally reffered to as "5% modulus" as well as the yield stress). A small but progressive decrease in yield strain is also quite evident. The most striking change, however, has been the fall in breaking extension which at the highest level of the stretch reduces to half the value of the untreated yarn. The changes in the mechanical characteristics seem to be marked by similar changes in X-ray Orientation Index. Detailed study of the structural changes in the treated samples is underway.

Studies on the Effect of Swelling Treatments on Yarn Irregularity with Special Reference to Uster Evenness Value (U%)

Yarn samples of 20s and 40s counts were treated with different concentrations of caustic soda under slack condition and then stretched to the original length by two different methods, viz. (i) dewaxing and kier boiling the yarns and (ii) using mercerol as wetting agent for the gray yarns and tested on Uster Evenness Tester for yarn irregularity. It was observed that there was no significant difference between the Uster value of the treated yarns and the control. However, in the case of yarns mercerised with wetting agent, the Uster value was significantly highter for both the counts as compared to their respective controls.

During the period, studies on the effect of KOH treatment on yarn regularity was taken up and two yarn samples of 20s and 40s counts were treated under salck condition with different concentrations of KOH, viz. 10%, 20%, 30% and 40% and then stretched to the original length. The treated yarns were tested on Uster Evenness Tester for yarn irregularity and on Uster Single Thread Strength Tester for yarn strength.

It was observed that there was no significant difference between the Uster value of the treated yarns and the control, although there was marginal decrease in U% in the case of 20s count and marginal increase in the case of 40s count. As far as single yarn strength was concerned, for both the counts, there was increase in the tenacity values and a decrease in the yarn elongation value on treatment with both NaOH and KOH. However, in the case of yarn mercerised with wetting agent, there was no change in tenacity values of treated sample and the control.

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

During the period, an attempt was made to fix up FQI ranges for various counts to get optimum CSP of 8.5 (C+200). Preliminary studies were carried out on 50 cottons, ten from each of the four species and ten sample

of Hybrids. The correlation between $\sqrt{FQI}$ and actual CSP was found to be $r = + 0.8507^{**}$. It may be mentioned that $\sqrt{FQI}$ was taken for correlation, as it was found earlier that CSP was better related to $\sqrt{FQI}$ than FQI. For confirmation of the results, controlled, experiments on 35 cottons spinnable to a wide range of counts from 20s to 100s were chosen (5 cottons for each count). Each cotton was spun to two counts and CSP was determined. Out of the two CSP values, one which was close to the optimum CSP was selected. The correlation between $\sqrt{FQI}$ and CSP was found to be $r = + 0.9485^{**}$. The corresponding regression equation worked out as $CSP = 12 (\sqrt{FQI} + 120)$. The data were further analysed and the range of $\sqrt{FQI}$ and FQI corresponding to optimum CSP for each count, were fixed (Table 16).

TABLE 16 : FQI RANGES FOR COTTONS SPINNABLE TO VARIOUS COUNTS AT OPTIMUM CSP

Count	Standard** CSP at CTRL by Bulk Spinning	Standard*** CSP by Shirley Miniature Spinning Plant at Surat Unit	$\sqrt{FQI}$ Range (Average)	FQI Range (Average)
1	2	3	4	5
20s	1870	1540	37.5 – 42.5 (40)	1410 – 1810 (1600)
30s	1955	1610	40.5 – 45.5 (43)	1640 – 2070 (1850)
40s	2040	1680	44.5 – 49.5 (47)	1980 – 2450 (2210)
50s	2125	1750	50.5 – 55.5 (53)	2550 – 3080 (2310)
60s	2210	1820	62.5 – 67.5 (65)	3910 – 4560 (4225)
80s	2380	1960	76.5 – 81.5 (79)	5850 – 6640 (6240)
100s	2550	2100	88.5 – 93.5 (91)	7830 – 8740 (8280)
120s	2720	2240	100.5 – 105.5 (103)	10, 100–11, 130 (10, 609)

** Formula for Standard CSP (for CTRL) : $CSP = 8.5 (C+200)$
*** Formula for Standard CSP (For Surat Unit) : $CSP = 7 (C+200)$
Drafting System used at CTRL : SKF or LR (Carded)
Twist Multiplier used in CTRL : 3.75 for above 50s count
4.00 for 30s – 50s count
4.25 for 16s – 28s count

In addition, the data for 35 medium staple cottons were analysed for FQI and spinnability and it was observed that the equation $CSP = 12 \times (\sqrt{FQI} + 120)$ could be used successfully for assessing the spinning potential of medium staple cottons as seen from Table 17.

TABLE 17 : FIBRE PROPERTIES, FQI AND CSP VALUES FOR TYPICAL MEDIUM STAPLE COTTONS

No.	Variety	2.5% Span Length (mm)	50% Span Length (mm)	Weight of Fibre beard (mg)	Strength $\frac{1}{8}$" gauge length (g/t)	Micronaire Value (μg/in)	Maturity Coefficient	FQI Modified (I_1)	FQI (I_1)	FQI-SITRA (Q_1)	CSP Observed	CSP Predicted from the formula $12(I^1 + 120)$	CSP Predicted from the formula $(310-C)Q_1$	Count Spun
1.	197 – 3	23.9	11.6	111.7	26.8	5.6	0.84	1584	39.8	46.2	1844	1918	1972	20s
2.	Jayadhar	23.1	11.1	98.3	22.9	5.5	0.90	1576	39.7	41.6	1842	1885	1870	20s
3.	DH. 22	23.8	12.1	120.0	30.0	5.9	0.80	1718	41.4	49.6	1966	1937	2042	20s
4.	MU. 2. C. 9	25.0	11.5	81.8	21.8	4.2	0.77	1818	42.6	46.2	1852	1866	1971	20s
5.	AK. 277	23.5	11.4	76.3	27.6	5.1	0.90	2066	45.4	55.1	2024	2011	2155	20s
6.	G. 2525	25.1	12.4	99.1	20.6	4.2	0.84	1657	40.7	50.4	1915	1923	1987	30s
7.	Digvijay	22.2	11.3	82.8	26.4	3.6	0.63	1772	42.1	52.8	1955	1945	2035	30s
8.	Sanjay	24.4	11.9	80.3	27.0	4.4	0.90	2091	45.7	65.5	2051	2027	2266	30s
9.	170. CO2	26.8	12.2	95.4	20.6	3.8	0.86	1884	43.4	56.7	1981	1961	2109	30s
10.	G. 11	25.9	12.8	113.4	26.9	4.7	0.80	2042	45.2	58.8	1923	1982	2147	30s
11.	Deviraj	26.2	12.5	102.5	21.5	4.2	0.82	1800	42.4	52.6	1952	1949	1958	40s
12.	G. Cot. 11	26.2	12.9	101.9	30.4	4.9	0.81	2666	51.6	65.1	2028	2060	2178	40s
13.	Digvijay	25.0	12.3	90.3	30.4	3.2	0.73	2580	50.8	85.2	2032	2050	2492	40s
14.	SRT. 1	28.1	13.6	92.8	24.6	4.7	0.86	2846	53.3	61.3	2190	2080	2036	50s
15.	CPH. 4802	27.2	13.4	101.3	25.7	4.6	0.87	2515	50.2	65.7	2125	2042	2107	50s

Correleation Coefficient values Between $\sqrt{FQI}$ and CSP Values :

rab	–	+0.83 **
rac	–	+0.64 **
rad	–	+0.85 **
rae	–	+0.47 **

** – Significant at 1% level

a – Observed CSP

b – $\sqrt{FQI}$ (Modified CTRL formula)

c – $\sqrt{FQI}$ (SITRA formula)

d – Predicted CSP From Modified CTRL formula

e – Predicted CSP from SITRA formula

The correlation between CSP calculated from the above equation is better related to observed CSP than that calculated from established SITRA formula.

Open-End Spinning of Indian Cottons and Cotton Wastes

Four different methods of carding, viz. (i) single card with conventional clothing (SCC), (ii) single card with metallic clothing (SCM), (iii) double carding with conventional clothing (DCC) and double carding with metallic clothing (DCM) were used for producing slivers from a high trash content mixing and these slivers had been used for production of 20s yarn on OE machine.

The OE yarns from all combinations and the SCC ring spun yarns were doubled at three levels of doubling twist of 11.2, 14.3 and 16.7 TPI being used for OE yarns and the middle level used for ring spun yarns. The single yarns were also used for production of a plain handloom fabric. The doubled yarns with 14.3 TPI were also slack mercerised on a laboratory model mercerising unit and stretched to original length. The doubled yarns were tested for various yarn characteristics.

The yarn test results are given in Tables 18 and 19. Fabric tests did not reveal any significant difference between the various combinations except for a loss in strength of 6%–8% for fabrics made out of OE yarns compared to that made from ring spun yarns.

TABLE 18: TEST RESULTS OF DOUBLED YARNS

Particulars	SCC (Ring)		SCC (OE)		SCM (OE)		DCC (OE)				DCM (OE)		
Doubling TPI	14.3	11.2	14.3	16.7	11.2	14.3	16.7	11.2	14.3	16.7	11.2	14.3	16.7
Tenacity (g|t)	13.7	9.9	10.9	10.5	10.2	11.0	11.4	9.1	11.4	11.4	10.5	10.9	11.9
Elongation (%)	8.2	9.6	9.2	11.0	9.6	9.7	10.0	8.0	9.9	10.2	9.2	9.2	10.8
U%	11.7	9.9	9.1	9.5	9.5	8.8	9.5	9.3	8.9	8.5	9.0	9.0	9.2
Neps/100 M	27	6	10	2	4	3	8	5	3	3	1	4	2

TABLE 19 : TEST DATA ON MERCERISED DOUBLED YARN – (DOUBLING TPI : 14.3)

Particulars	Ring		SCC		DCC		DCM	
	Control	Merc.	Control	Merc.	Control	Merc.	Control	Merc.
Tenacity (g|t)	15.4	17.1	12.1	13.7	12.7	13.6	12.7	14.6
Elongation (%)	9.0	7.2	9.5	7.5	9.2	7.2	9.5	7.5
Improvement in Tenacity (%)		10.0		13.2		7.1		15.0
Elongation Retention (%)		80.0		79.8		78.3		78.9

Studies on Lakshmi – Rieter Drawing and Speed Frames

During the year, studies on optimisation of processing factors on can-fed intermediate were started. Varalaxmi cotton used earlier for drawframe studies, was processed through blow room, carding and through two passages of high speed Laksmi-Rieter drawframe using break drafts of 1.7 and 1.3 for the first and second passages, respectively. The zonal settings on drawframe were 39 mm in the front and 44 mm in the back, as found suitable by earlier trials. The drawframe sliver was then divided into three parts A, B and C and these were then processed to 3 hk roving on the intermediate frame using break drafts of 1.21, 1.52 and 1.76, respectively with a back zone settings of 40 mm. The rovings were then supn to 80s count and tested for yarn characteristics.

The test results from carding to yarn for the various samples are given in Table 20.

TABLE 20 : PROPERTIES OF THE DRAW-FRAME SLIVER AND PROCESSED MATERIALS

Particulars of	A	B	C
Break Draft	1.21	1.52	1.76
Card Sliver U%	4.1	4.1	4.1
Draw Frame Sliver II U%	3.6	3.6	3.6
Roving U%	7.2	7.2	7.1
Yarn U%	17.8	19.0	19.7
Neps/100 M	200	212	214
Lea CSP	2298	2356	2372
Single Yarn Tenacity (g/t)	16.8	16.7	17.0
Breaking Elongation (%)	6.7	6.8	6.9

As seen from the table, no significant difference is noticed in roving, U% or yarn strength and elongation between the materials from different break-drafts. However, the lowet break draft has produced yarns of better regularity. Further trials will be undertaken next year.

Optimal Blending of Standard Varieties of Indian Cottons

During the period under review, the spinning of blend No. M6 (Laxmi – 30%, B. 1007–20% and L. 147–50%) as well as on M10 (Laxmi–50%,

B. 1007–30% and L. 147–20%) were completed. Processing and spinning to 20s and 30s of Laxmi, B. 1007 and L. 147 individually using shortened sequence of processing and spinning on both LR and SKF drafting was also completed. With this, studies on medium staple cottons are over.

Processing and spinning of 197-3 and Virnar, belonging to the short staple group of Maharashtra was then done, the yarns being spun to 12s and 16s on LR drafting system.

Test results of yarns spun from Laxmi, B. 1007 and L. 147 are given in Table 21 and the results for yarns from 197-3 and Virnar are given in Table 22.

TABLE 21 : PROPERTIES OF YARNS SPUN ON LR AND SKF DRAFTING SYSTEMS FROM LAXMI, B. 1007, AND L. 147

Code No.		M. 7		M. 8		M. 9	
Variety		Laxmi		B. 1007		L. 147	
Nominal Count	(Nc)	20s	30s	20s	30s	20s	30s
Corrected CSP	LR	2260	2136	2162	1923	2048	1869
	SKF	2344	2190	2090	1929	2172	1872
Single Yarn Tenacity (g/t)	LR	15.0	14.0	14.1	12.6	13.8	12.7
	SKF	14.6	13.2	13.8	11.7	13.6	11.6
Breaking Elongation (%)	LR	7.8	7.0	6.2	5.5	6.6	5.7
	SKF	8.3	7.6	6.8	5.5	7.1	5.3
U%	LR	13.4	15.4	14.1	16.2	14.3	16.9
	SKF	12.4	15.6	13.9	16.6	15.4	17.2
Neps/100 M	LR	73	83	160	132	106	130
	SKF	58	79	94	129	105	128
ASTM Appearance	LR	+ D	+ D	D	+ D	D	+D
	SKF	+ D	+ D	D	D	D	D

TABLE 22 : YARN PROPERTIES OF 197-3 AND VIRNAR SPUN ON LAKASHMI RIETER DRAFTING SYSTEM

Code No.	C. 1		C. 2	
Variety	197-3		Virnar	
Nominal Count (Nc)	12s	16s	12s	16s
Corrected CSP	1842	1744	2045	1869
Single Yarn Tenacity (g/t)	11.6	11.4	12.9	11.9
Breaking Elongation (%)	7.0	6.6	7.2	6.1
U%	16.2	17.0	15.9	16.2
Neps/100M	19	21	14	21
ASTM Appearance Grade	+ B	+ B	+ B	+ B

Blending of Cotton with Man-made Fibres

Though blends of cotton with man-made fibres were not tested due to non-availability of man-made fibres, studies on blends of viscose and polyester staple fibre were carried out by both OE and ring spinning. The blends were pertaining to the original mixes that were used in three mills, from where flat strips had been obtained and processed during last year and the results of which had already been reported. The spinning particulars for ring and OE spinning were kept consistently the same as those used for the flat strips so that valid comparison could be made. As in the case of earlier trials, it was found that the ring-spun yarns from ployester-viscose blends are stronger than the OE yarns by about 24% to 30%. Unlike cotton spinning, the OE yarns do not show better regularity than ring spun yarns except in the case of flat strips from one particular mill. In this case, the ring spun yarns were very irregular and neppy compared to OE yarns. Thus, in general, no specific advantage seems to result from OE spinning for man-made fibre blends except for the high productivity.

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

Earlier work on mercerized and crosslinked cotton yarns had established that dynamic modulus and tensile recovery parameters such as immediate elastic recovery and work recovery are highly correlated and that their relationship is specific to the type of treatment.

The control sample, viz. dewaxed and kierboiled leas of L. 147 cotton (30s count), was subjected to mercerization with and without stretch. The sample designations were : (1) DKMs (Slack mercerized sample) (2) DKM-8% (stretched to 92% of the original length) (3) DKM-0% (stretched to original length) and (4) DKM 3% (stretched to 103% of the original length). The control was also cross linked with HCHO and DMDHEU, the former by the Form 'W' process and the latter by the pad-dry cure method. Three alternative concentrations, viz. 1%, 3% and 5%were used in both the resin treatments The sample designations were XH1% XH3% and XH5% in the case of HCHO and XD1% XD3% and XD5% for the DMDHEU treated samples. The bound HCHO was determined by chemical means while N% for DMDHEU treated samples was measured by the infrared method based on the carbonyl absorption.

The crease recovery angle (CRA) was measured on yarn pads by a procedure employing the Metrimpex CR tester, earlier standardised at CTRL. The yarn pad samples five at a time, were mounted on Metrimpex CR tester in the same manner as the fabric samples mounted for the test. As per ASTM prodedure the CRA values were determined after applying a load of 500g on each specimen for 5 minutes and allowing the sample to relax for 5 minutes. Ten specimens were tested from each sample and the average value of CRA is reported in each case. The values of dynamic modulus of the control and treated samples already reported last year, were used in the present analysis.

TABLE 23 : MERCERIZED SAMPLES

Sample	Dynamic Modulus (g/d)	CRA (degrees)
Controal	73.2	70
DKM	34.9	72
DKM – 8%	56.4	79
DKM 0%	82.0	98
DKM + 3%	94.3	97

Table 23 summarizes the results on mercerized samples. CRA of slack mercerized yarn did not show any appreciable change with respect to the control. With increasing stretch during mercerization the dynamic modulus and CRA showed progressive increase. It is quite evident that dynamic modulus is highly correlated with CRA, in other words with the bending recovery.

The results obtained on control, crosslinked with HCHO and DMDHEU of various concentrations are reported in Table 24. The dynamic modulus of cross-linked sample showed an increase in its magnitude with respect to control, the increase being severe on highly cross linked sample as indicated by bound HCHO and N (%) content. This could be due to the rigid structure of fibres within, arising out of introduced crosslinks.

TABLE 24: DATA ON BOUND HCHO/DMDHEU, DYNAMIC MODULUS AND CRA SAMPLES TREATED AT VARIOUS CONCENTRATIONS

HCHO				DMDHEU			
Sample	Bound HCHO	Dynamic Modulus (g/d)	CRA (degrees)	Sample	N%	Dynamic (g/d)	CRA (degrees)
Control	–	73.2	70	Control	–	73.2	70
XH 1%	0.28	96.03	73	XD 1%	0.38	74.4	131
XH 3%	0.71	106.2	85	XD 3%	1.38	102.6	137
XH 5%	1.22	111.6	93	XD 5%	1.44	119.2	145

It is apparent from the Table that the CRA increased with degrees of crosslinking in both the reagents. For a given treatment there existed a very high correlation between the dynamic modulus and the CRA. So the changes in sonic modulus could as well be used as a substitute for bending recovery change resulting from a given chemical modification.

Study of Uniformity of Blend Composition in Polyester/Cellulosic Blends

The infrared (ir) method developed earlier for the analysis of cotton/polyester blends has been used for the analysis of viscose/polyester blends and a new calibration graph was obtained for the same.

A minimum yarn length of 40 cm – 50 cm is required for a single test by ir method. Hence short range variations (of the order of fibre length – 4 cm) could not be studied by the ir method. However, a study of medium range and long range variations in blend composition of the polyester/viscose blended yarn having blend composition (nominal) 15/85 was completed for both blow-room blended original material and flat strips. For medium range variation, about 20 tests were done on each sample, while for long range variation 15 tests were done for each of the two samples studied. The sample for the medium range variation study consisted of segments of length of about 40 cm each taken out continuously from a given lea of the particular blend while for long range variation study, segments of about 40 cm length were removed at the intervals of 28 m.

Table 25 gives the average value of the blend composition along with CV (%) for the four different samples tested (all of nominal blend composition – 15% polyester and 85% viscose).

TABLE 25 : AVERAGE BLEND COMPOSITION AND C. V. (%) FOR THE MEDIUM RANGE VARIATION TEST ON POLYESTER/VISCOSE YARNS

	Original Material		Flat Strips	
	Open End	Ring Spun	Open End	Ring Spun
Average Polyester Content	15.2	14.8	14.2	14.0
C. V. (%)	5.8	8.02	5.8	5.5

It is interesting to note that the average value of the blend composition has very close agreement with the nominal value; the C.V. (%) also is not very high. Between open end and ring spun yarn samples, the C.V. is slightly lower for the former. The individual test data (not included in the table) in no case showed a variation that exceeded ± 3% from the average. The results for the long range variations were almost similar. This indicates that both open end and ring spinning of the original material and the flat strips produce uniform blends when polyester is blended with viscose staple in the 15/85 proportion. Work on the other blends is in progress.

Study of Inverse Relaxation/Stress Recovery Property of Cotton and Other Textile Fibres

A cotton (PSH. 4804) in the fibre and spun yarn (30s count) forms, was tested for inverse relaxation. Initially the breaking load and percentage breaking extension of the fibre and yarn were determined, and then, the fibre and yarn samples were tested for 4% extension and 1% retraction levels.

Inverse relaxation tests for the yarn (50s count) of PSH.4804 cotton were carried out for various levels of retraction at the 4 levels of extension, viz. 2%, 3% 4% and 5% of the gauge length (50 cm). Inverse relaxation was determined for a polyester staple yarn – jailene (50s count) – at various levels of retraction corresponding to the four levels of extension of 2%, 4%, 8% and 12% of the gauge length. Tests on viscose staple yarn (35s count) at various levels of extension and retraction are in progress.

All these tests show a similar trend in inverse relaxation behaviour. Upto a certain (small) level of retraction at any extension, there is only stress relaxation. Then, there is a transition zone in which there is a slight increase in load after inverse relaxation which is almost stable for a small duration of time and then decreases before stabilizing. Beyond the transition i.e. for retraction levels greater than transition zone, there is nothing but inverse

relaxation. This goes on increasing with increasing retraction level upto a maximum and then decreases. When the retraction level is greater than the combined recovery for the particular extension level, inverse relaxation becomes zero.

The following fibre samples were tested for breaking strength and breaking extension (average of 100 tests) : (1) Ramie-double degummed, cation softened, (2) Polyester-Cafi-2 Denier, 51 mm, (3) Viscose staple-2 Denier, 51mm.

Response of Cottons to Pre-swelling and Cross-linking Treatment and Influence of Ultra-and Fine Structure on Mechanical Properties of Treated Cottons

Investigation on the influence of two parameters, viz. fibre cross sectional circularity and X-ray angle on mechanical properties of different cottons was carried out. For this purpose, nine cottons, viz. 320 F, Khandwa 2, LSS, Sea Island, G. 1422, Suyodhar, Sujay, Westerns 1 and V. 797 were selected. Table 26 gives values of circularity and 50% X-ray angle of different cottons.

TABLE 26 : CIRCULARITY AND 50% X-RAY ANGLE OF THE NINE COTTONS SELECTED

Sr. No	Variety	Circularity	50% X-Ray Angle L
1.	320 F	0.668	26.7
2.	Khandwa 2	0.883	22.8
3.	LSS	0.817	26.7
4.	Sea Island	0.774	31.5
5.	Sujay	0.874	27.3
6.	Westerns 1	0.802	25.8
7.	V. 797	0.746	28.3
8.	Suyodhar	0.636	26.1
9.	G. 1422	0.797	28.3

Further studies on convolution angle, fibril reversals, mechanical properties, etc. are in progress.

Ten Indian Standard Cottons were given cross linking treatment to evaluate their response to cross linking treatment. The cottons mentioned in Table 27 were found to be well balanced in respect of Nitrogen content, tenacity and elongation retention and crease recovery angle (CRA) after the treatment.

TABLE 27 : NITROGEN CONTENT, TENACITY RETENTION, ELONGATION RETENTION AND CRA OF SELECTED COTTONS

Variety	N%	Tenacity Retention (%)	Elongation Retention (%)	CRA
1	2	3	4	5
Digvijay	0.84	48.2	65.5	121
Bhagya	0.82	43.4	65.7	116
Maljari	0.82	46.8	63.9	–
Srisailam	0.81	46.6	60.0	117
H. 777	0.82	41.3	62.7	115
Hampi	0.83	42.4	60.6	118

Seven cottons pertaining to early breeding material received from Central Institute for Cotton Research, Nagpur were screened for response to cross-linking treatment. The values of tenacity and elongation retentions are given in Table 28.

TABLE 28 : TENACITY RETENTION AND ELONGATION RETENTION VALUES OF BREEDING MATERIAL RECEIVED FROM CICR

Sample No.	Tenacity Retention(%)	Elongation Retention (%)
1	41.0	56.1
2	49.2	77.2
3	33.3	59.1
4.	39.8	67.1
5	39.7	67.7
6	43.7	69.6
7	44.4	58.4

It can be seen from the above Table that sample No. 2 and 6 had good retention in respect of both tenacity and elongation, whereas sample No. 4 and 5 had good elongation retention with low tenacity retention.

With a view to establish relationship between CRA and DP, fabrics having three different constructions, viz. Sheeting, Poplin and Drill were selected and given DMDHEU treatment in six different concentrations viz. 4% 8%, 10%, 12%, 15% and 20% for obtaining a wide range of CRA and DP appearance rating.

The analysis of the data revealed that in the case of all the three fabrics, there was good correlation between CRA and DP rating.

To investigate the effect of mercerisation on OE yarns, the yarns were mercerised with 20% NaOH for 3 min under slack condition and for 2 min after stretching it to normal length. These mercerised and untreated yarns were evaluated for tenacity and elongation. The result indicated that there was tenancity retention varying from 107% to 115% and elongation retention varying from 78% to 80% after mercerisation.

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

During the period under report, scoured, bleached and mercerised cotton poplin fabric samples were crosslinked with 10% of DMDHEU in the presence of mixed catalyst systems and additive such as 2% solution of polyethylene emulsion as softener and 0.1% wetting agent. The mixed catalyst systems were as given below :

(i) 2.5% $Al_2(SO_4)^3 . 16 H_2O$ + 1.0% Citric acid monohydrate .....A
(ii) 0.5% $Al_2(SO_4)_3 . 16 H_2O$ + 1.5% Citric acid monohydrate .....B

All the treated samples were dried at 60°C for 7 min and cured at two different temperatures, viz. 140°C and 160°C. After curing, all the samples were throughly washed and dried.

The samples were then evaluated for resin add-on, nitrogen content and physical properties including D. P. ratings, wrinkle recovery angle (WRA), breaking strength and tearing strength.

From the results it could be seen that DP ratings and WRA for both the sets of samples were markedly improved. The fabrics samples treated in the catalyst system 'A' showed higher DP rating and lower strength retention as compared to that in 'B'. In both the cases, the samples cured at 140°C showed higher breaking and tearing strength retention compared to the samples cured at 160°C.

Study on Migration of Cross-Linking Resin Finishes during Durable Press Finishing Treatments of Cotton and Cotton Blended Fabrics

(i) Migration behaviour of DMDHEU resin was studied during the cross-linking of cotton fabrics in the presence of a mixed catalyst of 1.0% $Al_2(SO_4)_3 . 16H_2O$ and 2.5% Citric acid monohydrate. Resin padded cotton fabric samples were dried for different periods varying from o min to 60 min and cured at 140°C for 10 min. The cross-linked samples were studied for rate of drying, migration of resin, and nitrogen content. From the results it was observed that the rate of drying and agent migration varied from 14.7% (5 min) to 38.8% (60 min) and from 20% (5 min) to 53% (60 min), respectively.

These results were compared with the results from earlier treatments in which 2.0% of mixed catalyst was used. It was observed that in the case of higher concentration of catalyst (3.5%), the rate of water drying was higher at any given time. If the case of migration of resin, samples treated with 2.0% of mixed catalyst showed slightly higher migration (19.8%) in the beginning, compared to the samples treated with 3.5% catalyst (16.2% migration).

Data obtained on resin migration using different softener on cotton terene blends were analysed.

(ii) Data on various physico-chemical properties of cotton yarn samples, mercerised under varying tensions and cross-linked with formaldehyde by 'D' and 'W' bath were analysed. From the results it was seen that in both the processes, as the percentage of stretch increased, the formaldehyde content and the breaking elongation decreased while the breaking strength and distention index increased. Formaldehyde and distention index values of samples cross-linked in 'W' bath were higher than those in 'D' bath. This may probably be due to longer reaction time allowed in the case of 'W' bath.

Studies on Grafting of Vinyl Monomers on to Cotton Fabrics

Scoured, bleached and mercerised, poplin cotton fabric used for grafting treatments was desized before the treatments. Cotton fabric of 22 cm × 28 cm size was fixed in the S. S. frame specially prepared for this treatment. Acrylonitrile monomer washed with 8% NaOH and freed from alkali by washing with distilled water and distilled under vacuum was used for grafting treatment. Ceric ammonium nitrate (0.005M) was used as initiator in 1 : 50, M : L ratio for this treatment. The fabric fixed in the frame was immersed with the initiator solution in the S.S. Tray and acrylonitrile monomer was added in the bath in different M-L ratios. The reaction tray was kept for varying periods of time with occasional shaking. After the reaction period was over, the fabric was taken out, washed thoroughly with soap solution and then with water. The fabric was allowed to dry and then it was extracted with acetone in soxhlet extractor to remove ungrafted monomer.

The fabric was dried in oven at 100°C and the percent graft calculated. Percent graft varied from 4% to 16% depending on percentage of monomer used and the reaction time. The fabric samples were tested for breaking strength on vertical cloth tester. Fabric with upto 10% graft showed slight improvement in strength while there was slight fall in strength above 10% graft. Further tests on these samples are in progress.

Finishing of Cotton and Cotton Blended Fabrics with Resin and Metallic Monomers

During the period under report, scoured, bleached, mercerised and desized cotton fabrics were given a simultaneous cross-linking and polymerisation treatment. The finish consisted of 8% DMDHEU. 1% softener, 0.1% wetting agent, 0.25% N – N methylene-bis-Acrylamide, 0.5% $K_2 S_2 O_6$ and zinc monomers of acrylic, methacrylic and itaconic acids. The monomers were prepared by combining one eq. of zinc oxide with one mole of the above mentioned acids. The treated fabrics were dried at 120°C for 10 min and cured at 160°C for 3 min.

For comparision purpose, four DMDHEU treated fabrics were prepared and evaluated as controls, of which three were prepared at conventional 8% level in the pad bath (with 1% softener) and was catalysed., by : (1) 0.5%$K_2S_2O_3$ (2) 0.8% Zn (NO_3) 6 H_2 O (3) 4% Glycolic acid.

The fourth one was given a conventional treatment using 3% DMDHEU 0.45 Softener and 1.5% $MgCl_2$ 6 H_2 O. These fabrics were dried at 80°C for 7 min and cured at 160°C for 3 min.

These finished samples and the DMDHEU controls were evaluated for various physical and chemical properties such as resin add-on, DP rating, conditioned and wet WRA, breaking strength and elongation, nitrogen and formaldehyde content.

The combinations of DMDHEU with zinc monomers of acrylic, methacrylic and itaconic acids resulted in durable press performance of cotton fabrics with higher retention of strength compared to the conventionally treated samples.

Durable Flame Retardant (FR) Finishes for Textiles

FR finish to cotton fabrics was imparted by phosphorylation treatment using easily available, non-durable agents Diamonium hydrogen orthophosphate (DAP) and urea. To increase the wash fastness of finish, trials were undertaken using the FR agents in combination with cross-linking agents. Two cross-linking agents, DMDHEU and Epichlorohydrin were tried. The perfomance of Epichlorohydrin was better as regards FR characteristics but the strength loss was higher. Hence, a new reactive polymer, Hydrosyn, was tried.

The fabric was immersed in a bath containing DAP, Urea, Hydrosyn, wetting agent and silicone emulsion and was padded, dried and cured at 150°C for 30 min.

The efficiency of this treatment was assessed by comparing the flamability characteristics with those of the fabrics treated with conventionally durable FR agent, pyrovatex CP. The fabric sample was soaked in a bath containing pyrovatex, melamine, phosphoric acid, a wetting agent and a softener. After padding to a pick-up of 65% – 70%, the fabric was dried at 120°C and cured at 145°C for 4½ min. The treated sample was washed with warm sodium carbonate solution.

Add-on of percents of both the treated fabrics are found to be nearly equal (12% – 14%). Pyrovatex treated fabrics retained their original strength, whereas phosphorylated – hydrosyn treated fabrics showed a better hand, retaining 70% of the orignal strength. Retention of tearing strength was also found to be better in the present treatment as against that of pyrovatex.

Further, phosphorylated hydrosyn treated fabrics showed improvement in CRA (248°) and the same was unaffected by severe washings. Better flamability characteristics like (higher Limiting Oxygen Index (LOI) was achieved by pyrovatex, while phosphorylated – hydrosyn treated fabrics lost unreacted FR agent in the first severe wash itself; subsequent washings had no effect. However, it could be possible to achieve certain permanency in FR finish without undergoing any detrimental effect on other fabric properties.

Preliminary Mill trials were conducted for phosphorylated hydrosyn treatment in two Mills in Bombay. The FR finishing treatment given to the fabrics in the Mills showed LOI of 28.0% which after severe washes decreased to 23.0%. As there was some practical difficulty to maintain the curing conditions of 150°C for 30 min the same has been modified to 170°C for 4 min in subsequent trials. Since the mill strike was going on in Bombay, further trials were carried out at two Mills in Ahmedabad. The analysis of the FR finished fabric exhibited similar trend as that of Laboratory trials in respect of LOI (20% to 41%), breaking strength retention (Warp way – 65% to 75% and Weft way – 65% to 96%) and CRA (228° to 239°).

Analysis and Grading of Cotton Linters

The popular cottonseed varieties from different regions of Maharashtra State were collected. The varieties H. 4 from Nanded and Akola, B 1007 and L. 147 were delinted on the Laboratory Model Delinter.

Ten commercial samples of linters were tested for ash content, iron content and acid insoluble matter content in raw state and after purifying by kiering and bleaching. Cellulose yield and cellulose content were determined on the purified linter and samples.

Preliminary trials were carried out to reduce mineral content in defibrated linters. The samples were hydrolysed with three different concentrations (1%,

3% and 5%) of HCL and H_2SO_4 at two different temperatures, viz. about 30°C and 50°C. The hydrolysed samples were kiered and tested for ash and iron contents. The mineral content did not decrease, as expected, however, the experiment is being repeated using demineralised water.

To ascertain the relationship between trash content and iron content, four linter samples were tested for trash content by Shirley Analyser and iron content by Thiocyanate Method using Lovibond Comparator. No definite trend was observed.

For the proposed plan of survey of existing delinting units in India, a suitable questionaire was prepared. The survey work in Maharashtra State was completed. In all, eight delinting units in Maharashtra State were visited.

The general findings of the Survey are presented below :

1) Almost all the delinting factories in the State were rather small, having 6 to 9 delinting machines.
2) Tre delinting was carried out seasonally from December to March.
3) The storage conditions for cottonseed as well as linters were not satisfactory.
4) All the seeds purchased were not delinted as the delinting depended on the export demand of decorticated cottonseed cake.
5) The delinting units were operated by unskilled persons.
6) Usually mixed varieties of cottonseeds were delinted.
7) The linters produced were not free from foreign matter such as seed coats, dust particles, etc.
8) The linters produced were not tested for quality, but directly sold to paper manufacturers or agents.
9) The linter producers were not aware of testing standards.
10) There is wide spread dissatisfaction about the low price offered for linters even if the same is cleaned.

Fatty Acid Composition of Cottonseed Oil of Different Varieties

In all, oil content of 13 cottonseed samples was determined. In the case of seven samples of Varalaxmi seeds obtained from different locations, oil content varied from 16.16% (Kolhapur) to 19.6% (Padurgalla). In the case of six samples of Hybrid 4 seeds, oil content varied from 17.25% (Pachora) to 19.40% (Khargaon).

Twenty six samples of cottonseed oil was tested for fatty acid composition. There was considerable variation in the major components, viz. Palmitic, oleic and linoleic acids. Palmitic acid varied from 22.64% (EL. 87056) to 26.68% (1645). Oleic acid varied from 14.40% (I G L. 68-3) to 25.32% (G. Cot. 10). Linoleic acid varied from 43.51% (G. Cot. 10) to 57.35% (Varalaxmi – Raichur).

Variation in fatty acid composition of cottonseed of 7 varieties of Varalaxmi from different locations are given in Table 21.

TABLE 29 : FATTY ACID COMPOSITION OF VARALAXMI SEEDS FROM DIFFERENT LOCATIONS

Place	Oil Content (%)	Fatty Acid Content (%)					
		Myristic	Palmitic	Palmit-oleic	Stearic	Oleic	Lino-leic
1. Avinashi	18.88	0.91	24.77	0.66	2.99	19.66	51.01
2. Phalton	16.81	0.76	24.71	0.70	2.71	19.77	51.35
3. Ahamednagar	17.90	0.73	24.12	0.55	2.52	20.45	51.63
4. Kolhapur	16.16	0.86	23.81	0.72	3.25	18.33	53.03
5. Pidugurla	19.63	0.67	22.07	0.64	2.64	19.06	54.92
6. Sabarkanta	18.06	0.72	22.05	0.59	2.78	17.73	56.13
7. Raichur	19.18	0.66	21.67	0.66	2.61	17.05	57.35

Fatty acid analysis of Kapok seeds of two varieties obtained from the Director, School of Genetics, Coimbatore was carried out on GLC. The two varieties showed presence of all the fatty acids generally present in cottonseed oils. These varieties also showed mark difference in oleic and linoleic acid contents.

The local variety had 24.1% oleic and 42.0% linoleic acids while Singapore Kapok had 27.3% oleic and 39.4% linoleic acid. These samples were free from gossypol pigment.

Utilization of Cotton Plant and Cottonseed By-Products with Special Reference to Cottonseed Hull

During the period under report, cottonseed hull was ground in pulveriser and mixed with a solution of the binding resin in different concentrations that varies from 0% to 15% and a catalyst. The concentration of catalyst was kept constant. The samples were then suitably adjusted for moisture content before preparing the particle boards. The boards were pressed at constant pressure and temperature for 5 min. The size of the board prepared was 15 cm X 15 cm

The above particle boards were tested for moisture content, density, water absorption, tensile strength and bending strength. It was observed that boards prepared using varying resin concentrations showed marked variation in their properties. The boards prepared keeping moisture content at 20% showed gradual increase in tensile strength and modulus of rupture with increase in resin content.

Moisture content and water absorption of these boards showed gradual decrease and density showed gradual increase with increase in resin concentration.

The results are being analysed.

Esterification and Isolation of Fatty Acids especially Palmitic, Oleic and Linoleic from Cottonseed Oil.

During the period, the cottonseed samples were collected for oil extraction by solvent extraction method. The oil was extracted and esterified to prepare mixtures of pure acids from the oil. Mixture so obtained was saponified. Attempts are being made to isolate the pure acids from the saponified mixtures of acids by fractional crystallisation.

Studies on Biosynthesis of Cellulose by Microorganism and Higher Plants

Experiments on the biosynthesis of cotton were repeated using C – 14 – labelled uridine diphosphoglucose (DPG–C 14) and particulate enzyme obtained from cotton fibres at different stages of development.

The electron diffraction patterns on cotton fibres obtained from 5, 10, 15 and 20 days old cotton bolls were recorded. It was observed that the ED pattern from 5 days old cotton fibres showed only four spots corresponding to the planes 002 and 021 of cellulose I, while the fibres belonging to later periods gave a completely normal cellulose I pattern. It may be mentioned that the particles of cellulose obtained by drastic hydrolysis of cotton normally gave diffraction patterns of the former type.

The organism **Acetobacter xylinum** was grown in a medium described by Hestrin and Schramm from 5 to 20 days. The pellicle formed was washed thoroughly and the electron diffraction patterns were recorded. Only cellulose I pattern was observed.

Cotton seeds (Suvin variety) were collected at different stages of boll development from 10 days post-anthesis to maturity and the proteins were fractionated on the basis of their solubility. Oil from crushed seeds was removed by cold hexane extraction. The hexane treated meal was then

sequentially extracted with water, 1.0 m NaCl Alkali (PH 10) and 80% alcohol and each extract was then estimated for its nitrogen content by Kjeldhl's method. The water-soluble proteins (albumins) increased gradually from 5 day old seeds to 25 day old seeds and then decreased through 30 to 40 day old seeds; it increased again till maturity.

The salt-soluble protein (globulins) on the other hand increased steadily throughout the period of seed development.

The alkali-soluble proteins (glutelin) increased during early stages of seed development upto 40 days post-anthesis, after which their concentration dropped as the seed maturity progressed. The content of alcohol-soluble protein (Prolamine) remained consistantly low throughout the boll development stages.

Studies on Production of Amylase by Bacillus subtilis – 159 and Application of the Enzyme

Wheatbran which is a cheap carbon source and various oil seed cakes which are cheap nitrogen sources were tried in amylase production by **Bacillus subtilis** 159 with a view to replace the usual Tendler's non-synthetic (TNS) medium.

Bacillus subtilis – 159 was grown for 48 hr in a medium containing 1.5% peptone and wheatbran at concentrations ranging from 0.1% – 4.0% The medium containing 1.0% – 1.5% wheatbran gave the maxium amylase production at 48 hr, while wheatbran at 2.0% and above was found to give very low yield of amylase. The effect of incubation period on amylase production by **B. subtilis** – 159 on wheatbran medium was studied by growing the organism in a medium containing 1.0% and 4.0% wheatbran for 144 hr; peptone was added as nitrogen source. In addition to this $CaCO_3$ was added to the medium containing 4.0% wheatbran.

It was observed that 1.0% wheatbran gave maximum amylase at 48 hr and remained constant upto 72 hr.; thereafter it decreased gradually. In the case of the medium containing 4.0% wheatbran, there was very little amount of amylase at 48 hr, but thereafter, a sharp increase in amylase production was noticed. This increase in amylase was continued upto 96 hr. The amylase produced from 4.0% wheatbran was four times more than the amylase produced from the medium containing 1.0 – 1.5% wheatbran and 7–8 times more than TNS medium alone. The amylase produced from 4.0% wheatbran medium was found to be strong liquifying agent. It could liquify 10.0% starch solution within 10 min.

The effect of oil seed cakes on amylase production was studied by growing the organism on nine different oil seed cakes. These oil seed cakes were added to the medium on nitrogen basis at four different concentrations; 4.0% wheatbran was added as carbon source. Sesame black at 0.75% and sesame white at 1.4% produced amylase similar in quantity as that produced by 1.5% peptone.

Enrichment of Cattlefeed by Microbiological Methods

The growth of **Beijerinekia mobilis** on acid hydrolysed and alkali neutralised substrates, viz. paddy straw, wheat straw, tur stalks, cotton stalks and groundnut hulls was determined by enumerating them on Waksman's No. 77 medium by the standard plating method. It was observed that the population of the bacterium increased upto 10^6 /5g of the substrate in the case of groundnut hulls presumably because of its high hemicellulose content. In other cases, it ranged from 10^3 to 10^5/5g of the substrates hydrolysed. Analysis of the samples for crude protein indicated that there was about two fold increase in the case of paddy straw and groundnut hulls. The increase in crude fat content was also proportional to the cell number.

Attempts to grow **Plurotus sajor-caju,** a mushroom fungus on the above substrates without any pre-treatment resulted in protein rich end products. The crude protein increase varied from one and half to two folds with a slight but concomitant increase in crude fat content. Cotton seed hull is also a good substrate to enrich the crude protein percentage with this fungus.

Production of Biogas from Cellulosic Wastes from Textile Mills

On the basis of the experience gained in the Laboratory trials as well as in the experimental plant trials for batch fermentation, a continuous fermentation plant was designed and fabricated. The design was basically a modified china plant of fixed dome type with a provision for partition wall and scum breakers. The necessity of the partition wall is to increase the detention time and scum breakers is to break the thick scum during the up and down movement of the fermneting material. The entire assembly has been fabricated out of High Density Polyethylene (HDPE).

Initially, the plant was charged with 90 kg. of willow-dust with a substrate : water ratio of 1 : 12. Biogas production started after one week and it was observed that by charging about 10 kg willow dust every week, about 500-600 litres of biogas was produced.

A series of experimental studies at the bench scale on the reduction of water in the batch fermentation indicated that biogas can be produced with a

substrate : water ratio of 1 : 1.5 from the fermenting material as against the earlier reported ratio of 1 :6. When the studies were carried out in 10 litre bottles as much as 350 – 400 litres of biogas was produced during the 30 days of active period using 2.5 kg willow-dust. Similarly, when the trials were on in the experimental biogas plant, about, about 15 m^3 – 17 m^3 of biogas was produced during 30 days of active gas generation phase.

Pot culture trials are underway in assessing the manurial value of the digested slurry on the cotton crop (Laxmi variety).

A project entitled 'Operational Research Project on the utilisation of the willow-dust, a textile mill waste, for the production of bioenergy to meet partly the energy requirements in the textile industry has been sanctioned by CASE to undertake pilot plant trials at one of the N.T.C. mills, Bombay.

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

Aqarious bisporous commenly called the button mushroom and **plourotus** sp – the oyster mushroom, were grown both on composted material and unfermented cellulosic materials. The latter species can be grown both on fermented and unfermented materials. **Pleurotus sajor-caju** was successfully grown on cellulosic waste materials like willow-dust, cotton stalks and cotton seed hulls at this Laboratory. It has been reported that willow-dust can be composted early by giving turnings at alternate days for about 10 days. But the compost required to grow mushrooms has to be well balanced to obtain maximum yield of mushrooms. An effort was therefore, made to obtain a type of compost from willow-dust. Accordingly, 100 kg willow-dust was mixed well with 150 l of water containing 300 g of ammonium sulphate 1 kg superphosphate and 1 kg muriate of potash. The entire material was heaped and the turnings were given at alternate days. After 7 days 10 kg gypsum was added and mixed well. The compost was ready after 10 days. Suitability of the material will be tested by sending the material to a place where button mushrooms are being grown. Efforts were also made to grow **Pleurotus sajor-caju** on willow-dust, cotton stalks and cotton seed hulls, after supplementing them with NPK so as to ascertain whether the total yield can be increased. However, it was observed that the above mentioned supplementation hindered their growth considerably.

Research work done at Regional Quality Evaluation Units

COIMBATORE

Standardisation of Shirley Miniature Spinning (SMS) Plant :

Thirty cotton samples were spun to different counts (30s–70s) on the SMS plant at Coimbatore and by Microspinning Method using the same twist multiplier

at the CTRL. It was observed that the yarns spun by the Microspinning technique were stronger than those spun on the SMS Unit, by about 30 percent. Since the number of samples spun for counts other than 60s was small, further spinning tests are being carried out for lower counts. It has been decided to use a correction factor of 25% on the SMS results for 60s count to give the values of lea CSP on par with those by CTRL microspinning technique.

Blending of Kapok with Cotton :– An experiment was conducted to explore the possibility of blending Singapore Kapok (**Ceiba pentandra**) with medium staple cottons MCU. 7 and CRH. 71 in different proportions of (85|15, 80|20. 75|25, 70|30, 60|40 and 50|50 and the blends were spun to 20s count.

The blended fibres and yarns were evaluated for quality parameters. (It was observed that the fibre strength and yarn CSP gradually decreased as the proportion of Kapok increased in the blend. It may, however, be possible to blend upto about 20% Kapok without any serious deterioration in yarn quality. However, since the studies have been made in small quantities using the Shirley Miniature Spring Unit, it would be necessary to carry out large scale trials on regular machinery to confirm the trends and also examine the applicability of such blended yarns).

INDORE

Study of the important factors effective for high ginning percentage with respect to fixed range of seed weight (Seed Index)

Six varieties from **G. arboreum** species and four varieties from **G. hirsutum** species, were selected and a trial was conducted at Indore in Random Block Design with four replications and adopting usual agronomic practices. Well developed and healthy bolls were collected from each replications separately and 10 seeds were picked at random from these bolls. These seeds were hand-ginned separately. Samples were tested for G. P., lint weight, fibre length, and micronaire value. and the number of fibres per seed were calculated. It was observed that in the case of **G. hirsutum** the correlation between G.P. and number of fibres per seed was significant, while in the case of **G. arboreum** cottons this association was non-significant. Mean fibre length and micronaire value had little contribution towards G.P.

NANDED

Effect of gamma rays on economical, morphological and physical properties of cottons :– Seeds of four varieties NA. 39, PA. 32, NA. 239 and SRT. 1 were exposed to gamma rays at 15, 20, 30 kr dose at the rate of 7 kr mt. Irradiated seeds were sown on June 15, 1982. Morphological observations like plant

habbit, plant sterility, etc. were recorded. Plantwise fibre quality studies are being done.

Efficacy of various formulations of synthetic pyrethroids against cotton bollworms, and its influence on fibre quality and yield : Different pyrethroidal products were included in this trial to judge their efficacy against bollworms on Hybrid 4 variety and the effect of these treatment on the fibre quality of Hybrid 4 was also studied. All the synthetic pyrethroids were superior over the traditional insecticides in minimising the infestation and increasing the yield of seed cotton without affecting the quality.

Effect of spinning dates on the yield and fibre quality : Six promising varieties viz. NH. 239, SRT. 1, NH. 44, H. 4; NA. 39 and CJ. 73 were sown two times consicutively in the month of may and June. In general, there was no significant difference in the quality of May sown and June sown cottons, May sowing recorded higher kapas yield as compared to June sowing.

SURAT

Study of green fuzz in ginned lint :– The four parents, Texas Green and 6268 (with green fuzz) and G. Cot. 10 and G. Cot. 100 (with white fuzz) and their diallele crosses in F. 1 were sown in randomisel blocks with three replications. Five plants from each replication – 15 from 3 replications – for each entry have been collected and the seeds examined for fuzz colour and seed weight. The green and white fuzz colour seeds were collected and ginned separately to obtain G.P. for each fuzz colour. Texas Green a parent with 100% green fuzz continued to give in its crosses nearly total green fuzz, the white fuzz content being negligible. Other green fuzz parent (about 80%) yielded crosses dominating in white fuzz. The two completely white fuzz parents, G. Cot. 10 and G. Cot. 100, produced white fuzz seeds only in their crosses.

The lint from different fuzz colour seeds was tested for fibre properties. It was observed that the green fuzz seed tended to give slightly longer, coarser, and stronger lint, besides recording a higher seed weight and lower ginning percentage.

3. PUBLICATIONS

During 1982, 2 Technological Reports, 39 Research Publications and 87 Technological Circulars were issued apart from 9 papers presented at calendar year 1981.

A. Annual Report

Annual Report of the Cotton Technological Research Laboratory for the calendar year 1981.

B. Technological Reports

1. Technological Reports on Trade Varieties of Indian Cottons, 1980-81 Sesason.
2. Technological Report on Standard Indian Cottons, 1980-81 Season.

C. Research Publications (CTRL Publication – New Series)

No. 180 Evaluation of some Methods for Assessment of Spunability of Cottons – by M. S. Parthasarathy and M. S. Anjane (Reprinted from **Indian Textile Journal**, Vol. LXXXXI, No. 5, P. 79-84 Feb. 1981).

No. 181 Cotton Quality and End Uses – by M. S. Parthasarathy and V. Sundaram (Reprinted from **Indian Cotton Mills' Federation Journal**, Vol. 17, No. 12, P. 45-52; 1981).

No. 182 Application of Electron Diffraction Technique in Determining Crystallinity and Line Broadening Analysis of Cellulose – by K. M. Paralikar (Reprinted from **Colourage**, Vol. XXVII, No. 7; P. 36-40, March, 1980).

No. 183 Cotton Improvement Research under ICAR from 1966 to 1981 – by V. Sundaram (Reprinted from **Indian Cotton Mills' Federation Journal**, Vol. 18, No. 5; P. 18-29; September; 1981).

No. 184 Studies in Open End Spinning – by M. S. Parthasarathy and B. Srinathan (Reprinted from **Indian Textile Journal**, Vol. LXXXXI, No. 10, P. 101-110; July; 1981).

No. 185 A Layer Expansion Study of Cotton Fibre using the Scanning Electron Microscope – by K. M. Paralikar and Najamul Hussain (Reprinted from **Textile Research Journal**, Vol. 51, No. 9, P. 616-618, Sept., 1981).

No. 186 Effect of Cellulase on the Morphology and Fine Structure of Cellulosic Substrates – by S. M. Betrabet, K. M. Paralikar and N. B. Patil (Reprinted from **Cellulase Chemistry and Technology**, Vol. 14, P. 811-820, Nov-Dec., 1980).

No. 187 Crystallinity of Native Cotton – Does it Influence Other Fibre Properties ? – by P. Bhama Iyer, K. R. Krishna Iyer and N. B. Patil (Reprinted from **Textile Research Journal**, Vol. 51, No. 10, P. 679-681, Oct. 1981).

No. 188 Direct Evidence of Crystalline Aggregation of Dyes in Cellulose Fibres by Electron Diffraction – by N. K. Chaudhuri, S. Aravindanath and S. M. Betrabet (Reprinted from **Journal of Polymer Science, Polymer letter Edition**, Vol. 19, P. 131-135; 1981).

No. 189 The structure of Cotton Cellulose II and III Investigated by Electron Diffraction Technique – by K. M. Paralikar and S. M. Betrabet (Reprinted from **Journal of Polymer Science, Polymer Letters Edition**, Vol. 19, P. 555-560, Nov. 1981).

No. 190 Cyclopropenoid Fatty Acid Content and Iodine Value of Crude Oils from Indian Cottonseed – by S. N. Pandey and L. K. Suri (Reprinted from **Journal of the American Oil Chamists' Society**, Vol. 59, P. 99-101, Feb. 1982).

No. 191 Bio-gas from Cotton Textile Mill Waste – by S. Ganesan, R. H. Balasubramanaya, V. G. Khandeparkar and V. Sundaram (Reprinted from **Journal of Indian Society for Cotton Improvement**, Vol. VI, No. 2, Sept. 1981).

No. 192 Bio-gas from Willow-dust for Textile Mills – by V. G. Khandeparkar, R. H. Balasubramanya, S. Ganesan and V. Sundaram (Reprinted from **Journal of Indian Cotton Mills' Federation**, Vol. XVIII, No. 8, P. 5-10; Dec. 1981).

No. 193 Radiation Induced Cross-linking of Cellulose – by I. G. Bhatt, V. Sundaram, S. M. Betrabet, V. Iyer and A. W. Shringarpure (Reprinted from **Indian Textile Journal**, Vol. LXXXXI, No. 1, P. 119-127, October 1980).

No. 194 Further Studies on Cellulose III Polymorphs Transformations to Cellulase IV Latties and Subsequent Reactions – by P. K. Chidambareswaran, S. Sreenivasan and N. B. Patil (Reprinted from **Journal of Applied Polymer Science,** Vol. 27, No. 2, P. 709-730, Feb. 1982).

No. 195 Durable Flame – Retardant Finishes for Cotton – by V. Iyer, I. G. Bhatt, V. Sundaram; S. N. Bellur; G. R. Phalgumani and B. R. Manjunatha. (Reprinted from **Flame Retardant Finishes of Textiles – The State of Art in India,** BTRA Publication, 1982).

No. 196 Estimation of Cotton Fibre Maturity Using Micronaire Spacer Technique – by A. K. Antony, Santa Nayar and C. P. Venugopalan (Reprinted from **Journal of the Textile Association,** Vol. 43, No. 4, P. 136-136, July, 1982).

No. 197 Nepping Potential of Cotton Blends – by S. R. Ganatra, V. G. Munshi and D. Srinathan (Reprinted from **Indian Textile Journal,** Vol. LXXXXI, No. 4, P. 109-111, January, 1981).

No. 198 Rapid Method for Evaluation of Coefficient of Variation of Fibre Length – by Janaki K. Iyer (Reprinted from **Journal of Textile Association,** Vol. 43, No. 5, P. 175-176, September, 1982).

No. 199 Association of Cross-sectional Shape with Other Fibre Characters of Cottons of Species **Gossypium Herbaceum** – by B. M. Petkar, P. G. Oka and V. Sundaram (Reprinted from **Journal of the Textile Association,** Vol. 43, No. 5, P. 173-174, September, 1982).

No. 200 Influence of Fibre Properties on Hairiness of Cotton Yarns Measured by Fibrograph Method – by S. B. Pai and V. G. Munshi (Reprinted from **Journal of the Textile Association,** Vol. 43, No. 5, P. 167-171, September, 1982).

No. 201 Structural Study of Cellophane – by S. Aravindanath, K. M. Paralikar, S. M. Betrabet and N. K. Chaudhuri (Reprinted from **Polymer,** Vol. 23, P. 823-828, June; 1982).

No. 202 Relationship between Strength – Elengation Characteritics of Single Fibres and Fibre Bundles of Cotton – by (Smt.) J. K. S. Warrier and V. G. Munshi (Reprinted from **Indian Journal of Textile Research,** Vol. 7, No. 2, P. 42-44, June, 1982).

No. 203 Inverse Relaxation/Stress Recovery in Cotton Fibres and yarn – by R. P. Nachane, G. F. S. Hussain and K. R. K. Iyer (Reprinted from **Textile Research Journal**, Vol. 52, No. 7, P. 483-484, July 1982).

No. 204 Fatty Acid Composition of Indian Cottonseed Oil – by S. N Pandey and N. Thejappa (Reprinted from **Journal of the Oil Technologists Association**, Vol. XIII, No. 3, P. 107-108, July, September, 1982).

No. 205 Use of Proper Cleaning and Ginning Techniques for Improving Quality and Productivity of Ginned Lint – by M. S.: Parthasarathy and V. Sundaram (Reprinted from Proceedings of the International Conference on **Development in Spun Yarn Production** held at SITRA in January, 1982).

No. 206 Some Comment on the Power Law Dashpot Model for Creep in Wool Fibres – by Janaki K. Iyer and K. R. Krishna Iyer (Reprinted from **Indian Journal of Textile Research**, Vol. 7, No. 3, P. 98-100, September; 1982).

No. 207 Changes in Cross-Sectional Dimensions of Cotton Fibres on Cross-linking and on Subsequent Wetting – by G. F. S. Hussain, B. M. Petkar, K. R. Krishna Iyer and N. B. Patil (Reprinted from **Textile Research Journal**, Vol. 52, No. 8, P. 503-506, August, 1982).

No. 208 Studies on Abrasion of Sewing Threads with Scanning Electron Microscope – by V. G. Munshi, S. D. Pai and A. V. Ukidve (Reprinted from **Textile Research Journal**, Vol. 52. No. 12, P. 776-779, December, 1982).

No. 209 Alkali Swelling and Stretching of Normal Viscose Rayon Filament Yarn – by K. R. K. Iyer, D. R. Murthy, N. B. Patil and V. Sundaram (Reprinted from **Textile Research Journal**, Vol. 52, No. 12, P. 780-781, December, 1982).

No. 210 Ideal Cotton Fibre Strength and its Relation to Observed Strength Maturity and Fineness – by D. V. Mhadgut (Reprinted from **Textile Research Journal**, Vol. 52, No. 12, P. 781-782, December; 1982).

No. 211 Characterisation of Cotton – Polystyrene Graft Copolymers – by N. Thejappa and S. N. Pandey (Reprinted from **Journal of Applied Polymer Science**, Vol. 27, No. 7, P. 2307-2315, July, 1982).

No. 212 Count Strength Product Correction Factor for Polyester/ Cotton Blended Yarns – by D. V. Mhadgut (Reprinted from **Textile Research Journal**, Vol. 52; No. 10, P. 668-670, October, 1982).

No. 213 Influence of Mercerization and Cross-linking on the Dynamic and Static Moduli of Cotton Yarns – by G. F. S. Hussain, K. R. K. Iyer and N. B. Patil (Reprinted from **Textile Research Journal**, Vol. 52, No. 10, P. 663-665, October, 1982).

No. 214 Some SEM Observations on OE Spun Yarns and Other Textile Materials – by S. M. Betrabet, N. Balasubramaniam; K. M. Paralikar and M. S. Parthasarathy (Reprinted from **BTRA Scan**, Vol. XIII, No. 1, P. 1-10, March, 1982).

No. 215 Enzymatic Saccharification of Cellulosic Materials – by A. S. Dighe, V. G. Khandeparkar and S. M. Betrabet (Reprinted from **Indian Journal of Microbiology**, Vol. 21; No. 2; P. 126-130, April-June, 1981).

D. Other Publications

1. Cottonseed Oil – by V. Sundaram, (Published in the **Journal of Indian Farming**, Special Number on Oil Seeds, November, 1982.
२. बिनौलों से साढे तीन लाख टन तेल मिल सकता है – वी. सुन्दरम्, खेती, तिलहन विशेषांक, पे. 87, डिसम्बर, 1982

E. Miscellaneous Publications

1. Investigation of the Preparation of Radio-Resistant and Radio – Sensitive Celluloses to Obtain Basic Information on the Chemistry of Cotton Cellulose – by V. Sundaram and Jai Prakash, PL-480 Project Report No. UR-A7 (20-33) 1982.

F. Papers Presented at Conferences/Seminars

1. Improvement in Mechanical Properties of Different Cotton Varieties after Preswelling and Crosslinking – by M. S. Sitaram, N. D. Nachane, S. M. Betrabet and V. Sundaram (Presented at the Conference organised by **North India Textile Research Association**, Ghaziabad held at New Delhi during 12-13 February, 1982.
2. Migration of Crosslinking Reagents in Blended Fabric during Resin

Finishing – by S. N. Pandey and C. R. Raje (Presented at the Conference organised by **North India Textile Research Association, Ghaziabad** held at New Delhi during 12-13 February, 1982).

3. Enrichment of Cattlefeed with Microbial Protein – by S. P. Bhatawdekar and R. H. Balasubramanya (Presented at the **Twenty-third Annual Conference of Association of Microbiologists of India** held at Mysore during 22-24 November, 1982).

4. Application of Electron Microscopy and Electron Diffraction for the Study of Dyes in Cotton Cellulases – by S. Aravindanath S. M. Betlabet and N. K. Chaudhri (Presented at the **Fifteenth Conference of Electron Microscope Society of India** held at Varanasi during 16-18 December, 1982).

5. Need for Emphasis on Medium Staple Cottons – by V. Sundaram (Presented at the Seminar on **Focus on Development of Medium Staple Cottons with Special Reference to Gujarat State** held at Surat on 17-18 December, 1982).

6. Medium Staple Cottons of Gujarat – A Technological Review – by L. R. Jambunathan, Y. Subramanyam and M. C. Bhalod (Presented at the Seminar on **Focus on Development of Medium Staple Cottons With Special Reference to Gujarat State** held at Surat on 17-18, December, 1982).

7. Some Observations on the Technological Characters of Cottons grown in Gujarat State – by P. G. Oka, B. M. Petkar and M. S Sitaram (Presented at the Seminar on **Focus on Development of Medium Staple Cottons with Special Reference to Gujarat State** held at Surat on 17-18 December, 1982).

8. Prediction of Spinning Performance of Cottons from Modified Fibre Quality Index with Special Reference to Medium Staple Cottons – by V. G. Munshi, A. V. Ukidve and V. Sundaram (Presented at the the Seminar on **Focus on Development of Medium Staple Cottons with Special Reference to Gujarat State** held at Surat on 17-18, December, 1982).

9. Open End Spinning of some Gujarat Cottons – by B. Srinathan and M. S. Parthasarathy (Presented at the Seminar on **Focus on Development of Medium Staple Cottons with Special Reference to Gujarat State** held at Surat on 17-18, December, 1982).

G. Technological Circulars on Trade Varieties of Indian Cotton

T.C. No.	*Variety*	*T.C No.*	*Variety*
	1980–81 Season		
2143	Digvijay (Dakor)	2174	JK Hy. 1 (Pamwa)
2144	Varalaxmi (Raichur)	2175	Bhagya (Raichur)
2145	Godavari (Parbhani)	2176	Virnar (Chompala)
2146	C Indore 1 (Chittogad)	2177	G. Cot. 11 (Baroda)
2147	Sea Island Andrews (Shimoga)	2178	Hybrid 4 (Wardha)
		2179	Varalaxmi (Shimoga)
2148	Bikaneri Narma (Kankroli)	2180	Sea Island Andrews (Shimoga)
2149	SRT. 1 (Bodwad)		
2150	G 46 (Nanded)	2181	Hampi (Raichur)
2151	Hybrid 6 (Baroda)	2182	C. Indore 1 (Bhilwada)
2152	Kalagin (Porabander)	2183	Varalaxmi (Raichur)
2153	Suvin (Coimbatore)	2184	L. 147 (Yavatmal)
2154	Varalaxmi (Adoni)	2185	AK 235 (Daryapur)
2155	Varalaxmi (Ahmednagar)	2186	Laxmi (Naragund)
2156	K. 9 (Kovilpatti)	2187	Sanjay (Botad)
2157	Khandwa 2 (Khandwa)	2188	Shankar 4 (Khargone)
2158	Jk. Hy. 1 (Khandwa)	2189	Deviraj (Dhargandhra)
2159	MCU. 5 (Coimbatore)	2190	V. 797 (Kadi)
2160	MCU. 8 (Srivallipatur)	2191	J. 34 R/G (Bhatinda)
2161	Bikaneri Narma (Rajasthan)	2192	Badnawar 1 (Dhar)
		2193	J. 34 S/G (Sriganganagar)
2162	MCU. 5 (Kanakipadu)	2194	B. 1007 (Adilabad)
2163	Varalaxmi (Coimbatore)	2195	Bengal Desi (Kalanwali)
		2196	Shankar 4 (Palej)
	1981–82 Season	2197	Bengal Deshi (Sriganganagar)
2164	Laxmi (Erode)	2198	MCU. 5 (Guntur)
2165	MCU. 7 (Manaparai)	2199	Jayadhar (Hubli)
2166	Digvijay (Dakor)	2200	Buri 1007 (Amaravati)
2167	Hybrid 4 (Baroda)	2201	Maljari (West Nimad)
2168	SRT 1 (Baroda)	2202	MCU. 5 (Khamgaon)
2169	Varalaxmi (Amod)	2203	Buri 147 (Washim)
2170	Hybrid 6 (Sabarkanta)	2204	Varalaxmi (Suru Road)
2171	Wagad (Morvi)	2205	Bikaneri Narma (Bhilwada)
2172	Deviraj (Gokak)		
2173	Digvijay (Jambusar)	2206	J. 34 (Sirsa)

T.C. No.	*Variety*	*T.C. No.*	*Variety*
	1980–81 Season		
2207	J. 34 (Ahmedgarh)	2211	Y. 1 (Anjar)
2208	Hybrid 4 (Jalna)	2212	Varalaxmi (Idar)
2209	Digvijay (Kapadvary)	2213	Westerns 1 (Bellary)
2210	Virnar (Badnapur)		

H. Technological Circulars on Standard Indian Cottons

S.C. No.	*Variety*	*S C. No.*	*Variety*
	1980–81 Season		
223	Narmada	231	AKH 4
224	Khandwa 2	232	G. Cot. 11
225	Jayadhar	233	Varalaxmi
226	AK. 235	234	Hybrid 4
227	Badnawar 1	235	Hybrid 6
228	V. 797	236	G. Cot. 10
229	Digvijay	237	Buri 1007
230	Westerns 1	238	Sanjay

4. EXTENSION

CTRL does not have the facility of a farm to undertake all field work associated with cotton growing research and therefore, field trials are carried out by Central Institutes and Agricultural Universities in various parts of the country. However, scientists of CTRL and of its Regional Quality Evaluation Units actively participate in many of these trials. Eventhough CTRL is not directly dealing with the farming community, extension services are indirectly rendered by supplying reliable and accurate data on various descired quality parameters of samples received from them. In addition to imparting training in cotton technology which includes training in the quality evaluation aspects of cotton fibres, yarns and fabrics and training to gin fitters; assistance is rendered by way of development of useful new equipments for the field, their fabrication and supply.

Testing Work

Apart from the research samples received from various agricultural stations, Cotton Technological Research Laboratory 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 1982 together with the corresponding figure for 1980 and 1981 and for the quinquennium 1976-80 are given in Table 30.

TABLE 30 : NUMBER OF SAMPLES RECEIVED FOR PAID TESTS

Type of Test	Average for the quinquennium 1976-80	1980	1981	1982
Spinning	51	32	34	53
Fibre (EICA)*	158	72	130	97
Fibre (Others)	121	128	48	79
Yarn	48	67	69	44
Cloth	76	76	47	54
Moisture	—	—	40	38
Miscellaneous	17	10	14	29
TOTAL :	471	385	382	394

* These samples from 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.

The total fees realised during calender year 1982 for carrying out paid tests on samples received amount to Rs. 23,582.00 against 28,381.55 during 1981.

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

(1) Two samples of cotton were received from a composite mill of South India asking expert opinion regarding certain processing difficulties experienced by them. After completely analysing the samples, our observations were sent to the party.

(2) Five seed-cotton (Kapas) samples connected with a Research Project were received from the Cotton Project Officer, Indian Cotton Mills Federation, Devengere. These samples were tested for ginning, fibre properties, spinning performance and trash content by Shirley Analyser and our comments were communicated to the party.

(3) A large number of samples of Viscose staple fibre imported from Taiwan have been tested for length (oil plate method), fineness and moisture regain percentage.

(4) Two blended samples sent by a Pharmaceutical firm were analysed for quantitative identification of component fibres, besides mean length and percentage of short fibres.

(5) One yarn sample received from a Co-operative Spinning Mill and a grey sheeting cloth sent by a Bombay based firm were tested for composition (quantitative estimation) of component fibres.

(6) Two sewing thread samples were received from Indian Standards Institution for Cuprammonium Fluidity Test. The results were communicated to the party.

(7) One cloth sample received from the Maharashtra Handloom Co-operative Federation Ltd., was analyed for pH value. (Cold extract and Hot extract) besides usual fabric tests.

(8) One polypack containing Round Textile Tape Pluge recevied from a private party was tested for quantitative percentage component fibres, number of braided threads in the tape, number of single yarn in each braided thread and linear density. The results were communicated.

Training

Two full time training courses which included lectures and practical work on methods of evaluation of cotton fibre quality and interpretation of test results based on statistics were conducted from July to September and October to December, 1982 while persons deputed by Cotton Trading Organisation in Bombay city attended the first coerse, the second course was arranged for the personnel from mofussil centres. The names and address of all of the trainees are given below :—

1. Shri L. D. Vadia,
   C/o. East India Cotton Association Ltd.,
   Cotton Exchange, Marwari Bazar,
   Bombay 400 002.

2. Shri H. J. Patel,
   C/o. M/s. Amersey Damodar,
   20/21, Cotton Exchange Building,
   Cotton Green, Bombay 400 033.

3. Shri N. P. Garadia,
   C/o. M/s. C. A. Galiakotwala & Co. Pvt. Ltd.,
   125, Nagindas Master Road,
   Fort, Bombay 400 023.

4. Shri Khan F. Ibrahim Zafarulla,
   501, Sammandhapuram,
   Rajapalayam,
   Pin 626 117.

5. Shri D. V. Kolhapure,
   C/o. The Laxmi Vishnu Textile Mills Ltd.,
   Station Road, Sholapur,
   Pin 413 001.

6. Shri D. S. Desai,
   C/o. Director,
   The Maharashtra State Co-operative Marketing
   Federation Ltd.,
   Sales Office, Khetan Bhavan,
   Bombay Pin 400 020.

Besides, special training was imparted from 19.8.82 to 8.9.82 to some officers deputed from Cotton Corporation of India (CCI) in quality evaluation of cotton fibres and in elementary statistics. The names of the personnel who attended the course are given below :

1. Shri D. B. Kanwalu
2. Shri V. S. Kakde
3. Shri V. S. Bhende
4. Shri Joseph Michael
5. Shri L. S. Rathi
6. Shi P. R. Sarode
7. Shri B. V. Pandya
8. Shri B. B. Passey

5. CONFERENECES AND SYMPOSIA

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

Sr. No.	Meeting/Conference	Place	Date	Name of Officers who attended the Meeting/Conference
1	2	3	4	5
1.	Seminar on Open-End Spinning sponsored by BTRA.	Bombay	4-1-1982	Shri M. S. Parthasarathy and Shri T. N. Ramamurthy
2.	International Textile Conference on Developments in Spun Yarn Production held at SITRA.	Coimbatore	7-1-1982 and 8-1-1982	Dr. V. Sundaram, Shri M. S. Parthasarathy, Shri B. Srinathan and Dr. K. M. Paralikar
3.	Seminar on Jobin Voon Preparative Liquid Chromatography.	Blue Star Bombay	21-1-1982	Dr. S. N. Pandey
4.	Meeting of the Regional Committee No. VII held at Indian Institute of Agricultural Engineering.	Bhopal	11-1-1982 and 12-1-1982	Dr. V. Sundaram
5.	Twenty-third Joint Technological Conference, sponsored by ATIRA, BTRA, SITRA and NITRA.	New Delhi	12-2-1982 to 13-2-1982	Dr. V. Sundaram, Dr. S. N. Pandey and Shri M. S. Sitaram.
6.	Meeting of the Research Advisory Group of ATIRA.	Ahmedabad	25-2-1982	Dr. V. Sundaram
7.	Meeting of the Panel of Pest Harvest Technology of ICAR	New Delhi	26-2-1982 to 27-2-1982	Dr. V. Sundaram
8.	Meeting of the Research Advisory Committee of SITRA.	Coimbatore	15-3-1982 and 16-3-1982	Dr. V. Sundaram
9.	North Zone Panel Meeting of AICCIP.	Mathura	1-4-1982 and 2-4-1982	Shri P. G. Oka

10.	Meeting of the Review Committee of ICDP held at Punjab Krishi Vidya peeth.	Akola	8-4-1982 and 9-4-1982	Dr. V. Sundaram
11.	Central Zone Panel Meeting of AICCIP held at Gujarat Agricultural University.	Surat	20-5-1982 and 21-5-1982	Dr. V. Sundaram. Shri P. G. Oka, and Shri M. S. Sitaram
12.	International Food Conference of AFST.	Banglore	23-5-1982 to 26-5-1982	Dr. S. N. Pandey
13.	Silver Jublee Celebration of NBSS & LUP.	Nagpur	1-10-1982	Dr. V. Sundaram
14.	Conference of the Directors of Institutes under ICAR.	New Delhi	6-10-1982 to 8-10-1982	Dr. V. Sundaram
15.	Meeting of the World Bank Aided ICDP held at Punjab Agricultural University.	Ludhiana	9-10-1982	Dr. V. Sundaram
16.	Meeting of the Regional Committee No. VII held at Agricultural College, Pune.	Pune	16-10-1982 and 17-10-1982	Dr. V. Sundaram
17.	National Seminar on Cotton held at Haryana Agricultural University.	Hissar	3-11-1982 to 5-11-1982	Dr. V. Sundaram
18.	Seminar on British Scientific Instruments Technology.	Taj Hotel Bombay	4-11-1982 and 5-11-1982	Dr. S. N. Pandey
19.	Twenty-third Annual Conference of Association of Microbiologists of India.	Mysore	22-11-1982 to 24-11-1982	Dr. R. H. Balasubramanya
20.	Seminar on Textile Information and Documentation"	Ahmedabad	23-11-1982 to 25-11-1982	Shri T. K. M. Das
21.	Fifteenth Annual Conference of the Electron Microscope Society of India.	Varanasi	16-12-1982 to 18-12-1982	Shri S. Aravindanath

22.	ICMA Lecture Series on Recent Advances in Textile Processing Chemicals"	Bombay	17-12-1982	Dr. S. N. Pandey
23.	Seminar on Focus on Development of Medium Staple Cotton with Special Reference to Gujarat State.	GAU Surat	17-12-1982 and 18-12-1982	Dr. V. Sundaram Dr. V. G. Munshi Shri P. G. Oka Shri T. N. Ramamurthy Shri A. V. Ukidve Shri M. S. Sitaram Shri B. M. Petkar Shri A. W. Shringarpure Shri T. K. M. Das Shri P. V. Varadarajan and Kum. I. K. P. Iyer
24.	Symposium on Modern Concepts in Spectroscopy	Bombay	17-12-1982 and 18-12-1982	Dr. K. R. Krishna Iyer Dr. P. K. Chidambareswaran Dr. (Mrs.) P. Bhama Iyer

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

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

6. SUMMARY OF THE REPORT

This is the fiftynineth Annual Report of the Laboratory that covers the calendar year 1982. CTRL was collaborating actively with the Agricultural Departments in various cotton growing tracts of the country in their work for producing cottons which are superior in quality and/or yield, by rendering technological assistance by way of authoritative evaluation of the quality of new strains and norms fixed for quality levels. The work is in progress for establishing a Ginning Training Centre at Nagpur under the Integrated Cotton Development Project funded by the World Bank. Two Technological Reports, 39 Research Publications and 87 Technological Circulars were issued during 1982 apart from nine papers presented at various Conferences. While 2261 cotton samples received from different agricultural trials were tested for technological characters at CTRL, Bombay, more than 15,000 samples were tested for quality characters at the eleven Quality Evaluation Units at different cotton growing regions of the country. About 400 samples of cotton, yarn and fabrics were received for paid tests and an amount of Rs. 23,582.00 realised by way of test fees on them, during the year. Two full-time training courses on evaluation of fibre quality, elementary statistics, etc. were conducted for six trainees from cotton trading organisations and from mofussil cotton centres, while special training was imparted to eight officers deputed from Cotton Corporation of India during 1982.

Research Activities

CTRL continued to function as the co-ordinating centre for technology under the AICCIP, apart from carrying out research on the physical, chemical, structural and technological aspects of textile materials. 1368 cotton samples from various stages of trials in different cotton growing States in the country were screened for quality characters and reports sent with recommendations/ suggestions, etc. 200 samples from various other schemes of Agricultural Universities and State Governments had also been received for quality evaluation.

The Panel Meetings of the Breeding and Technology Group of the AICCIP recommended the new LRA. 5166 variety for release in the irrigated and rainfed tracts in the south zone, where MCU. 5 is grown at present. LH. 580 variety was identified as promising for Punjab area at the panel meeting of the AICCIP for North Zone.

With a view to study the varietal variability and inheritance characteristics of neppiness in cotton, 540 samples were tested for nep content and the results indicated that the genotypes were significantly different and the neppiness was governed by dominant genes, the effect of dominance being significant.

In a study conducted to assess the effects of nitrogen, phosphorus and potash on the yield and quality of Hybrid 4 cotton, it was observed that the application of Nitrogenous fertilisers were quite beneficial to the cotton crop with respect to yield, while the other two fertilisers did not benefit the cotton crop and that the application of all the three fertilisers did not show any impact on the quality characteristics.

In connection with the study on the influence of various insecticide treatments on the quality of Hybrid 4 cotton, 24 samples were subjected to tests for quality characters and on statistical analysis it was observed that permethrin and carbaryl treatments significantly improved bundle tenacity at 3 mm gauge length, while cypermethrin comparatively improved fineness and yield.

Fabrication work of a seed cotton cleaner is in progress.

Two quadrant balances for measuring Ginning Percentage of cotton have been developed and their working was quite satisfactory. Improvements are being planned in the design of the hydrostatic balances.

With a view to confirm the better applicability of the equation – $Mc = 0.2335\ M_D + 0.3712$ .... (1), where Mc – Maturity coefficient and M_D – the difference in Micronaire values with and without spacer, data of maturity coefficient of samples of 1980-81 season determined using caustic soda method as well as Micronaire Spacer technique were compared with the predicted values using the above equation as also the equation $Mc = 0.1753\ M_D + 0.3934$ ....(2) where Mc – Maturity coefficient and M_D difference in Micronaire values with and without spacer, which is being followed at CTRL. It was observed that the maturity coefficient value estimated by the new formula (1) were either equal to or slightly greater than the actual values obtained by the caustic soda method (mean difference being 0.02 ± 0.005), whereas the values predicted by the formula (2) were consistently lower than the actual values (mean difference being 0.06 ± 0.005).

Application of standard solvent exchange procedure to a few more varieties of cotton belonging to **G. arboreum and G. herbaceum** species showed that a near complete absence of convolution was not possible even after repeated solvent exchange trials. The absence of convolution in the solvent dried samples produced a difference of only 3° –4° which may be due to the few number of convolutions characteristic of the species unlike in the case of **G. hirsutum** and **G. barbadense** cottons where the differences were much higher.

In the case of cottons belonging to **G. arboreum** and **G. herbaceum** species, the values of x-ray angle were nearly equal after solvent exchange. These

values were also close to those reported earlier on similarly treated samples from **G. hirsutum** and **G. barbadense** species (range 23° – 26°). From these results it could be inferred that the value of original spiral angle in different varieties of cotton are nearly equal and that the pronounced spread in the x-ray angle in air-dried state is largely attributable to differences in the number of convolutions.

Having completed the mechanical fabrication work, the final assembly of the various components of the Electronic Fibre Length Scanner has been taken up in hand.

Structural and morphological studies conducted on Suvin, AK. 235 and Varalaxmi cottons showed that the percentage of fibre breakage in the vicinity of reversal was 34, 56 and 78 while the reversal density per cm for them was 29, 23 and 27, respectively indicating that fibres with a high reversal density need not exhibit a high probability of breaks occuring in the vicinity of reversal. Further, the average breaking tenacity, extension and linear density did not show any difference in the case of these cottons which confirms the earlier report that the observed drop in bundle tenacity at higher lengths is not correlated with reversal density in cottons.

The TEM study of cellulase treated samples revealed secondary cell wall with fomation of open spaces in a fibrillar sheet and erosion of fibrillar surface at the end of the first cycle of enzyme treatment. After continuous enzyme treatment for 18 days, considerable fragmentation of cell wall occurred and sharper fibrillar image was observed with the eventual formation of discrete needle shaped particles of 900 A° to 1100 A° length akin to hydrocellulose like particles. The particle length progressively reduced with repeated enzyme action, but even drastic acid hydrolysis could not yield particles of 300 A° length.

The strength uniformity ratio (SUR), stiffness and toughness for 80 cottons were correlated with crystallite orientation parameters. SUR and toughness showed the same trend as percent elongation, viz. best association with 75% x-ray angle and poor association with fx while stiffness showed more or less similar association with all orientation parameters. No significant correlation was noticed between maturity and strength-elongation parameters.

Orientation profiles of yarns of Suvin and Sudan cottons spun to various counts confirmed that effect of twist on orientation profile is stronger in yarns of coarse counts. Besides, for comparable counts the effect was more evident in yarns of Suvin than in those of Sudan.

Study of contrast ratio of various cottons revealed that the same variety exhibits different levels of lustre, but long staple cottons have higher contrast ratio as compared to short staple cottons.

Investigation conducted on the swelling of regenerated cellulose fibres in NaOH showed progressive rise in yarn tenacity with stretch, eventually reaching a value significantly above that of the untreated yarn and at the highest level of stretch, the breaking extension falls to half the value of the untreated yarn. Tests on yarn samples of 20s and 40s count showed that there was no significant effect of KOH treatment with different concentrations on the yarn irregularity. As far as single yarn strength was concerned, there was increase in tenacity values and decrease in yarn elongation on treatment with both NaOH and KOH for both the counts. However, in the case of yarn mercerised with wetting agent, there was no change in tenacity values of treated samples and the control.

On the basis of fibre and yarn test data for 35 cottons, equation $CSP = 12 (\sqrt{FQI} + 120)$ has been derived for establishing CSP from FQI. The predicted CSP from FQI values were very close to those obtained experimentally showing the suitability of using the equation to predict spinning potential of cottons.

Fabrics made from yarns obtained from a high trash content mixing employing four different methods of carding did not reveal any significant difference between the various combinations except for a loss in strength of 6% – 8% in the case of fabrics made out of OE yarns compared to that made from ring spun yarns.

Studies on Lakshmi Rieter drawing and speed frames showed no significant difference in roving, U% or yarn strength and elongation between the materials from different break-drafts, though the lowest beak-draft produced yarns of better regularity.

Processing and spining of three samples, viz. Laxmi, B. 1007 and L. 147 belonging to medium staple cottons and their blends were completed. Two cottons belonging to short staple variety from Maharashtra, 197|3 and Virnar, also were taken up for processing.

Studies on blends of viscose and polyester staple fibre carried out by both OE and ring spinning showed no specific advantage from OE spinning for man-made fibre blends except for the high productivity.

With increase in stretch during mercerization, both dynamic modulus and CRA showed progressive increase in their values with respect to control In the case of samples treated with HCHO and DMDHEU also, the same trend

was noticed as the severity of crosslinking increased. For a given treatment, as there exists a very high degree of correlation between dynamic modulus and CRA, the change in sonic modulus could as well be used as a substitute for studying bending recovery changes resulting from a given chemical modification.

The study of long range and medium range variations in blend composition of polyester/viscose (15 : 85) blend by infrared method had shown that when components of the same staple length and nearly same denier were mixed in a blow room and processed, both the original material and the flat strips produced yarns of good uniformity in composition by both OE and ring spinning systems. Variation in individual test value never exceed + 3% from the average when 40 cm yarn segments were used for infrared analysis.

Inverse relaxation tests for PSH 4804 and Jailene (both 50s count) and viscose staple yarn of 35s count at various levels of extension and retraction indicated initially stress relaxation followed by a transition region and inverse relaxation. When the retraction level is greater than the combined recovery for the particular extension level, inverse relaxtion becomes zero.

With a view to establish relationship between CRA and DP, fabrics having three different constructions were given DMDHEU treatment in six different concentrations and the analysis of the data revealed that there was good correlation between CRA and DP rating for all the three fabrics.

Yarns mercerised with 20% NaOH for 3 min under slack condition and for 2 min after stretching to normal length together with untreated yarns were evaluated for tenacity and elongation. After mercerisation there was tenacity retention varying from 107% to 115% and elongation retention varying from 78% to 80%.

Cotton fabric samples were treated with DMDHEU in the following two mixed catalyst systems with 2% solution of polyethylene emulsion as softener and 0.1% wetting agent: (1) 2.5% $Al_2(SO_4)_3 .16 H_2O$ +1% citric acid monohydrate (2) 0.5% $Al_2(SO_4)_3 .16 H_2O$ + 1.5% citric acid monohydrate. The samples were dried at 60° and cured at 140°C and 160°C and evaluated for various physical and chemical properties. The catalyst system (1) resulted in comparatively higher DP rating and Lower strength retention. In both cases the samples cured at 140°C had higher breaking and tearing strength values as compared to those cured at 160°C.

Cotton fabrics crosslinked with DMDHEU resin in the presence of mixed catalyst consisting of 1.0% $Al_2(SO_4)_3 .16H_2O$ and 2.5% citric acid mono-

hydrate, dried for varying periods and cured at 140°C for 10 min showed that rate of drying and agent migration varied considerably.

Data on various properties of cotton yarn samples mercerized under varying tension and crosslinked with formaldehyde by 'D' and 'W' bath showed that with increase in tension during mercerization, the formaldehyde content and breaking elongation decreased while the breaking strength and distention index increased.

Scoured, bleached, mercerized and desized cotton poplin fabric was grafted with acrylonitrile monomer using ceric ammonium nitrate as initiator in the M : L ratio of 1 : 50 and acrylonitrile was added to the bath in different M : L ratios. It was observed that, depending on the reaction time and monomer used, percent graft varied from 4 to 16 and the breaking strength showed slight improvement with 10% graft.

Simultaneous finishing of cotton with DMDHEU and a polymerisable zinc monomer was carried out and the same was evaluated for various physico-chemical properties together with fabrics treated conventionally using different catalysts in different concentrations. The combinations of DMDHEU with zinc monomers of acrylic, methacrylic and itaconic acids resulted in durable press performance of cotton fabric with higher retention of strength compared to the conventionally treated samples.

Flame Retardant (FR) finish to cotton fabrics imparted by phosphorylation treatment using easily available non-durable agents Diamonium hydrogen orthophosphate (DAP) and urea can be made more durable by using Hydrosyn, a new reactive polymer as the crosslinking agent. The efficiency of this treatment was assessed by comparing the flammability characteristics with those of fabrics conventionally treated with pyrovatex CP. While pyrovatex treated fabrics retained their original tensile strength, phosphorylated-hydrosyn treated fabric showed a better hand, retaining 70% of the original tensile strength as well as better retention of tearing strength. Analysis of preliminary mill trials of FR finished fabrics exhibited similar trend as that of Laboratory trials in respect of Limiting Oxygen Index (LOI), breaking strength retention and CRA.

Ten commercial samples of linters were tested for ash content, iron content and acid insoluble matter in raw state as well as after purifying by kiering and bleaching. After the treatment mineral content did not decrease as expected. The experiment is being repeated using demineralised water.

Four linter samples were tested for trash content by Shirley Analyser and iron content by Thiocyanate method using Lovibond Comparator and their

relationship ascertained. But no definite trend was observed. The survey of existing delinting units in Maharashtra was completed with visits to eight delinting units in the State.

Oil content of 13 cotton seed samples determined, varied from 16.16% to 19.63%. Fatty acid content of 26 samples of cotton seed oil determined by GLC for palmitic, oleic and linoleic fatty acids showed marked variation.

Ten samples of kapok seeds were analysed for chemical composition and fatty acid contents, employing GLC technique. The samples were free from gossypol, but contained all the fatty acids present in cotton seed oil.

Particle boards of size 15cm x 15cm prepared from cottonseed hull using different concentration of binder (0 – 15%) and a catalyst were tested for moisture content, water absorption, density, tensile strength and bending strength. The boards prepared with 20% moisture content showed gradual increase in tensile strength, modulus rupture and density with increase in resin concentration and decrease in moisture content and water absorption with increase in resin concentration.

Oil was extracted from cottonseed samples by solvent extraction method, which was subsequently esterified and saponified. Attempts are on to isolate pure acids from the saponified mixture by fractional crystallisation.

Experiments on biosynthesis of cotton were repeated using C^{-14} labelled UDPG and particulate enzyme obtained from cotton fibres at different stages of boll development. The ED patterns from 5 days old cotton fibre showed only four sports corresponding to the planes 002 and 021 of cellulose I, while the fibres frum later period gave a completely normal cellulose I pattern. Pellicle formed by growing **Acetobacter xylinum** from 5 to 20 days also gave cellulose I pattern.

The proteins of cottonseeds at different stages of development were fractionated into four fractions and nitrogen content of each was studied. Each fraction showed a different pattern of change in their nitrogen content.

The study on the effect of various concentration of wheat bran and oil seed cakes on the production of amylase from **Bacillus subtilis** showed that 1.0% wheat bran gave maximum amylase after 48 hr and remained constant upto 72 hr while with 4% wheat bran the major amylase production started after 48 hr and continued upto 96 hr, yielding four times more amylase than that obtained from 1.0% wheat bran. It was also noticed that 4% wheat bran with 0.75% seasame cake (black) or 1.4% seasame cake (white) produced amylase similar in quantity as that produced by 1.5% peptone.

Semi-solid fermentation of acid-hydrolysed and alkali neutralised substrates, viz. paddy straw, wheat straw, tur stalks, cotton stalks and groundnut hulls enhanced the crude protein percentage to about 1.5 – 2.0 folds when **Beijerinekia mobilis,** a free living nitrogen fixing bacterium was used. **Plurotus-sajor caju,** a mushroom fungus, can be easily grown on the above substrates to enhance the crude protein and **invitro** rumen digestibility (IVRD) without any pretreatment.

An experimental biogas plant which is a modification of china plant of fixed dome type for continuous fermentation of willow-dust was designed and fabricated out of High Density Polyethylene (HDPE). The plant was charged initially with 90 kg aerobically fermented willow-dust with substrate to water ratio of 1 : 12 and the yield of about 500-600 l of biogas daily was maintained by charging 10 kg of aerobically fermented willow-dust at an interval of 7 days. Attempts were made to reduce the water content to a bare minimum from the batch fermentation process. It is now possible to produce biogas as effectively as before with a substrate to water ratio of 1 : 1.5. Good quality compost was prepared from willow-dust to grow **Agaricus bisporus** and its suitability is being judged.

7 PERSONNEL

A list encompassing the staff position in the Scientific, Technical, Administrative and Supporting catagories as on December 31, 1982, is given in Appendix II. Major changes in the personnel matters during 1982 are summarised below :

A. Appointments

1. Technical Staff

Sarvashri P. L. Meshram and H. Sengupta to the posts of Technical Assistant Grade T-II-3 with effect from 1-2-1982 and 1-3-1982, respectively.

2. Auxiliary Staff

Smt. K. R. Joshi to the post of Hindi Translator (with effect from 21-7-1982).

3. Supporting Staff

Shri Narayan Singh to the post of Supporting Staff Grade I (with effect from 20-10-1982).

B. Assessment

1. Technical Staff

The Five Yearly Assessment of the eligible technical personnel of CTRL was held in 1982 and promotions/advance increments granted as detailed below :

Promotions

Sr. No.	Name	Grade to which promoted		Effective date of promotion
1.	Smt. Santa Nair	T-5	(Rs. 650-1200)	1-7-1982
2.	Shri T. K. M. Das	T-5	(Rs. 650-1200)	1-7-1982
3	Shri N. O. Anthony	T-I-3	(Rs. 425- 700)	1-7-1982
4.	Shri S. S. Patekar	T-2	(Rs. 330- 560)	1-7-1982

Advance Increments

Sr. No.	Name	Grade		Number of advance increments	Effective date of increment
1.	Shri S. R. Ganatra	T-5	(Rs. 650-1200)	2	1-7-1982
2.	Shri K. S. Bhyrappa	T-5	(Rs. 650-1200)	2	1-7-1982
3.	Shri A. W. Shringarpure	T-5	(Rs. 650-1200)	2	1-7-1982
4.	Shri B. S. Ganvir	T-4	(Rs. 550- 900)	2	1-7-1982
5.	Shri C. P. Venugopalan	T-4	(Rs. 550- 900)	2	1-7-1982
6.	Shri V. Jose Joseph	T-4	(Rs. 550- 900)	2	1-7-1982
7.	Shri D. L. Upadhye	T-I-3	(Rs. 425- 700)	1	1-7-1982
8.	Shri M. M. Shaikh	T-I-3	(Rs. 425- 700)	2	1-7-1982
9.	Shri P. B. Gurjar	T-I-3	(Rs. 425- 700)	2	1-7-1982
10.	Shri S. G. Dalvi	T-I-3	(Rs. 425- 700)	2	1-7-1982
11.	Shri A. R. S. Abdulla	T-I-3	(Rs. 425- 700)	1	1-7-1982
12.	Shri Purushottam Vira	T-2	(Rs. 330- 560)	2	1-7-1982
13.	Shri P. K. Gopalan	T-1	(Rs. 260- 430)	2	1-7-1982
14.	Shri Bechan Nokhai	T-1	(Rs. 260 430)	1	1-7-1982
15.	Shri K. V. Nair	T-1	(Rs. 260- 430)	2	1-7-1982
16.	Shri H. K. Pawar	T-1	(Rs. 260- 430)	2	1-7-1982

C. Obituary

Shri A.R.S. Abdulla, Senior Fitter (Ginning), Grade T-1-3, expired on 10-8-1982, while in service.

Shri Ramkishan Taleram, Supporting Staff Grade II, expired on 8-9-1982, while in service.

D. Deputation/Foreign Assignments

Shri G. S. Patel, Senior Technical Assistant, Grade T-4, deputed for training in Scanning Electron Microscope at M/s. Cambridge Scientific Instruments, Ltd., England, U.K., from 15-11-1982 to 26-11-1982.

8 APPENDICES

Appendix I

Financial Statement

EXPENDITURE AND RECEIPT OF THE LABORATORY DURING 1981-82

	Sanctioned Grant (Rs.)	Actual Expenditure (Rs.)	Saving (−) Deficit (+) (Rs.)
A. EXPENDITURE			
I. Technological Research Laboratory including Regional Stations (Non-Plan)			
(a) Capital Expenditure including Regional Stations (Non-Plan)		7,21,681.08	
(b) Working Expenditure	46,72,000.00	39,50,341.56	(+)22.64
	46,72,000.00	46,72,022.64	(+) 22.64
II. Scheme for Modernisation and Strengthening of CTRL for Intensive Research on cotton (Plan)	25,65,000.00	16,53,527.44	(+) 9,11,472.36
III. Schemes financed from funds			
Varieties of Indian Cottons : i. Optimal Blending of standard	96,000.00	50,870.98	(+) 45,12901

B. RECEIPTS	
I. Sale proceeds of fruits, vegetables, Plants and Seedlings, etc.	315.00
II. Sale proceeds of Vehicles Machine, Tools, Plant Equipments and other non-consumable materials	3,906.00
III. Analytical and testing fees	22,615.00
IV. Rent	84,074.91
V. a) Application fees from candidates in connection with recruitment b) Other application fees, tution fees, etc.	10,936.00
VI. Receipts from service rendered by the Institute	2,569.20
VII. Sale of publications	4,788.90
VIII. Interest on Loans and Advances granted to Institute employees	597.70
IX. Miscellaneous (including sale of cotton wastes, etc.)	13,718.75
Total :	1,43,521.96

Appendix II

Staff working at the Cotton Technological Research Laboratory as on 31-12-1982.

(List does not include vacant posts)

A. At CTRL, Bombay

Director : Dr. V. Sundaram, M.Sc., 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.Sc. Tech. 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)	,,	Dr. P. K. Chidambareswaran, M.Sc., Ph.D.
,, (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.)
,, (Physics)	,,	Shri A. V. Ukidve, M.Sc.
,, (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.
,, (Chemistry)	,,	Shri S. Aravindanath, M.Sc.
,, (Chemistry)	,,	Shri R. M. Gurjar, 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. Shaikh, M.Sc.
,, (Electronics and Instrumentation)	,,	Shri P. V. Varadarajan, M.Sc.
,, (Farm Machinery and Power)	,,	Shri N. Ramesh Babu, B.E., M.Tech.
,, (Chemistry)	,,	Shri U. N. Borkar, B.Sc. (Agri.), B.Sc. (Agri. Engg.), M.Tech.

APPENDIX

Scientist			
,,	(Microbiology)	S–I	Dr. R. H. Balasubramanya, M.Sc., Ph.D.
,,	(Microbiology)	,,	Kum. A. S. Dighe, M.Sc.
,,	(Organic Chemistry)	,,	Shri L. K. Suri, M.Sc.
,,	(Physics)	,,	Shri G. F. S. Hussain, M.Sc.
,,	(Physics)	,,	Dr. (Smt.) P. Bhama Iyer, M.Sc., Ph.D.
,,	(Physics)	,,	Shri R. P. Nachane, M.Sc.
,,	(Physics)	,,	Dr. S. Sreenivasan, M.Sc., Ph.D.
,,	(Physics)	,,	Dr. N. C. Vizia, M.Sc., Ph.D.
,,	(Quality Evaluation)	,,	Smt. K. L. Datar, M.Sc.
,,	(Quality Evaluation)	,,	Shri A. K. Gupta, M.Sc., LL.B., W.P.M.M.T.
,,	(Quality Evaluation)	,,	Shri B. M. Petkar, M.Sc.
,,	(Quality Evaluation)	,,	Smt. J. K. S. Warrier, M.Sc.
,,	(Statistics)	,,	Smt. Janaki K. Iyer, M.Sc.
,,	(Textile Manufacture)	,,	Shri Muntazir Ahmed, B.Sc., B.Sc.(Text.)
,,	(Biochemistry)	,,	Shri S. G. Gayal, M.Sc.
,,	(Instrumentation)	S	Shri G. S. Patel, M.Sc.
,,	(Quality Evaluation)	,,	Shri P. Bhaskar, M.Sc.
,,	(Quality Evaluation)	,,	Shri D. N. Makwana, M.Sc.
,,	(Statistics)	,,	Shri D. V. Mhadgut, M.Sc.

TECHNICAL STAFF

Quality Evaluation Officer	T–6	Shri M. S. Sitaram, B.Sc.
Technical Officer (Elect. Engg.)	T–6	Shri H. U. Gangar, B.E. (Electrical)
Junior Quality Evaluation Officer	T–5	Shri K. S. Bhyrappa, L.T.T., A.T.A.
,, ,, ,, ,,	,,	Shri K. Chandran, B.A.
,, ,, ,, ,,	,,	Shri S. Chandrasekhar, L.T.M., A.T.A.
,, ,, ,, ,,	,,	Shri S. R. Ganatra, MSc.
,, ,, ,, ,,	,,	Kum. I. K. P. Iyer, B.Sc.
,, ,, ,, ,,	,,	Shri H. R. Laxmivenkatesh, D.T.T., A.T.A.
,, ,, ,, ,,	,,	Smt. S. D. Pai, M.Sc.
,, ,, ,, ,,	,,	Shri A. W. Shringarpure, B.Sc.
,, ,, ,, ,,	,,	Shri N. Thejappa, M.Sc.
Technical Information Officer	,,	Shri T.K.M. Das, B.Sc., D.B.M., Dip.J., D.P.R., Cert. ISRS
Senior Technical Assistant (Photography)	T–4	Shri R. M. Modi, S.S.C. (Cert. in Photography).
,, ,, (Quality Evaluation)	,,	Shri K. V. Ananthakrishna, B.Sc., D.B.M.
,, ,, ,, ,,	,,	Smt. R. P. Bhat, B.Sc.
,, ,, ,, ,,	,,	Smt. P. A. Dabholkar, B.Sc.
,, ,, ,, ,,	,,	Shri B. S. Ganvir, B.Sc.
,, ,, ,, ,,	,,	Shri C. R. Sthanusubramony Iyer, B.Sc.
,, ,, ,, ,,	,,	Shri V. Jose Joseph, B.Sc.
,, ,, ,, ,,	,,	Smt. N. D. Nachane, B.Sc.
,, ,, ,, ,,	,,	Smt. S. V. Sukhi, B.Sc.
,, ,, ,, ,,	,,	Shri V. B. Suryanarayanan, B.Sc.
,, ,, ,, ,,	,,	Shri G. Vishwanathan, B.Sc., A.T.A.

Technical Assistant (Microbiology)	T-II-3	Smt. A. A. Kathe, B.Sc.
Technical Assistant (Quality Evaluation)	"	Shri S. M. Gogate, B.Sc.
" " "	"	Shri S. J. Guhagarkar, B.Sc.
" " "	"	Shri I. H. Hunsikatti, B.Sc., A.T.A.
" " "	"	Smt. S. R. Kamath, B.Sc.
" " "	"	Shri M. Karmakar, B.Sc.
" " "	"	Shri P. K. Mandhyan, B.Sc.
" " "	"	Shri E. A. Pachpinde, B.Sc.
" " "	"	Shri R. S. Pathare, B.Sc.
" " "	"	Shri D. Radhakrishnamurthy, M.Sc.
" " "	"	Shri K. B. Rajagopal, B.Sc.
" " "	"	Shri N. Ramanathan, B.Sc.
" " "	"	Shri S. Sekar, B.Sc.
" " "	"	Shri H. Sengupta, B.Sc., Part I, Diploma in Tertile Tech.
" " "	"	Shri S. Vancheswaran, B.Sc.
Senior Library Assistant	"	Smt. Rekha K. Shahani, B.Sc., B.Lib.
Draughtsman	T–I–3	Shri P. B. Gurjar
Electrician	"	Shri R. B. Pawar
Laboratory Assistant (Chemistry)	"	Shri N. O. Anthony
Mechanic	"	Shri R. K. Landge
Turner	"	Shri M. M. Shaikh
Electrician	T–1	Shri A. A. Gote
Laboratory Assistant	"	Shri S. B. Kamble
Wireman	"	Shri D. V. Kambli

AUXILIARY STAFF

Operator (Refrigeration)	(Rs. 550–900)	Shri V. V. Kshirsagar
" "	(Rs. 425–700)	Shri S. G. Dalvi
Machine Operator	"	Shri D. L. Upadhye
Translator (Hindi)	"	Smt. K. R. Joshi
Senior Operator	(Rs. 330–560)	Shri P. J. Ahire
"	"	Shri R. A. Dalvi
"	"	Shri Purushottam Veera
Carpenter	"	Shri G. D. Narkar
Driver	"	Shri S. S. Patekar
Plumber	"	Shri H. B. Tambe
Senior Operator	(Rs. 260–430)	Shri D. B. Gadankush
"	"	Shri P. K. Gopalan
"	"	Shri Bechan Nokai
"	"	Shri H. K. Pawar
"	"	Shri S. G. Shinde
Driver	"	Shri P. C. Dutta
"	"	Shri B. B. Gaykar

APPENDICES

ADMINISTRATIVE STAFF

Administrative Officer	Shri P. Ramamurthy, B.A.
Asstt. Administrative Office	Shri V. N. Wadhwani
Asstt. Accounts Officer	Shri V. J. Antony, B.Com. F.S.A.A. (India)
Superintend	Shri D. L. Kalsekar
Assistant	Shri M. P. Juwale
"	Shri F. C. Fernades
"	Shri K. S. Deshpande
"	Shri D. P. Naidu
"	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
Junior Stenographer	Smt. Chellamma Damodaran
"	Shri Venu Thanikal
"	Shri V. T. Bhuvad, B.A.
"	Kum. T. A. Rodrigues
Cashier	Shri S. N. Salve
Senior Clerk	Shri V. M. Kasabe
"	Smt. M. V. Kamerkar, B.A.
"	Smt. Veena Kotwani, B.A.
"	Shri K. W. Khamkar, B.A.
"	Shri B. D. Sawant
"	Shri A. B. Dalvi
"	Shri D. G. Kulkarni
Junior Clerk	Smt. S. S. Shanbhag
"	Shri K. N. Iyer
"	Shri H. G. Kini
"	Shri G. N. More
"	Smt. V. V. Desai
"	Smt. S. D. Ambre
"	Smt. S. M. Desai
"	Kum. V. E. Sagwekar
"	Shri A. P. Natu
"	Kum. Sujata G. Nayar
"	Shri M. Sarkar
Telephone Operator	Smt. K. K. Kale

SUPPORTING STAFF

Grade IV	Shri K. D Mohite
"	Shri M. M. Rupawate
"	Shri R. G. Chiplunkar
"	Shri P. G. Kadam
Grade III	Shri M. B. Thokrul
"	Shri K. K. Kasar
"	Shri T. R. Kadam
Grade II	Shri Babu Aba Babar
"	Shri R. R. Khurdekar
"	Shri H. N. Gawde
"	Shri Obilal Parsuram
"	Shri S. V. Patil
"	Shri Ratansingh Gussain
"	Shri R. S. Pawar
"	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 Shamji Waghela
"	Shri G. G. Ambare
"	Shri A. R. Bane
"	Shri G. S. Devrukhkar
"	Shri S. L. Gawde
"	Shri A. B. Sawant
"	Shri B. K. Sawant
"	Shri V. Y. Unhalekar
"	Shri M. B. Chandanshive
"	Shri B. R. Satam
"	Shri D. M. Chougule
"	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 O. T. Thapa
"	Shri M. K. Ghadge
"	Shri M. Z. Rathi
"	Shri Narayan Singh

B. Regional Quality Evaluation Units of CTRL

Station	Technical Officer (Quality Evaluation), Grade T-7	Technical Officer, (Quality Evaluation) Grade T-6	Junior (Quality Evaluation), officer Grade T-5	Senior Technical Assistant (Quality Evaluation), Grade T-4	Scientist, Grade 'S'	Technical Assistant (Quality Evaluation), Grade T-II-3	Senior Operative/ Laboratory Assistant, Grade T-1	Assistant (Administration)	Supporting Staff, Grade III	Supporting Staff, Grade II	Supporting Staff Grade I
1	2	3	4	5	6	7	8	9	10	11	12
Akola	—	—	—	—	—	Kum. V. S. Ayyar, B.Sc.	—	—	—	—	—
Coimbatore	—	—	Shri A. K. Antony, B.Sc. Smt. Santa V. Nair, BSc.	Shri C. P. Venugopalan B.Sc.	—	—	Shri K. V. Nair	—	Shri N. Arumugham	Shri V. M. Subramaniam	—
Dharwad	—	—	Shri E. S. Abraham, B.Sc.	—	—	Shri M. T. Danolli, B.Sc.	—	—	Shri R. P. Belamaddi	Shri Y. R. Sone	—
Guntur	—	—	Shri R. Dwarakanath, B.Sc.	—	—	Shri S. Mukundan, B.Sc.			Shri Ch. Timmanna	—	Shri V. Y. M. Suvarchala Rao
Hissar	—	—	Shri S. N. Nagwekar, B.Sc.	—	—	—	—	—	Shri Gian Singh	Shri Harisingh Babar	—
Indore	—	—	—	—	Shri S. B. Jadhav, M.Sc.	—	Shri Sunil Sharma, B.Sc.	—	Shri John Robert	Shri Kamikkar Singh	—
Ludhiana	—	—	—	—	—	Shri V. K. Madan, B.Sc.	—	—	—		—
Nagpur	—	—	—	—	—	Shri V. M. Kulmethe, B.Sc.	—	—	—	—	Shri Satyana-rayan Gope
						Shri P. L. Meshram, B.Sc.				—	
Nanded	—	—	—	—	Shri L. D. Deshmukh M.Sc.	Shri N. V. Bansode, B.Sc.	—	—	—	Shri L. R. Indorkar	—
Sriganga-nagar	—	Shri Ram Parkash, B.Sc	—	—	—	—	—	—	ShriVijendra Singh	—	Shri S. M. Saini
Surat	Shri L. R. Jambunathan, B.Sc. A.M.I.C.T., L.T.I.		—	Shri M. C. Bhalod, B.Sc.	Shri Y. Subramanyam, M.Sc.	Shri J. K. Gohel, B.Sc. Shri G. G. Mistry, B.Sc.	—	Shri G. Sasidharan	Shri J. B. Dhodia	—	Shri K. M. Rathod

Appendix III

STATEMENT SHOWING THE TOTAL NUMBER OF EMPLOYEES AND THE NUMBER OF SCHEDULED CASTES/SCHEDULED TRIBES AMONGST THEM AS ON DECEMBER 31, 1982.

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	38	–	4%	–	–	–
	Temporary	8	2				
Class II	Permanent	37	–	7.5%	–	–	–
	Temporary	4	3				
Class III	Permanent	42	4	13%	–	2%	–
	Temporary	48	9		2		
Class IV (excluding Safaiwala)	Permanent	29	6	19%	2	5%	–
	Temporary	28	5		1		
Class IV (Safaiwala)	Permanent	1	1	100%	–	–	–
	Temporary	4	4				

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 1982.

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

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

9 ANNEXURES

ANNEXURE – I

NEW EQUIPMENTS PURCHASED DURING 1982

1. Electronic Tensiometer along with accessories
2. Systronics Double Pulse Generator
3. Oscilloscope with accessories
4. Deep Freezer
5. Padding Mangle
6. Haraeus Flask Type Combustion Apparatus
7. Analytical Balance
8. Model 485 Instaweigh Balance
9. Sartorious Balance
10. Poland Make Projection Microscope
11. ADCO Kjeldahl Digestion Heater
12. Stelometers
13. Textool Doublewinder
14. Pentex Camera with accessories.

ANNEXURE – II

DISTINGUISHED VISITORS TO CTRL DURING 1982

1. Mr. R. M. Dharmadasa Banda,
   Deputy Minister of Textile Industries,
   Colombo, Sri Lanka,
2. Mr. L. P. Donglas Pemasiri,
   Trade Commissioner for the Democratic
   Socialist Republic of Sri Lanka,
   Sri Lanka House, 34, Homi Modi Street,
   BOMBAY-400 023.
3. Shri R. N. Banerji,
   Managing Partner,
   Star Industrial & Textile Enterprises Ltd.
4. Dr. V. G. Cheremisinov,
   Assistant Agricultural Attache,
   USSR Embassy in India,
   NEW DELHI.
5. MR. E. B. Dissanaike,
   Govt. Analyst and Director of the
   Textile Service and Training Centre,
   Sri Lanka.
6. Dr. A. B. Joshi,
   Ex-Vice-Chancellor,
   Mahatma Phule Krishi Vidyapeeth,
   Rahuri, Ahmednagar,
7. Mr. Fred Gillham,
   Head, Technical Information Section,
   I C A C
   1225, 19th Street,
   Washington D.C.
8. Dr. R. Nagarcenkar.
   Director, Central Sheep and Wool Research, Institute.
   Avikanagar.

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   Assistant Agricultural Attache,
   USSR Embassy in India,
   NEW DELHI.

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   Govt. Analyst and Director of the
   Textile Service and Training Centre,
   Sri Lanka.

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   1225, 19th Street,
   Washington D.C.

8. Dr. R. Nagarenkar,
   Director, Central Sheep and Wool Research Institute
   Avikanagar.

Cotton Technological Research Laboratory

Indian Council of Agricultural Research

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BOMBAY