COTTON TECHNOLOGICAL RESEARCH LABORATORY

Indian Council of Agricultural Research

भाकृअनुप
ICAR

Annual Report
1986

BOMBAY

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Introduction

This sixty-third Annual Report of Cotton Technological Research Laboratory (CTRL) covers the calendar year 1986.

CTRL situated at the precincts of the five gardens near Dadar, Bombay, was established in the year 1924 by the Indian Central Cotton Committee (ICCC) with the objective of undertaking spinning tests on different strains of cotton received from Departments of Agriculture in various parts of the country as also to carry out tests for the fibre properties and relating the same to the spinning values of cotton. Accordingly, the Laboratory had been working in close collaboration with the State Departments of Agriculture, till all the commodity committees including ICCC were abolished in 1966 and the administrative control was taken over by the Indian Council of Agricultural Research (ICAR). Under ICAR, the research efforts of CTRL were reoriented and intensified to fulfil the overall responsibility of ICAR to undertake, aid, promote and coordinate agriculture and animal husbandry research and education and its application in practice. Concerted efforts were directed to produce cottons superior in yield and quality for better utilisation of cotton lint and cotton plant by-products, thereby making cotton cultivation more lucrative and opening up employment potential for rural masses that ultimately gives a boost to the economy of the country.

Functions

1. To participate actively in the programmes for improvement in production and quality of cotton in India by evaluating the quality of new strains evolved by agricultural scientists and giving them necessary technical guidance.
2. To carryout research on physical, structural and chemical properties of cotton in relation to quality and processing performance.
3. To carryout research 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 Government departments, the trade and other bodies.
7. To collect and disseminate technical information.

Organisation

The Director, who is the head of the institution is assisted by a team of Senior and Junior Scientists and Technical Officers in various disciplines and grades. In the administrative matters, he is assisted by an Administrative Officer and two Assistant Administrative Officers, while an Accounts Officer looks after the financial aspects and internal audit of accounts of the Laboratory. An organisational chart is given in Annexure I.

Library

CTRL maintains an up-to-date library of books on cotton, cotton technology, basic disciplines in physical science and related subjects. During the year 1986, 153 books and 108 bound volumes of journals were added to the collection of books in the library thereby bringing the total number of books by the end of the year 1986 to 3882 and of bound volumes to 4824. About 200 journals which comprise 150 foreign and 50 Indian journals, were being regularly received at the library of which about 100 journals were through subscription and the remaining by way of gratis/exchange/complimentary. The size of the holdings at the library are as follows :

The total library expenditure during the current financial year was about Rs. 1,20,000/-.

In addition to the staff of the Laboratory the library facilities were utilised by students and research workers from colleges affiliated to the Bombay University and from other research institutions and industry. Inter-library loan facilities were maintained with other libraries in Bombay.

S. No.	Type	Current Total	Average Annual Addition
1.	(a) Books	3,882	150
	(b) Monographs, Conference Proceedings, Reports, etc.	2,000	100
2.	Bound Volumes of Journals	4,824	150
3.	Patents	45	—
4.	Standards	3,000	120
5.	Translation articles	45	—

New Equipments

A list of some of the new equipments purchased during 1986 has been given in Annexure II.

Distinguished Visitors :

Dr. N. S. Randhawa, Director General, ICAR, Dr. D. N. Srivastava, Deputy Director General (CS), ICAR, Dr. C. Kempanna, Asstt. Director General, ICAR, Dr. N. L. Bhale, Direc-

tor, CICR and a few other senior officers of ICAR visited the Laboratory for official purposes. A list of some of the other dignitaries from India and abroad who visited the Laboratory during the year is given in Annexure III. In addition, group visits by students and research workers has been a regular feature during 1986 also.

Management Committee

The reconstituted Management Committee of CTRL met once during the year 1986. The meeting held on October 24 and 25, 1986 had four new members and therefore, the meeting started by introducing them and welcoming them to the Committee. Agenda items discussed were as follows :

1. Confirmation of the Minutes of the Previous Meeting.
2. Action taken on the Recommendations of the Management Committee at its Meeting held on 12-9-1985.
3. Progress of Expenditure.
4. Progress of Works.
5. Action taken on the recommendations of the Institute Joint Council and Grievance Cell.
6. Progress of research during 1985 and Programme of Research work for 1986.
7. Purchase of furniture for the Committee Room on single quotation.

Staff Research Council

The eighty-fifth meeting of the Staff Research Council was held on five preliminary sessions on March 13, 14, 24, 25, 1986 and April, 9, 1986 and a final session with the Management Committee on October 25, 1986, mainly to discuss the progress of research work during 1985 in various divisions of the Laboratory and to finalise a programme of work for the year 1986. Dr. V. Sundaram, Director chaired all the sessions. In all, eleven research projects were completed/discontinued during the year, while 34 new projects were suggested of which 32 have been approved. In the meeting discussions were held about the submission of Milestone document of on-going research projects to the Council.

Research Projects

There were 55 on-going research projects, of which six were common laboratory projects and one inter-institutional entitled 'Technological Evaluation of Germ Plasm Material' in collaboration with Central Institute for Cotton Research, Nagpur.

Hindi Day Celebration

Hindi Day was celebrated on September 11, 1986 with a function presided over by Shri K. N. Mehta, Hindi Officer, Office of the Central Excise, Bombay. Shri Vinod Godre, Reader and Shri Madhushri Kabra of Bombay University were the Chief guests. Cash prizes were distributed by the Chief guest to the successful members of staff, who participated in the following competitions arranged during the Hindi Week :

1. Noting and Drafting in Hindi (Only for Administration staff)

2. Quiz programme 'What's the good word?' (Uchit Shabdh Kya Hai)
3. Essay Competition
4. "Turant Bataiye" Contest (Only for Supporting Staff)
5. Elocution Competition

Hindi Teaching Scheme

One staff member was sponsored for training under this scheme and she passed the Hindi Pragya Examination.

Post Graduate Training

The recognition granted to CTRL by the Bombay University as a post graduate institution was continued during the year. Ten post graduate students were being guided for M.Sc. — two in Physical Chemistry, two for Organic Chemistry and the remaining for Physics (Textiles), while one student was guided for M.Text. (Spinning). Three students were being guided for Ph.D. degree in Physics (Textiles) and two in Textile Technology.

Three members of the staff were awarded M.Sc. degree in Physics (Textiles), during the year.

The following Scientists were the recognised research guides for various degrees during 1986.

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

Membership on Other Organisations

The Director, CTRL was nominated as a member of the High Level Committee set up by the Government of Maharashtra to undertake management study of the working of Maharashtra State Co-operative Cotton Growers' Marketing Federation Ltd. Besides, the Director continued to be member in the following committees/ bodies during the year :

1. Cotton Advisory Board of the Office of the Textile Commissioner, Government of India, Ministry of Commerce, Bombay.
2. Board of Directors of Cotton Corporation of India Ltd., Bombay.
3. Research Advisory Committee of South India Textile Research Association (SITRA), Coimbatore.
4. Governing Council of General Advisory Committee of the Research and Liaison of Bombay Textile Research Association (BTRA), Bombay.
5. Cotton Research Advisory Sub-Committee of Indian Cotton Mills' Federation Cotton Development and Research Association, Bombay.

6. Board of Management of Victoria Jubilee Technical Institute (VJTI), Bombay.
7. Editorial Board of the Journal of Textile Association, Bombay Chapter.
8. Research Advisory Committee of ATIRA and Chairman of the Panel of Experts for 'Physics Oriented Studies of ATIRA', Ahmedabad.

In addition, the Director and other scientists of CTRL continued to represent CTRL/ICAR in various committees of the Indian Standards Institution, as in the past.

Grievance Cell

The Grievance Cell of the Laboratory has been reconstituted with the following members :

Shri P. G. Oka (Chairman)
Shri P. Ramamurthy (Member)
Shri D. S. Ranganathan (Member)
Smt. S. S. Shanbhag (Member)
Shri S. S. Patekar (Member)
Shri M. B. Thokrul (Member)
Shri K. Parleshwar
(Non-member Secretary)

In all, nine meetings were held and thirteen individual grievances were dealt with during the year.

Institute Joint Council

Three meetings were held during the year — on April 19, 1986, July 19, 1986 and October 21, 1986 — to discuss various items as per agenda. A special meeting with Grievance Cell members and the Secretary (Staff Side) of the Central Joint Council also was held on April 24, 1986.

ICAR Sports Meet

CTRL participated in Badminton individual and Team Championship and Kabaddi in the Inter Zonal Final Tournaments for Team events held at the Central Arid Zone Research Institute at Jodhpur from February 13 to 16, 1986. Shri A. K. Gupta of CTRL was runner-up in the Badminton Individual Championship.

CTRL actively participated with a contingent strength of 38 at the ICAR Zonal Sports Meet (Zone IV) held at Lucknow from October 4 to 7, 1986. CTRL participated in 5 team events and 2 individual events apart from atheletics, conducted at K.D. Singh Babu Stadium and Secured First/ Second place in the following events :

1. Badminton Team Event —
   Winner (Shri A. K. Gupta, Shri R. M. Gurjar and Shri S. N. Nagwekar)
2. Badminton Singles — Winner (Shri A. K. Gupta)
3. Volley Boll (Shooting) — Runner up
4. Kabbaddi — Runner up
5. Relay Race (4 x 100 metres) —
   Winner (Shri S. Venkatakrishnan,
   Shri N. V. Kambli,
   Shri P. V. Jadhav and
   Shri T. K. M. Das)

Finance

A statement showing sanctioned budget grant of CTRL and actual expenditure for the financial year 1985-86 has been furnished in Annexure IV. As could be seen from the statement, the actual expenditure under non-plan was Rs. 78,11,132/- as against the sanctioned grant of Rs. 77,32,000/-. An expenditure of Rs. 59,43,531/- was incurred on the scheme for modernisation and strengthening of CTRL for Intensive Research on Cotton (Plan) as against the sanctioned grant of Rs. 60,00,000/-.

Significant Research Findings

The boll rind toughness tester developed and fabricated at CTRL was used to test the hardness of 20 days old bolls of eighteen genotypes and 10 and 30 days old bolls of eight genotypes to study the relation between age and toughness of cotton bolls. It was observed that the strongest boll offered thrice as much resistance to penetration as the weakest bolls at the age of 20 days for the cottons tested and that most of the bolls have rinds 2-3 mm thick and the variation of strength of penetration for these two depths is not significant in any single variety. For shoots the strength increased significantly from first node to second node.

The morphological deformities in fibres of Jayadhar cotton examined under SEM have been classified into 10 categories. The most frequently occurring deformities which affect the fibre strength are (i) reversal of direction of convolution associated with a structural reversal (ii) 90° phase change in convolution direction (iii) sudden change in the direction of curvature of bean shaped cross-section (iv) S or Z edge along the length of the fibre. Examination of broken ends of fibres shows that the rupture is mostly associated with one or the other morphological deformities. The occurrence of V and U bend, S or Z edge and sharp twists is very low but their presence affects the fibre strength seriously. All the structural reversals are not weak places in the fibre. Reversals which are weak sections in the fibre are characterised of being located at thin and flat sections of fibre and have distinctly clear line of demarcation dividing the reversal into two halves.

When cotton fibres are swollen in 65% zinc chloride for about 30 min. at room temperature ($\simeq$ 32°C) and stretched to original length, tenacity at both 0 and 3 mm gauge lengths showed substantial increase. Improvement in 3 mm gauge strength was as high as 100% or nearer, especially when the variety had a low 3 mm gauge strength and poor uniformity ratio to begin with. However, it is observed that swelling of cotton fibres in aqueous zinc chloride at higher temperatures (40°C or above) at both the swelling maxima (viz. 65% (w/w) and 70% (w/w) was detrimental to the strength of stretched fibres.

A study of the comparison of two methods of yarn twist measurement has revealed that the untwist-retwist method carried out with the pretension limited to tex/2 grams gives accurate twist results. The study has also shown that the torsional equilibrium'

method suggested for open-end yarns must be applied with caution as the results are affected by the pre-tensioning weight applied to the yarn as well as by the damping level during relaxation of torsion.

Effect of gauge length on tenacity, breaking strain and work of rupture, studied on 20s count yarns spun from Varalaxmi cotton with twist multipliers of 4.0 and 5.5 and by OE and ring spun methods has shown that the tenacity and breaking strain decrease as gauge length increased and the drop in these parameters with gauge length increase was more in the case of ring spun yarns than OE yarns. The percentage of decrease was more severe for breaking strain. Work of rupture instead of increasing in proportion to test length, increased at a far slower rate due to the progressive fall in tenacity and breaking strain with gauge length. The increase in work of rupture with reference to that at 1 cm was more for OE yarns in comparison with ring spun yarns at any specimen length.

Viscoeleastic index determined for filament yarns of viscose (450D/90f), polyester and nylon for loading, unloading and reloading cycle has shown that in the first cycle of loading it goes on increasing upto a certain strain and then decreasing as the strain increases for viscose and polyester, it increases upto about 3% strain for nylon and then remains almost constant for further strains. During unloading, there is a continuous decrease in viscoelastic index. For viscose, viscoelastic index increases with strain in the second cycle, but it remains almost constant for polyester and nylon in the second cycle.

The effect of doubling on the yarn x-ray angle was more marked in the case of open-end spun singles yarns. The yarn x-ray angle was found to be associated with breaking tenacity of coarser yarns, and breaking elongation of finer yarns. A relationship in which fibre bundle and yarn x-ray angles figure was found promising in understanding structure-strength relations in ring spun yarns.

The resistance offered by fabrics to moisture transmission measured by the control dish method was found to be in good agreement with the time taken for moisture transfer obtained in the present study. The time taken to reach mean rh was found to be greatly influenced by fabric parameters viz. thickness and weight in the case of cotton fabrics and by fabric cover of all-polyester fabrics. In the case of blended fabrics none of the fabric parameters directly influenced moisture transfer. A partial correlation analysis indicated that the time of transfer depended on the percentage polyester content as well as on the weight of the blended fabric.

Good quality superabsorbents which are likely to have application in agriculture, were prepared from starch and guargum by gamma ray radiation for grafting purpose. Mutual irradiation gave satisfactory grafting results.

The microcrystalline cellulose prepared from bagasse pulp, cotton stalk pulp and wheat straw pulp was on par

with the standard microcrystalline cellulose, Avicel, as far as the various properties were concerned.

The cotton plant parts such as stems, petiole, leaves, bracts and boll rind were found to have gram negative bacteria that cause byssinosis or mill fever in significant numbers and that there was marked difference in their numbers in the four cultivated species.

Good quality pulp and paper have been prepared by kraft and soda pulping process using linseed stalk as the chief raw material.

Janata Biogas plants with stationery scum breakers laid out at Dharwad and CTRL using willow-dust as the chief raw material has been working satisfactorily with a charge of 50 kg willow-dust at weekly intervals to maintain constant supply of 1.7 m^3 biogas.

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Progress of Research

A brief account of the research work carried out during 1986 is given below :

EVALUATION OF THE QUALITY OF COTTON SAMPLES RECEIVED FROM AGRICULTURAL TRIALS

Considerable number of samples are received every year for technological evaluation from trials undertaken under All India Co-ordinated Cotton Improvement Project (AICCIP) as well as at Agricultural University and State Departments of Agriculture.

The number of such samples received for tests during the years 1984, 1985 and 1986 together with the average for the quinquennium 1981-85 has been given in Table I (a). The total number of samples tested at the various quality evaluation units of CTRL is summarised in Table I (b).

The samples received from agricultural trials are tested in the order of their receipts and test reports are sent as soon as the tests are over. The test results on Trade Varieties and Standard Indian Cotton Samples are reported in the form of periodical technological circulars and at the end of the year, these circulars are compiled for the whole season and published as Technological Reports — one for Trade Varieties of Indian cottons and the other for Standard Indian cottons.

Every year CTRL receives some samples for miscellaneous tests such as determination of quality of ginning, oil content in cotton seed, etc. and reports on them are issued as soon as the tests are over.

Some samples are also received pertaining to on-going research projects. Tests reports are not generally issued on these samples, as the results form part of the relevant research publications.

Table 2 gives the state-wise figures for the number of samples tested for fibre characteristics and spinning performance under two sub-heads : (i) All India Co-ordinated Cotton Improvement Project and (ii) Other State Schemes.

ALL INDIA CO-ORDINATED COTTON IMPROVEMENT PROJECT

This is the nineteenth year of the AICCIP. As many as 1035 samples were tested for fibre properties and spinning potential during the year. Test data on various trials were

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

Type of Test	Average for the quinquennium 1981-85	1984	1985	1986
Fibre and Full Spinning	188	187	217	279
Fibre and Microspinning	1730	1362	2228	1904
Microspinning Alone	—	—	6	—
Fibre Tests Alone	212	549	248*	244**
Mill Tests	8	4	8	12
Standard Cottons	13	22	23	28
Trade Varieties :				
— Lint	15	14	8	105
— Kapas	52	45	35	32
Technological Research	138	45	20	13
Miscellaneous	20	—	3	3
TOTAL	2376	2228	2796	2620

* Excludes 1713 lint samples received under "Germ Plasm" and "Agronomy" Projects.

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

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

Regional Quality Evaluation Unit	Quality Parameters				
	Fibre length	Fibre fineness	Fibre maturity	Fibre strength	Micro-spinning tests
Akola	2698	400	400	400	—
Coimbatore	2149	2149	2149	2149	714
Dharwad	1515	1202	1202	1202	—
Guntur	568	844	491	565	—
Hissar	572	677	454	371	—
Indore	578	575	608	578	—
Nagpur	755	240	243	315	—
Nanded	993	844	957	910	—
Rahuri	1290	1287	1287	300	—
Sriganganagar	2202	1534	1534	1647	—
Surat	11538*	6645**	7068	6817†	551

* Out of which, 4022 samples were tested on Fibrograph with one pair of combs.

** Out of which, one lot of 686 samples was tested on Micronaire.

† Out of which, three breaks were made on the Pressley Strength Tester for 1654 samples.

TABLE 2: NUMBER OF SAMPLES TESTED AND REPORTS SENT DURING 1986

State	Fibre and Full spinning	Fibre and Micro-spinning	Fibre Test only	Total
(i) *All India Co-ordinated Cotton Improvement Project*				
Punjab	49 (9)	45 (5)	10 (1)	104 (15)
Haryana	10 (2)	93 (14)	—	103 (16)
Uttar Pradesh	—	17 (3)	—	17 (3)
New Delhi	—	—	—	—
Rajasthan	25 (5)	36 (4)	12 (1)	73 (10)
Madhya Pradesh	—	145 (14)	—	145 (14)
Gujarat	69 (11)	43 (6)	—	112 (17)
Maharashtra	27 (6)	87 (12)	—	114 (18)
Andhra Pradesh	2 (1)	6 (1)	—	8 (2)
Karnataka	—	433 (33)	—	433 (33)
Tamil Nadu	2 (1)	92 (11)	12 (1)	106 (13)
Orissa	—	—	—	—
TOTAL	184 (35)	997 (103)	34 (3)	1215 (141)

(ii) *Other State Schemes*

State	Fibre and Full spinning	Fibre and Micro-spinning	Fibre Test only	Total
Punjab	—	12 (2)	26 (2)	38 (4)
Haryana	10 (2)	—	108 (12)	118 (14)
Uttar Pradesh	—	—	—	—
New Delhi	—	—	—	—
Rajasthan	10 (6)	—	40 (1)*	50 (7)
Madhya Pradesh	—	—	—	—
Gujarat	6 (6)	—	—	6 (6)
Maharashtra	36 (32)	92 (13)	743 (18)*	871 (63)
Andhra Pradesh	—	—	—	—
Karnataka	4 (3)	86 (6)	—	92 (9)
Tamil Nadu	13 (13)	4 (2)	54 (10)	71 (25)
Orissa	—	—	4 (1)	4 (1)
TOTAL	79 (62)	196 (23)	975 (44)	1250 (129)

* 40 (1) samples from Rajasthan and 302 (3) samples from Maharashtra belong to "Germ Plasm" Projects.
Figures in brackets indicate the number of reports sent.

presented at the respective panel meetings held at New Delhi for North Zone, Surat for Central Zone and Coimbatore for South Zone.

NORTH ZONE

North Zone comprises the states of Punjab, Haryana, Rajasthan, Uttar Pradesh and Delhi. Most of the area in these states is under irrigation and hence the yield levels are generally higher than those of the remaining cotton growing states in this zone.

Major emphasis in this zone is given to identify high yielding American type of strains, superior to the existing ones. Attention is also given to identify strains which are early maturing (sowing to harvesting period about 150 days). Trials are also conducted to evolve high yielding **desi** varieties and adaptable short duration hybrids.

G. hirsutum Trials

The Co-ordinated Varietal Trial of **G. hirsutum** under Normal Plant Type was conducted at Faridkot, Hissar, Ludhiana and Sriganganagar and under Compact Plant Type at Hissar, Ludhiana and Sriganganagar. This trial was also conducted for the strains which mature earlier than the normal period at Faridkot, Hissar, Ludhiana, Sirsa and Sriganganagar.

The ranges of 2.5% span length, Micronaire value, maturity and bundle strength along with spinning potential of various strains under this trial have been compiled in Table 3.

Promising strains from these trials at different locations were as given below :

Location	*Count*	*Promising strains*
	Normal Plant Type — Br 04 (a)	
Faridkot	30s	F.572, H.912, F.505, LH.886 and F.286 (Control)
Hissar	40s	LH.886, H.974, B.N. and H.777 (Control)
Ludhiana	40s	LH.886, RS.610, LH.1000, RS.634, and F.286 (Control)
Sriganganagar	30s	LH.1000, H.974, LH.892, RS.634, H.912, and G.Ageti (Control).
	Compact Plant Type — Br 04 (b)	
Hissar	30s	Pusa 31, Pusa 95, LH.900 and H.777 (Control)
Ludhiana	40s	HS(CP)-23, Pusa 31, LH.947, LH.900 and F.286 (Control)
Sriganganagar	40s	H.83-6, Pusa 95, F.725 and G.Ageti (Control)
	Early Maturing Type — Br 04(c)	
Faridkot	30s	LH.722, F.470, F. 671, and F.286 (Control)
Hissar	30s	RS.510, HS.45, Pusa 595-B, and H.777 (Control)
Ludhiana	40s	HS.6, HS.45, LH.722, and F.286 (Control)
Sriganganagar	30s	LH.722, HS.6, F.671, HS.45 and HS.381

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

Location	No. of samples	Ranges of				Count	Spinning Control performance		
		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 — Br 04(a)									
Faridkot	6F	23.0—26.9 (25.9)	4.2—4.9 (4.5)	74—89 (83)	45.0—50.4 (48.0)	30s	5	—	F.286
Hissar	6F	23.7—25.0 (24.2)	4.1—5.1 (4.6)	70—86 (81)	42.3—43.7 (45.0)	40s	4	—	H.777
Ludhiana	6F	24.5—25.9 (25.0	3.5—4.5 (4.0)	67—81 (74)	45.6—49.3 (47.5)	40s	5	1	F.286
Sirsa	5M	23.9—25.4 (24.6)	4.4—5.1 (4.7)	78—87 (82)	47.7—50.4 (48.8)	50s	—	1	H.777
Sriganganagar	6F	24.3—27.9 (25.9)	4.0—5.4 (4.9)	72—91 (81)	45.0—49.8 (46.8)	40s	2	—	G.Ageti

TABLE 3 : (Contd.)

1	2	3	4	5	6	7	8	9	10
				Compact Plant Type — Br 04(b)					
Hissar	7F	25.2—28.5 (26.4)	3.8—4.8 (4.4)	73—85 (80)	42.9—48.2 (44.6)	30s	4	—	H.777
Ludhiana	6F	24.7—27.8 (26.2)	3.7—4.7 (4.2)	72—77 (74)	44.0—50.9 (47.2)	40s	5	—	F.286
Sriganganagar	7F	23.8—27.0 (25.5)	3.9—4.7 (4.5)	76—86 (82)	46.1—50.9 (48.4)	40s	4	2	G.Ageti
				Short Duration Type — Br 04(c)					
Faridkot	6F	24.3—26.3 (25.6)	4.2—4.9 (4.4)	79—86 (82)	42.3—48.8 (45.1)	30s	4	2	F.286
Hissar	6F	23.4—26.6 (24.8)	3.7—4.7 (4.3)	75—86 (80)	44.5—47.7 (45.6)	30s	4	1	H.777
Ludhiana	6F	23.8—26.0 (25.0)	3.7—4.4 (3.9)	65—75 (68)	39.7—47.7 (44.0)	40s	4	—	F.286
Sirsa	6M	23.9—26.2 (24.8)	4.3—5.3 (4.7)	74—89 (83)	45.6—50.4 (48.2)	40s	—	3	H.777
Sriganganagar	5F	23.6—25.9 (24.5)	4.3—4.9 (4.6)	79—86 (83)	43.4—48.2 (45.3)	30s	4	—	No Control

A — Samples spinnable to the counts selected.
B — Samples having spinning performance on par or better than control.
F — Full Spinning.
M — Microspinning.

Note : Values in brackets indicate averages.

Preliminary Varietal Trial for Normal Plant Type was conducted at Faridkot, Hissar, Ludhiana, Mathura, Sirsa and Sriganganagar. This trial for Early Maturing Type was also conducted at Faridkot, Hissar, Ludhiana, Mathura, Sirsa and Sriganganagar.

The following strains fared well at the locations indicated below :

Location	*Count*	*Promising strains*
	Normal Plant Type — Br 03(a)	
Faridkot	30s	F.683, F.889, and F.286 (Control)
Hissar	40s	F.682, F.683 and F.889
Mathura	30s	B.N., H.994, F.889 and Pramukh (Control)
Sriganganagar	40s	F.683
	Early Maturing Type — Br 03(b)	
Faridkot	30s	LH.964, F.780, HS.137, LH.357-E and F.286 (Control)
Hissar	40s	H.989 and H.777 (Control)
Mathura	30s	B.N. and Pramukh (Control)
Sirsa	30s	B.N., HS.137 and H.777 (Control)

Initial Evaluation Trial was conducted at Faridkot, Hissar and Sirsa. Promising strains were as given below :

Location	*Count*	*Promising strains*
Faridkot	30s	F.286 (Control)
Hissar	40s	H.1027, H.1033 and H.777 (Control)

G. arboreum Trials

The main object of Co-ordinated Varietal Trial (CVT) of **G. arboreum** is to identify short staple and very coarse strains (Micronaire value above 7.0) which have a good export potential.

The entries which have recorded Micronaire value over 7.0 were as listed below.

Hissar : RG.8

Ludhiana : LD.299, DS.5, LD.260, HD.58 and RG.8

Sirsa : DS.5, LD.26 and DS.1 (Control)

Sriganganagar : G.27, LD.299, DS.5, LD. 260, HD.58, RG.8, RG.11, RG.12 and G.1 (Control)

From the spinning point of view, the following **arboreum** strains recorded desired yarn strength at 20s count in the preliminary Varietal Trial.

Hissar : LD.329

Ludhiana : Pusa-Desi 4, SD.6-9

In the hybrid trial conducted in North Zone, six hybrids, viz. PCHH.9, HH.1, HH.2, FCH.1 and FCH.3, raised at Faridkot recorded satisfactory performance at 30s count.

CENTRAL ZONE

The States of Madhya Pradesh, Gujarat and Maharashtra comprised the Central Zone. This zone has the largest area under cotton cultivation. Although, emphasis is given to improve the existing American type cotton **(G. hirsutum)**, sizeable percentage of cottons from **G. arboreum** species is also under cultivation as most of the area is under rainfed cultivation. For the last many years, hybrids such as Hybrid 4, Hybrid 6, JKHy.1, Godavari, etc. are being commercially cultivated in this zone. Attempts are being made to identify early maturing hybrids without sacrificing the yield. Considering the increasing demand for the medium and superior medium cottons, attempts are also directed to identify **desi** hybrids.

Further, trials are also conducted for improvement in **G. herbaceum** cottons — the species which are traditionally grown in some pockets in the state of Gujarat.

G. hirsutum Trials

The Co-ordinated Varietal Trial was conducted at Surat under irrigated conditions, while this trial was conducted under rainfed conditions at Akola, Badnapur, Bharuch, Indore, Khandwa, Nanded and Somnathpur. The strains which are identified for earliness are also tried at Padegaon where sowing is done much earlier than scheduled for the Zone.

The ranges of 2.5% span length, Micronaire value, maturity and bundle strength along with their spinning potential have been compiled in Table 4.

Promising strains from spinning point of view were listed as under :

Location	*Count*	*Promising strains*
		Irrigated
Surat	40s	G.4812, JK.119-25-68, NH.258 and G.Cot.10 (Control)
Talod	40s	DS.70-480, G.4812, JK.119-25-68, G.2482 and G.Cot.10 (Control)
		Rainfed
Akola	40s	79.BH.5-3
Badnapur	30s	8246, NH.210, NH.290, ACH.540 and NH.239
Bharuch	30s	081, PH.36 and G.Cot.10 (Control)
Indore	40s	ACH.540, NH.210, 081, 79.KH.1945, AC.938 ACH.247 and 79.BH.5-3
Khandwa	40s	KH.81-1911, NH.290, ACH.540, NH.210, NH.247, LRA.5166, 79.KH.1945, AC.938 and ACH.247.
Nanded	30s	8246, AC.938, NH.247, ACH.540 and Purnima (Control)
Somnathpur	30s	AC.938, NH.210, 79.BH.5-3, ACH.540 and 8246

TABLE 4 : SUMMARY OF TEST RESULTS OF STRAINS TRIED IN CO-ORDINATED VARIETAL TRIALS OF G. HIRSUTUM IN CENTRAL ZONE

Location	No. of samples	Ranges of				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
Irrigated Trial — Br 04(a)									
Surat	7F	25.0—30.1 (27.1)	3.4—4.6 (4.2)	76—87 (83)	36.4—47.2 (42.6)	40s	5	2	G.Cot.14
Talod	7M	25.3—27.8 (26.8)	3.2—4.4 (3.8)	69—83 (75)	41.8—51.5 (46.3)	40s	6	7	L.C.
Padegaon (N.Z.)	6M	25.6—28.2 (26.5)	3.6—4.3 (4.1)	71—82 (78)	39.7—44.5 (42.8)	—	—	—	Laxmi
Rainfed Trial — Br 04(b)									
Akola	7M	23.0—28.0 (24.5)	3.4—4.9 (4.3)	65—85 (78)	37.0—50.4 (45.0)	40s	1	6	L.147
Badnapur	6M	25.0—30.7 (27.0)	2.8—3.6 (3.2)	—	39.1—45.0 (42.8)	30s	5	3	NH.239
Bharuch	7F	24.1—26.9 (25.4)	3.7—4.5 (4.1)	73—85 (79)	42.9—47.7 (45.2)	30s	4	—	L.C.

TABLE 4 : (Cond.)

1	2	3	4	5	6	7	8	9	10
Indore	20M	22.4—29.4 (25.3)	2.7—3.7 (3.1)	—	40.7—49.3 (43.8)	40s	7	4	L.C.
Khandwa (1985-86)	20M	21.7—29.8 (26.6)	3.8—5.4 (4.5)	76—90 (85)	42.3—50.9 (48.7)	40s	9	9	L.C.
Khandwa (1984-85)	5M	24.1—28.2 (25.5)	3.8—4.6 (4.2)	77—85 (81)	45.0—52.5 (46.7)	40s	—	2	G.Cot.10
Nanded	6M	26.4—29.6 (27.5)	3.4—4.3 (3.9)	—	44.0—48.8 (46.5)	30s	5	2	Purnima
Somnathpur	6M	24.7—31.3 (27.3)	3.4—4.6 (4.0)	66—77 (72)	37.5—45.6 (41.6)	30s	5	—	No Control

A — Samples spinnable to the counts selected.

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

NZ — North Zone Entries.

F — Full spinning test.

M — Microspinning test.

Note : Values in brackets indicate averages.

Preliminary Varietal Trial was conducted at Junagadh under irrigated conditions and at Akola, Amreli and Khandwa under rainfed conditions. This trial under irrigated conditions was also conducted at Padegaon with the entries identified for North Zone.

Promising strains which have recorded desired yarn strength at the count chosen were as given below :

Location	*Count*	*Promising strains*
Junagadh (I)	30s	G.2987, G.5249, and G.Cot.10 (Control)
Akola (R)	40s	0442 and 79.BH-5-2
Amreli (R)	40s	NHS.23, 79.BH-5-2, G.2987 and CPD.11-1-C and G.Cot.10 (Control)
Khandwa (R)	40s	0442, G.4406, G.4814, PH.34, Ankur-H-22, G.464, G(T)325, 80-BH-10-6, 79-BHO.5-2, G.4812, NH.208 and Ankur-H-216

I — Irrigated R — Rainfed

Initial Evaluation Trial was conducted at Akola, Khandwa, Somnathpur and Talod. Following strains fared well at the count indicated below :

Location	*Count*	*Promising strains*
Akola (R)	40s	PH.293
Khandwa (R)	20s	G.84, PH.47, PH.67, NH.294 and G.4812
Somnathpur (R)	30s	PH.93, NH.210, NH.347, NH.262(A) and Suman
Talod (I)	40s	G.1846, G(T).119, G(T).996, G(T).940, PH.093, PH.23, G(T).1042 and G.Cot.10 (Control)

I — Irrigated R — Rainfed

G.arboreum Trials

Co-ordinated Varietal Trial was conducted at Akola, Khargone and Somnathpur. The promising strains at different locations were as listed below :

Location	*Count*	*Promising strains*
Akola	20s	PH.65, AKH.5 (Local Control) and AKH.4 (Control)
Khargone	20s	PA.65, AK.161, NA.80, PA.33, PA.9 and AKH.4 (Control)
Somnathpur	20s	PA.65, PA.9, NA.80 and AKA.161

Preliminary Varietal Trial was also conducted at Akola. Amreli, Khargone and Somnathpur. The following strains recorded satisfactory performance at 20s count :

Location	*Promising hybrids*
Akola	JLA.91, 83/PA-46, AKA.157 and AKA.5 (Local Control)
Amreli	36 I-N.KWA.2, 83/PA-59, and Sanjay (Control)
Khargone	83/PA.46, JLA.91, AKA.81, AKA.156, JLA.93, NA.208, AKA.154, JLA.89, KWA.2, AKA.157, 83/PA-39 and AKH.4 (Control)
Somnathpur	G(AA)-1 and NA.208

G herbaceum Trials

Samples pertaining to this trial were received from Bharuch and Surat under irrigated conditions.

Two strains, viz. GH.3549 and GH.377 raised at Bharuch recorded satisfactory yarn strength at 40s count. At Surat also two strains, viz. GH.317 and G.Cot.11 recorded satisfactory yarn strength at 30s count.

Promising strains at the respective locations are as listed below :

In the preliminary Varietal Trial conducted at Bharuch, two strains, viz. GH. 479 and GH.1335/1 recorded promising results at 40s count.

Hybrid Trials

Hybrids involving **hirsutum** x **hirsutum** crosses were tried at Akola, Khandwa and Surat under irrigated conditions and at Akola under rainfed conditions.

Location	*Count*	*Promising Hybrids*
Akola (I)	40s	GBHH.3, AHN.468 (Local Control) and Hybrid 4 (Control)
Khandwa (I)	50s	GHH.334, GBHH.3, JKHy.2, GBHH.2 and Hybrid 4 (Control)
Surat (I)	50s	MECH.1, GHH.334, MECH.3 and G.Cot.Hy.6 (Local Control)
Akola (R)	50s	GBHH.2

Hybrids involving **hirsutum** x **barbadense** crosses were tried at Surat under irrigated conditions. Three hybrids fared well at 80s count. They are NIRH. 1411, MECH.1001 and DCH.32.

A trial involving **herbaceum** x **arboreum** crosses was conducted at Akola.

The following five hybrids fared well at 20s count :

GDH.22, GAA.155, 83/PA-1, GDH.149 and DAA.83

Evaluation of Dwarf Material

Dwarf type plants have certain advantages in respect of yield over the normal type plants. In order to study the yield and technological aspects of such plant types, trials were conducted at Akola, Indore and Khandwa. The following strains gave encouraging spinning performance at the locations indicated :

Location	*Count*	*Promising strains*
Indore	40s	0133, DCI.120 and G.Cot.10 (Control)
Khandwa	40s	0133, 081, Surat Dwarf, 083, NH.262 and Khandwa 2 (Local Control)

Miscellaneous Trial

In order to identify material resistant to saline soil trials were being conducted at Indore. A selection, termed Barwaha Selection, from the above trial recorded mean length of about 25.0 mm with Micronaire value of 3.8 and bundle strength of 49.3 g/t. It has recorded desired yarn strength at 50s count.

SOUTH ZONE

South Zone comprises the States of Karnataka, Andhra Pradesh and Tamil Nadu. Cottons belonging to **G. hirsutum** species cover a large area in this zone. Cottons from other species, viz. **G. arboreum, G. herbaceum** and **G. barbadense** are also grown in some tracts of this zone. In addition, hybrid cottons especially of **hirsutum-barbadense** are largely cultivated in this zone.

G. hirsutum Trial

Co-ordinated Varietal Trial was conducted at Arabhavi under irrigated conditions and at Dharwad and Shimoga under rainfed conditions. Ranges of 2.5% span length, Micronaire value, maturity and bundle strength along with their spinning performance are given in Table 5.

Promising strains from this trial from the spinning point of view, were as given below :

Location	*Count*	*Promising strains*
Arabhavi (I)	30s	ACP.71-51-9, DIC.16, DS.27, LRA.5166 LS.133-1, ACP.71-27-1/1, DIC.29, MCU.5 and Sharada
Dharwad (R)	40s	JK.236-2, LRA.5166 and Laxmi
Shimoga (R)	40s	LRA.5166, JK.236-2, and RAS.253-17

I — Irrigated R — Rainfed

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

Location	No. of samples	Ranges of				Count	Spinning performance		Control
		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
Co-ordinated Varietal Trial — Br 04									
Arabhavi (I)	10M	23.1—33.3 (27.8)	2.4—3.2 (2.9)	47—73 (61)	40.2—47.7 (43.8)	30s	10	3	L.C.
Dharwad (R)	9M	22.6—28.1 (26.5)	3.4—4.4 (3.9)	61—77 (71)	39.7—47.7 (43.0)	40s	3	8	L.C.
Shimoga (R)	10M	24.6—29.8 (27.1)	3.3—4.6 (3.9)	61—83 (81)	41.3—48.2 (44.7)	40s	5	1	L.C.

A — Samples spinnable to the counts selected.

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

M — Microspinning.

I — Irrigated

R — Rainfed

Note : Values in brackets indicate averages.

Preliminary Varietal Trial was conducted at Arabhavi and Siruguppa under irrigated conditions and at Dharwad and Shimoga under rainfed conditions. Strains which have shown desired yarn strength at the respective counts were as given below :

Location	*Count*	*Promising strains*
Arabhavi (I)	30s	SRG.574, MESR.27, EMS.3, L.2, SIMA.1, DIC.8, DIC.10, MCU.5, SRG.659, TCH.665 and LRA.5166
Siruguppa (I)	40s	DIC.8, SRG.574, L.2, SIMA.1, LRA.5166, EMS.3, MESR.24, MESR.27, RAS.312, DIC.10, LPS.141, SRG.659 and MCU.5 (Control)
Dharwad (R)	40s	JK.404, JK.279, NA.896, SRG.804, LRA.5166 and Laxmi
Shimoga (R)	40s	JK.402, JK.404, DRG.247, SRG.804, LRA.5166, NA.1135, RAS.309, JK.279, NA.896, L.1, JK. 349, DRC.15, Laxmi and Sharada

I — Irrigated R — Rainfed

Initial Evaluation Trial

This trial was conducted at Arabhavi under irrigated conditions and at Dharwad under rainfed conditions. The following strains fared well at the locations and counts indicated below :

Location	*Count*	*Promising strains*
Arabhavi (I)	30s	RAS.311, L.387, ACP.71-19-1/1,L.1, MCU.5, JK.258, LRK.516, KM.1, SRG.214, LPS.36, L.75, TKH.4-3, L.389-1, AH.130, SRG.759, LPS.141, SRG.139, TSM.162, HLS.321729, ACP.72-12-5, TKH.4-4, VS.5, LRA.5166, AH.107, MESR.32, AH.113, AS.104, JK.405 and Sharada.
Dharwad (R)	30s	TKH.495, KM.1, AH.107, L.2, VS.5, TKH.4-3, NA.1162, JK.258, DRC.6, RAMP.218, TKH.496, NA.1026, LRK.156, JK.285, DRC.17, NA.1202, JK.401, NA.1171, HLS.321729, DCI.C.JK.406, RAMP.155, TKH.4-4, IS.11, NA.1149, RAMP.290, VS.2, DCI.B., Laxmi and Sharada (Local Control)

I — Irrigated R — Rainfed

G.barbadense Trial

Co-ordinated Varietal Trial was conducted at **Maddirala** under irrigated conditions. Range of 2.5% span length was between 29.6 mm and 35.1 mm. Micronaire value ranged between 2.5 μg/in and 3.1 μg/in. Maturity was low to average. Bundle strength values were good at both the gauge lengths. As many as three out of six strains viz. C.16, C.17 and BCS.9-95 alongwith the control variety Suvin, recorded satisfactory yarn strength at 80s count.

G.herbaceum Trial

Co-ordinated Varietal Trial was conducted at Dharwad under rainfed conditions. They have recorded a narrow range of 2.5% span length, i.e. between 21.4 mm and 24.2 mm. Micronaire value also ranged between 4.7 and 5.4. Maturity and bundle strength values were satisfactory. The following strains fared well at 20s count :

DB.2-12-82-83, SM.140, SM.88, SM.150, SM.6, DB.3-12-5-132, DB.3-12-83-225, KJT.12-2-5-84 and Control varieties namely DB.3-12 and Jayadhar.

Hybrid Trials

Hybrid trials involving **hirsutum x hirsutum** crosses were conducted at Dharwad and Shimoga under rainfed conditions. The promising strains at 40s count were as given below :

Location	*Promising Hybrids*
Dharwad	M_9 x T_1, Somnath, DCH.397, JKHy.1, T_7 x M_{12}, NHH.39, CIN.1 and CIN.3
Shimoga	JKHy.1, CIN.3, T_6 x M_7, NHH.39, Somnath, CIN.1, $MAXT_1$, CIN.3, DCH.397 and T_7 x M_{12}.

A trial on **desi** hybrid was conducted at Dharwad under rainfed conditions. Three hybrids, viz. AH.71, GDH.22 and DDH.2 fared well at 20s count.

Pilot Project Demonstration Trial

This trial was conducted at Arabhavi under irrigated conditions and at Dharwad and Shimoga under rainfed conditions. The promising strains from the spinning point of view were as follows.

Location	*Count*	*Promising strains*
Arabhavi (I)	40s	MCU.5 and LRA.5166
Dharwad (R)	20s	NA.920, DP.452, DRC.68, RKR.4145, LRA.5166, DRC. 153, Laxmi, CPD.11-1-2 and Sharada (Local Control).
Shimoga (R)	40s	DRC.68, LRA.5166, CPD.11-1-2, Laxmi, DRC.153 and Sharada

I — Irrigated R — Rainfed

National Elite Varietal Trial

In order to study the performance of the promising varieties already released/pre-released, trial was conducted at most of the Main Cotton Research Stations in the country. The following strains gave desired yarn strength at the counts and locations indicated :

Location	*Count*	*Promising strains*
Abohar	40s	LH.900, F.572, HS.45 and F.286 (Control)
Akola	40s	Vikram, Khandwa.3 and LRA.5166
Faridkot	40s	F.572, and F.286 (Control)
Hissar	40s	H.777, SRT.1, Vikram, LRA.5166, Supriya, MCU.10 and HS.45
Jullunder	50s	LH.886, F.505, LH.900 and B.N.
Khandwa	30s	NA.247, Supriya LRA.5166, Sharada, G.Cot.10, Khandwa.3, H.777, Vikram, DC.761, F.286, F.414, PKV.081 and Khandwa.2 (Control)
Kheri	40s	B.N., LH.886 and F.505
Ludhiana	50s	HS.45, and F.286 (Control)
Sirsa	30s	LH.886, F.572, HS.45, LH.900 and H.777 (Control)
Sriganganagar	40s	F.572, HS.45, LH.900, RS.513, B.N. and G.Ageti (Control)

MILL TEST

After careful consideration of quality parameters of cotton strains at field trials as well as technological evaluation of them at CTRL, the promising varieties of cotton are being subjected to mill test to gauge their performance under mill conditions. The recommendations for large scale propagation of these improved strains will be generally made only after their performance at the mill conditions is confirmed. CTRL arranges mill tests with the cooperation of a few textile mills in the country.

During the year mill tests were arranged for samples received from Faridkot and Srivilliputhur and the test results are reported in Table 6.

It may be seen from the table that the new strain, viz., F.505 identified at Faridkot recorded lower CSP than the control variety F.286 at the mill. The count selected was a coarser count of 18s. Another new strain, SVPR.763 identified at Srivilliputhur recorded lower yarn strength and CSP value at the mill than at the Laboratory. The CSP values recorded for SVPR.763 was lower as compared to that for the control variety, MCU.7. Both the cottons gave desired yarn strength at 40s count.

TABLE 6 : COMPARATIVE SPINNING TEST RESULTS AT MILL AND CTRL FOR THE YEAR 1986

Sr. No.	Place	Variety	Mill Test Results			CTRL Test Results		
			Count	Lea strength (lb)	CSP	Count	Lea strength (lb)	CSP
1.	Faridkot	F.505	18s	118.6	2135	NA	NA	NA
		F.286 (C)	18s	123.1	2216	NA	NA	NA
2.	Srivilliputhur	SVPR.763	40s	48.4	1937	40s	49.4	1976
		MCU.7 (C)	40s	49.7	1987	40s	55.0	2200

C — Control, NA — Not available

EVALUATION OF MAJOR TRADE VARIETIES OF COTTON GROWN IN DIFFERENT PARTS OF THE COUNTRY

Lint samples of fair average quality of the major Trade varieties of Indian cottons are being obtained for each season through East India Cotton Association, Bombay. Representative **Kapas** samples of these varieties are also procured from State Departments of Agriculture for determination of ginning percentage. The fibre and the spinning test results, ginning percentage, and other test results on each variety of cotton are being published as Technological Circulars as early in the season as possible for information to cotton trade and industry. Such Circulars were issued during 1984 on 28 Indian cottons as given under Chapter 3.

EVALUATION OF THE QUALITY OF STANDARD INDIAN COTTONS

To assess 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 every year. These varieties are grown in Government farms and cotton research stations under the supervision of senior cotton scientists of Agricultural Universities every year under identical conditions. Extensive fibre and spinning tests are regularly being done on such samples and the test results are published as Technological Circulars for information of cotton breeders and other research workers, as early as in the season as possible. During 1986, 14 such circulars were issued. The results of samples of 1984-85 season were consolidated and published as Technological Report on Standard Indian Cottons 1984-85 season.

TECHNOLOGICAL EVALUATION OF GERMPLASM MATERIALS

While breeding programmes are executed, very valuable genetic mate-

rial is developed. However, only very few cultures can reach to the level of release as variety. Such material, which are not yet recognised as variety, might have some character or combination of characters to be considered as very useful source of donors. A system of registration of such material will help their preservation and future use at appropriate time.

A project 'Technological Evaluation of Germplasm Material' was therefore taken up to help the cotton breeders by providing data on the proper cultures, for improving the quality character or characters, during the course of their research work.

Under this project, during 1986, fibre quality determination of the available Germplasm (GP) stocks was carried out. A total of 504 genotypes, of which 302 belonged to **G. hirsutum** 40 belonged to **G.arboreum** and 162 to **G.barbadense**, were evaluated to identify the dominant quality characters of each cultivar.

2.5% span length and length uniformity ratio were determined on Fibrograph, Micronaire value and maturity coefficient were obtained on Micronaire instrument and bundle strength at zero gauge length was determined on Stelometer.

G.hirsutum

The values of mean length ranged between 18.8 mm and 30.5 mm, Micronaire values ranged from 2.4 to 5.5, with a great deal of scope for the selection. About 30 cultures were too fine (i.e. less than 3.0 Micronaire value) and immature.

Variability in bundle strength also showed good scope for selection, as tenacity values at zero gauge were between 33.0 g/t and 51.1 g/t.

G.arboreum

2.5% Span length ranged from 17.1 mm — 26.3 mm. Strain RG.8 was shorter (16.5 mm mean length and hence coarser, Micronaire value being 7.7.

G.barbadense

Out of 254 cultures received from CICR, Nagpur, as mentioned earlier only 162 genotypes were technologically analysed. As the work is in progress the same will be reported in the next report after completion.

INHERITANCE STUDY OF FINENESS IN DESI COTTONS

The F_1 produce from 28 diallele crosses with 8 parents was sown on June 19, 1986 in a randomised block design, replicated thrice. The lint obtained from 108 samples was tested for GP, lint index and seed index. The testing work for fineness will be commenced soon.

INVESTIGATION ON THE ENVIRONMENTAL FACTORS AFFECTING FIBRE QUALITY— SOIL FACTOR

The experiment was continued for the second year during 1985-86. Three varieties were grown in each of 8 soil profiles, at Surat and the same 3 varieties were simultaneously grown at the places from where the soils were brought, as follows :

Varieties : 3	*Soil profiles* : 8	*Environments* : 2
V1 : G. Cot. 10	S1 : Surat	E1 : Surat
V2 : G. Cot. Hybrid 6	S2 : Anand	E2 : the concerned place from where the soil was brought
V3 : G. Cot. Hybrid 7	S3 : Bharuch	
	S4 : Arnej	
	S5 : Junadgadh	
	S6 : Talod	
	S7 : Viramgam	
	S8 : Amreli	

There were 3 replications for each variety. All the 135 samples have been analysed for the fibre properties.

The analysis of variance indicated that the varieties are significant for all the fibre properties, as expected.

The treatments were analysed varietywise and the findings are discussed below :

I. **LENGTH**

G.Cot. 10 : Length was significant for different soils and environments. Surat environment gave considerably higher length than the other. Arnej soil gave maximum length and it is on par with Surat and Talod soli. Interaction between soils and environment was effective for Anand, Bharuch, Junagadh and Talod soils.

G.Cot. Hybrid 6 : Surat environment was favourable for long fibres and soils were marginally effective for length.

G.Cot Hybrid 7 : Environment was not effective. Soil profiles showed effect on fibre length. Interaction was observed in Arnej soil.

II. **FINENESS (Micronaire value)**

G.Cot.10 : Variation in fineness was observed for different soil profiles. Value increased for Viramgam soil.

G.Cot. Hybrid 6 : Environments were not effective. Soil profiles were effective considerably. At Surat, the soils of Junagadh, Talod were effective for the decrease in fineness.

G.Cot. Hybrid 7 : Fineness was highly significant for different soils (ranging from 4.4 to 5.5 for different soils). It was also influenced due to interaction between soil and environment.

III. **MATURITY**
(Percentage Mature Fibres)

G.Cot.10 : Maturity was significant for soils. Viramgam soil produced less number of mature fibres when compared to others. Environment could not influence maturity. Under Surat environment, Talod and Viramgam soils gave higher mature fibres whereas the trend was reverse for Anand soil.

G.Cot.Hybrid 6 : Amreli soil gave maximum number of mature fibres with Surat environment. Maturity decreased for Anand and Viramgam soils whereas for Talod soil the trend was opposite.

G.Cot.Hybrid 7 : Marginal changes were observed in maturity under different soils and then interaction with environments.

IV. Fibre Strength (Tenacity at zero gauge length)

G.Cot.10 : Tenacity was significantly higher for Surat environment. Arnej soil gave stronger fibres (50 g/t) while the fibres from Viramgam (45 g/t), Anand (47.4 g/t) and Bharuch (47.6 g/t) were weaker.

G.Cot. Hybrid 6 : Tenacity was not influenced by the soils or environments.

G. Cot. Hybrid 7 : Tenacity was significantly affected by soils. At Surat, Viramgam soil gave a lower strength while Amreli soil a higher strength.

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

In all 446 lint samples received from (1) Main Cotton Research Station, Surat (2) Central Institute for Cotton Research, Nagpur (3) Agricultural Research Stations, Khandwa and Morena from M.P. were analysed for major fibre properties, viz. 2.5% span length, fibre fineness, fibre bundle strength and fibre maturity. The samples were from the following agronomic trials,

I. Main Cotton Research Station, Surat

246 lint samples analysed were pertaining to the following trials.

(a) Agronomic Trial of Pre-release varieties viz. G.Cot.10, 2637 and Surat dwarf. Response of these varieties to two levels of spacing and four levels of fertilizer was studied.

(b) Agronomic requirements of G.Cot. 11, G.Cot.DH.7, and DH.149 was studied. The experiment consisted of different plant density and four levels of nitrogen.

(c) Agronomic requirements of two new hybrids viz. G.HH.334 and G.Cot. Hy. 6. The study consisted of three spacings (120 × 30 cm, 120 × 45 cm, and 120 × 60 cm) and four levels of nitrogen, varying from 80kg/ha to 320 kg/ha.

II. Central Institute for Cotton Research, Nagpur

72 lint samples received from Nagpur were analysed to study the effect of Telephone system on economic characters of cotton. The experiment consisted of the following treatments :

Treatment 1.

Normal sowing with 120 × 90 cm and 90 × 60 cm Spacings and N 90, P 45, K 45 Kg/ha.

Treatment 2.

Intensive cultivation with Spacing 120 × 90 and 90 × 60 and Fertilizer dose N 240, P 120 and K 120 Kg/ha.

Treatment 3.

Similar treatment No. 2 but Telephone system is introduced to keep the plant erect.

III. **Agriculture Research Station from Morena and Khandwa**

(a) Agronomy Trials from Morena Agro 4 :

Eight different schedules of spray was given to one variety of cotton. Six treatments along with control with varying doses of insecticides partly sprayed and partly given to soil and last treatment was water spray only.

(b) Agro 3 : (a) One variety of Cotton was given four levels of nitrogen, viz. 0, 40, 80 and 120 kg/ha and three different levels of spraying schedule for plant protection.

IV. **Agriculture Research Station, Khandwa**

48 lint samples received from Agro 9 were analysed for major fibre properties. As the details of the experiment was not supplied, the data is kept pending for statistical analysis.

STUDIES ON THE IMPROVEMENT OF FIBRE QUALITY IN COTTON BY NUTRITIONAL MANIPULATION

For this study, two pot cultures and one field experiment, were in progress. In the first pot culture five levels of sodicity and four chemicals, viz EDTA, chelated Na, K and Ca were sprayed from the time of square formation stage, separately and in combination. The square shedding which was very limited, was made. The ginning of the cotton was in progress.

In the second pot culture experiment, two levels of saline soil and two levels of sodic soil and two levels of saline-sodic soil were created by adding soluble salts in naturally occurring sodic soil. The cotton was grown in such soils. The picking of the cotton was done and ginning was in progress for obtaining the G.P. and lint for determining fibre quality.

The third experiment was conducted in the field in the normal soil. The spraying of different chelated metals, separately and in combination, was carried out. In that experiment also the ginning was in progress.

FABRICATION OF HARDNESS TESTERS FOR BOLL RIND AND COTTON SHOOTS

The existing boll toughness tester was modified to accommodate testing of cotton shoots. A depth indicator was also fabricated and attached to the device. Eighteen genotypes of cottons were studied for the cotton boll hardness when they were 20 days old. Eight of these varieties were studied when they were 10 days and 30 days old to obtain relation between age and strength. Each of the above tests required depths of penetration measurement and force measurement, the former being in steps of 0.5 mm upto 4 mm.

Cotton shoots belonging to the above varieties were also tested. For this purpose, the two nodes adjacent to the fruiting bud were selected from plants. The results were tabulated. In addition, the cotton boll rinds were peeled and tested for the piercing

strength by the above device. Based on the experience gained by these tests, a modified instrument had been designed and was being fabricated.

Tests results indicated that :

1. The strongest bolls offer thrice as much resistance to penetration as the weakest bolls at the age of 20 days for the cottons tested in Dharwar Farm.
2. Most of the bolls have rinds 2-3 mm thick and the variation of strength of penetration for these two depths is not significant in any single variety. The excess force needed for 3 mm depth over 2 mm depth can be inferred as due to the fine membrane enclosing the lint and seed and also due to the inside material.
3. Beyond 3 mm depth the force tends to remain at a constant value indicating the maximum strength.
4. For shoots, the strength increases significantly from first node to second node. Further, chemical protection tends to increase the strength of shoots.

STUDY OF THE QUALITY OF COTON LINT FROM DIFFERENT PICKINGS OF DIFFERENT CULTIVATED SPECIES AND THEIR HYBRIDS

Details regarding species and varieties are given below :

No.	*Species/Group*	*Varieties*
1.	**G.arboreum**	Sanjay, 824, G.27
2.	**G.herbaceum**	G.Cot.11, Digvijay, G.Cot.13
3.	**G.hirsutum**	G.Cot.10, G.2637, Surat Dwarf
4.	**G.barbadense**	Suvin, ERB.13754, ERB.13758
5.	**G.arboreum × G.herbaceum**	G.Cot.Hy.7, DH.149, DH.158
6.	**G.hirsutum × G.hirsutum**	Hybrid 4, Hybrid 6, GHH.334
7.	**G.hirsutum × G.barbadense**	Varalaxmi, HB.304, HB.325

The lint was tested for 2.5% span length, fineness, percentage of mature fibres, bundle strength at zero gauge and 1/8″ gauge lengths. Species-wise findings are given below :

G.arboreum

1. Different pickings had no effect on fibre length. Marginal change in Micronaire value was noticed.
2. Tenacity at 1/8″ gauge length was decreased considerably for the third picking.

G.herbaceum

1. Slight decrease in Micronaire fineness was noticed for later pickings.

2. Decrease in percentage mature fibres (PM) was noticed for third picking.
3. The interaction was significant for fineness between the varieties and pickings.

G.hirsutum

1. Length decreased for later pickings.
2. Micronaire value was less for the third picking due to the immaturity.
3. Tenacity at 1/8″ gauge length was decreased for third picking.

G.barbadense

1. Increase in Micronaire value was observed in the third picking.
2. Tenacity at zero gauge length is affected for the third picking in the case of ERB.13754 variety.

G.arboreum X G.herbaceum

1. Significant decrease in fibre length was observed in the third picking.
2. Interaction was noticed between varieties and pickings for Micronaire value.
3. Slight increase in tenacity at 1/8″ gauge length was seen in the third picking.

G.hirsutum X G.hirsutum

1. In the second picking, length decreased.
2. The change in Micronaire value was negligible between the pickings.

G.hirsutum X G.barbadense

1. Decreasing trend was seen in the second and third pickings for length.
2. Reduction in Micronaire value was noticed in the second picking.
3. Higher Pm was obtained in the bolls of third picking.

Observations from Pooled Data Analysis (Species Vs. Pickings)

1. It is observed that 2.5% Span length was more for the bolls of first picking. As far as the mean values for species and pickings are concerned, the variation between the pickings was more in **G.hirsutum** group (3.0 mm) followed by **(G. hirsutum X G.barbadense)** group (2.0 mm) and **(G.hirsutum X G.hirsutum)** group (1.4mm). In the other groups the change in length between the pickings was not significant.
2. Little influence was observed on fibre fineness. The variation is only marginal and not specific.
3. Maturity was not affected in the pooled data, for different pickings. However, interaction is seen among the species and pickings. Significant decrease in maturity was noticed in **G. arboreum, G.herbaceum, G.hirsutum** species in the third picking, whereas in **G.hirsutum X G.barbadense** the action was reversed.
4. Tenacity at zero gauge length was marginally influenced.

5. Interaction was observed for tenacity at 1/8″ gauge length strength. In the third picking significant change was noticed for **G.arboreum** and **G.hirsutum** species, whereas increasing trend was seen in **G.barbadense** and **(G.arboreum X G.herbaceum)** group.

STUDIES IN THE CHANGES OF FIBRE CHARACTERS DURING THE DEVELOPMENT PERIOD OF BOLL WITH SPECIAL REFERENCE TO HYBRID COTTONS

During the period under report, cotton bolls picked at weekly intervals for the season 1986-87 were collected from Surat and Nanded. These samples were tested for boll size (by water displacement method), fibre length (by Bear Sorter method), maturity (by caustic soda method) and bundle strength (by Stelometer). From test data, the following observations were made :

Boll size

1. There was considerable variation in the volume of the bolls of the same age. (The number of bolls available for each age was not same).
2. Although there was overall increase in the boll size with increasing age of boll, there was no consistency in the case of some cottons.
3. The boll sizes of Varalaxmi and Laxmi pertaining to 1984-85 season were noticeably greater than those of the same cottons pertaining to 1985-86 season.
4. Surprisingly, the boll size of Laxmi was bigger than that of Varalaxmi, both at Surat and Nanded for the same seasons.
5. Location appeared to have influenced the size of the bolls. (It was observed that bolls of Varalaxmi and Laxmi at Surat were significantly bigger than those at Nanded).
6. The rate of increase in the size of bolls was higher at the earlier stages of boll development than at the later stages.

Mean Length

1. The lengthening period of fibre did not seem to have ceased at the end of third week after anthesis, but it continued upto 35 days. In the case of cottons such as SB.289, Varalaxmi and Sujay, the lengthening period continued upto 42 days.
2. In the case of intra-specific hybrids like Hybrid 6, the mean length appeared to be between the mean length recorded by their parents. However, in the case of inter-specific hybrids like Varalaxmi or GDH.22 (desi hybrid), the mean length of the hybrids was influenced by the parents having longer fibres.

Maturity

As expected the maturity increased with the increasing age of the boll; but the rate of increase in maturity with the development of the boll was not the same for all cottons.

It was observed that the maturity of the hybrids, at each stage of develop-

ment was between the maturity recorded by their respective parents, at all the corresponding stages.

Fibre Strength

With increase in the age of the boll, bundle strength of the fibres also increased initially upto 28 or 35 days. This increase in the later stages was not consistent. Samples from Surat recorded higher bundle strength than those from Nanded.

THE EFFECT ON FIBRE QUALITIES AND ECONOMICS DUE TO EARLY PICKED GREEN BOLLS OF DIFFERENT SPECIES OF GOSSYPIUM

As the cotton crop is generally of long duration, there is difficulty in growing a second crop. Hence, various attempts are being made to reduce duration of the cotton crop. One of the methods being attempted is to harvest the bolls before bursting. Early picking of the green bolls will reduce the duration of cotton crop so that farmers will get sufficient time for preparation and sowing of the second crop which will help in increasing the yield per unit area. In the present trial, early pickings were done of the green bolls of different ages, say 40, 50 and 60 days after anthesis and dried in the sunlight besides the normal picking so as to compare the yield levels and fibre quality parameters.

The experiment was laid out in randomized block design at Cotton Research Station, Nanded. NA.48 (Rohini-**G.arboreum**), NH 239 (Purnima – **G. hirsutum**), NHH.44 (intra-species hybrid), DCH.32 (inter-species hybrid) were sown in the kharif season 1986-87 in two replications.

Recommended dose of fertilizer (N:P:K—50:25:25 kg/ha) were applied after the basal dose of farm yard manure 12q/ha. Plant protection measures taken were (1) Spraying of Sumicidin (2) Dusting BHC.

Total rainfall received during the season 1986. was 556.8 mm in 54 rainy days.

Tagging was started after anthesis so as to collect the bolls of different ages (40, 50 and 60 days) besides normal picking. The bolls of different ages were picked and dried in sunlight separately. The produce obtained will be ginned to study the fibre properties. Similarly seeds from the bolls of different ages were preserved to test the germination capacity, oil content and general development of seed.

In the second part of the experiment the cotton crop was grown under normal conditions. Recommended dose of fertilizer and plant protection measures were given crop was maintained for 150 days or up to time for preparatory sowing of the second crop. After completion of the picking of the well-opened cotton, remaining green bolls were collected and dried in sunlight so as to clear the field for second crop.

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

The seeds of promising strain NA.39 (**G.arboreum** diploid) were irradiated for 15 kr, 20 kr. and 30 kr. doses of

gamma rays at the rate of 7 kr./mt. by 27 CO^{60} source at the Division of Genetics, IARI, New Delhi and chemical mutagenic treatment of ethyl methane sulphonate (EMS) was applied to seeds for 24 hours before sowing. Treated as well as untreated seeds of NA.39 were sown. From the produce obtained the seeds were collected and sown to raise M5 generation.

There appeared to have been considerable morphological changes after gamma ray irradiation and EMS treatment.

Plant-wise selection was then done on the basis of following observations :

1. High bearing, 2. Big boll size, 3. Big seed size, 4. Non-fuzzy seeds, 5. Short fibre content, 6. Early bursting and 7. Abnormal plants.

The screening of 208 SPS was done on the basis of extreme variations in the fibre properties as well as major changes observed in the inter-relationship between fibre properties.

The fibre properties of irradiated material revealed significant changes due to mutation as compared to control. Hence, it is proposed to carry out detailed fibre structural studies also.

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

Since the presence of motes in hybrid cottons is supposed to be a major cause of nep formation in yarn, a preliminary study on Varalaxmi and Hybrid 4 seed-cottons from three locations in Karnataka was carried out.

Fifty bolls of each sample were carefully analysed for both big and small motes as per method followed by USDA. The results of the analysis are given in Table 7.

A fairly large variation in mote content was noticed between the three locations in both varieties, the difference being mainly in small motes. The overall average mote content was, however, about the same in both H.4 and Varalaxmi, contrary to expectations. Since interspecific hybrids like Vara-

TABLE 7 : PERCENT MOTES IN HYBRID COTTONS FROM THREE LOCATIONS

	Small Motes		Large Motes		Total	
Location	H.4	Varalaxmi	H.4	Varalaxmi	H.4	Varalaxmi
Asundhi	12.3	9.3	3.6	2.9	15.9	12.7
Kanpur	16.0	19.0	2.6	2.0	18.6	21.0
Nelogal	8.2	6.6	1.2	1.8	9.4	8.4
				Average	14.6	14.0

laxmi normally show a higher mote content, the above results will be confirmed from an analysis of larger number of varieties.

STUDIES ON THE INHERITANCE OF STRENGTH AND STRUCTURAL PARAMETERS IN COTTON FIBRES

During the year under report, crystallite orientation measurements on the crossed samples belonging to F_1 generation from one replication were conducted. The samples were : P_1 x P_2/ F_1 —I (number of samples = 10), P_2x P_1/F_1 —I (n = 10), (P_1 x P_2) BP_1 — BC_1/F_1 —I (n = 23) and (P_1 x P_2) P_1 BP_1 BC_1 F_1 —I (n = 27).

It was observed that the mean value of 50% x-ray angle ψ of each of the set of crossed samples, was nearer to the value corresponding to the low strength parent P_x This result is in agreement with that reported earlier using strength data.

Further, tenacity measurements on samples belonging to the series P_1 x P_3 — F_2(n=76) were made. The mean value of tenacity (39.2 g/tex- was observed to be closed to that of P_1 x P_2 — F_1 (38.8 g/tex).

X-RAY DIFFRACTION STUDIES ON STRUCTURAL PARAMETERS OF YARNS WITH A VIEW TO UTILISING THEM FOR TEXTILE YARN CHARACTERISATION

During the year under report, the effect of doubling of ring-spun and open end spun yarns were examined through x-ray orientation profiles of yarns. Yarns with 4.0 and 5.5 TM and 20s singles count were doubled (S/Z) using different doubling ratios to obtain doubled yarns having 10s count. A study of the yarn orientation angle ψ_y, showed that :

(1) ψ_y starts increasing with doubling ratio only after a minimum value of the latter,

(2) this minimum doubling ratio is higher when the twist in the singles yarn is higher and

(3) the change in ψ_y at a particular doubling ratio is comparatively more for OE yarns.

These results are in agreement with the relatively compact nature of the highly twisted ring spun yarn and that of the loose structure of OE yarns.

Further, tenacity and breaking elongation values of yarns spun from Jyoti and Laxmi cottons (spun to 20s, 30s and 40s each with a set of different TMs) were determined. In addition to the above, eight **desi** cottons which were spun to 20s, 30s and 40s with appropriate TMs were also tested on Instron Tensile Tester for tenacity and breaking elongation values. Analysis of the results led to the following conclusions :

(1) For coarser yarns (20s — 40s) normally spun from coarser cottons, the relation between ψ_y and T was better (r = 0.60 to 0.68) than that observed for relatively finer yarns (60s — 100s) spun from finer cottons (r = 0.47 to 0.57). The relationship between ψ_y and elongation

(E/y) was also good although it was better for finer yarns (r = 0.83 to 0.89) than for coarser yarns (r was generally around 0.72). These results could be due to the predominance of yarn unevenness in deciding yarn strength for finer yarns and the comparatively larger role that may be played by fibre slippage in determining the elongation of coarser yarns.

(2) For normal yarn spun to 20s and 30s from cottons having Micronaire value greater than 3.8, the correlation of ψ_y with Ty decreased, while that with E increased as counts become finer.

(3) The relationship $Ty/Tf = A \cos^2 \alpha (1\text{-}K \text{ Cosec } \alpha)$, where T_y is fibre tenacity, α refers to twist angle (A and K being constants) was explored after substitution of α with ψ_y and T_y with ψ_y, ψ_B being the 50% x-ray angle for fibre bundles and was found promising as a general relationship for spun cotton yarns.

STUDY ON THE ORIENTATION BEHAVIOUR OF COTTON FIBRES UNDER TENSILE STRESS

During the year, the changes in orientation with stretch of six varieties of cotton were studied. The following observations were made from the results obtained :

(i) The extension at which the maximum orientation was recorded as well as the slope of the linear portion of the orientation-extension curve appear to be related to the x-ray angles of the cottons at normal stretch.

(ii) The morphological parameters such as convolution angle, circularity and cell wall thickness appear to have a comparatively larger influence on the extension at which maximum orientation was recorded.

STUDIES ON MORPHOLOGICAL DEFORMITIES AND THEIR CHARACTERISATION IN COTTON

Five varieties of cotton, viz. Jayadhar **(G.herbaceum)**, AK.235 **(G.arboreum)**, S.I. Andrews **(G.barbadense)**, Badnawar **1 (G. hirsutum)** and Digvijay **(G.herbaceum)** were selected for the study. Fibres from representative slivers were sorted out into three length groups using Baer Sorter.

Nearly 30 to 40 fibres from Jayadhar cotton pertaining to each of the three length groups of fibres viz., (i) Longer than upper quartile length, (ii) Longer than lower quartile length but shorter than upper quartile length and (iii) Shorter than lower quartile length, were critically examined under Scanning Electron Microscope (SEM). The length examined for the first two groups of fibres was 20 mm, while it was only 10 mm for the last group. Various types of morphological deformities observed along the length of the fibres were noted and mirographs representing each type of deformity were recorded separately.

Bundle of fibres taken from one of the length groups of Jayadhar and after the tensile break in Pressley clamps were suitably mounted on specimen stub and scanned under SEM to examine the deformities present at/near the broken ends of the fibres. Single fibres after the tensile break at 20 mm gauge length were also examined in the same way.

On the basis of examination of fibres under SEM, the morphological deformities observed in the case of Jayadhar cotton were classified into the following 10 categories :

1. V bend
2. U bend
3. Sharp twist or loop formation
4. Reversal of direction of convolutions associated with a structural reversal
5. 90° phase change in convolution
6. Sudden change in direction of curvature of bean shaped cross-section
7. S or Z edge along the fibre length
8. Knee
9. Thick and thin sections
10. Others (abnormal side growth, tapering etc.)

Of these, the most frequently occurring types of deformities in Jayadhar cotton fall under the categories : (4), (5), (6) and (7).

Examination of broken ends of fibres (after tensile break) revealed that rupture in a fibre is mostly associated with some of the morphological deformities listed above. The frequency of occurrence of some of the deformities such as V and U bends and S or Z edge is very low (1 cm in the case of Jayadhar). But their presence appears to seriously deteriorate the fibre strength. In the absence of these deformities the fibre tends to break at a place where the curvature of bean shaped cross-section is suddenly changed.

Careful examination of a large number of structural reversals under SEM reveals that all the structural reversals do not constitute weak places in the fibre, especially in a thick walled fibre having circular cross-section. However, some of the reversals, viz those located at thin and flat sections of mature fibres are really weak places.

STUDIES ON LATTICE CONVERSION BEHAVIOUR OF COTTON FIBRES

Fibres of Giza 7 cotton were treated with NaOH solution having normality range from 0 to 15 N under specifically standardised conditions. Each treatment was done in duplicate. In all, solutions having 30 different concentrations were used for treatments. All the samples were subjected to x-ray diffraction studies and cellulose I to cellulose II conversion was estimated using the Lattice Conversion Ratio (LCR). The LCR values increased with concentration above 3.50 N and showed a tendency to decrease at concentrations greater than about 5.0 N. Further experiments are underway to obtain more comprehensive data through additional treatments with alkali concentrations lying close to the ranges producing the maximum changes in LCR.

STUDY OF THE VISCOELASTIC BEHAVIOUR OF TEXTILE MATERIALS

Determination of dynamic modulus D(e) and static modulus S(e) for filament yarns of nylon, polyester and viscose was carried out at different strains. The yarns were differentially loaded upto a predetermined level on yarn mount of PPM-5R Dynamic Modulus Tester. The maximum load was suitably chosen for each sample so that no rupture of filaments took place. After this, the load was reduced in steps. At each step the specimen was allowed to undergo inverse creep for 200 sec., after which the dynamic modulus was determined. Soon after each inverse creep, the strain in the specimen was also measured. When the load on the sample became zero, the specimen was reloaded in the same manner as described above. D(e) values at selected strains e were then interpolated.

The Instron Tensile Tester was used to determine the static modulus at different strains for these samples. Gauge length used was 50 cm. Each sample was strained to the level (of maximum extension) to which it was strained in the dynamic experiment. From this strain it was retracted back to the original gauge length. A relaxation time of 200 sec. was allowed and it was again strained to the predetermined level. From the stress-strain curves on the Instron for loading, unloading and reloading, S(e) was determined at selected strains by taking derivative of the stress-strain curve at these strains e.

Change in visco-elastic index, viz. D(e)/S(e) with e, is similar to that described in earlier report for the first cycle of loading for all the three samples studied. It goes on increasing initially and then decreasing as the strain increases for viscose and polyester. It increases upto about 3% strain level for nylon, after which it remains steady. During unloading, there is a continuous decrease in viscoelastic index with increasing strain. In the second cycle of loading viscoelastic index increases with strain for viscose alone, while it remains almost constant for polyester and nylon.

INFLUENCE OF FIBRE LENGTH AND FIBRE LENGTH DISTRIBUTION PARAMETERS ON YARN QUALITY

The overall analysis on 34 samples, varying in 2.5% SL from 18.6 to 37.7 mm and its processed materials, was carried out during the period under report.

It has been found that the 50% SL obtained by sliver clamp technique for the processed materials, viz. card and draw frame slivers, was in good agreement ($r = 0.80$) with the 'fibre extent' of the hooked fibres. Hence, the 50% SL of the processed materials was compared with the UR and FFI at 66.7% and 50% SL levels. But, the secant length at 66.7% and 50% SL were found to exceed the 2.5% SL for the processed materials and hence were not useful for calculating FFI values.

As an alternative, the FFI (12.5% SL) was calculated and correlated with

UR ($r = -0.9451^{**}$) for the processed materials. The FFI (12.5% SL) was found to decrease as the process advanced, indicating improvement in parallelisation and the simultaneous increase of UR. To check this inter relationship, the UR and FFI (12.5% SL) were compared with the 50% SL. The following significant correlations were obtained for 102 cottons :

Between 50% SL and UR :
$r = +0.5702^{**}$
Between 50% SL and FFI
(12.5% SL) : $r = -0.5934^{**}$

The above mentioned significant associations have led to simplification of the testing for hook study. The Fibrosampler used for normal testing on Fibrograph, can be employed for testing processed materials, thereby dispensing with the sliver clamp technique.

To check the reliability of FFI value (12.5% SL), five cottons were tested on Baer Sorter, adopting the Double Sorter Technique. The mean length, short fibre percentage 12.5% SL and FFI values are given in Table 8 :

It will be seen that mean length and SF% by Baer Sorter are in good agreement with 12.5% SL and FFI (at 12.5% SL) respectively.

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

Swelling and stretching of fibres in the two swelling maxima for aqueous zinc chloride (65% and 70% w/w) at two different temperatures for one particular variety of cotton was completed first. It was noted that higher temperatures and higher concentrations had a detrimental effect on the strength of the fibres obtained after stretching. A 10 min. swelling in 65% zinc chloride at 32° ±1°C produced almost the same extent of decrystallization as obtainable with 24% sodium hydroxide. Hence, this concentration and temperature were chosen for a detailed investigation with different varieties. Swelling periods of 10 min. 30 min. and 50 min. were employed. Increasing the time of swelling resulted in more uniform fibres after stretching as revealed by strength measurements at 3 mm gauge length.

Five more varieties of cotton having different fibre properties were swollen slack and also stretched to original length. Bundle strengths at 0 and 3 mm gauge lengths and x-ray orientation angle have been measured for all the samples. Extent of decrystallization was determined by both x-ray and infra-red measurements.

Analysis of the data indicated that time plays an important role in swelling and that at 32°C and 65% (w/w) concentration of zinc chloride, swelling is almost complete in about 30 min. Fibres stretched to original length after 30 min swelling showed substantial improvement in strength at both 0 and 3 mm gauge lengths. Improvement in 3 mm gauge strength was as high as 100%, or nearer especially when the variety has a poor 3 mm gauge strength and low uniformity ratio to begin with. Bundle orientation as measured by 50% x-ray angle came almost to the level for all the varieties.

TABLE 8: FIBRE QUALITY PARAMETERS USING DOUBLE SORTER TECHNIQUE

Cotton	Card				DF.1 Silver				DF.2 Silver			
	ML (in.)	12.5% SL (in.)	SF%	FFI	ML (in.)	12.5% SL (in.)	SF%	FFI	ML (in.)	12.5% SL (in.)	SF%	FFI
Laxmi	0.76	0.79	31.8	31.0	0.80	0.86	28.2	28.6	0.84	0.91	24.8	26.8
Virnar	0.80	0.79	26.8	28.6	0.84	0.82	25.5	29.6	0.89	0.90	19.6	27.7
Varalaxmi	0.92	1.02	35.1	32.1	1.02	1.11	27.9	28.1	1.02	1.15	29.0	28.0
H.4	0.88	0.90	28.0	27.3	0.97	1.00	19.8	24.1	0.98	1.02	21.1	22.9
DCH.32	1.05	1.18	38.9	28.7	1.25	1.24	23.2	27.3	1.26	1.29	24.5	28.4

Fibres from all the six varieties are also being treated with sodium hydroxide of mercerising strength in a similar way so as to make a comparative assessment of the changes in fibre properties brought about by the two reagents.

OPTIMAL BLENDING OF STANDARD VARIETIES OF COTTONS OF SOUTHERN REGION OF INDIA COMPRISING ANDHRA PRADESH, KARNATAKA AND TAMIL NADU

During the reporting period, one bale each of H.4 and LRA.5166 were procured through the Cotton Corporation of India. One bale of DCH.52 was still awaited.

The individual evaluation of Laxmi and MCU.5 cottons was started. 25 kg lots of each variety were processed through Blending, Hopper-Hopper feeder-S.C. Beater-Hopper-Kirchner. Beater-Scutcher in the blow-room followed by carding on the Semi-High Production Card. The material was then given Two passages of High-Speed drawing and then converted into roving on the Can Fed Inter. Laxmi cotton was spun to 20s (check for open-end yarn), 30s and 40s. MCU.5 cotton was spun to 50s and 60s. Laxmi cotton was also spun to 16s and 20s on the Open end spinning system.

The testing for fibre properties and trash content have been completed. The cleaning efficiency of Laxmi and MCU.5 has also been determined and the results were as follows :

Cleaning Efficiency	Laxmi	MCU.5
Blow Room	55.0	38.0
Carding	60.3	72.9
Overall	80.2	85.3

The yarn tests were in progress.

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

To standardise the manual lap preparation for micro-spinning technique the laps of 10 samples were made manually and carded. The carded slivers were tested on Uster evenness tester. It was observed that variation in U% values of the slivers was less than 5% which is within the prescribed limit.

Till now, 40 samples of Trade and Standard cottons were spun with micro-spinning technique to three counts of 20s, 30s and 40s. Out of these, 22 samples were tested for single thread strength on Uster Single Thread Strength Tester. From the above samples, the yarns of 16 Trade Varieties and 15 Standard Cottons spun by Fullscale spinning technique were available and they were tested for single thread strength.

From the analysis of the available data, it was observed that in general, single thread strength for full-spinning yarn was higher than the micro-spinning yarn; for 20s count it, varied from 1% to 16% and for 30s, it varied from 1% to 23%. But, wherever the differences in strength values were

very high, it would be due to the high differences in tex values and this could be avoided by applying suitable correction factor. The confirmation of the above observation however, needs more data.

TO STUDY THE WEAK-LINK EFFECT IN OPEN END AND RING SPUN YARNS

Experimental work was conducted on 20s yarns spun from Varalaxmi cotton with the twist multipliers (TM) of 4.0 and 5.5, and by OE and ring spinning (RS) methods.

Tests were carried out on Instron Tensile Tester with specimen lengths of 1 cm, 2 cm, 5 cm, 10 cm, 25 cm, 50 cm and 70 cm. Broken individual specimens were weighed to obtain tex values. For each gauge length, 50 specimens were tested and the average values of breaking load, tenacity, breaking strain and work of rupture were calculated.

From the data so far collected, the following information could be gathered :

1. Breaking load as well as tenacity decreased with increasing gauge length in both OE and RS yarns. But in comparison with OE yarns RS, yarns experienced higher reduction. For example, for yarns of 4.0 TM when tested at 70 cm gauge length the tenacity dropped by 20% relative to the value at 1 cm for OE yarns whereas the drop was 25% for RS yarns.
2. Breaking strain also exhibited a similar trend — the value decreased as gauge length increased. But the percentage drop in strain with gauge length was more than that of tenacity with gauge length. Here again, RS yarns suffered greater reduction in magnitude with increase in gauge length than OE yarns. Breaking strain for 4.0 TM, RS yarn at 70 cm gauge length was 44% of that at 1 cm gauge length whereas for OE yarn the corresponding figure was 53%.
3. On account of gradual fall in tenacity and breaking strain as gauge length increased, the work of rupture, which should increase in proportion to specimen length, increased at a far slower rate. It was also observed that increase in work of rupture is always higher for the OE yarns at any gauge length.

SOME STUDIES ON YARN TWIST MEASUREMENTS

Work on this project is completed. The project was divided into two parts. The first part dealt with a critical evaluation of the popular "untwist-retwist (UR)" method with reference to the standard "straightened fibre (SF)" method of twist measurement. The second part comprised a study on the influence of some experimental conditions on the results obtained by the "torsional equilibrium (TE)" method adopted for open-end yarns.

(i) **Comparison of SF and UR Methods :** The SF and UR methods have been compared on the basis of

data on 50 yarn samples varying widely in twist. Tests by the SF method were carried out at a test length of 1/4 in. with the help of an experimental arrangement specially set up for the purpose. For tests by the UR method, a commercial instrument was used. In the latter case, twist measurement was carried out at two levels of pre-tension viz. tex/2 and 2 tex grams. In each case, the specimen was taken through three UR cycles so that twist could be calculated by both the conventional method (one cycle) and by the Schutz method (three cycles).

From an analysis of the results on all the fifty yarn samples, the following conclusions could be arrived at :

(a) The SF and UR methods of twist determination give comparable results under normal conditions of test. It follows that the tension of tex/2 grams applied to the yarn in the UR method permits only a negligible amount of fibre slippage; thus ensuring accuracy in the estimation of twist.

(b) The use of Schutz formula which involves twist readings taken after each of three successive twist cycles gives accurate twist value even when the tension is increased a four-fold, from tex/2 grams 2 tex grams. Thus, the formula is valid over a wide range of pre-tensions. The practical use of the method involving measurements after three cycles is however, very limited because textile yarns do not generally suffer from fibre slippage during the twist test by UR method.

(ii) **Use of TE Method for Open-end Yarns :** The TE method was suggested by Lord (Text. Res. J., **41**, 778 (1971) for application to open-end yarns as other known methods of twist measurements are not quite suitable. The purpose of the present study was to assess the influence of the two experimental conditions, viz. (i) the weight attached to the yarn and (ii) the level of damping during torsional relaxation on the twist measurements by the TE method.

An experimental set-up was prepared for twist determination by the TE method. In this set-up, a $\frac{1}{4}$ in. long segment of yarn was made to untwist under the action of a load attached to its free end. The load could be varied and the untwisting speed controlled by the use of a damping liquid. The twist was measured at different values of suspended load and damping levels. The results have led to the following conclusions :

(i) The twist recorded by the TE method increased with the weight of the suspension. In most cases, the twist tends to level off beyond a certain weight. The highest weight the yarn segment can hold seems to be the best choice.

(ii) At low levels of damping, the suspension overshoots beyond the equilibrium position leading to oscillation which take a longer time to die down. The damping therefore must be increased to a level at which the oscillations are minimal.

STUDIES ON THE EFFECT OF SWELLING TREATMENTS ON YARN IRREGULARITY WITH SPECIAL REFERENCE TO USTER EVENNESS VALUES (U%).

Earlier studies on yarn irregularity on mercerisation revealed that there was increase in Uster values on mercerisation. It was also found that the increase in Uster value on swelling was not due to actual increase in unevenness but may be due to the changes in other factors such as circularity, dielectric, etc. due to swelling of yarn. The objective of the study was to confirm the trends observed and explore the possible reasons for increase in Uster valve. It was also confirmed that the changes in circularity and variation within the same due to swelling treatment may not cause increase in Uster value (U%).

During the period, preliminary experiments to measure the electrical conductivity and dielectric constants of mercerised and control samples were carried out. However, due to procedural difficulties method could not be standardised. Attempts are being made to overcome the difficulties and standardise the method.

PERFORMANCE CHARACTERISTICS OF SEWING THREADS

The object of the study was to assess the quality of sewing thread by a consolidated index called Sewing Quality Index (SQI) taking into account all the desirable properties. It was reported earlier that 18 sewing thread samples were tested for 17 various properties.

During the period, attempts were made to compute Sewing Quality Index (SQI) from all the properties tested. The method followed involved the use of equal weightage. For each property the thread having the highest value was selected and these values were considered as 100%. The values for other threads were interpolated on the basis of the highest value. Having calculated these values the **average** was worked out giving SQI (A) for a particular thread. Thus, for an ideal thread SQI value would be 100. Having worked out SQI, the correlations with individual properties were also worked out to study, which of the properties are important. On the basis of correlation coefficient values and including toughness index the SQI (I) were computed on the basis of only 11 properties. The correlation (+0.9891**) between the two was found to be highly significant. Further, it was thought desirable to see whether SQI could be computed with limited easily derivable properties, without sacrificing the fair estimation of quality. It was found that SQI (Im4) from the four parameters, viz. breaking strength, elongation, U% and abrasion resistance together gave very good idea about the quality of sewing threads (r = AIm4) = 0.9586**). Since abrasion resistance determination is not easy, the correlation with breaking strength, elongation and U% considered together for SQI (Im3), was also worked out which gave fairly good idea (r AIm3) = +0.9586**).

A REVIEW OF THE STUDIES ON THE STATISTICAL RELATIONSHIPS BETWEEN FIBRE PROPERTIES, SPINNING PERFORMANCE AND YARN CHARACTERISTICS

Literature survey of papers concerned with the statistical relationships between fibre, spinning and yarn properties from available textile journals was completed. One hundred and seventy eight papers suitable for the review have been abstracted for compilation. Subjectwise compilation of the abstracted papers is completed. Summary of all the abstracted papers is being written.

INTRODUCTION OF PERMANENT PLEATS IN COTTON FABRICS

The process of pleating fabrics has been standardised and optimum experimental conditions have been arrived at. A few fabric samples pleated under optimum conditions have been stitched into apparels and latter given out for wear trials :

The treatment that has been standardised comprises the following sequence :

(i) Formation of pleats on a fabric placed on a table and stitching the pleats by hand-stitching along the fabric edge.
(ii) Wetting of the pleated fabric with mercerising alkali (21% NaOH) in a plastic tray.
(iii) Pressing of the alkali-swollen fabric in a hydraulic press in batches of two or three at a time.
(iv) Neutralisation and washing of the pleated fabric.

The pleated fabric is later given a crosslinking treatment in formaldehyde so as to impart wash-wear characteristics. Many skirts and frocks have been made in the above manner.

For crosslinking treatment in formaldehyde, a reaction tank has been fabricated. The tank, made of stainless steel, has provision for accommodating six pieces of fabrics which can remain hanging in vertical planes, with pleats in proper position. The reaction liquor is showered from the top of the tank onto the fabrics and the liquor that collects at the bottom of the tank is pumped to the top to complete the cycle. Washing of the crosslinked fabrics can also be done in the tank itself, by circulating water in the same way.

A STUDY ON THE COMFORT PROPERTIES OF TEXTILE FABRICS

During the year under report, the control dish apparatus to measure the resistance offered by fabrics to moisture transfer was set up and all the fabrics used in the investigation were subjected to resistance measurement. Resistance (R) of the fabric to moisture transfer expressed as equivalent cms. of air column resistance, was worked out by measuring the rate of water loss from specimen fabric as well as control dishes under identical conditions, using standard procedure.

Further, using the moisture transfer apparatus set up in this study, the time taken (T) to reach mean RH was measured on blended fabrics in which polyester was one component, as well as on 100% polyester fabrics of diffe-

PLATE I

CTRL CONTINGENT AT THE ICAR ZONAL SPORTS MEET HELD AT K. D. SINGH BABU STADIUM, LUCKNOW

March-Past

PLATE II

INTRODUCTION OF PERMANENT PLEATS IN COTTON FABRICS

Frock Stitched from Pleated Cotton Cloth

rent thickness and construction. The dry chamber was maintained at 65% RH before the start of the experiment and the time of transfer measured for fabrics.

Analysis of the results obtained led to the following conclusions :

(1) Very good agreement was noticed between T and R, in the case of all cotton fabrics ($r = 0.94$). When blended as well as polyester fabrics were included, this relation became slightly poorer ($r = 0.83$). However, the gradation of fabrics remained unchanged.

(2) In the case of all-cotton fabrics, a strong dependence was noticed between T and fabric thickness (t) and fabric weight (W) ($r = 0.97$ and 0.96, respectively). The dependence on fabric cover (K) was however less ($r = 0.84$). Further, the multiple correlation between T, t and K did not significantly improve ($r = 0.98$). This result is identical to the one reported last year, except that only apparel fabrics have been considered here.

(3) A fairly strong relationship existed between T and K ($r = 0.73$) for all-polyester fabrics. There was only a marginal dependence of T and t and W (the correlations being 0.36 and 0.42, respectively). However, the improved multiple correlation between T, t and K ($r = 0.80$) and T, W and K (0.85) indicated that although T is primarily influenced by cover, there is a sizeable contribution from fabric parameters t and W, as well.

(4) When blended fabrics were considered, the moisture transfer parameter T did not seem to be influenced by any of the fabric parameters, viz. t (0.20), W (0.24), K (0.13) and even by % polyester content P (−0.11), the correlation coefficients are indicated in brackets. These fabrics had varying proportions of polyester, in addition to different fabric parameters. Also, they had varying proportions of one or more of the cellulosic fibres, viz. cotton, polynosic and viscose. A partial correlation analysis of T with all the four independent parameters (t, W, K and P%) revealed that T was highly influenced by W and percent polyester content, almost equally.

(5) Even fabrics made of hydrophobic fibres such as polyester could be made as comfortable as cotton fabrics (both had same value of T), by proper selection of constructional details in addition to fabric parameters. Further, since in the present investigation all commercial fabrics were used as such (without any special treatment for removal of finishes), the moisture-transfer might have been influenced by the post-weaving chemical treatments, which would have led to some extent to the poorer relationships between T and fabric parameters, especially in case of blended and polyester fabrics.

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

During the period under report, apart from literature survey, the fabric samples were desized and all the treatments were carried out on desized fabric.

In order to assess the effect of hard water on the properties of treated fabric, well water was used as hard water and distilled water as soft one. Liquor bath preparations and washings were carried out with the respective water. The following two treatments were carried out using DMDHEU and Melamine resins. (1) The formulation of the crosslinking bath was DMDHEU 8%, softner 1%, wetting agent 0.1% and $Zn(NO_3)_2$ $6H_2O$ 1% as catalyst. The treated samples were dried at 110° for 7 minutes and cured at 160°C for 3 minutes. After curing, the fabric samples were washed thoroughly and air dried.

(2) In the second treatment Methylated melamine formaldehyde resin was used and the formulation of the crosslinking bath was Methylated melamine formaldehyde (8%), softner 1%, wetting agent 0.1% and $Mgcl_2.6H_2O$ 1.5% as catalyst. The treated samples were dried at 110°C for 7 minutes and cured at 160°C for 3 minutes. After curing the fabric samples were washed thoroughly and air dried.

The samples were then evaluated for resin add-on, formaldehyde content, Nitrogen content and physical properties such as tensile strength, crease recovery angle (wet and dry), abrasion resistance and tearing strength. The results are being evaluated.

EVALUATION OF THE RESPONSE OF RESIN FINISHING TREATMENT ON DECRYSTALLISED AND STABILISED COTTON YARN

Doubling of about 1 kg of singles (30s) yarn of MCU.7 variety was carried out in the Mechanical Processing Division. The same was dewaxed and kiered under standard conditions. The decrystallisation of the yarn was carried out using 15% NaOH (w/w) under slack conditions. The conditions for partial acetylation (4% acetyl content) of the decrystallised, but not washed yarns (pick up adjusted around 100%) were standardised. The following three sets a) untreated yarn, b) only decrystallised (under slack conditions) and c) decrystallised and partially acetylated without washing, were crosslinked, using DMDHEU resin in nine different concentrations ranging from 1% to 9%. All the above samples were tested for tensile strength, elongation and crease recovery angle. In the above experiment, it was observed that the decrystalisation under slack conditions caused crimp formation on the treated yarn which made the measurement of CRA unsatisfactory. Hence, the entire set of the above experiment was repeated with the decrystalisation done at normal stretch condition. Once again the conditions for partial acetylation under the changed condition was standardised. The sets of a) only decrystalised at normal stretch and b) decrystalised and partially acetylated

without washing, were cross-linked using DMDHEU resin in nine different concentrations. The tensile strength, elongation and crease recovery angle of all the above samples were measured.

The results of the experiment show a better balance of mechanical properties by way of higher increase in CRA and higher tenacity retension at all resin concentrations of the samples modified through decrystalisation and partial acetylation. It is also observed that the increase in CRA is much higher at lower resin concentrations than at higher resin concentrations as compared to the control samples.

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

Desized cotton fabric samples were padded to 80% wet pick up with three different concentrations of glyoxal, viz. 5%, 10% and 15%. Aluminum sulphate alone or with citric acid was used to catalyze the reaction. A softner and a wetting agent were the other additives used in the treatment.

Two different conditions of drying and curing were used, viz. (1) 80°/5 min for drying and 160°/3 min for curing (2) 100°/5 min for drying and 180°/3 min for curing. In a conventional treatment fabric samples were crosslinked with DMDHEU in the presence of 100% aluminum sulphate and other additives. Fabric properties, viz. DP rating, add-on, wrinkle recovery angle, breaking and tearing strength were determined by standard methods.

It was observed that glyoxal treated samples had markedly improved the wrinkle recovery angle compared to DMDHEU treated sample. As the concentration of glyoxal in pad bath solution increased, strength retention of the treated fabric also improved.

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

Sewing thread samples of different construction, different finish, etc. were collected from the market. These samples have been tested for various parameters.

RADIATION (GAMMA RAY) STERILIZATION OF CHEMICALLY MODIFIED COTTON FABRICS

Cotton fabric was chemically modified by phosphorylation treatment using diammonium hydrogen phosphate (DAP) and urea. This and untreated control fabric samples were analysed for bacterial count. The phsophorylated fabric samples were irradiated with gamma rays at four different dosages, viz. 1.0, 1.5, 2.0, 2.5 m. It was observed that bacterial count of phosphorylated fabric was lower than the untreated control fabric.

PREPARATION OF SUPER-ABSORBENTS BY IRRADIATION

Superabsorbent polymers can be prepared by grafting monomers to polymers like starch and Guar gum by gamma ray irradiation technique. The method of using mutual irradiation gave satisfactory grafting results.

Raw starch samples were irradiated to different dosages of radiation and their viscosities determined. There was a fall in the viscosity with increase in dosage.

Several trials were carried out on starch and Guar gum to get optimum grafting percentage. At each of the trials, the following operations were carried out :

1. Separation of the grafted product.
2. Removal of homopolymer.
3. Confirmation of grafting through chemical method as well as IR analysis.

After fixing appropriate conditions, grafting was carried out at five different doses for starch and nine different doses for Guar gum. This was done to get the optimum dose level to obtain the required product. At each dosage, in addition to the operations mentioned above, saponification of the grafted product and isolation of the grafted chain of PAN (poly acrylonitrile) from the backbone by acid hydrolysis was carried out. Determination of molecular weight of PAN, viscosity and absorbency tests of the saponified product were also measured.

STUDIES ON THE ENHANCED ENZYMOLYSIS OF NEVER DRIED COTTON AND OTHER CELLULOSIC MATERIALS

Enzymolysis of never-dried cotton cellulose from the variety DCH.32 was done during 1985. The study was extended to four varieties drawn from all the four cultivated species of cotton. All the varieties were subjected to enzymolysis as before upto 6 hr at 50°C. Weight loss, total reducing sugars and glucose were estimated during the course of enzymolysis. The results indicated that about 90% of total reducing sugars were obtained after 6 hr in the case of **Desi** varieties as against 100% in the case of **G. hirsutum** and **G. barbadense** cottons. The glucose yields from the **Desi** varieties, however, was only around 15% whereas it was around 25% with **hirsutum** and **barbadense** species.

Residues obtained after enzymolysis of the never-dried fibres for varying periods of time were subjected to x-ray examination. From the equatorial x-ray diffractograms, the amorphous content as well as crystallite breadth of (002) were measured. Analysis of the results revealed that the course of enzymolysis as followed by x-ray studies were different for different varieties.

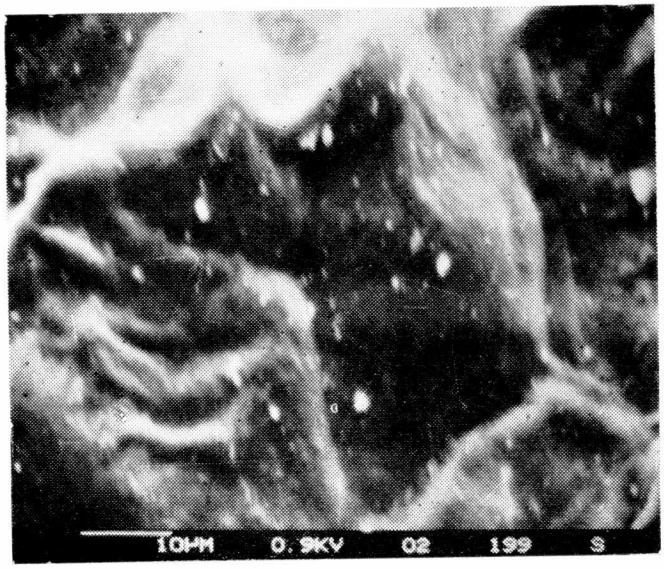
DP measurements were also made on all the samples before and after enzymolysis. There was a decrease in DP after 6 hr of enzyme treatment in all the samples tested.

PREPARATION OF LOW VISCOSITY STARCHES USING BACILLUS SUBTILIS-159 AMYLASE

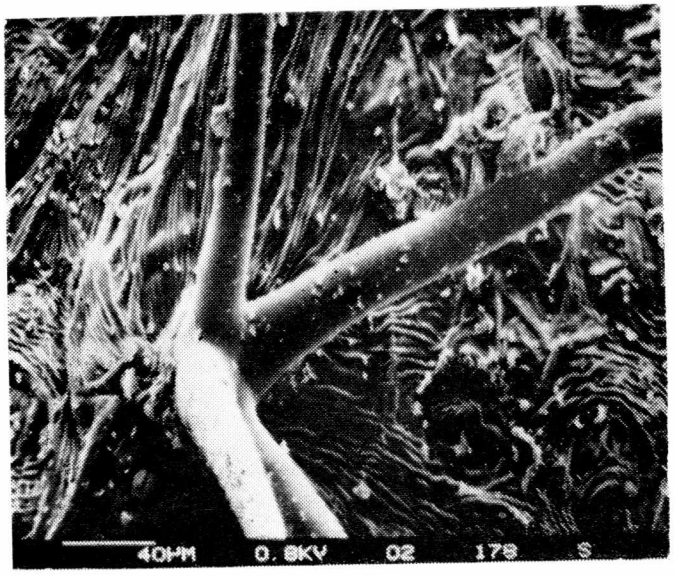
Low viscosity starches are preferred for sizing of fabrics because of their uniform viscosity, better penetration and binding property. Attempts were being made to prepare low viscosity starches suitable for sizing of fabric by the action of **Bacillus subtilis-159** amylase on native starches.

PLATE III

ELECTRON MICROGRAPHS SHOWING THE PRESENCE OF *BEIJERINCKIA SP.* IN BRACT AND LOCULES OF COTTON

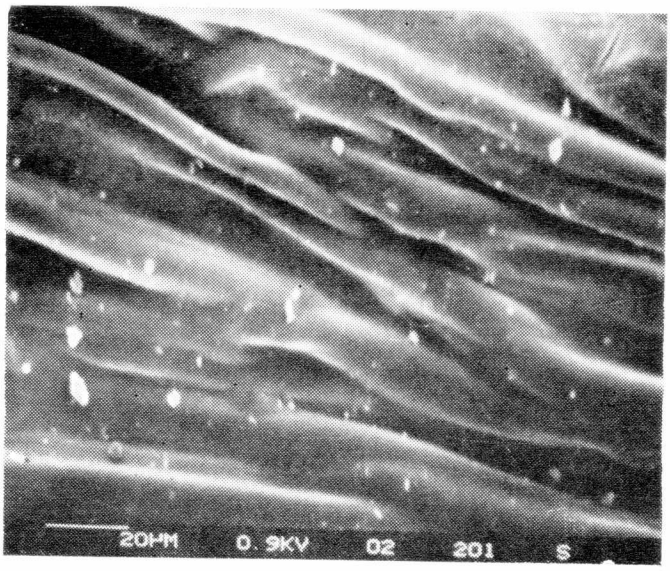


Suvin (Bract)

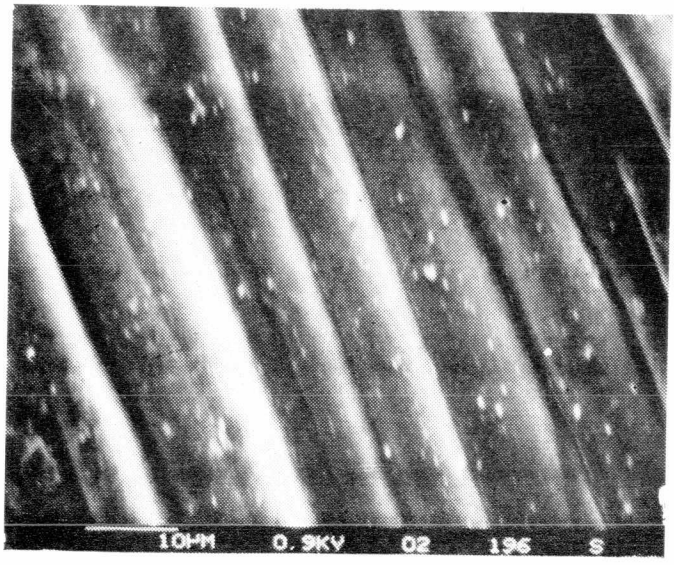


Laxmi (Bract)

PLATE III (contd.)



Suvin (Locule)



Laxmi (Locule)

The amylase enzyme was prepared by growing **B. subtilis-159** in a medium containing wheat bran 4.0%, and peptone 1.5%, as carbon and nitrogen sources, respectively for 96 hr. The broth was centrifuged to get a clear, cell-free enzyme at 10,000 rpm in Sorvall RC 2B centrifuge.

A 6.0% slurry of corn starch in distilled water was prepared in a beaker and allowed to geltatinize in a boiling water bath, with constant stirring. After gelatinization, the paste was held for 5 minutes in the above water bath and then kept in a water bath set at 60°C. The amylase enzyme was added to the paste with constant stirring and it was incubated for 2 hr at 60°C. After certain time interval, the drop in viscosity of paste was measured using Brook-field Viscometer.

Simultaneously, viscosity of 6.0% Anilose E' starch, which is a commercially available thin boiling starch, was also measured. It was observed that enzymatically degraded starch could attain the viscosity level of 6.0% 'Anilose E' starch within 20 min.

To study the effect of enzyme concentration on drop in viscosity, **B. subtilis**-159 amylase was added at 1 ml, 2.5 ml, 5.0 ml, 7.5 ml, and 10 ml quantity to the pastes of 6.0% corn starch, separately. The viscosity was measured after 30 min of incubation period. It was observed that 2.5 ml enzyme gave optimum reduction in viscosity and no further appreciable drop in viscosity was noticed at higher concentration of enzyme.

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

The occurrence of **Enterobacter agglomerans**, the Gram negative bacterium has been found to be present in significant numbers in cotton-dust. The role of this bacterium as a source of endotoxins, one of the causative agents of 'mill fever' or byssinosis has been reported. **Bijerinckia sp.**, the free living nitrogen fixing bacterium is found to be present in significant numbers in cotton-dust. The cotton plant parts were screened for the occurrence of this bacterium since cotton-dust carries a considerable portion of them.

Four varieties of cotton plants drawn from each species of cultivated cotton were selected for the study apart from cotton-dust samples collected from two textile mills. The cotton plant parts, viz. stems, petiole, leaves, bracts and boll rind were used for enumerating the microorganisms by standard dilution plate technique. Scanning Electron Microscopy (SEM) was employed to observe the microorganisms **in situ.** The results indicated that the organisms were present in all the species but in different numbers. Their role in aggravating the level of endotoxins is being studied.

EFFECT OF BLEACHING TREATMENTS ON THE LINTERS OF PURE VARIETIES

Cotton seeds of five varieties, viz. H4, Varalaxmi, Jayadhar, H.6, AKH.4 (saw ginned as well as roller ginned) were obtained. These varieties were first

ginned and then delinted. The linter samples are being cleaned by Shirley Cleaner.

STUDIES ON RANCIDITY OF COTTONSEED OIL

Cotton seeds of four popular varieties were collected and oil extracted using petroleum ether as the solvent. A commercial sample of cottonseed oil (double refined) was also obtained. The oil samples were tested for peroxide value, free fatty acids, and colour. Small portions of these oils were taken in different plastic containers and stored at room temperature without the addition of any antioxidant as also with the addition of antioxidants such as tocophenol, butylated hydroxyamirole, and butylated hydroxy toluene.

PREPARATION AND CHARACTERIZATION OF CELLULOSE DERIVATIVES FROM PULP MADE FROM VARIOUS AGRICULTURAL WASTES

During the year, high quality rayon grade pulp was prepared from cotton plant stalk using kraft process. The yield was about 56%. The cotton stalk pulp was having brightness 40%. Therefore, it was further bleached using sodium hypochlorite. Further, cotton stalk pulp was prepared using nitric acid and bleached. The properties of pulps are being studied.

PREPARATION AND CHARACTERIZATION OF MICROCRYSTALLINE CELLULOSE

Pulp was prepared from cotton stalk using 10% nitric acid and was bleached to get maximum brightness. The pulp was hydrolysed by 2N HCl at 100°C to get microcrystalline cellulose.

The properties such as crystallinity, degree of polymerisation, moisture regain particle length, etc. were determined for the microcrystalline cellulose. The crystallinity was 82%. The DP value reduced from 951 for the control to 349, after hydrolysis. The moisture regain values dropped from 9.5% to 8.7%, after hydrolysis. Microcrystalline cellulose was also prepared from wheat straw pulp and its properties were determined. It has been observed that the properties of microcrystalline celluloses prepared from bagasse pulp, cotton stalk pulp and wheat straw pulp are well in agreement with those of the standard microcrystalline cellulose, **Avicel.**

UTILISATION OF CELLULOSE BEARING MATERIALS LIKE COTTON PLANT STALK, MESTA, RAMIE, ETC. FOR PRODUCTION OF PULP AND VARIOUS GRADES OF PAPER

1. Preparation of pulps

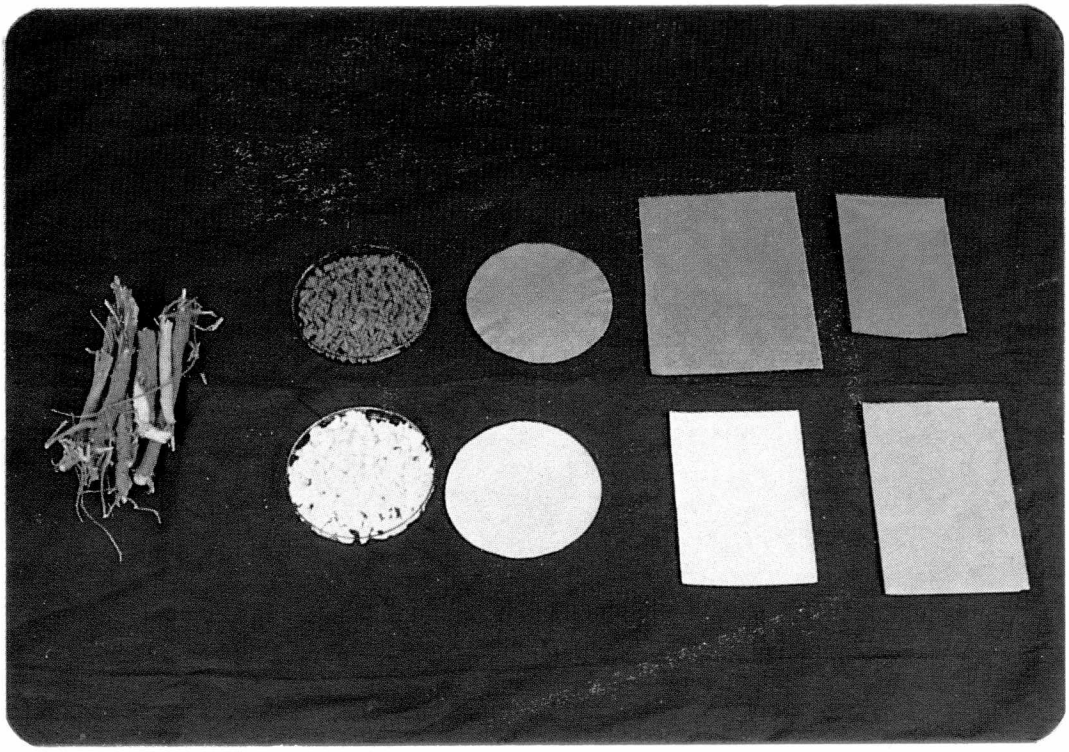
During 1986, the following two types of pulps were prepared using cotton stalk as well as bagasse :

a) Kraft Pulp from Cotton Plant Stalk

Kraft pulp was prepared by digesting 300 g cotton stalk chips with 18% kraft liquor in a rotary bomb digester. The material to liquor ratio was kept at 1:3 of oven dry weight of the raw material. The digestion was carried out at 160°C temperature for two

PLATE IV

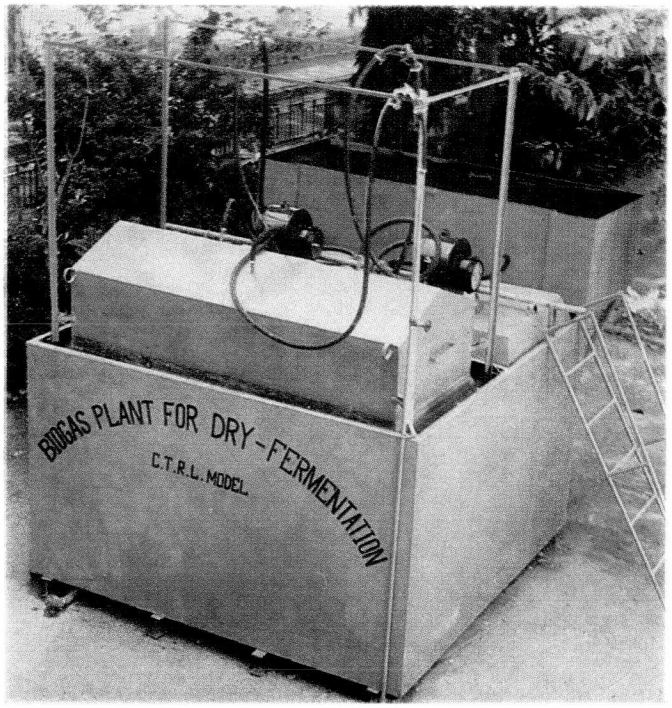
PULP AND PAPER FROM COTTON PLANT STALK



(From L to R) (i) Cotton Stalk (ii) Unbleached and Bleached Pulp in Dish (iii) Paper Specimens

PLATE V

CTRL DRY FERMENTATION BIOGAS PLANT



hours. The cooked material was washed thoroughly to remove the excess chemicals as well as the black liquor. The black liquor was analysed for assessing the amount of chemical consumed and total solid content in the liquor. The cooked material was disintegrated and then screened to remove the uncooked materials and fibre bundles. The pulp was then beaten in a valley beater to get the desired Canadian Standard Freeness (CSF) of 235.

b) **Chemi-Mechanical Pulp from depithed Bagasse**

300 g of depithed bagasse chips were digested with 12% of active alkali on the OD weight of the raw material in a rotary bomb digester. The material to liquor ratio was kept at 1:3 of the OD weight of the raw material. The digestion was carried out at 140°C temperature for 1½ hours. The cooked material was washed to remove the excess chemicals and black liquor. The cooked material was then refined in a disc refiner at 10 thou clearance in one passage and then screened to remove the rejects.

2. **Blending of Cotton Stalk Pulp with Bagasse Pulp**

The kraft pulp prepared from cotton plant stalk was blended in various proportions with chemi-mechanical bagasse pulp and then beaten in a valley beater to get the desired CSF of 250.

3. **Bleaching of Pulps**

A known quantity of all the above pulps was bleached employing a two step process using hyprochlorite at 10% consistency, 45°C temperature for three hours (90 min + 90 min). The total chlorine demand was 8%.

4. **Sheet Making and Testing**

Unbleached and bleached paper sheets of 60 ± 1 gsm were prepared from the individual pulps as well as from mixed pulps on a standard sheet making machine. The sheets were dried in the air and conditioned at 65% RH and 27°C temperature for two hours and then tested for various physical properties such as bulk density, breaking length, burst factor, tear factor and number of double folds.

PULP FOR PAPER FROM LINSEED STALK

The total area under linseed production in India is around two million hectares. With a view to put linseed stalk which is an agricultural waste material of linseed cultivation, to better use, an investigation was undertaken in collaboration with the Parkhe Research Institute, Khopoli, Maharashtra to prepare good quality pulp and paper on a laboratory scale. Kraft and Soda pulping process were tried using various concentrations of the alkali and different cooking conditions. The economics and the wide variety of paper preparation can be explored after pilot plant studies envisaged are under taken and completed.

STUDIES ON THE PRODUCTION OF BIOGAS FROM CELLULOSIC WASTES OF TEXTILES MILLS

With a view to evaluate the efficacy of the digested slurry from biogas plant by anaerobic digestion of willow-dust at Apollo Textile Mills, field

trials on cotton crop have been laid out at Dharwad and Arabhavi during 1986. There were 9 treatments, replicated three times in a Randomized Block Design. Two varieties were sown at Dharwad under rainfed conditions and one at Arabhavi under irrigated conditions. Each plot measure 36m^2. The treatments included digested slurry, farm yard manure and NPK fertilizer in different doses and in different combinations. The results are awaited.

A pilot plant to process willow-dust by dry fermentation is being fabricated using MS sheets. The design consists of 2 batch fed digesters and common but separate gas holders. A platform has been provided at the top to mix willow-dust and openings at the bottom to take out the digested material. Trials will be undertaken during February, 1987.

Janata biogas plants with stationary scum breakers had been laid out at Dharwad and at CTRL. The CTRL plant was being charged with willow-dust and that at Dharwad with cow-dung. The plant at CTRL was being operated successfully with a charge of 50 kg willow-dust at weekly intervels to maintain a constant supply of 1.7 m^3 biogas. The plants at Dharwad are under observation.

STUDY ON VEGETABLE FIBRES (OTHER THAN COTTON, TO EXPLORE THEIR INDUSTRIAL APPLICABILITY PARTICULARLY IN TEXTILE FIELD)

Part A Pineapple : The selected pre-treatments with organic solvents for softening pineapple fibres were made in bulk. They were cut, blended in 50:50 proportion with short stapled cotton, B.147 and spun. The yarns produced had good strength; but higher percentage of droppings. Trials are on to reduce this loss.

Part B Ramie : The fibers of ramie were degummed by chemical as well as by microbiological methods to soften them and to make them more pliable. Sodium hydroxide and sodium bisulphite were used for chemical treatments. Microbiological methods with inoculum and enzymes with sodium hydroxide were tried. About 22 trials were undertaken and the fibres were tested for tenacity and elongation.

Pineapple fibres softened with organic solvents and sodium hydroxide could be blended well with cotton and the yarn thus prepared had good strength compared to raw pineapple. Ramie fibres treated with 1% sodium-hydroxide gave high tenacity values compared to the samples treated with the inoculum and enzymes.

RESEARCH WORK DONE AT THE REGIONAL QUALITY EVALUATION UNITS

GUNTUR

Effect of potassium fertilizers on fibre quality of MCU.5

MCU.5 variety was grown under three soil conditions (low, medium and high concentration of K) at Lam Centre during 1985-86. Five levels of K fertilizers (0 — 200 kg/ha) were applied to each soil type. It was observed that soil having high K content

showed increase in length at 50 kg/ha and above.

SURAT

Effect of P-fertilizers on fibre quality of cotton

Three investigations were conducted at the Agricultural Research Station, Surat on Hybrid 4 and Hybrid 6 varieties during 1979-84. Design of experiment was radomized block with three replications. Different doses of N, P, K fertilizers were applied. In general, P had effect on fibre quality although little effect was observed on fineness and strength.

SRIGANGANAGAR

Effect of different plant population on fibre quality of genotypes of cotton

Three genotypes G.1, G.8 and G.10 were grown at 45, 60 and 75 cm spacings during 1984 and 1985. Fibre quality was unaffected due to the change in spacings.

COIMBATORE

Study of the extent of fibre breakage in drawing process in the Shirley Miniature Spinning Plant

The preliminary study on Suvin cotton revealed that there was a steady increase in the short fibre percentage at each passage through the draw frame. This study is being extended to MCU.9, K.9 and Varalaxmi cottons.

INDORE

(i) Effect of graded levels of sodacity on cotton cultivars

This project was commenced in 1984-85.

During the year, Burwah selection, Khandwa 2, Vikram, Maljari and NA.39 varieties were grown in pots with different alkalinity levels created artificially by additing sodium salts. The samples of varieties grown at different levels of alkalinity were evaluated for fibre quality It has been observed that bundle tenacity increased with sodacity levels. Other properties were unaffected.

(ii) Correlation studies of oil content, seed index, G.P. and fibre properties of improved varieties of cotton

Five hybrids and five varieties grown in M.P. were selected for this study and replicated thrice under usual agronomical practices. The samples of hybrids/varieties were tested for oil content, seed index, G.P. and fibre properties. The oil content ranged from 17.5% to 23.5%. It was interesting to find that seed index and oil content were positively correlated, while oil and fineness gave a negative correlation.

HISSAR

Change in physical properties of cotton during its development

Dried bolls of 12 varieties were collected from a trial conducted at the HAU, Hissar, at an interval of five days from the date of flowering to 45th day. The fibres were separated from seeds by hand and 72 representative samples for different ages were prepared. They were tested for fibre properties. There was change in length of cotton fibres during the boll development. Fineness, maturity and strength increased with increase in the age of boll.

3

Publications

A. Annual Report

Annual Report of the Cotton Technological Research Laboratory for the calendar year 1985.

B. Research Publications (CTRL Publications — New Series)

302 K. R. Krishna Iyer and N. B. Patil — How to Make Permanent Pleats in Cotton Fabrics (Reprinted from the Indian Textile Journal, Vol. XCVI, No. 5, p. 82-85, February, 1986).

303 S. N. Pandey and A. J. Shaikh — Developments in Energy Preservation Technique (Reprinted from the Indian Textile Journal, Vol. XCVI, No. 5, p. 112-114, February, 1986).

304 A. V. Ukidve, P. G. Oka, P. Bhaskar, S. Chandrashekar and B. Srinathan — Comparison of Microspinning and Bulk Spinning Techniques (Reprinted from the Indian Society for Cotton Improvement Journal, Vol. X, No. 2, p. 128-134, September, 1985).

305 V. G. Munshi and V. Sundaram — Resume' of Studies on Effect of Agricultural Practices on Cotton Fibre Quality (Reprinted from the Indian Society for Cotton Improvement Journal, Vol. X, No. 2, p. 65-70, September, 1985).

306 V. G. Khandeparkar, R. H. Balasubramanya, H. U. Gangar, and V. Sundaram — Pilot Plant to Study the Production of Biogas and Biomanure from Willow-dust, a Textile Mill Waste (Reprinted from the Indian Society for Cotton Improvement Journal, Vol. X, No. 2, p. 140-142, September, 1985).

307 V. Sundaram, S. B. P. Rao and A. K. Basu — Cotton Improvement Research and Production Practices in India in Relation to Fibre Quality and End Use Requirements — part IV, Present Status of Cotton Production and Constraints (Reprinted from the Indian Cotton Mills' Federation Journal, Vol. XXII, No. 10 & 11, p. 9-14, February-March, 1986).

308 V. Sundaram, V. G. Khandeparkar, R. H. Balasubramanya and H. U. Gangar — Biogas from Willow-

dust, a Textile Processing Residue (Reprinted from the Indian Cotton Mills' Federation Journal, Vol. XXII, p. 28-32, No. 8 & 9, December, 1985 — January, 1986).

309 S. B. P. Rao and V. Sundaram — Quality of Cottonseed Used for Planting (Reprinted from the Indian Cotton Mills' Federation Journal, Vol. XX, No. 7-8, p. 4-8, November-December, 1983).

310 S. R. Ganatra and V. G. Munshi — Air Permeability and Bursting Strength of Cotton Fabrics (Reprinted from the Indian Textile Journal, Vol. XCVI, No. 8, p. 104-109, May, 1986).

311 M. S. Parthasarathy and V. Sundaram — Present Status of Ginning in India (Reprinted from the Indian Textile Journal, Vol. XCVI, No. 9, p. 116-126, June, 1986).

312 S. Aravindanath, P. Bhama Iyer and S. Sreenivasan — Further Evidence for the Presence of Cellulose I and II in the Same Cross Section of a Partially Mercerized Cotton (Reprinted from the Textile Research Journal, Vol. 56, No. 3, p. 211-212, March, 1986).

313 D. V. Mhadgut and Muntazir Ahmed — Assessment of Spinnability of Cotton by Single Thread Tenacity (g/t) (Reprinted from the Journal of Textile Association, Vol. 47, No. 3, p. 97-98, May, 1986.)

314 N. D. Nachane, M. S. Sitaram and I. G. Bhatt — A Note on the Relationship Between Crease Recovery Angle and Durable Press Rating in Fabrics with Different Construction (Reprinted From the Textile Dyers and Printers Journal, April, 1986).

315 M. S. Sitaram, N. D. Nachane, S. M. Betrabet and V. Sundaram — Improvement in Mechanical Properties of Different Cotton Varieties After Pre-Swelling and Crosslinking (Reprinted from the Colourage Journal, Vol. XXXIII, No. 9, p. 17-21, May 1, 1986).

316 V. G. Munshi, V. Sundaram and S. B. P. Rao — Effect of Application of Phosphatic Fertilizers on Cotton Fibre Quality (Reprinted from the Indian Cotton Mills' Federation Journal, Vol. XXII, No. 12, p. 21-27, April, 1986).

317 P. V. Varadarajan, A. W. Shringarpure, M. S. Sitaram and I. G. Bhatt — Report on Delinting Units in the States of Maharashtra, Andhra Pradesh and Karnataka (Reprinted from the Indian Cotton Mills' Federation Journal, Vol. XXIII, No. 1&2 , p. 22-29, May-June, 1986).

318 R. P. Nachane, G. F. S. Hussain, G. S. Patel and K. R. Krishna Iyer — Inverse Relaxation in Spun Yarns (Reprinted from the Journal of Applied Polymer Science, Vol. 31, No. 4, p. 1101-1110, March, 1986).

319 V. Sundaram, S. B. P. Rao and M. S. Parthasarathy — Cotton Improvement Research and Production Practices in India in Relation to Fibre Quality and End Use Requirements — part V; Quality Requirements for Specific End Uses (Reprinted from the Indian Cotton Mills' Federation Journal, Vol. XXIII, No. 3, p. 5-29, July, 1986).

320 R. H. Balasubramanya, V. G. Khandeparkar and V. Sundaram — Production of Biogas and Biomanure from the Textile Processing Residue, Willow-Dust by Dry Anaerobic Fermentation (Reprinted from the Agricultural Wastes Journal Vol. 16, No. 4, p. 295-302, 1986).

321 S. Aravindanath, S. Sreenivasan and P. Bhama Iyer — Electron Diffraction Study of Cellulose IV (Reprinted from the Journal of Polymer Science, Vol. 24, part C; No. 5, p. 207-209, May 1986).

322 B. Srinathan and M. S. Parthasarathy — Influence of Opening and Carding Conditions on Open End Spinning Performance (Reprinted from the Journal of Textile Association, Vol. 47, No.5, p. 151-157, September, 1986).

323 N. C. Vizia — How to Determine Ginning Percentage (Reprinted from the Indian Textile Journal, Vol. XCVII, No. 1, p. 102-104, October, 1986).

324 P. Bhama Iyer, S. Sreenivasan, P. K. Chidambareswaran and N. B. Patil — Recrystallisation of Cellulose (Reprinted from the Textile Research Journal, Vol. 56, No. 8, p. 509-511, August 1986).

325 R. H. Balasubramanya and K. M. Paralikar — Occurrence of Nitrogen Fixing Bacteria on Bracts, Locules and in Cotton Dust (Reprinted from the Textile Research Journal, Vol. 56, No. 8, p. 521-523, August, 1986).

326 K. M. Paralikar — Electron Diffraction Studies of Cotton Fibers from Bolls During Early Stages of Development (Reprinted from the Journal of Polymer Science : part C : Polymer Letters, Vol. 24, No. 8, p. 419-421, August, 1986).

327 P. K. Chidambareswaran, R. H. Balasubramanya, S. P. Bhatawdekar, S. Sreenivasan and V. Sundaram — Enhanced Enzymolysis of Cotton Fibres and Cotton Plant Stalk (Reprinted from the Enzyme and Microbial Technology Journal, Vol. 9, p. 561-567, September, 1986).

328 V. T. Srinivasan, B. B. Singh, P. K. Chidambareswaran and V. Sundaram — The Effect of Hydrogen Content on Estimation of Seed Oil by Pulsed Nuclear Magnetic Resonance (Reprinted from the Journal of American Oil Chemists Society, Vol. 63, No. 8, p. 1059-1062, August, 1986).

329 S. Sreenivasan, **P. Bhama Iyer,** P. K. Chidambareswaran and N. B. Patil — Milling of Partially Mercerized Cellulose (Reprinted from the Textile Research Journal, Vol. 56, No. 10, p. 647-649, October, 1986).

330 B. M. Petkar, D. V. Mhadgut and P. G. Oka — Distribution of Cross-sectional Area, Perimeter, Circularity and Secondary Wall Thickness of Different Cotton Fibers During Growth (Reprinted from the Textile Research Journal, Vol. 56, No. 10, p. 642-645, October, 1986).

331 L. R. Jambunathan, N. P. Mehta, C. J. Sanandia and Y. Subramanyam — Study of the Effects of the Application of Nitrogen Phosphorus and Potash on the Economic and Quality Characteristics of the Cotton, Hybrid 4 (Reprinted from the Indian Society for Cotton Improvement Journal, Vol. XI, No. 1, p. 26-29, March, 1986).

332 V. S. Iyer, and M. B. Mishra — Application of Single Seed Selection Technique for Improvement in Ginning Percentage and Fibre Quality (Reprinted from the Indian Society for Cotton Improvement Journal, Vol. XI, No. 2, p. 80-85, September, 1986).

333 R. H. Balasubramanya — An Edible Mushroom Crop on Cotton Stalks (Reprinted from the Indian Society for Cotton Improvement, Vol. VI, No. 2, p. 104-106, September, 1981).

334 P. Bhaskar, B. Srinathan, A. V. Ukidve and K. R. Krishna Iyer — Twist Measurement on Open-End Yarns (Reprinted from the Textile Trends Journal, Vol. XXIX, No. 9, p. 39-44, December, 1986).

335 B. Srinathan — Development in Ginning and Factors for the Improvement in Ginning (Reprinted from the Textile Industry and Trade Journal, Vol. XXIV, No. 3-4, p.5-8, March-April, 1986).

336 K. M. Paralikar and S. B. Bhatawdekar — Electron Diffraction Study of Enzyme Hydrolysed Cotton Samples (Reprinted from the Journal of Polymer Science, Vol. 32, No. 7, p. 6001-6004, November, 1986).

337 K. B. Rajgopal, K. Janaki Iyer and K. R. Krishna Iyer — Fibre Length Dispersion by Digital Fibrograph (Reprinted from the Indian Textile Journal, Vol. XCVII, No. 3, p. 114-116, December, 1986).

338 I. K. P. Iyer, M. S. Parthasarathy and V. Sundaram — Shortened Spinning Process for Fibre Hook Removal (Reprinted from the Indian Textile Journal, Vol. XCVII, No. 3, p. 82-86, December, 1986).

C. Other Publications

1. S. N. Pandey and A. J. Shaikh — Production of Various Grades of Paper from Cotton Stalk (Published in the Journal of Indian Pulp and Paper, Vol. XL, No. 4, p. 14-18, December, 1985 — January, 1986).

2. P. V. Varadarajan, K. H. Sawakhande and I. G. Bhatt — Chemical and Mechanical Analysis of Indian Cotton Linters (Published in the Journal of Indian Pulp and Paper Technical Association, Vol. 23, No. 2, p. 1-5, June, 1986).

3. S. N. Pandey and A. J. Shaikh — Studies on Chemical Composition of Cotton Plant Stalk of Different Species (Published in the Journal of Indian Pulp and Paper, Vol. XLI, No. 1, p. 10-17, June-July, 1986).

4. S. N. Pandey and N. Thejappa — Effect of Different Locations on Composition of cottonseeds (Published in the All India Cotton-seed Crusher's Association Newsletter, Vol. No. 7, p. 7-10, July, 1986).

5. I. K. P. Iyer, V. B. Suryanarayanan and V. G. Munshi — Rapid Method of Assessing Spinning Potential of Cotton Using Fibre Quality Parameters (Published in the Journal of Textile Association, Vol. 47, No. 4, p. 115-121, July, 1986).

6. S. N. Pandey and R. M. Gurjar — Fire Retardant Boards from Cottonseed Hulls (Published in the Research and Industry Journal, Vol. 31, No. 3, p. 206-210, September, 1986).

7. S. N. Bailur, G. R. Phalgumani (Textiles Committee) and I. G. Bhatt, A. W. Shringarpure and V. Sundaram (CTRL) — Flame Retardant Fabrics: An Economic Process for Public Safety of Textiles (Published in the Invention and Intelligence Journal, Vol. 21, No. 11, p. 404-407, November, 1986).

8. V. Sundaram — Fibre Quality Tests for Modern Spinning — I (Published in the Indian Textile Journal, Vol. XCVII, No. 3, p. 46-60, December, 1986).

D. Papers presented at Conferences/ Seminars/Symposia

1. V. Sundaram and P. G. Oka — Improvement of Quality of Cotton Production in India: Research Achievements and Problems encountered (Presented at the Seminar on "Strategies for Raising Production and Productivity of Cotton in Southern Cotton Zone, held at Central Institute for Cotton Research, Coimbatore during February 20-21, 1986.)

2. V. Sundaram, V. G. Munshi and S. B. P. Rao — Effect of Application of Phosphatic Fertilizers on Cotton Fibre Quality (Presented at the National Seminar on the 'Effect of Application of Phosphatic Fertilizers on Cotton held at the Gujarat Agricultural Uni-

versity, Surat during May 21-22, 1986).

3. Y. Subramanyam, N. P. Mehta and P. G. Mehta and P. G. Patel — Does the Application of Phosporus Improve the Fibre Quality of Cotton ? (Presented at the National Seminar on the 'Effect of Application of Phosphatic Fertilizers on Cotton, held at the Gujarat Agricultural University, Surat during May 21-22, 1986).

4. G. Viswanathan, V. G. Munshi and A. V. Ukidve — Hairiness of Ring and Open End Spun Cotton Yarns (Presented at the 43rd All India Textile Conference on Textiles — Today and Tomorrow held at Shanmukhananda Hall, Bombay, during December 15-16, 1986).

5. M. S. Sitaram, N. D. Nachane, A. W. Shringarpure and I. G. Bhatt — Pathways for Improving Mechanical Properties of Resin Finished Fabrics (Presented at the 43rd All India Textile Conference on Textiles — Today and Tomorrow held at Shanmukhananda Hall, Bombay, during December 15-16, 1986).

6. I. G. Bhatt, A. W. Shringarpure, C. Sundaram (CTRL) and S. N. Bailur, G. R. Phalgumani (Textiles Committee) — Durable Flame Retardant (FR) Process for Textile Mills (Presented at the 43rd All India Textile Conference on Textiles — Today and Tomorrow Held at Shanmukhananda Hall, Bombay, during December 15-16, 1986).

7. V. V. Hadimani (Raymond Woollen Mills, Thane), B. Srinathan (CTRL, Bombay) and M. K. Namboodri (VJTI, Bombay) — A Study of the Polyester & Silk-Waste Blended Yarn and Fabric Characteristics (Presented at the 43rd All India Textile Conference on Textiles — Today and Tomorrow held at Shanmukhananda Hall, Bombay, during December 15-16, 1986).

8. S. N. Pandey, (JTRL, Calcutta) and Prema Nair (CTRL, Bombay) — A New Poly-Set Process for Production of Improved D.P. Cotton (Presented at the 43rd All India Textile Conference on Textiles — Today and Tomorrow held at Shanmukhananda Hall, Bombay, during December 15-16, 1986).

9. R. H. Balasubramanya and K. M. Parlikar — Occurrence of **Bejerinekia** sp. the Free Living Nitrogen Fixing Bacterium on Various Parts of Cotton Plants and Its Relation to the Level of Endotoxins (Presented at the 27th Annual Conference of the Association of Microbiologists of India, held at Nagpur during December 20-22, 1986).

10. S. G. Gayal and V. G. Khandeparkar — Production and Purification of Amylase Produced by **Bacillus subtilis** 159 (Presented at the 27th Annual Conference of the Association of Microbiologists held at Nagpur during December 20-22, 1986).

11. I. G. Bhatt and V. Sundaram — Characterisation of Benzoylated Celluloses by Location of Substituent Group (Presented at the 23rd Annual Convention of Chemists held at the Annamalai University, Tamil Nadu during December 20-24, 1986).

12. I. G. Bhatt and V. Iyer — Effect of Gamma-ray Irradiation on Some Unsaturated Cellulose Derivatives (Presented at the Conference on 'Carbohydrates and Allied Subjects' held at Ahmedabad Textile Industry's Research Association, Ahmedabad during December 21-22, 1986).

E. Technological Circulars on Trade Varieties of Indian Cotton

T.C. No.	Variety	Place	T.C. No.	Variety	Place
2285	J.34(R/G)*	Farahabad	2301	MCU.5	Somanur
2286	Gaorani 6	Bhainsa	2302	MCU.5	Proddutur
2287	Sanjay	Botad	2303	DCH.32	Adoni
2288	Y.1	Panduma	2304	DCH.32	Raichur
2289	Laxmi	Ahmednagar	2305	LRA.5166	Kovilapatti
2290	Hybrid 4	Bewar	2306	MCU.7	Konganavaram
2291	Hybrid 4	Gondal	2307	Suvin (B)	Attur
2292	Varalaxmi	Indore	2308	Suvin(A)	Attur
2293	Jayalaxmi (DCH.32)	Ranibennur	2309	J.34 (R/G)*	Malout
2294	Nimbkar	Phaltan	2310	J.34 (R/G)*	Sriganganagar
2295	Shankar 4	Idar	2311	JKHy.1	Pollachigunta
2296	J.34(R/G)*	Karanpur	2312	Sanjay	Botad
2297	Virnar	Bijapur	2313	Varalaxmi	Gondvale
2298	Hybrid 4	Sanawad	2314	Y.1	Sirpur
2299	Bengal Desi	Sriganganagar	2315	MCU.5	Tirupur
2300	Varalaxmi	Gondvale			

* R/G = Roller Gin

F. Technological Circulars on Standard Indian Cottons

S.C. No.	Variety	Place
273	Buri. 1007	Achalpur
274	Hybrid 4	Surat
275	G.Cot.Hy.6	Surat
276	Bikaneri Narma	Sriganganagar
277	SRT.1	Jalgaon
278	Sanjay	Amreli
279	L.147	Amravati
280	Vikram	Indore
281	G.Cot.11(1449)	Bharuch
282	Digvijay	Bharuch
283	Deviraj	Junagadh
284	G.Cot.10	Bharuch
285	AKH.4	Akola
286	SRT.1	Akola

4

Extension

The extension work of CTRL is mainly confined to supply of reliable and accurate data on desired quality parameters of cotton, yarn and fabric samples received from cotton growers, research workers, traders and textile industry, apart from replies to technical queries received from people in the agriculture, textile and other related fields. Eventhough CTRL has no direct linkage with the farming community, it indirectly extends assistance by way of development of useful equipments for the field as also through discussions/suggestions/advices on the technological aspects. Scientists at the twelve quality evaluation units actively collaborative with the research programmes related to cotton, of agricultural universities of Government agricultural departments in the region for the benefit of the farmer community. CTRL conducts training courses in cotton technology chiefly on the quality evaluation aspects of cotton fibres, yarns and fabrics, in quality ginning and in statistical methods connected with the quality parameters. These services are rendered through various departments, as the laboratory does not have any farm attached to it or any extension wing functioning, independently.

Technical Queries

More than 15 written queries have been received during the year seeking information relating to various facets of textile field in addition to discussions and information sought in person. These queries were mainly seeking new technological know-how, recycling of agricultural and textile wastes, standards for various quality aspects, etc. The queries were regularly and promptly attended through the Technical Cell consisting of subject specialists.

Testing

Apart from the research samples received from various agricultural stations, CTRL continued to receive a number of samples of fiibre, 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 samples received and tested during the year 1986 together with the corresponding figures for 1984 and 1985 and average for the quinquennium 1981-85 are given in Table No. 9.

TABLE 9 : NUMBER OF SAMPLES RECEIVED FOR PAID TEST

Type of Tests	Average for the Quinquennium 1981-1985	1984	1985	1986
Spinning	50	52	92	59
Fibre (EICA)*	84	100	37	—
Fibre (Others)	117	125	174	459
Yarn	145	187	198	182
Cloth	60	78	60	36
Moisture	31	21	7	28
Miscellaneous	32	40	23	9

* 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 by them to this Laboratory.

The total fees realised during the calendar year 1986 for carrying out paid test was Rs. 68,174.00 as against Rs. 43,139.50 during 1985. It may be pointed out that this higher earning to the extent of 50% is due to more number of samples received for tests and the revised test charges, which came into force from June, 1985.

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

1. One sample of Spun-Dyed Coarse-denier viscose FR staple sample used for furnishing fabrics was received from a Bombay based manufacturing firm for conversion to 6s count on open-end system. The tests were carried out and the report with the spinning details were communicated to the party.
2. Antibacterial properties were determined on 5 fabric samples submitted by a reputed Mill in Bombay, and the test results alongwith comments were communicated to the party.
3. Two fabric samples received from a chemical Company at Ahmedabad, were tested for X-ray Crystallinity. The results with comments were forwarded to the party.
4. Ten samples of Sankar 4 cotton received from a Bombay based Company was qualitatively analysed for **honeydew** contamination.

The results were communicated to the party.

5. A rayon and silk manufacturing firm in Bombay sent two samples of Viscose Staple fibre for open-end spinning and yarn analysis. Each sample was spun for 9s count and the test results with comments on the spinning performance and details of the spinning procedure followed were communicated to the party.

Exhibition

It was reported last year that CTRL participated alongwith Central Institute of Fisheries Education (CIFE), Bombay, Central Institute for Cotton Research (CICR), Nagpur and National Bureau of Soil Survey and Land Use Planning (NBSS & LUP), Nagpur in the scientific and Industrial Exhibition organised in connection with the Congress Centenary Celebrations which commenced from December 12, 1985. Eventhough the exhibition was scheduled upto January 12, 1986, the ICAR stall was withdrawn on January 9, 1986 for participating in another exhibition at Anjora Farm, Durg organised as part of the Mass Awareness Convention by the Government of Madhya Pradesh.

The CTRL's display items comprised :

1. **Coloured display charts on:**

(i) Staple-wise composition of Indian Cottons (In Hindi and in English)

(ii) Mill Consumption of Textile Fibres (Hindi & English)

(iii) Quality of Cotton Pressed in Principal Indian States (English)

2. **Coloured display boards on :**

(i) New Cotton Varieties Released

(ii) State-wise Area and Production of Cotton in India (Hindi)

(iii) Particle Boards from Cotton Stalks (English)

(iv) Area, Production and Yield of Cotton In India (Hindi)

(v) Cottonseed and its By-products (Hindi)

(vi) Production of Bio-gas from Willow-dust for Textile Mills (English).

3. **Models and actual display pieces on:**

(i) Model of Bio-gas Plant commissioned at Apollo Mills, Bombay under an Operational Research Project.

(ii) Boll Hardness Tester

(iii) Ginning Percentage Balance

(iv) Upholsetery and curtain fabrics from Cotton-Jute and Cotton-Wool Blends

(v) Sarees and Dhotis made from Suvin Cotton

(vi) Particle Board specimen samples of different mesh size

(vii) Paper samples made from cotton plant stalk

(viii) Few Sample Publications

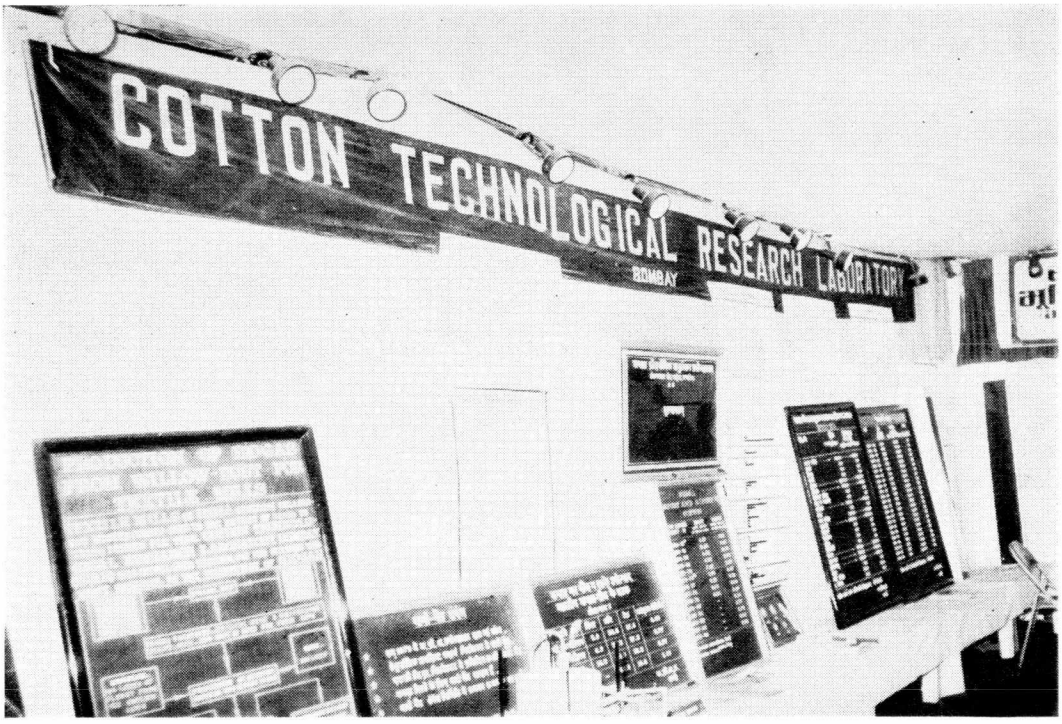
Information pamphlet about CTRL in folder type was prepared in English and Hindi separately and distributed to the visitors to the stall. A large

PLATE VI

SCIENTIFIC AND INDUSTRIAL EXHIBITION AT CROSS MAIDAN IN CONNECTION WITH CONGRESS CENTENARY CELEBRATIONS

ICAR Stall-A Front View

PLATE VI (contd.)



CTRL Exhibits at the ICAR Stall

number of persons visited the stall each day.

Training

During the year two full time training courses were conducted for persons deputed by Cotton Trading Organisations and industry in Bombay and moffusil centres — one from July 14, 1986 to September 6, 1986 and the other from September 16, 1986 to November 7, 1986. The training imparted was on methods of evaluation of quality of cotton fibres, yarns and fabrics and interpretation of test results using statistical methods. The names and addresses of the trainees were as follows :

1. Shri Hemant Hansraj Merchant,
M/s. Hansraj Laxmidas,
37, Shantiniketan,
95A, Marine Drive,
Bombay-400 002.

2. Shri Kiran Kumar Dhaniji Bheda,
B-101, Cotton Exchange Building,
Dhaniji Bhawanji and Co.,
Cotton Green,
Bombay-400 033.

3. Shri Manoj Sripatlal Bangdiwala,
B, Sripat Bangdiwala & Co.,
Room No. S-35, 1st Floor,
Cotton Exchange Building,
Cotton Green,
Bombay-400 033.

4. Shri Mahesh C. Thakker,
M/s. Perfect Cotton Co.,
62 E, Mittal Court,
6th Floor, 224, Nariman Point,
Bombay-400 021.

5. Shri K. Rajendra,
Sri Nataraja Ginning Mill,
Ponnapuram, 518503
Nandyal (Tq.), Kurnool (Dt.),
(Andhra Pradesh).

6. Shri L. Sethuraman,
The Gomathy Mills,
Vernvanallur, 627426,
Tirunelveli District,
Tamil Nadu.

7. Shri R. P. Singh,
C/o. Jt. Agricultural Marketing Adviser,
Department of Marketing & Inspection,
Branch Head Office,
New Secretariat Building,
Nagpur (Maharashtra State).

8. Shri B. S. Purohit,
C/o. Jt. Agricultural Marketing Adviser,
Department of Marketing and Inspection,
Branch Head Office,
New Secretariat Building,
Nagpur (Maharashtra State).

In addition, two weeks intensive training on the quality evaluation aspects of cotton was given to ten officials of the Cotton Corporation of India, Bombay from June 16, 1986 to June 30, 1986. The names of officials who attended the training course were as follows :

1. Shri N. K. Parauha
2. Shri L. S. Kushwaha
3. Shri R. C. Sharma
4. Shri U. P. Nagpal
5. Shri F. Changalrayndu
6. Shri D. T. Krishnamurthy
7. Shri D. S. Swamy
8. Shri M. V. Paniraja
9. Shri A. S. Bhalla
10. Shri N. S. Bhalla

An extensive special training was given to Mrs. Tran Thi Kien Trinh, an FAO nominee from Vietnam for a period of six months from November 22, 1986. In addition to training in the operation of various instruments used in the quality evaluation of cotton fibres, yarns and fabric and determination of quality parameters and statistical methods, visits were arranged to the Regional Units of CTRL in two major cotton growing states to acquaint with the agricultural practices.

5

Conferences and Symposia

Director and scientists of the Laboratory participated in the following Scientific and Technological Conferences besides Meetings connected with the work of this Laboratory.

Sr. No.	Meeting/Conference Seminar/Symposia, etc.	Place	Date	Name(s) of the Scientist(s) and Technical Personnel who attended the Conference/ Meeting, etc.
1	2	3	4	5
1.	National Seminar on Microbial Ecology	Coimbatore	23-1-1986 and 24-1-1986	Dr. R. H. Balasubramanya
2.	Bale Standardisation Committee Meeting	Bombay	12-2-1986	Dr. V. Sundaram and Shri M. S. Parthasarathy
3.	Seminar on 'Strategies for Raising Production and Productivity of Cotton in Southern Zone' organised by CICR	Coimbatore	20-2-1986 and 21-2-1986	Dr. V. Sundaram
4.	Twenty-seventh Joint Technological Conference of ATIRA, BTRA, SITRA and NITRA, organised by NITRA	New Delhi	21-2-1986 and 22-2-1986	Shri B. Srinathan
5.	Meeting to review the work carried out under Integrated Cotton Development Project	Nagpur	3-3-1986 and 4-3-1986	Dr. V. Sundaram

1	2	3	4	5
6.	National Seminar on 'Application of Radiation Energy in Industry and Research', organised by Sriram Institute for Industrial Research	New Delhi	8-3-1986 and 9-3-1986	Shri P. V. Varadarajan
7.	Seminar on Ginning, organised by South India Cotton Association	Coimbatore	18-3-1986	Dr. V. Sundaram and Shri M. S. Parthasarathy
8.	ICAR Post Harvest Technology Panel Meeting	New Delhi	19-3-1986 and 20-3-1986	Dr. V. Sundaram
9.	AICCIP North Zone Panel Meeting	New Delhi	4-4-1986 and 5-4-1986	Dr. V. Sundaram Dr. N. B. Patil and Shri P. G. Oka
10.	Seminar on Whiteflies	Guntur	29-4-1986 and 30-4-1986	Dr. V. Sundaram
11.	AICCIP Central Zone Panel Meeting	Surat	19-5-1986 and 20-5-1986	Dr. V. Sundaram Dr. V. G. Munshi and Shri P. G. Oka
12.	National Seminar on the 'Effect of Aplication of Phosphatic Fertilisers on Cotton' organised by Gujarat Agricultural University	Surat	21-5-1986 and 22-5-1986	Dr. V. Sundaram and Dr. V. G. Munshi
13.	AICCIP South Zone Panel Meeting	Coimbatore	18-6-1986 and 19-6-1986	Dr. V. Sundaram and Shri P. G. Oka
14.	Workshop on Information Services Management in ICAR Institute Libraries and Information organised by NAARM	Hyderabad	8-7-1986 to 11-7-1986	Shri T. K. M. Das
15.	ICAR Regional Committee Meeting	Nagpur	12-7-1986 and 13-7-1986	Dr. V. Sundaram

1	2	3	4	5
16.	Twenty-nineth Annual Rabi Oilseeds Workshop of Repeseed, Mustard, Safflower and Linseed, organised by G.B. Pantnagar University of Agriculture and Technology	Pantnagar	11-8-1986 to 14-8-1986	Dr. V. Sundaram
17.	National Seminar on Cotton, organised by Gujarat State Cooperative Cotton Federation Ltd.	Ahmedabad	24-8-1986 and 25-8-1986	Dr. V. Sundaram and Shri M. S. Parthasarathy
18.	Seminar on Textiles at the Twentieth Century, organised by the Textile Institute Manchester, Bombay Section	Bombay	2-10-1986 and 3-10-1986	Dr. V. Sundaram Dr. N. B. Patil Shri M. S. Parthasarathy Dr. V. G. Munshi Shri T. N. Ramamurthy and Shri B. Srinathan
19.	ICAR Post Harvest Technology Panel Meeting	New Delhi	14-10-1986 and 15-10-1986	Dr. V. Sundaram
20.	Director's Conference	New Delhi	30-10-1986 and 31-10-1986	Dr. V. Sundaram
21.	Seminar on Microbiological Dimensions of Biogas	Ahmedabad	13-11-1986 to 15-11-1986	Shri S. G. Gayal and Miss Y. D. Pai
22.	Seminar on 'Glycerol and Other Polyols', organised by Oil Technologists Association of India	Bombay	23-11-1986	Shri N. Thejappa
23.	Seminar on 'Indian Woolen Industry, Its Woolen Mills' Federation Potential for Growth and Development', organised by Indian Woolen Mills' Federation	Bombay	29-11-1986	Dr. V. Sundaram

1	2	3	4	5
24.	Meeting on R&D Projects on Biogas	New Delhi	8-12-1986 and 9-12-1986	Dr. R. H. Balasubramanya
25.	Forty-third All India Textile Conference on 'Textiles — Today and Tomorrow', organised by the Textile Association	Bombay	15-12-1986 and 16-12-1986;	Dr. V. Sundaram Dr. V. G. Munshi Dr. (Kum.) I. G. Bhatt Shri B. Srinathan Shri A. V. Ukidve Smt. Prema Nair Shri M. S. Sitaram Shri K. S. Bhyrappa Shri A. W. Shringarpure Shri H. R. Laxmivenkatesh Shri G. Viswanathan and Smt. N. D. Nachane
26.	Twenty-seventh Annual Conference of the Association of Micro-biologists of India, organised by the Association of Micro-biologists of India	Nagpur	20-12-1986 to 22-12-1986	Dr. R. H. Balsubramanya Dr. K. M. Paralikar and Shri S. G. Gayal
27.	Conference on 'Carbo-hydrates and Allied subjects' organised by the ATIRA	Ahmedabad	21-12-1986 and 22-12-1986	Dr. (Kum.) I. G. Bhatt and Smt. V. Iyer
28.	Germ Plasm Advisory Committee Meeting	Nagpur	22-12-1986	Dr. V. Sundaram

6

Summary of the Report

This is the sixty-third Annual Report of CTRL that covers the calendar year 1986.

This year also, CTRL continued to collaborate with the State Departments of Agriculture, Agricultural Universities and sister research institutions in their endeavour to evolve better quality cottons, to increase better utilisation of cotton lint as well as cotton plant by-products. CTRL continued to function as the co-ordinating centre for technology under AICCIP. The number of cotton samples received from agricultural trials for different tests at CTRL was 2620, while at the Regional Quality Evaluation Units, it was more than 20,000 samples mainly for fibre tests. During 1986, 153 books and 108 bound volumes of journals were added to the Library. About 200 journals were regularly being received at the library. There were 55 ongoing research projects during the year 1986, of which six were common laboratory projects and one, inter-institutional project. CTRL was continued to be recognised as a post graduate institution by the University of Bombay for M.Sc. degree in Physics (Textiles), Physical Chemistry and Organic Chemistry and Ph.D degree in Physics (Textiles) and Textile Technology and M.Text. (Spinning). The Hindi Day was celebrated with various programmes on September 11, 1986. Mill tests were arranged on two new strains, F.505 from Faridkot and SVPR.763 from Srivilliputhur with controls, F.286 and MCU.7, respectively.

Research Activities

In a project on 'Technological Evaluation of Germplasm Material, a total of 504 genotypes belonging to **G. barbadense, G. hirsutum** and **G. arboreum** were evaluated for fibre characters to identify the dominent characters of each cultivar. The germplasm stock under **G. hirsutum** and **G. arboreum** species exhibited wide scope in selections, as there was wide variability in major quality characters.

In connection with the study of inheritance of fineness in **Desi** cottons, 108 lint samples were tested for G. P., lint index and seed index.

Experiments for the second year with 3 varieties and 8 soil profiles under two environments were continued for the investigation on the environmental factors (soil factor) affecting fibre

quality. The observations with respect to length, fineness, maturity and strength of the three varieties G.Cot.10, G.Cot.Hy.6 and G.Cot.Hy.7, were reported.

With a view to study the influence of agronomic treatments on fibre and economic characters of cotton grown under different agro-climatic conditions, 446 samples received from Surat, Nagpur, Khandwa and Morena were analysed for major fibre properties.

For the study on the improvement of fibre quality in cotton by nutritional manipulation, two pot culture and one field experiment were in progress at Indore.

The boll toughness tester fabricated at CTRL was modified to accommodate testing of cotton shoots also. Apart from testing eighteen genotypes of cottons for boll hardness at 20 days old level and eight at 10 days and 30 days old level, cotton shoots from the two nodes adjacent to the fruiting bud were tested for hardness and the utility of the instrument has been demonstrated.

Quality of cotton lint from different pickings of various cultivated species of cotton and hybrids was studied by testing the samples for 2.5% span length, fineness, percentage of mature fibres and bundle strength. Observations based on analysis of species-wise data as well as pooled data were reported.

In connection with a study on the changes in fibre characters during the development period of boll with special reference to hybrid cottons, cotton bolls of hybrids from Nanded and Surat picked at weekly intervals for the season 1986-87 were tested for boll size, fibre length, maturity and bundle strength. After analysis of the test data, serveral conclusions drawn were reported.

With a view to assess the fibre qualities of early picked green bolls of different species and the resultant economical advantages, an investigation was under way at Nanded with NA.48, NH.239, NHH.44, and DCH.32 cotton samples. In the first experiment, bolls of different ages were collected (40, 50 and 60 days) besides normal picking and dried in sunlight to extract lint, while in the second experiment crop was maintained for 150 days and after picking well opened cotton, remaining green bolls were collected and dried in sunlight. The samples are under test.

Effect of irradiations and chemical treatment on economical and physical characteristics of cotton was studied with seeds of NA.39 variety irradiated for 15 kr, 20 kr and 30 kr doses of gamma rays and ethyl methane sulphonate application before 24 hours of sowing. 208 single plant selections (SPS) from irradiated seeds were done from which 75 SPS were promoted for next generation, M-5.

A preliminary study on Varalaxmi and Hybrid 4 seed cottons from the three locations in Karnataka for the presence of motes that is responsible for the formation of neps in yarn, revealed that fairly large variation

existed in mote content of samples from the three locations and the overall mote content remained the same for both H.4 and Varalaxmi.

Studies on crystallite orientation on the crossed samples belonging to F.1 generation, as part of the project on the inheritance of strength and structural parameters in cotton fibres, have shown that the mean value of 50% x-ray angle of each set, was nearer to the value corresponding to low strength parent which was in conformity with earlier observations.

In connection with the study on structural parameters of yarns with a view to utilising them for textile yarn characterisation, the effect of doubling of ring-spun yarn and open-end yarn was examined through x-ray orientation profiles of yarns and it was observed that as the doubling ratio was increased, the yarn orientation angle remained the same for a certain minimum value, beyond which increasing the doubling ratio, led to increase in yarn orientation angle. This minimum doubling ratio is higher when the twist in the singles yarn is higher and the change in yarn orientation angle at a particular doubling ratio is more for OE yarns. The results of the breaking tenacity and elongation values of yarns from Jyoti and Laxmi cottons as well as from eight **desi** cottons led to the conclusions that the relation between yarn orientation angle and tenacity was better for coarser yarns spun from coarser cottons than finer yarns from finer cottons and that for normal yarns from cottons having Micronaire value greater than 3.8 the correlation between the two attributes decreased.

Study on the orientation behaviour with stretch of six varieties of cotton has shown that the extension at which the maximum orientation was recorded and the slope of the linear portion of the orientation extension curve is related to the x-ray angles of the cottons at normal stretch and that some of the morphological parameters have a comparatively larger influence on the extension at which maximum orientation was recorded.

Morphological deformities and their characterisation in cotton were investigated using five varieties of cotton. On the basis of examination of broken fibres of Jayadhar cotton under **SEM**, the morphological deformities were classified into 10 distinct categories and their relative frequency of occurrence identified. Structural reversals examination under **SEM** has shown that all the structural reversals do not constitute weak places.

With a view to study the lattice conversion behaviour of cotton fibres, NaOH solution in 30 different concentrations were used for treatment with fibres of Giza 7 cotton and the conversion of Cellulose I to Cellulose II was estimated using Lattice Conversion Ratio (LCR). The LCR value increased with concentrations greater than about 5.0 N.

As part of the study on viscoelastic behaviour of textile materials, determination of dynamic modulus and

static modulus for filament yarns of nylon, polyester and viscose was carried out during loading, unloading and reloading cycle at different strain levels. For viscose and polyester, change in viscoelastic index increases with increase in strain initially and then decreases as the strain increased. In the second cycle, viscoelastic index increased with strain for viscose alone, when the other two remained constant.

In connection with investigation on influence of fibre length and fibre length distribution parameters on yarn quality, fibre length parameters of 34 samples and its processed materials were analysed. The FFI (12.5% SL) and UR were in good agreement for processed materials ($r = -0.9451^{**}$). The 50% SL being a measure of fibre extent of the hooked fibres, was found to have highly significant correlations with both UR ($r = 0.5702^{**}$) and FFI ($r = -0.5934^{**}$). Analysis of data for swelling and stretching of fibres at 32°C and 65% (w/w) concentration of zinc chloride indicated that swelling is almost complete in about 30 min and that the fibres stretched to original length after 30 min swelling showed substantial increase in strength. However, the bundle orientation as measured by 50% x-ray angle was almost the same for all the varieties.

Samples of H.4 and LRA have been received for the optimal blending studies of standard varieties of cottons from South India. The individual evaluation of Laxmi and MCU.5 cottons has been commenced and the processing work is completed. Fibre tests were over and yarn tests in progress.

As part of the evaluation of spinnability of cottons from single thread strength of micro spun yarns, carded laps from 10 samples were made manually and subjected to Uster evenness test which showed variation in U% values within 5%. Analysis of data of single thread strength of yarn samples spun using Full spinning and Microspinning techniques has shown that single thread strength for full spinning yarn was generally higher and varied from 1% to 16% and from 1% to 23%, respectively for 20s and 30s count.

To study the weak link effect in Open end (OE) and Ring Spun (RS) yarns, tensile tests were carried out using Instron Tensile Tester on 20s yarn spun from Varalaxmi cotton with 4.0 and 5.5 twist multipliers at 1 cm, 2 cm, 5 cm, 10 cm, 25 cm, 50 cm and 70 cm gauge lengths and average values of breaking load, tenacity, breaking strain and work of rupture were computed. It was observed that the breaking load, tenacity and breaking strain decreased with increasing gauge length for both OE and RS yarns, the reduction was higher for RS yarns and the percentage drop in strain with gauge length was more than that of tenacity with gauge length and that the increase in work of rupture, which was at a slower rate, was higher for OE yarns at any gauge length.

A critical evaluation was made of the "untwist-retiwst" (UR) method with reference to "straightened fibre " (SF) method of twist measurement, together with a study of some experimental conditions on the results obtained by

the "torsional equilibrium" (TE) method adopted for OE yarns. Based on the results of 50 yarn samples subjected to analysis several conclusions were drawn and reported.

For a study on the effect of swelling treatments on yarn irregularity, some preliminary experiments to measure the electrical conductivity and dielectric constants of mercerised and control samples were carried out.

In order to assess the quality of sewing thread by a consolidated index, 17 different properties of 18 sewing thread samples were considered giving equal weightage to all the properties. Further, Sewing Quality Index taking into consideration only four parameters, viz. breaking strength, elongation, U% and abrasion resistances, also was worked out which incidentally gave a very good idea of the quality of sewing thread.

A review of the papers relating to statistical relationships between fibre, spinning and yarn properties have been completed.

In connection with the production of permanent pleats in cotton fabrics, the experimental conditions have been standardised and a reaction tank fabricated for imparting treatment to a batch of six fabric pieces at a time.

In a study on comfort properties of textile fabrics, the resistance offered by fabrics to moisture transmission was studied and it was observed that (i) very good agreement exists between the time taken to reach mean RH and resistance of fabrics to moisture transfer (ii) the moisture transfer time T is strongly influenced by fabric thickness and weight in the case of cotton fabrics while it is strongly dependent on fabric cover for the polyester fabrics.

With a view to assess the effect of hardness of water on the properties of resin treated fabrics, well water was used with distilled water as control for treatment using DMDHEU and Methyl Melamine as resins. The treated fabrics are being evaluated for various physical and chemical properties.

A study on response of resin finishing treatment on decrystalised and stabilised cotton indicated that a better balance of mechanical properties by way of higher increase in CRA and higher tenacity retention could be achieved at all resin concentation of the samples modified through decrystallisation and partial acetylation. It was also observed that the increase in CRA was much higher at lower resin concentration than at higher resin concentration as compared to the control.

Glyoxal was used as crosslinking agent in a study of durable press finishing of cotton and cotton blended fabrics, with aluminium sulphate alone or in combination with citric acid as catalyst and it was observed that glyoxal treated samples had markedly improved the wrinkle recovery angle compared to DMDHEU treated samples and as the concentration of glyoxal increased from 5% to 15% in the pad bath, strength retention of the treated fabric also improved gradually.

For imparting durable flame retardant finishes, sewing thread samples having different characteristics were collected from market and properties were being evaluated.

Phosphorylated fabric samples were irradiated with gamma ray at four different dosages to impart sterilisation property and it was observed that the bacterial count of phosphorylated fabric was lower than the untreated control.

The superabsorbent polymers prepared by grafting monomers to polymers like starch and Guar gum by gamma ray irradiation, were found to be comparable to the commercially available samples for their relative water absorbancy capacity.

Enzymolysis of never dried cotton cellulose from varieties belonging to the four cultivated species was carried out and weight loss, total reducing sugars and glucose were estimated. The results indicated that about 90% of the total reducing sugars were obtained for **desi** varieties and 100% in the case of **G. hirsutum** and **G. barbadense** varieties. The glucose yield was, however 15% and 25% for the above two species. X-ray studies of the residues from enzymolysis revealed that the course of enzymolysis were different for different varieties. DP measurement also exhibited considerable decrease in value after enzymolysis.

Low viscosity starch prepared using **Bacillus subtilis** 159 was compared with the commercially available starch, Amilose E and it was observed that the enzyme degraded starch attain the viscocity level of 6.0% Amilose E starch within 20 min. It was also observed that 2.5 ml enzyme concentration imparted optimum reduction in viscosity.

Cotton plant parts, viz. stems, petiole, leaves, bracts and boll rind as well as cotton dust collected from textile mills were examined for the presence of microorganisms that produces endotoxins responsible for 'mill fever'. The results showed that the organisms were present in all the parts in varying numbers.

Cottonseeds of four popular varieties were collected and oil extracted using petroleum ether as the solvent. A commercial sample of cotton seed oil was also collected. These samples were tested for peroxide value, free fatty acids and colour. Small portions of these samples were kept in different plastic containers and stored at room temperature with and without the addition of anti-oxidants, to study their rancidity characteristics.

Microcrystalline celluloses were prepared from bagasse pulp, cotton stalk pulp and wheat straw pulp and it was found that these microcrystalline celluloses were as good as the standard microcrystalline cellulose, AVICEL in quality.

In the projects on production of pulp and paper from cotton plant stalk and other cellulose bearing materials, two types of pulps, viz. kraft pulp and chemi-mechanical pulp, were prepared using cotton stalk as well as bagasse. Blending studies were made by mixing the two types of pulps and bleached

before making bleached and unbleached paper on a standard paper making machine. The paper sheets were tested for various physical properties.

In collaboration with Parkhe Research Institute, Khopoli, Maharashtra, a project was undertaken to prepare pulp and paper using linseed stalk as the chief raw material. In view of the success of the Kraft and Soda pulping process tried out, pilot plant studies were envisaged.

In connection with the studies on the production of biogas from cellulosic wastes of textiles mills, field trials on cotton crop were laid out at Dharwad and Arabhavi to assess the efficacy of the digested slurry from biogas preparation as fertilizer. A pilot plant to process willow dust by dry fermentation also has been commissioned at CTRL. Further, two Janata biogas plants with stationary scum breakers also had been laid out at Dharwad and CTRL.

In connection with the study to explore the industrial applicability, particularly in textile field of other vegetable fibres, pineapple fibres softened with organic solvents and sodium hydroxide were blended with cotton and spun. It was observed that the yarn produced had good strength compared to raw pineapple fibre. Similarly Ramie fibres treated with 1% sodium hydroxide gave high tenacity values compared with the samples treated with inoculum and enzymes.

The research investigations at the Regional Units include the following projects :

1. Effect of potassium fertilizers on fibre quality of MCU.5.
2. Effect of Phosphorus fertilizers on the quality of cotton at Surat.
3. Effect of different plant populations on fibre quality of genotypes.
4. Study of the extent of fibre breakage in drawing process in the Shirley Miniature Spinning Plant.
5. Effect of graded levels of sodacity on cotton cultivars.
6. Correlation studies of oil content, seed index, G. P. and fibre properties of improved varieties of cotton.
7. Change in the physical properties of cotton during development.

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Personnel

Major activities in 1986 under personnel function at CTRL, are given below :

A. Appointments

Scientific Staff

Shri D. Rama Rao (w.e.f. 5-8-1986) to the post of Scientist S-1 (on transfer from CSWRI, Avikanagar).

Kum. Sujatha Saxena (w.e.f. 15-12-86) to the post of Scientist S-1.

Technical staff

Shri P. N. Raout (w.e.f. 15-7-86) to the post of Electrician Gr. T-1.

Administrative Staff

Shri B. D. Dhengale(w.e.f. 16-10-86) to the post of Jr. Clerk.

Kum. Nandini Lohe (w.e.f. 17-10-86) Kum. B. P. Govalkar and Shri J. R. Mangle (w.e.f. 11-11-86 and 20-11-86, respectively) and Shri J. I. Parmar (w.e.f. 9-12-86) to the post of Jr. Clerk.

Supporting Staff

Shri R. S. Rane (w.e.f. 4-6-1986) to the post of S. S. Gr. I (transferred from NDRI, Karnal).

Shri A. R. Chutale, (w.e.f. 10-7-86) to the post of S.S.Gr. I (Safaiwala-cum-Hamal)

Other appointments under Supporting staff were as follows :

Name	Date of Appointment	Grade
Shri H. C. Thapa	11-7-1986	S.S. Gr. I, Watchman
Shri S. G. Bode	11-7-1986	„ Mali
Shri J. B. Patel	10-7-1986	„ Watchman
Shri C. L. Mundale	11-7-1986	„ Lab-boy-cum-peon
Shri T. B. Khan	14-7-1986	„ Watchman
Shri D. G. Kamble	28-7-1986	„ Lab-boy (Transferred from NDRI, Karnal)
Shri V. S. Bhungawle	20-12-1986	„ Lab-boy-cum-peon-Farash
Shri H. B. Vaismiya	24-12-1986	„ Safaiwala-cum-Hamal
Shri R. K. Solanki	24-12-1986	„ Safaiwala-cum-Hamal

B. Assessment

Scientific Staff

The five yearly assessment of eligible scientific personnel of CTRL was held and promotion/advance increments granted as detailed below :

Promotions

Sr. No.	Name	Grade to which promoted	Effective date of promotion
1.	Dr. N. B. Patil	Scientists S-5 (Rs. 2000-2500)	1-1-1984
2.	Shri P. G. Oka	Scientist S-3 (Rs. 1500-2000)	1-1-1984
3.	Shri B. M. Petkar	Scientist S-2 (Rs. 1100-1600)	1-1-1984
4.	Shri R. P. Nachane	Scientist S-2 (Rs. 1100-1600)	1-7-1984
5.	Shri S. B. Jadhav	Scientist S-1 (Rs. 700-1300)	1-7-1984
6.	Shri P. Bhaskar	Scientist S-1 (Rs. 700-1300)	1-1-1984
7.	Shri L. D. Deshmukh	Scientist S-1 (Rs. 700-1300)	1-7-1984

Advance Increments

Sr. No.	Name	Grade	No. of Advance increments	Effective date of increments
1.	Shri A. K. Gupta	Scientist S-1 (Rs. 700-1300)	2 (Two)	1-1-1984
2.	Dr. N. C. Vizia	Scientist S-1 (Rs. 700-1300)	2 (Two)	1-7-1984

Technical Staff

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

Promotions

Sr. No.	Name	Grade to which promoted	Effective date of promotion
1.	Shri Ram Parkash	Tech. Officer Gr. T-7 (Rs. 1100-1600)	1-1-1985
2.	Smt. S. V. Sukhi	Jr. Q.E. Officer Gr. T-5 (Rs. 2000-3500)	1-1-1986
3.	Shri V. B. Suryanarayanan	Jr. Q.E. Officer Gr. T-5 (Rs. 2000-3500)	1-1-1986
4.	Shri R. M. Modi	Jr. Q.E. Officer Gr. T-5 (Rs. 2000-3500)	1-1-1986
5.	Shri V. M. Kulmethe	Sr. Tech. Asstt. Gr. T-4 (Rs. 1640-2900)	1-1-1986
6.	Shri P. K. Mandhyan	Sr. Tech. Asstt. Gr. T-4 (Rs. 1640-2900)	1-1-1986
7.	Shri V. K. Madan	Sr. Tech. Asstt. Gr. T-4 (Rs. 1640-2900)	1-1-1986
8.	Shri H. B. Tambe	T-I-3 (Rs. 1400-2300)	1-1-1986
9.	Smt. K. K. Kale	T-2 (Rs. 1200-2040)	1-1-1986
10.	Shri B. B. Gaykar	T-2 (Rs. 1200-2040)	1-7-1986
11.	Shri S. B. Kamble	T-2 (Rs. 1200-2040)	1-7-1986

Advance Increments

Sr. No.	Name	Grade	No. of advance increments	Effective date of increments
1.	Shri K. Chandran	T-5	2 (Two)	1-1-1986
2.	Kum. I. K. P. Iyer	T-5	3 (Three)	1-1-1986
3.	Smt. S. D. Pai	T-5	3 (Three)	1-1-1986
4.	Shri G. G. Mistry	T-II-3	2 (Two)	1-1-1986
5.	Shri M. T. Danoli	T-II-3	2 (Two)	1-1-1986
6.	Shri N. V. Bansode	T-II-3	3 (Three)	1-1-1986
7.	Shri K. S. Bhyrappa	T-5	* 3 (Three)	1-1-1986
8.	Shri S. Chandrasekar	T-5	3 (Three)	1-1-1986
9.	Shri R. Dwarkanath	T-5	3 (Three)	1-1-1986
10.	Shri S. R. Ganatra	T-5	* 3 (Three)	1-1-1986
11.	Shri H. R. Laxmivenkatesh	T-5	3 (Three)	1-1-1986
12.	Shri A. W. Shringarpure	T-5	3 (Three)	1-1-1986
13.	Smt. N. D. Nachane	T-4	3 (Three)	1-1-1986
14.	Shri P. J. Ahire	T-2	3 (Three)	1-1-1986
15.	Shri D. B. Gadankush	T-1	3 (Three)	1-1-1986
16.	Shri S. G. Shinde	T-1	3 (Three)	1-1-1986

* With the revocation of absorbed advance, the stagnation increment stands withdrawn.

C. Administrative Staff

Promotions

Shri G. Sasidharan to the post of Assistant Administrative Officer (w.e.f. 16-9-1986).

Shri K. Sudhakaran to the post of Superintendent (w.e.f. 10-1-1986).

Smt. V. V. Gore to officiate as Superintendent (w.e.f. 8-9-1986).

Shri A. B. Dalvi to the post of Assistant (w.e.f. 10-1-1986).

Smt. S. M. Desai to the post of Senior Clerk (w.e.f. 14-1-1986).

D. Transfers

Scientific Staff

Shri D. Rama Rao, Scientist S-1 from CSWRI, Avikanagar to CTRL, Bombay (w.e.f. 5-8-1986).

Administrative Staff

Shri E. T. Gurav, Junior Clerk from Q.E. Unit of CTRL, Surat to CTRL, Bombay, (w.e.f. 5-2-1986).

Shri N. V. Kambli, Junior Clerk from Q.E. Unit of CTRL, Surat to CTRL, Bombay, (w.e.f. 15-12-1986).

Supporting Staff

Shri Mohsin Ahmed, S.S. Gr.-I (Watchman), GTC & Q.E. Unit of CTRL, Nagpur to CTRL, Bombay (w.e.f. 11-9-1986).

E. Deputation/Foreign Assignments

Dr. N. B. Patil Scientist S-5 and Dr. V. G. Munshi, Scientist S-4 was deputed to USSR for study tour on "Fibre Quality & Technology of Cotton" under the Indo-USSR Protocol on Scientific and Technical Cooperation in the field of Agriculture from 12-8-1986 to 9-9-1986.

Shri Muntazir Ahmed, Scientist S-1 and Shri S. Chandra Shekar, Junior Quality Evaluation Officer, Gr. T-5 was deputed to U.K. for training in knitting of cotton and blended yarns under Indo-UK Collaborative Programme from 21-9-1986 for 10 months.

Repatriation

Shri D. S. Ranganathan, Assistant Accounts Officer has been repatriated to his parent department as on 22-12-1986.

F. Resignation/Termination of Service

Scientific Staff

Kum. A. S. Dighe, Scientist S-1 resigned from service w.e.f. 11-4-1986.

Shri N. Ramesh Babu, Scientist S-2, resigned from service w.e.f. 31-5-1986.

Smt. G. Revathi, Scientists S-1, resigned from service w.e.f. 1-8-1986.

Dr. S. Aravindanath, Scientist S-2, resigned from service w.e.f. 7-11-1986.

Supporting Staff

Shri S. G. Bonde, S.S. Gr. T-I (Mali) terminated from service (w.e.f. 1986).

G. Retirement

Scientific Staff

Smt. K. L. Datar, Scientist S-1 retired from service (w.e.f. 30-9-1986 AN).

Administrative Staff

Shri D. J. Raut, Assistant, retired voluntarily from service (w.e.f. 17-5-1986 AN).

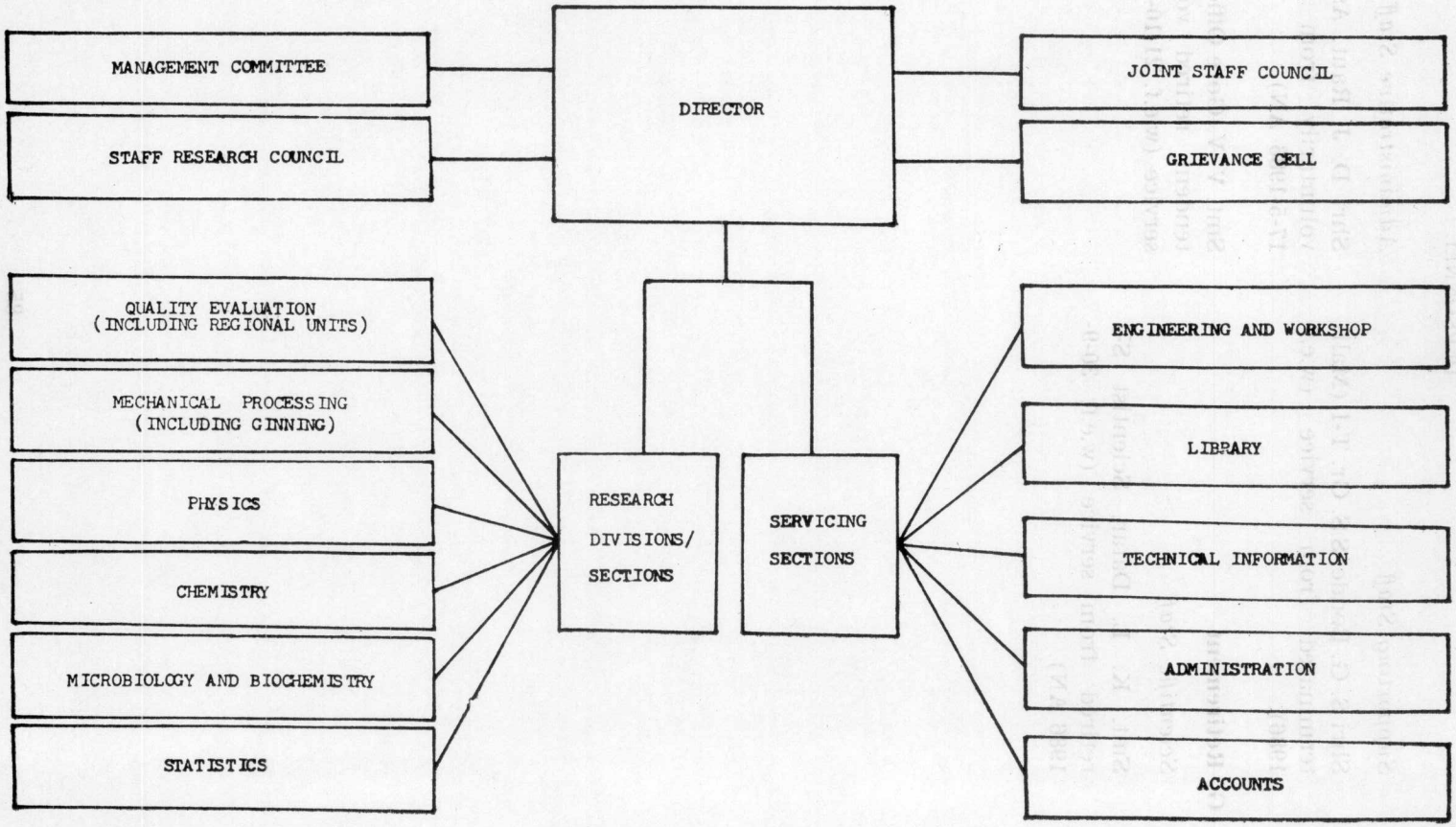
Smt. V. V. Gore Officiating Superintendent retired voluntarily from service (w.e.f. 21-10-1986 AN).

8. Annexures

ANNEXURE — I

COTTON TECHNOLOGICAL RESEARCH LABORATORY

ORGANISATION CHART



ANNEXURE — II

NEW EQUIPMENTS PURCHASED DURING 1986

1. TAIRO Miniature Roving Frame RV/4
2. TAIRO Miniature Draw Frame MD-2
3. Ring Doubler Twister
4. Canon Plain Paper Photocopying Machine — Model PC-25.
5. Electronic Moisture Meter
6. Uster Classimat
7. Water Cooler — Model ST 8 — 150

ANNEXURE — III

DISTINGUISHED VISITORS

1. Prof. Manzoor Ahmad,
   Department of Entomology,
   Agricultural University,
   Faisalabad, Pakistan.

2. Dr. Kazim Frgashev,
   Department of Chemical Technology,
   Tashkent Textile Institute, USSR.

3. Prof. M. A. Nabar,
   Bombay University, Bombay.

4. Dr. M. M. Sharma,
   Bombay University, Bombay.

5. Dr. T. S. Varadharajan,
   Bombay University, Bombay.

6. Shri M. C. Purohit,
   Research Officer,
   Office of the Official Language, Bombay.

7. Mr. Richard Hardwick,
   First Secretary,
   Education & Science,
   British Council, Bombay.

8. Mr. Robert D. Jackson,
   Director,
   U.S. Department of Agriculture
   for Eastern Regional Research Office,
   New Delhi.

9. Mr. James Barron,
   ODA Photographer,
   C/o. British High Commission, Bombay.

10. Dr. Dietor Seefeldt,
    Hoechst,
    Frankfurt, W. Germany.

11. Mr. Noelie R. Bertoniere,
Southern Regional Research Centre,
New Orleans, USA.

12. Dr. P. Grosberg,
Leads University, UK.

13. Mr. Pham Huy Kinh,
Director,
Central Cotton Company,
Vietnam.

14. Mr. Nguyen Huu Binh,
Deputy Director (Research),
NHAHO Cotton Research Centre,
Vietnam.

15. Mr. Nguyen Van Thouang,
Director,
Animal Husbandry Institute,
Vietnam.

16. Mr. Nguyen Duc Thac,
Animal Husbandry Institute,
Vietnam.

17. Mr. Nguyen Van Vue,
Director,
Buffalo and Forage Research Centre,
Vietnam,

18. Mr. Phong Van Dinh,
Deputy Director,
Buffalo and Forage Research Centre,
Vietnam.

19. Dr. M. N. Razdan,
ITEC Expert at the Buffalo and Forage Research Centre,
Vietnam.

ANNEXURE — IV

FINANCIAL STATEMENT

EXPENDITURE AND RECEIPTS OF LABORATORY DURING 1985-86

	Sanctioned Grant Rs.	Actual Expenditure Rs.	Saving(—) Deficit(+) Rs.
A. EXPENDITURE			
I. CTRL including QE Units of CTRL at Regional Stations			
(a) Capital expenditure including expansion of Laboratory	6,93,000.00	6,93,690.00	(+) 690.00
(b) Working expenditure	70,39,000.00	71,17,442.00	(+)78,442.00
Total	77,32,000.00	78,11,132.00	(+)79,132.00
II. Scheme for modernisation and strengthening of CTRL for intensive research on cotton (Plan)	60,00,000.00	59,43,531.00	(—)56,469.00

B. RECEIPTS	Rs.
Sale proceeds of fruits, vegetables, plants, etc.	437.00
Sale of vehicles, tools, plants and other non-consumable stores	1,200.00
Analytical and testing fee	61,300.50
Rent	1,22,632.25
Fees for training, application fees, etc.	23,736.00
Sale of publications	4,218.00
Interest on loans & advances granted to Council's employees	1,946.05
Miscellaneous receipts (including sale of mixed cotton waste)	1,86,737.85
	4,02,208.53

9. Appendices

APPENDIX — I

STAFF WORKING AT THE COTTON TECHNOLOGICAL RESEARCH LABORATORY AS ON DECEMBER 31, 1986

(List does not include vacant posts)

List of Staff in the Headquarters

Scientific Personnel

Director

Dr. V. Sundaram, M.Sc., Ph.D., F.T.I.

Scientist S-5

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

Scientist S-4

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

Scientist S-3

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

Scientist S-2

1. Dr. R. H. Balasubramanya, M.Sc., Ph.D.
2. Smt. S. P. Bhatawdekar, M.Sc.
3. Shri G. F. S. Hussain, M.Sc.
4. Dr. (Smt.) P. Bhama Iyer, M.Sc., Ph.D.
5. Smt. J. K. Iyer, M.Sc.
6. Smt. Vatsala Iyer, M.Sc., M. Phil.
7. Shri R. P. Nachane, M.Sc.
8. Dr. K. M. Paralikar, M.Sc., Ph.D., F.R.M.S.
9. Shri B. M. Petkar, M.Sc.
10. Kum. C. R. Raje, M.Sc.
11. Dr. S. Sreenivasan, M.Sc., Ph.D.
12. Shri A. V. Ukidve, M.Sc.

Scientists S-1

1. Shri Muntazir Ahmed, B.Sc., B. Text. (Text. Tech.)
2. Shri P. Bhaskar, M.Sc.
3. Shri S. K. Chattopadhyay, M. Tech. (Text. Engg.)
4. Shri S. G. Gayal, M.Sc.
5. Shri R. M. Gurjar, M.Sc.
6. Shri A. K. Gupta, M.Sc., L.L.B., W.P.M.M.T.
7. Shri D. N. Makwana, M.Sc.
8. Shri D. V. Mhadgut, M.Sc.
9. Smt. Prema Nair, M.Sc.
10. Shri G. S. Patel, M.Sc.
11. Shri D. Rama Rao, M.Sc.
12. Shri A. J. Shaikh, M.Sc.
13. Kum. Sujatha Saxena, M.Sc.
14. Shri P. V. Varadarajan, M.Sc.
15. Dr. N. C. Vizia, M.Sc., Ph.D.
16. Smt. J. K. S. Warrier, M.Sc.

Scientist 'S'

1. Shri K. H. Sawakhande, M.Sc.
2. Shri N. Thejappa, M.Sc.

Technical Personnel

Technical Officer T-7

Quality Evaluation

1. Shri M. S. Sitaram, B.Sc.

Technical Officer T-6

Electrical Engineering

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

Technical Officer T-5

Quality Evaluation

1. Shri K. V. Ananthakrishnan, M.Sc., D.B.M.
2. Smt. R. P. Bhatt, M.Sc., D.F.L. (German)
3. Shri K. S. Bhyrappa, L.T.M., A.T.A.
4. Shri K. Chandran, B.A.
5. Shri S. Chandrasekhar, L.TM., A.T.A.
6. Shri B. S. Ganvir, B.Sc.
7. Shri S. R. Ganatra, M.Sc.
8. Kum. I. K. P. Iyer, M.Sc.
9. Shri C. R. Sthanu Subramony Iyer, B.Sc.
10. Smt. S. V. Sukhi, M.Sc., D.F.L. (German)
11. Shri V. B Suryanarayan, B.Sc.
12. Shri H. R. Laxmivenkatesh, D.T.T., A.T.A.

13. Shri R. M. Modi, S.S.C., Cert. Photography
14. Shri S. N. Nagwekar, B.Sc.
15. Smt. S. D. Pai, M.Sc.
16. Shri A. W. Shringarpure, B.Sc.
17. Shri G. Viswanathan, M.Sc., A.T.A.

Technical Information

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

Senior Technical Assistant T-4

1. Smt. P. A. Dabholkar, B.Sc.
2. Shri S. J. Guhagarkar, B.Sc.
3. Shri I. H. Hansikatti, B.Sc., A.T.A.
4. Smt. A. A. Kathe, B.Sc.
5. Shri P. K. Mandhyan, B.Sc.
6. Smt. N. D. Nachane, B.Sc.
7. Shri E. A. Pachpinde, B.Sc.
8. Shri R. S. Pathare, B.Sc.
9. Shri K. B. Rajagopal, B.Sc.
10. Shri D. Radhakrishnamurthy, M.Sc., M. Phil.
11. Shri S. Sekar, B.Sc.
12. Smt. R. K. Shahani, B.Sc., B. Lib.
13. Shri S. Vancheswaran, B.Sc.

Technical Assistant T-II-3

1. Shri S. G. Dalvi, S.S.C., Cert. Wireman, Cert Ref. & A.C., Govt. Elec. Sup.
2. Shri S. M. Gogate, B.Sc.
3. Smt. S. R. Kamath, B.Sc.
4. Shri M. M. Shaikh
5. Shri S. Venkatakrishnan, B.Sc.

Technical Assistant T-I-3

1. Shri N. O. Anthony
2. Shri P. B. Gurjar
3. Shri R. K. Landge
4. Shri R. B. Pawar

Technical Assistant T-2

Shri S. B. Kamble

Technical Assistant T-1

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

Auxiliary Personnel

Senior Operator (Refrigeration)

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

Hindi Translator

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

Senior Fitter (Mechanical Processing)

1. Shri P. K. Gopalan
2. Shri Purshottam Vira

Operator (Workshop Machinery)

Shri D. L. Upadhye, S.S.C. (Technical) NCTVT (I.T.I. and C.T.I.)

Senior Operative (Mechanical Processing)

1. Shri P. J. Ahire
2. Shri R. A. Dalvi
3. Shri D. B. Gadankush
4. Shri Bechan Nokai
5. Shri K. D. Mohite
6. Shri H. K. Pawar
7. Shri M. M. Rupawate
8. Shri S. G. Shinde

Plumber

Shri H. B. Tambe

Carpenter

Shri G. D. Narkar

Driver

1. Shri B. B. Gaykar
2. Shri S. S. Patekar

Administrative Personnel

Administrative Officer

Shri P. Ramamurthy, B.A.

Asstt. Administrative Officer

1. Shri D. L. Kalsekar
2. Shri G. Sasidharan, B.A., L.L.B.

Superintendent

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

Assistant

1. Shri D. P. Naidu
2. Shri G. Moosad, B.Com.
3. Smt. S. S. Dongre, B.A.
4. Smt. K. Jayagouri Shivaramakrishnan
5. Shri M. Z. Bhagat
6. Shri V. M. Kasabe
7. Smt. M. V. Kamerkar, B.A.
8. Smt. Veena Kotwani, B.A.
9. Shri K. W. Khamkar, B.A.
10. Shri S. N. Salve
11. Shri B. D. Sawant
12. Shri A. B. Dalvi

Stenographer

Shri Venu Thanikal

Junior Stenographer

1. Smt. Chellamma Damodaran
2. Kum. V. T. Bhuvad, M.A.
3. Kum. T. A. Rodrigues

Senior Clerk

1. Shri D. G. Kulkarni
2. Smt. S. S. Shanbhag
3. Smt. V. V. Desai
4. Smt. S. D. Ambre
5. Smt. S. M. Desai
6. Shri B. S. Bhenwal

Junior Clerk

1. Shri K. N. Iyer
2. Smt. J. J. Karanjavkar
3. Shri A. P. Natu
4. Kum. S. G. Nayar
5. Shri E. T. Gurav
6. Shri U. A. Gupte, B.Com.
7. Shri K. Parleshwar
8. Smt. S. R. Shirsat, B.A.
9. Shri N. V. Kambli
10. Kum. A. Fernandes
11. Kum. B. P. Govalkar, B.Com.
12. Shri J. R. Mangale

Telephone Operator

Smt. K. K. Kale

Supporting Staff Grade IV

1. Shri R. G. Chiplunkar
2. Shri K. K. Kasar

Supporting Staff Grade III

1. Shri T. R. Kadam
2. Shri Obilal Parsuram
3. Shri Chatrapal Mhatri
4. Shri R. R. Khurdekar
5. Shri Babu Aba Babar

Supporting Staff Grade II

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

Supporting Staff Grade I

1. Shri B. R. Jadhav
2. Shri M. B. Gurve
3. Shri N. R. Kamble
4. Shri A. R. Gurjar
5. Shri M. B. Chandanshive
6. Shri O. T. Thapa
7. Shri B. R. Satam
8. Shri D. M. Chaugule
9. Smt. T. V. Bhowar
10. Shri S. D. Gurav
11. Shri M. K. Ghadge
12. Shri M. Z. Rathi
13. Shri Narayan Singh
14. Shri Mohsin Ahmed
15. Shri C. S. Salvi
16. Shri D. M. Raje
17. Shri P. V. Jadhav
18. Shri D. B. Temgire
19. Smt. Birmo R. Taleram
20. Shri C. P. Solanki
21. Shri M. J. Sumra
22. Shri K. T. Mahida
23. Shri R. R. Gosai
24. Shri R. S. Rane
25. Shri V. S. Bhungawle
26. Shri H. B. Vaismiya
27. Shri R. K. Solanki

APPENDICES

List of Staff at the Quality Evaluation Units

1. AKOLA :

Technical Assistant T-II-3

Kum. V S. Ayyar, B.Sc.

2. COIMBATORE :

Technical Officer T-5 (Quality Evaluation)

1. Shri A. K. Antony, B.Sc.
2. Smt. Santa V. Nayar, B.Sc.
3. Shri C. P. Venugopalan, B.Sc.

Auxiliary Staff (Sr. Operative)

Shri K. V. Nair

Supporting Staff Grade III

Shri N. Arumugham

Supporting Staff Grade II

Shri V. M. Subramanyam

3. DHARWAD :

Technical Officer T-5 (Quality Evaluation)

Shri E. S. Abraham, B.Sc.

Technical Assistant T-II-3

Shri M. T. Danolli, B.Sc.

Supporting Staff Grade II

Shri Y. R. Sone

Supporting Staff Grade I

Shri C. J. Bagalkoti

4. GUNTUR :

Technical Officer T-5 (Quality Evaluation)

Shri R. Dwarkanath, B.Sc.

Technical Assistant T-II-3

Shri S. Mukundan, B.Sc.

Supporting Staff Grade III

Shri Ch. Thimmanna

Supporting Staff Grade I

Shri V. Y. M. Suvarchala Rao

5. HISSAR :

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

Supporting Staff Grade IV
Shri Gian Singh

6. INDORE :

Scientists S-1
Shri S. B. Jadhav, M.Sc.

Supporting Staff Grade III
1. Shri John Robert
2. Shri H. S. Bhabar

7. LUDHIANA :

Supporting Staff Grade III
Shri Kamikkar Singh

8. NAGPUR :

Scientist S-2
Shri G. R. Anap, M. Tech.

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

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

Electrician Grade T-1
Shri P. N. Raout

Junior Clerk
1. Shri B. P. Dhengale
2. Kum. N. M. Lohe, B.A.

Supporting Staff Grade I
1. Shri Satyanarayan Gope
2. Shri M. P. Tohakar
3. Shri B. H. Umredkar
4. Shri H. B. Thapa
5. Shri A. R. Chutale
6. Shri J. B. Patel
7. Shri T. B. Khan
8. Shri C. L. Mundale

9.	NANDED	:	*Scientist S-1* Shri L. D. Deshmukh, M.Sc.
			Technical Assistant T-II-3 Shri N. V. Bansode, B.Sc.
			Supporting Staff Grade II Shri L. R. Indurkar
			Supporting Staff Grade I Shri R. K. Pallewad
10.	RAHURI	:	*Senior Technical Assistant T-4* Shri R. S. Darade, B.Sc.
			Supporting Staff Grade I Shri D. G. Kamble
11.	SRIGANGANAGAR	:	*Technical Officer T-7 (Quality Evaluation)* Shri Ram Parkash, B.Sc. L.L.B.
			Technical Assistant T-II-3 Shri D. N. Moon, B.Sc.
			Supporting Staff Grade IV Shri Vijendra Singh
			Supporting Staff Grade II Shri Sanwarmal Saini
12.	SURAT	:	*Scientist S-1* Shri Y. Subramanyam, M.Sc.
			Technical Officer T-5 (Quality Evaluation) Shri M. C. Bhalod, B.Sc.
			Technical Assistant T-II-3 Shri G. G. Mistry, B.Sc.
			Junior Clerk Shri J. I. Parmar
			Supporting Staff Grade IV Shri J. B. Dhodia
			Supporting Staff Grade II Shri K. M. Rathod

APPENDIX — II

Statement showing the total number of Government servants and the number of Scheduled Castes and Scheduled Tribes amongst them as on December, 1986

Group/Class	Permanent / Temporary	Total No. of employees	Scheduled Castes	Percentage to total employees	Scheduled Tribes	Percentage to total employees	Remarks
Gr. A (Class I)							
Permanent							
(i) Other than lowest rung of Class I		26	1				
(ii) Lowest rung of Class I		12	1	5%	—	—	—
Total		38	2				
Temporary							
(i) Other than lowest rung of Class I		—	—		—	—	—
(ii) Lowest rung of Class I		11	1	9%	—	—	—
Total		11	1				
Gr. B (Class II)	Permanent	25	2				
	Temporary	23	4	12.5%	1	2%	—
Gr. C (Class III)	Permanent	62	8				
	Temporary	12	3	15%	—	—	—
Gr. D (Class IV) (Including Sweepers)	Permanent	57	14	24%	4	6%	—
	Temporary	11	2		2		
Gr. D (Class IV) (Sweepers)	Permanent	—	—		—	—	—
	Temporary	7	7	100%	—	—	—

APPENDIX — III

Statement showing the number of Reserved Vacancies filled by Members of Scheduled Castes and Scheduled Tribes during the Year 1986

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

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