Cotton Technological Research Laboratory

Indian Council of Agricultural Research

Annual Report
1971

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I. Introduction

This is the Forty-eighth Annual Report of the Laboratory and pertains to the calendar year 1971.

This Laboratory was founded by the Indian Central Cotton Committee in 1924, in view of the essential need for an authoritative and scientific estimation of the inherent quality of the new varieties of cotton evolved. The Laboratory came under the administrative control of the Indian Council of Agricultural Research from the 1st April, 1966, on the abolition of the Indian Central Cotton Committee.

The chief functions of this Laboratory are:

(*i*) to help the Agricultural Departments in evaluating the *quality of new strains* evolved,

(*ii*) *to carry out research* on the physical and chemical properties of cottons in relation to quality and spinning performance,

(*iii*) to carry out investigations on the *ginning problems* of Indian cottons,

(*iv*) to investigate the *greater and better utilization* of cotton, cotton wastes, linters, cotton seed, etc.,

(*v*) to help the trade and the industry by furnishing true valuation of different *Trade Varieties* cultivated,

(*vi*) to issue *authoritative reports* on the samples received for tests from the Government Departments, the trade and other sources, and

(*vii*) to disseminate *technical information.*

This Laboratory maintains a good up-to-date Library of books on cotton technology. At the end of 1971, there were 2,577 books, 108 of which were added during the year. The number of bound volumes was 2,498. The Library received regularly about 154 journals dealing with textiles and allied subjects, 69 of which were subscribed for and the others received on exchange or complimentary basis.

New Equipment Purchased

During the year, the following equipments were acquired for the use of the Laboratory:

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(*ii*) Stelometers with Precision Balances (3),
(*iii*) Micronaires (3),
(*iv*) Tension Load Cells CM and BM for use with the Instron Tester,
(*v*) Projectina Microscope,
(*vi*) Constant Deviation Spectrometer with accessories,
(*vii*) Simpson Multimeter Model 260,
(*viii*) D.C. Regulated Power Supply Unit (Range : 0-500V),
(*ix*) Pressure/Vacuum Pump,
(*x*) Incubator, and
(*xi*) Laboratory Padding Mangle.

Distinguished Visitors

Among the distinguished persons who visited this Laboratory during the year under review, mention may be made of the following :

1. Professor Sher Singh, Minister of State for Agriculture, Government of India, New Delhi.
2. Dr. M. S. Swaminathan, Director, Indian Agricultural Research Institute, New Delhi.
3. Dr. B. K. Soni, Deputy Director General (A.S.), Indian Council of Agricultural, Research, New Delhi.
4. Captain Ranjit Singh, Chairman, Cotton Development Council, Bombay.
5. Shri M. L. Vidhani, Joint Agricultural Commissioner (S.L.), Government of India, New Delhi.
6. Dr. V. R. Bhalerao, Assistant Director General (Dairy), Indian Council of Agricultural Research, New Delhi.
7. Dr. S. B. Bandyopadhyay, Director, Jute Technological Research Laboratories, Calcutta.
8. Dr. R. M. Acharya, Director, Central Sheep and Wool Research Institute, Malpura, Rajasthan.
9. Dr. C. Kempanna, Assistant Director General, Indian Council of Agricultural Research, New Delhi.
10. Dr. Kishan Singh, Director, Indian Institute of Sugarcane Research, Lucknow.
11. Dr. David M. Daugherty, Assistant Director, USDA, Far Eastern Regional Research Office, American Embassy, New Delhi.
12. Shri S. C. Chakraborty, Joint Director of Agriculture, Calcutta, West Bengal.
13. Shri A. K. Majumdar, Principal Agricultural Officer, 24 Parganas (North), West Bengal.

14. Shri H. N. Ghosh, Principal Agricultural Officer, 24 Parganas (South), West Bengal.
15. Shri Dharam Dev, Secretary, Cotton Corporation of India Ltd., Bombay.
16. Shri N. V. Ghatalia, Marketing Manager, Cotton Corporation of India Ltd., Bombay.
17. Shri Hiralal Lakdawala, Marketing Manager, Cotton Corporation of India Ltd., Bombay.
18. Shri N. D. Udeshi, Marketing Manager, Cotton Corporation of India Ltd., Bombay.
19. Shri Shantilal Siswawala, Marketing Manager, Cotton Corporation of India Ltd., Bombay.
*20. Dr. V. B. Chipalkatti, Director, Shri Ram Institute for Industrial Research, Delhi.
*21. Prof. M. R. Padhye, University Department of Chemical Technology, Bombay.
22. Shri C. T. Patel, Cotton Specialist, Surat.
*23. Shri T. V. Ananthan, Officiating Director, BTRA, Bombay.

Staff Research Council

During the year, three meetings of the Staff Research Council were held at the Laboratory.

The first meeting was held on the 24th February, 1971, in which the progress of various research investigations during 1970 were considered and the programme of research work for 1971 was finalised and approved.

The second meeting was held on the 29th July, 1971, when the following subjects were considered :

(*a*) Half yearly report for the period ending the 30th June, 1971.

(*b*) Progress of work on the various research projects, and

(*c*) Admission of outside students in the CTRL for post-graduate studies in Textile Physics.

The third meeting was held on the 28th December, 1971, when the following items were considered :

(*a*) Progress of work on the various research projects and

(*b*) Suggestions relating to new research projects for inclusion in the programme of research work for 1972.

Besides these regular meetings, the following three lectures were arranged during the year :

1.	Dr. M. S. Swaminathan Director, IARI, New Delhi.	(4-2-1971)	Trends in agricultural research in India.

* Members of Achievement Audit Committee.

2.	Dr. V. Santhanam, Head, IARI Regional Research Station, Coimbatore.	(8-2-1971)	Recent trends in crop improvement with special reference to cotton.
3.	-do-	(12-10-1971)	Recent developments in cotton research in the U.S.S.R.

Inter-Institutional Collaborative Projects

It had been mentioned in the last Annual Report that four project proposals were submitted by the Laboratory to the ICAR for carrying out research work in collaboration with the Jute Technological Research Laboratories (JTRL) and the Central Sheep and Wool Research Institute (CSWRI).

Similarly, the JTRL and the CSWRI had also submitted projects for collaborative research. All these projects were considered by the Scientific Panel on Animal Products Technology of the ICAR in January, 1971. The Panel had recommended that projects of similar types which had been submitted by the various institutes should be combined together to form three distinct projects and one project each should be concentrated at each of the three Laboratories which should take up the responsibility for concentrating work on the project with the collaboration of the other two institutions, and in turn extend collaboration to the other two institutions for carrying out work on the other projects.

In order to examine this point further, a meeting was convened at the CTRL on the 26th and the 27th June, 1971, under the Chairmanship of Dr. B. K. Soni, Deputy Director General (A.S.), ICAR. In addition to the Directors and Senior Scientists from the three institutes, the meeting was attended by Dr. Bhalerao, Additional Director General, ICAR, Dr. Ram Sarup, Scientist, ICAR, Dr. M. M. Bhan, Scientist, Sri Ram Institute for Industrial Research, New Delhi, and Shri A. D. Sule, Assistant Director, Wool Research Association, Bombay. On the basis of the discussions held, new intensive research projects between the three institutes were submitted to the ICAR, which are as follows :

1. Studies on spinning from blends of cotton with wool, jute and ramie on cotton system (to be carried out at the CTRL).
2. Studies on use of jute/wool and cotton/wool blends in wool and carpet industries (to be carried out mainly at the CSWRI).
3. Studies on blending of jute, wool and cotton for non-woven fabric machinery and on jute spinning system (to be carried out mainly at the JTRL).

The above three projects were again considered by the Panel on Agricultural Sciences Technology of the ICAR in July, 1971, and have been recommended for being financed by the Council. Actual work on these projects would be commenced on receipt of the financial sanction from the ICAR.

In addition to the above, another project entitled "Studies on de-burring of raw wool using mechanical device" has been submitted for being carried out at this Laboratory. This is under the consideration of the Council.

It may be further pointed out that the testing facilities available at this Laboratory have been used by the CSWRI for carrying out tests for strength and evenness on samples of yarns from various projects now in progress at the CSWRI. For this purpose, Research Assistants from the CSWRI have been deputed on different occasions along with the samples, and necessary help, including assistance of technical personnel, has been given for carrying out tests on these samples.

In addition to the above collaborative projects, preliminary work has also been taken up on the utilization of "Chitosan", a product developed from prawn shell waste by the Central Institute of Fisheries Technology (CIFT), ICAR, Cochin. The work carried out so far in collaboration with Prof. E. H. Daruwalla, Director, University Department of Chemical Technology, Bombay, has shown that the product has potentiality for being used as a finishing agent for cotton textile goods. Treated fabrics appear to have better lustre and stiffness than the untreated control. It is proposed to carry out large scale trials on receiving adequate quantities of "Chitosan" from the CIFT.

Membership on Other Organizations

The Director continued to be an *ex-officio* member of the following bodies:

(*i*) Indian Council of Agricultural Research Society,

(*ii*) Advisory Board of the Indian Council of Agricultural Research,

(*iii*) Agricultural Sciences Technology Panel of the Indian Council of Agricultural Research,

(*iv*) Board of Management of the Victoria Jubilee Technical Institute, and

(*v*) (*a*) Senate, (*b*) Academic Council, (*c*) Faculty of Science, (*d*) Board of Studies in Physics, and (*e*) Board of University Teaching for subjects in the Faculties of Arts and Science of the Bombay University.

The Director and other Scientific Officers of this Laboratory continued to represent the Indian Council of Agricultural Research on the various Committees and Sub-Committees of the Indian Standards Institution dealing with Cotton Textiles. Dr. V. Sundaram continued to be the Vice-Chairman of TDC:1 (Physical Methods of Tests Sectional Committee), Chairman of TDC:2 (Cotton and Cotton Products Sectional Committee), and Convener of TDC:1:1 (Sub-Committee for Physical Methods of Test for Cotton), TDC:1:1:12 (Panel for Yarn Appearance Standards), and TDC:2:1:1 (Panel for Market Varieties of Cotton Fabrics).

Merits and Awards

Dr. S. M. Betrabet, Senior Scientific Officer, was awarded merit promotion to a supernumerary post of Senior Scientist in the scale of pay of Rs. 1100-50-1400 under the ICAR Scheme for Merit Promotion and Advance Increments, by virtue of his work of outstanding merit during the year 1968.

Under the same scheme, Dr. S. N. Pandey, Junior Scientific Officer, was granted three advance increments with effect from the 1st January, 1969, for work of outstanding merit.

Dr. V. Sundaram, Director, was awarded the Fellowship of the Textile Institute, Manchester (F.T.I.), in May, 1971.

Post-Graduate Training

The University of Bombay continued to recognize this Laboratory as a Post-Graduate Institution for guiding students for M.Sc. and Ph.D. degrees in Textile Physics and M.Sc. degree in Physical Chemistry, during the year. Dr. V. Sundaram (Director) and Dr. R. L. N. Iyengar (Retired Scientist) continued to be teachers for guiding students for Ph.D. and M.Sc. degrees of the University of Bombay in Textile Physics (by research). Dr. V. Sundaram (Director) and Dr. S. N. Pandey (Junior Scientific Officer) continued to be teachers for guiding students for M.Sc. degree of the University of Bombay in Physical Chemistry (by research). During the year, eight members of the Research Staff were being guided for M.Sc. and two for Ph.D. degrees in Textile Physics (by research) and two for M.Sc. degrees in Physical Chemistry (by research) of the Bombay University.

Expansion and Modernization

The modernization programme for this Laboratory has made considerable progress during the year under report. All the imported blow room machinery including rotary filters have since been installed in the Spinning Division. With the approval of the Council, the work connected with the rewiring and other electrical fittings necessitated for commissioning the new blow room machinery, has been awarded for execution through the agency of the Central Public Works Department (CPWD). The work is in progress and is proposed to be completed in two phases. It will be possible to put the new blow room machinery into commission as soon as the work in the first phase is completed.

The workshop of the Laboratory, which was hitherto located in a small room on the ground floor of the Research Laboratory Building, has been shifted to the hall on the ground floor of the New Research Laboratory Building as planned in the modernization programme. Re-installation of the entire workshop machinery is being done departmentally.

The Council has also sanctioned the proposal of providing and installing a controlled humidity and temperature plant for the Spinning Division at a cost of Rs. 5,88,987 as estimated by the Electrical Division of the CPWD. This work has been assigned to the CPWD for execution.

With a view to meeting the pressing requirements of additional floor space needed by the Laboratory for the expansion of its various sections, the Council has accorded sanction to the preliminary estimate prepared by the CPWD for the construction of an additional floor over the New Research Laboratory Building. The approval of the Council to the estimate has been duly communicated to the CPWD for execution of the work.

The scheme for modernization and strengthening of the Laboratory for intensive research on cotton during the Fourth Plan was sanctioned by the Council in 1970, at an estimated cost of Rs. 22 lakhs. Appointments to some of the senior posts have been made and action to fill up other posts is in progress. Action has

also been taken to purchase various equipments provided for in the scheme for modernization of the CTRL.

Staff Amenities

The construction work of 16 Type I quarters, which are intended for providing housing accommodation to the Class IV members of the staff has been taken up for execution in November, 1971, by the contractor appointed by the CPWD. The work is progressing satisfactorily.

Finance

A statement showing the sanctioned budget grant of the Laboratory and the actual expenditure during the financial year 1970-71 is furnished in Appendix I. It will be noticed that the actual expenditure is Rs. 15.24 lakhs as against the sanctioned grant of Rs. 15.39 lakhs, leaving an amount of Rs. 0.15 lakh unutilized. An expenditure of Rs. 0.44 lakh was incurred under the Fourth Plan Scheme for Modernization and Strengthening of Cotton Technological Research Laboratory for Intensive Research on Cotton against the sanctioned grant of Rs. 1.95 lakhs. The savings were due to non-materialization of certain purchases of equipments. Apart from this, an expenditure of Rs. 1.24 lakhs was incurred on Technological Schemes (including projects financed from P.L.480 Funds) against the sanctioned grant of Rs. 1.26 lakhs, leaving an amount of Rs. 0.02 lakh unutilized.

Significant Results

(*i*) At the 5th Annual Workshop organised by the All India Co-ordinated Cotton Improvement Project (AICCIP) held at Dharwar in June, 1971, three new improved high-yielding varieties were released, viz. Hybrid 4 to replace Gujarat 67, 3943 to replace Digvijay, and KW.66-2096 (named Khandwa 2) to replace Maljari.

(*ii*) A large number of samples received under the AICCIP trials was screened for technological properties at the CTRL. Some of the promising strains are listed below :

North Zone (Haryana, Punjab and Rajasthan) :
A.218, H.275, H.297, RS.83, RS.89, PS.9, PS.10, PS.16, SS.167 and SS.265.

Central Zone (Gujarat, Madhya Pradesh and Maharashtra) :
IAN.579(188), IAN.579(1456), B.59-1684, 66BH.5/55, 66BH.5/91, 66BH.25/10, 68BH.25/60, DHY.286, MCU.5, Sujata, IBSI, N.28, 3200 and 3943/1879.

South Zone (Andhra Pradesh, Mysore and Tamil Nadu) :
A.56, EL.0162, EL.031, ELS.117, ELS.139, 1143EM and 0078F.

(*iii*) Studies have been initiated for blending superior quality Indian cottons with polyester (Terene) in different proportions with a view to increase the utilization of indigenous cottons in such blends.

(*iv*) Seeds of several new improved varieties, like MCU.5, IAN. 560, Hybrid 4, etc., were found to have high oil content. Some strains of MCU.5, having high oil and linter content, were free from harmful gossypol and rich in protein.

(*v*) The nature of free radicals formed by gamma-ray irradiation on accetylated cotton samples showed the presence of peroxy-radicals when analysed by e.s.r. spectroscopy. These radicals are of great interest as they can be utilized for imparting various chemical finishing treatments to cotton.

(*vi*) There is a marked structural difference in the cell walls of American *hirsutum* cottons as compared to *desi herbaceum* cottons with respect to micropores.

(*vii*) Study on the microbial degradation of cotton under storage and under marine conditions have helped in isolating several highly cellulolytic cultures ; particular mention may be made of fungus *Penicillium funiculosum*.

(*viii*) A study of the cross-sectional shape of the cotton fibre indicated that *G. arboreum* and *G. herbaceum* cottons had higher percentage of round fibres than the *G. barbadense* and *G. hirsutum* cottons.

(*ix*) For determining the fibre weight per unit length of very coarse *desi* cottons, two different methods were tried and it was found that the one using 50 grains of cotton under a reduced pressure of 4 lb./sq. in. was quite satisfactory as the results agreed closely with the gravimetric values.

(*x*) From the test results on about 4,000 cottons, it was observed that the Balls Sorter equivalent values of fibre length (1) can be estimated from the Digital Fibrograph 2.5% span length values (L) using the equation $1 = 0.821\ L + 0.095$.

(*xi*) A new gadget to measure the fibre length using an optical interference technique has been fabricated and some finer adjustments are being made.

(*xii*) Effect of different insecticidal treatments on the fibre properties of Sujata and MCU.5 was studied. Increase in fibre bundle strength was noted in the treatment with carbaryl and sulphur.

II. Progress of Research

During the year under review, considerable progress has been made in the various research investigations undertaken at this Laboratory. A few papers based on the research work completed were published in suitable scientific and technical journals. In the case of a few more investigations, the experimental work has been completed and the results are being analysed.

With regard to the project on the evaluation of quality of new strains of cotton, it may be pointed out that nearly 2,000 samples were received from various trials under the All India Co-ordinated Research Project on Cotton. In many cases, the tests had to be carried out urgently so as to have the results for discussion at the respective Zonal Workshop Meetings held in April and June, 1971. Consequently, there was a heavy pressure of testing work in the earlier part of the year, which caused some dislocation in the progress of other research investigations.

The progress made in each Research Project is indicated briefly in the following pages :

1. Evaluation of the Quality of Cotton Samples Received from the State Agricultural Departments

The Laboratory receives a large number of samples for various tests from the State Departments of Agriculture. Some samples are obtained in connection with various research investigations at the Laboratory. The number of samples received during the years 1970 and 1971 together with the corresponding average figures for the quinquennia 1960-65 and 1966-70 are given in Table 1(*a*). The number of samples tested at various outstations during 1971 is given in Table 1(*b*).

The samples received from the State Departments of Agriculture are generally tested in the order of their receipt and the test results are sent to the officers concerned as quickly as possible. The results of tests on each of the Trade Variety and Standard Indian Cotton samples are reported in the form of a Technological Circular immediately after tests are completed. Later, the test results are consolidated for the whole season and published as two Technological Reports, one on the Trade Varieties and another on the Standard Indian Cottons. The technological research samples are utilized for the Laboratory's research work ; no test reports are usually issued on such samples as the results are included in the relevant research papers published by the Laboratory. Besides these, some samples are received for miscellaneous tests, such as determination of quality of ginning, neppiness, oil content in cotton seed, etc. A few of the small samples received for tests are in the form of *kapas* and they are first ginned in the Ginning Section before they are tested for various properties. During 1971, about 17 samples had been

TABLE 1 (*a*) : NUMBER OF COTTON SAMPLES RECEIVED FROM THE STATE DEPARTMENTS OF AGRICULTURE AND TESTED AT THE MAIN LABORATORY

Type of test	Average for the quinquennia		1969	1970	1971
	1960-65*	1966-70			
Fibre and full spinning	857	597	587	485	467
Fibre and Microspinning) Microspinning alone)	2,064	2,250	2,408	2,739	2,811
Fibre tests alone	213	143	115	28	139
Mill tests	**	14	10	11	20
Standard cottons	22	23	23	23	21
Trade varieties (lint)	90	27	20	25	22
Trade varieties (*kapas*)	***	42	57	28	59
Technological Research	634	272	16	—	138
Miscellaneous	40	100	255†	—	—
Total	3,920	3,468	3,491	3,411	3,677

* For the year ending 31st May. ** Included under item 1. *** Included under Technological Research. † Includes 17 samples for chemical tests.

TABLE 1(*b*) : NUMBER OF COTTON SAMPLES TESTED AT THE REGIONAL STATIONS

Station	Fibre properties tested			
	Length	Fineness	Maturity	Strength
Coimbatore	1,387	1,334	1,312	1,340
Dharwar	1,083	673	548	904
Hissar	331	331	—	—
Indore	658	668	643	467
Ludhiana	212	1,220	1,220	67
Nanded	876	948	787	772
Nandyal	260	223	150	225
Sriganganagar	184	184	184	184
Surat	3,933*	3,727	3,806	3,106

*3,912 samples were tested on Digital Fibrograph and 21 on Balls Sorter.

Note : At these outstations, samples are tested for specified fibre properties, while at the main Laboratory, each sample is tested for various fibre properties.

received as *kapas* and were ginned. Further, 50 samples of *kapas* of Trade Varieties were ginned for determining their ginning outturn.

The State-wise break up of the number of samples received from the State Departments of Agriculture and tested for different properties, on which reports were issued to the concerned officers in 1971, are given in Table 2.

TABLE 2 : NUMBER OF SAMPLES TESTED AND REPORTED FOR THE STATE DEPARTMENTS OF AGRICULTURE

A. *Co-ordinated Project*

State	Fibre and full spinning	Fibre and micro-spinning	Micro-spinning	Fibre tests	Total
Maharashtra	23 (4)	67 (7)	416 (42)	— (—)	506 (53)
Gujarat	158 (21)	110 (12)	132 (12)	— (—)	400 (45)
Madhya Pradesh	35 (3)	49 (4)	95 (8)	— (—)	179 (15)
Rajasthan	— (—)	— (—)	— (—)	— (—)	— (—)
Punjab	— (—)	12 (1)	283 (15)	11 (2)	306 (18)
Haryana	— (—)	— (—)	36 (1)	— (—)	36 (1)
Uttar Pradesh	— (—)	— (—)	42 (4)	— (—)	42 (4)
Mysore	32 (7)	170 (17)	78 (7)	— (—)	280 (31)
Andhra Pradesh	7 (2)	5 (1)	53 (6)	— (—)	65 (9)
Tamil Nadu	36 (8)	124 (15)	64 (7)	114 (7)	338 (37)
Others	6 (2)	— (—)	84 (5)	4 (1)	94 (8)
Total	297 (47)	537 (57)	1,283 (107)	129 (10)	2,246 (221)

B. *Other State Schemes*

Maharashtra	34 (16)	— (—)	336 (34)	169 (17)	539 (67)
Gujarat	48 (15)	— (—)	144 (14)	— (—)	192 (29)
Madhya Pradesh	8 (6)	— (—)	— (—)	— (—)	8 (6)
Rajasthan	1 (1)	— (—)	— (—)	— (—)	1 (1)
Punjab	7 (5)	— (—)	47 (4)	— (—)	54 (9)
Haryana	3 (2)	— (—)	— (—)	— (—)	3 (2)
Uttar Pradesh	2 (2)	24 (4)	— (—)	— (—)	26 (6)
Mysore	47 (20)	9 (1)	109 (18)	42 (5)	207 (44)
Andhra Pradesh	16 (9)	— (—)	106 (10)	40 (1)	162 (20)
Tamil Nadu	25 (16)	9 (1)	— (—)	49 (2)	83 (19)
Others	2 (2)	— (—)	4 (1)	2 (1)	8 (4)
Total	193 (94)	42 (6)	746 (81)	302 (26)	1,283 (207)

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

ALL INDIA CO-ORDINATED RESEARCH PROJECT ON COTTON

The Laboratory, as in the past, continued to be actively associated with the All India Co-ordinated Research Project on Cotton initiated by the ICAR, with effect from the 1st April, 1967. In order to render timely service to the cotton breeding officers, test results on 1,139 samples were presented in the two workshop meetings held at New Delhi and Dharwar, during April and June, respectively. In addition, 931 samples were tested after the workshop meetings making the total number of samples tested as 2,070. In addition, some pending samples of the previous season were also tested. Cotton samples for tests were received from 10 locations in the North Zone consisting of the States of Haryana, Punjab, Rajasthan and Uttar Pradesh, 31 locations in the Central Zone comprising of the States of Gujarat, Madhya Pradesh and Maharashtra, and 13 locations from the South Zone comprising of the States of Andhra Pradesh, Mysore and Tamil Nadu. In all, 221 reports giving the test results were issued.

A brief summary of the important test results on the samples pertaining to various trials conducted at different locations in the three zones is given below.

NORTH ZONE

G. hirsutum Trials

In the Co-ordinated Varietal Trial of *G. hirsutum* (Normal Plant Type), samples were received from Bulandshahr, Faridkot, Hissar, Jullundur, Meerut, New Delhi, Raya and Sirsa. The test results are summarised in Table 3. It was observed that the mean fibre length for the 12 strains in this trial ranged from 20.9 mm to 29.2 mm. Fibre maturity was not satisfactory in the case of samples from five out of the eight locations, as many strains had recorded low maturity. The bundle strength, however, was satisfactory at all places. Regarding spinning, many strains raised at Bulandshahr, Faridkot, Hissar, Jullundur, New Delhi and Sirsa recorded higher spinning potential than the local controls, such as Pramukh, 320F, H.14, J.34, etc. The strains which showed promising performance in this trial were H.275, RS.83, RS.88 and RS.89, in addition to A.218 which had been giving impressive technological performance for the last four years.

In the case of Co-ordinated Varietal Trial (New Plant Type), samples were received from Bulandshahr, Faridkot, New Delhi and Sirsa. Their fibre properties were almost identical with those of Normal Plant Type strains. Although none of the strains was found suitable for 50s count, many strains raised at Faridkot, Sirsa and New Delhi showed higher spinning potential than the local controls. The promising strains in this trial were SS.167, SS.264 and SS.268.

Samples pertaining to Preliminary Varietal Trial were received from Faridkot, Hissar, Jullundur, New Delhi and Sirsa. Test results of the 36 strains from each of the above places indicated that they had mean fibre length ranging from 23.2 mm to 30.7 mm. The fibre maturity was average in the case of samples received from Faridkot and Jullundur and low in the case of those from Hissar, New Delhi and Sirsa. The spinning performance of the samples received from Faridkot and Hissar was rather poor at 50s and 40s counts, respectively.

The strains SH.369, SH.469 and RS.67 fared well at three out of five locations.

TABLE 3 : SUMMARY OF THE TEST RESULTS OF THE STRAINS TRIED IN CO-ORDINATED VARIETAL TRIAL OF *G. hirsutum* NORMAL PLANT TYPE, BR.04(*a*), IN NORTH ZONE

Place	Number of strains tried	Range of mean fibre length (mm)	Maturity	Bundle strength	Count spun (micro)	Number of strains spinnable to the count selected	Number of strains better than control	Control strain
Bulandshahr	12	22·4—27·8	Average to good	Average to good	30s	0	11	Pramukh
Faridkot	12	23·4—26·0	Low to average	Average to good	40s	0	11	320F
Hissar	12	22·2—25·8	Fairly average	Average to good	40s	2	9	H.14
Jullundur	12	24·7—29·1	Average	Average to good	40s	12	9	J.34
Meerut	12	24·1—27·9	Low	Average to good	40s	2	2	C.500
IARI, New Delhi	12	26·0—29·2	Low to average	Average to good	50s	5	8	H.14
Raya	12	23·8—28·5	Average	Good	50s	0	3	Pramukh
IARI, Sirsa	12	20·9—26·2	Low to average	Average to good	50s	0	3	320F

In the Initial Evaluation Trial conducted at Jullundur, the strains A.327, A.323, A.322 and 136/69 fared well at 50s count (micro) when spun on S.K.F. high-drafting system. It may be pointed out that the two strains, viz. C.2 (A. 231 × × EL.909) × Reba-B.50 and C.3 (A.231 × MCU.5) × Reba-B.50, had recorded high bundle strength values (above 50.0 g/t).

G. arboreum Trial

The trial on *G. arboreum* (*desi* cottons) was conducted at Ludhiana. All the strains except one recorded mean fibre length below 20.3 mm (0.80 in.). Of these, the strains Shyamali and SD.1 gave impressive yarn strength at 10s count.

Miscellaneous Trials

The Feeler Trial on Hybrid cottons was taken up at Faridkot and Jullundur. Three hybrids, viz. Jagdish x Laxmi, Hybrid 4 and MCU.5 × J.34, raised at Faridkot recorded good spinning performance at 40s count.

In the experiment entitled "Selection from Inter Varietal Crosses of *G. hirsutum*" at Sirsa, nine out of 33 strains recorded encouraging CSP at 50s count. The strain RRS.7 recorded highest CSP in the lot.

Among the seven samples of Pusa Selections (*G. hirsutum* varieties tried at the IARI, New Delhi), PS.16 recorded impressive fibre properties and spinning potential. Other Pusa selections worth mentioning were : PS.7, PS.17, PS.13 and PS.15.

CENTRAL ZONE

G. hirsutum Trials

In the Co-ordinated Varietal Trial, samples were received from eight locations, viz. Junagadh, Surat, Talod, and Achalpur under irrigated conditions and from Badnawar, Khandwa, Indore and Nanded under rainfed conditions. The test results are compiled in Table 4. It is seen from the table that the strains had recorded wide range of mean fibre length (23.1 mm to 31.8 mm). The maturity of the samples from Khandwa and Indore was not satisfactory. Regarding spinning, the trial appeared to be very successful at Nanded, Achalpur and Talod, with many strains being spinnable to 50s count. Many strains from Junagadh, Surat, Talod, Achalpur, Badnawar, Khandwa, and Indore had shown better performance than the respective controls. The technological performance of the strains tried under rainfed conditions was on par with that of the samples tried under irrigated conditions. It was observed that the strain MCU.5 had recorded impressive performance at seven out of eight locations, the other promising strains being 66BH.5/91, B.59-1684, 66BH.5/55 and DHY.289.

In the early sown areas in the Central Zone, where irrigated facilities were available, the *G. hirsutum* entries approved for the Northern Zone Co-ordinated Varietal Trial were raised. These trials were conducted at Gwalior in Madhya Pradesh, and at Kopergaon and Nanded in Maharashtra. In the Normal Plant Type trial, two strains, viz. H.275 and A.218, at Gwalior and one strain, H.275,

TABLE 4 : SUMMARY OF THE TEST RESULTS OF THE STRAINS TRIED IN CO-ORDINATED VARIETAL TRIAL *G. hirsutum*, BR.04, IN CENTRAL ZONE

Place	Number of strains tried	Range of mean fibre length (mm)	Maturity	Bundle strength	Counts spun	Number of strain spinnable to the count selected	Number of strains better than control	Control strain
Junagadh (I)	16	23·1—29·2	Low to average	Average	50s (full)	0	13	Deviraj
Surat (I)	16	24·4—30·0	Low to average	Average	50s (full)	3	14	Deviraj
Talod (I)	16	24·8—29·7	Low to average	Average to good	50s (full)	8	14	Gujarat 67
Achalpur (I)	16	24·9—31·5	Low to average	Average to good	50s (micro)	11	14	B.147
Badnawar (R)	17	24·1—31·8	Low to average	Average to good	50s (full)	0	9	Badnawar 1
Khandwa (R)	16	23·9—29·0	Low to average (unsatisfactory)	Average to good	50s (micro)	1	10	Khandwa 1
Indore (R)	16	25·1—29·2	Low to average (unsatisfactory)	Average	50s (micro)	3	8	Badnawar 1
Nanded (R)	16	25·1—29·2	Low to average	Average to good	50s (micro)	16	4	.1 007

(I) = Irrigated. (R) = Rainfed.

at Kopergaon were found suitable for 50s count. In the New Plant Type trial conducted at Nanded, none of the 16 strains was suitable for 50s count.

Samples belonging to the Preliminary Varietal Trial were received from Junagadh, Surat and Talod under irrigated conditions and from Achalpur, Akola, Indore, Khandwa, Nanded and Parbhani under rainfed conditions. As many as 13 out of 20 strains from Talod and five out of 18 strains from Junagadh were found suitable for 60s count. Many strains raised at these two locations were better than the control strains. In the case of samples from other locations, such as Surat, Achalpur, Khandwa and Nanded, many strains had shown spinning potential of 50s and above. In the case of samples from Parbhani, 16 out of 18 strains were found suitable for being spun to 40s count. Many strains from Junagadh, Surat, Talod, Parbhani and Achalpur had shown better spinning performance than their respective controls. None of the strains raised at Indore was found suitable for 50s count which may be probably due to their poor maturity. Amongst the individual strains in this trial, the strains 68BH.25/10 and 68BH.25/60 fared well at most of the locations, the other promising strains being IAN.579-187-2 and IAN.579-188-4.

In the case of Initial Evaluation Trial, samples were received from Junagadh under irrigated conditions, and from Achalpur, Akola and Badnawar under rainfed conditions. The following strains showed good spinning performance at the locations indicated.

Junagadh	:	ISC.67 × Nectariless F-1 Pira/4757 and Culture 500.
Achalpur	:	C.59-228.
Akola	:	B.67-2278, CSH.4 and Culture 500.
Badnawar	:	Culture 500, B.69-2756 and B.69-2766.

G. barbadense Trials

Samples belonging to the Co-ordinated Varietal Trial were received from Surat, Junagadh, Talod and Nanded. Table 5 summarises the performance of the individual strains. All the strains had recorded good mean fibre length, maturity and bundle strength at all the locations. The strains Sujata, Giza 7, IBSI, and SB.1085-6 were found suitable for 80s count at all the locations while the strains N.28 and Andrews were found suitable for 80s count at three and two locations, respectively.

In another trial of *G. barbadense*, the strains Sujata, Monteserrat, Marrad, SIV.2727, and Allapo 70/57-2 fared well at 80s count at Nanded while the strains Sea Island, Sujata, Allapo 70/57 and Monteserrat fared well at 80s count at Surat.

In the Pilot Trial of extra-long staple cottons conducted at Kopergaon, the best spinning performance at 80s count was shown by Pima-S.4, followed by Pima-S.3, Sujata, N.28 and Andrews. The *G. hirsutum* check, viz. MCU.5, also recorded impressive yarn strength at 50s count.

G. arboreum Trials

These trials were conducted at Amreli, Badnapur, Buldana, Indore, Jalgaon, Nagpur, Nanded, Parbhani and Somanathpur. In order to assess the performance

TABLE 5 : SUMMARY OF THE TEST RESULTS OF THE INDIVIDUAL STRAINS TRIED IN PRELIMINARY VARIETAL TRIAL OF *G. barbanense*, BR. 13, IN CENTRAL ZONE

Name of strain	Number of places tried	Range of mean fibre length (mm)	Maturity	Range of bundle strength (g/t)	Number of places from which samples were spinnable to 80s count	HSC at Surat
Sujata	4	20·7—30·7	Staisfactory under irrigated conditions	45·0—50·9	4	88s
Giza 7	4	28·2—31·0	Satisfactory	45·6—49·0	4	81s
N.28	4	29·5—32·5	Satisfactory	49·3—50·4	3	85s
Andrews	4	29·5—32·5	Satisfactory	45·0—47·7	2	66s
IBSI	4	30·0—30·5	Satisfactory	40·2—50·9	4	85s
SB.1085-6	4	27·4—33·3	Fairly satisfactory	49·8—50·9	4	(micro)

of the *G. hirsutum* simultaneously, two *G. hirsutum* strains, viz. Reba-B.50 and MCU.6 along with a local *G. hirsutum* control were included in this trial. As expected, *G. hirsutums* had recorded better performance than *G. arboreums* at all the locations.

The strains which were found suitable for the counts indicated may be listed as follows :

Location	*G. arboreum* (*30s count*)	*G. hirsutum* (*40s count*)
Amreli	Sanjay	—
Badnapur	S.65-1258 and Sanjay	—
Buldana	Sanjay	Reba-B.50 and B.147
Indore	—	—
Jalgaon	Sanjay, B.10-24-A.67 and K.52-462	B.1007, Reba-B.50 and MCU.6
Nagpur	—	—
Nanded	—	B.1007, Reba-B.50 and MCU.6
Parbhani	Gaorani 1422, B.10-24-A.67 and K.52-462	B.147, Reba-B.50 and MCU.6
Somanathpur	—	—

G. herbaceum Trials

In the Co-ordinated Varietal Trial of *G. herbaceum*, samples were received from Surat under irrigated conditions and from Broach and Hansot under rainfed conditions. Three strains, viz. 3200, 2680 and 3943/5021, recorded better technological performance than the control strain, Digvijay, at Surat while only two strains, viz. 3200 and 3943/1879, recorded better spinning performance than control, Digvijay, at Broach. No strain was found to be superior to Digvijay at Hansot.

A few *G. hirsutum* strains were also simultaneously tested in this trial. They were found superior in respect of fibre length and spinning potential. Although the maturity of these strains was not quite satisfactory, their bundle strength values were satisfactory at all the three locations.

In addition to these main trials, many other trials of important nature were also taken up at many locations in the Central Zone. The important findings of these trials were as follows :

Trial-cum-Demonstration of Promising G. hirsutum Cottons

This trial was conducted at Jadugan, Junagadh, Khandwa, Ratanpur, Sahayaba, Savala, Tegra, Thasra, Vankuva, Badnawar, Indore and Surat. The following strains have shown encouraging performance at 50s count at the locations indicated.

Jadugan	MCU.5 and 66BH.5/91
Junagadh	66BH.5/91 and MCU.5

Khandwa	Nil
Ratanpur	MCU.5 and IAN.579(1456)
Sahayaba	66BH.5/91 and IAN.579(188)
Savala	66BH.5/91 and MCU.5
Badnawar	MCU.5 and 66BH.5/91
Indore	MCU.5, 66BH.5/91, A.218 and Badnawar 1
Surat	66BH.5/91, MCU.5 and IAN.579(1456)

It is seen from the above that the strains MCU.5 and 66BH.5/91 had shown good performance at many of the locations tried. The IAN cultures also fared well.

Feeler Trial of Promising G. hirsutum Cottons

This trial was conducted at Achalpur, Akola, Badnapur, Buldana, Jalgaon, Kutki, Nagpur, Nanded, Parbhani, Somanathpur, Washim and Yeotmal under rainfed conditions. The strains Laxmi and Reba-B.50 gave impressive spinning performance at 40s count at 11 and nine locations, respectively, while the strains MCU.6 and GS.23 recorded good performance at five and four locations only. In this trial also, the performance of *G. hirsutum* strains was far superior to that of *G. arboreums*. Samples pertaining to this trial were also received from Badnawar and Indore. However, none of the strains was better than the local variety, Badnawar 1.

Hybrid Trials

In order to exploit the hybrid vigour for higher yields, many trials were conducted at a few locations in Central Zone. From the technological point of view the following hybrids may be considered for further trials.

INTER-HIRSUTUM HYBRIDS

Surat	:	G.67 × Reba-B.50 (HSC 69s) and G.67 × H.152-63 (HSC 59s)
Achalpur (50s count)	:	G.67 × H.152-63 and G.67 × Allen 333
Nanded (60s count)	:	G.67 × H.152, G.67 × 104F and G.67 × American Big Boll

INTERSPECIFIC HYBRIDS

Surat	:	G.67 × N.28 (HSC 100s), 815-3-2 × USSR.76 (HSC 90s), G.67 × USSR.76 (HSC 88s), Co-ano.8-3-2 × USSR.76 (HSC 80s) and Co-ano.8-3-2 × Sea Island (HSC 77s)
Nanded (80s count)	:	815-3-2 × USSR.76 and Co-ano.8-3-2 × USSR.76

Feeler Trial of Promising Hybrids

The samples belonging to this trial were received from Nanded and Surat under irrigated conditions and from Achalpur under rainfed conditions. The hybrid MCU.5 × J.34 fared well at 50s count at Nanded and Achalpur while Hybrid 4 and Laxmi × B.59-1684 fared well at Surat and Achalpur, respectively.

Samples of four other hybrids were received from Surat. All were found suitable for 50s count. The best performance was shown by (IAN.579 × B.59-1684) followed by (G.67 × H.152-63), (G.67 × A.218) and (G.67 × P.30).

Trial of Sowing Period of Hybrid 4

The test results of the three samples of Hybrid 4 sown in September, October and November, with a sample of IAN.579(188) sown in September indicated that among the three samples of Hybrid 4, the one which was sown in the month of September had better spinning potential. This trial was conducted at Surat.

Evaluation of Glandless Types of G. hirsutum Cottons

With a view to evaluate glandless cottons, nine glandless types were raised at Indore. Types 1 to 6 were indicated as Sel. Badnawar glandless × Badnawar 1 and types 7 to 9 were indicated as Sel. G.67 × *G. raisutum*. Their mean fibre length ranged from 20.6 mm to 27.7 mm. Although they had recorded poor maturity, the bundle strength was quite satisfactory. As many as six out of the nine recorded impressive yarn strength at 40s count.

Physiology Trial

In this trial, six strains, namely H.14 and J.34 (North Zone), IAN.560 and Gujarat 67 (Central Zone) and MCU.1 and MCU.5 (South Zone), were taken up at Surat for the third successive year. Comparing the technological performance of these strains during the last three years, it was observed that the strains MCU.5 and IAN.560 were consistently good.

SOUTH ZONE

G. hirsutum Trials

Samples pertaining to the Co-ordinated Varietal Trial were received from Arabhavi, Amaravati, Coimbatore and Siruguppa under irrigated condition, and from Dharwar, Gadag, Kovilpatti and Ranibennur under rainfed conditions. The tests results are summarised in Table 6. All these strains had satisfactory mean fibre length and bundle strength at most of the locations. Maturity was, however, low in many cases. As regards spinning, seven strains had shown spinning potential of 50s count and above only at Ranibennur. However, many new strains had given better spinning performance than the local control at most of the places. Amongst the different strains, MCU.5, MCU.4, ELS.0162 and ELS.117 fared well at many locations.

TABLE 6 : SUMMARY OF THE TEST RESULTS OF THE STRAINS TRIED IN CO-ORDINATED VARIETAL TRIAL OF *G. hirsutum*, BR.04, IN SOUTH ZONE

Place	Number of strains tried	Range of mean fibre length (mm)	Maturity	Bundle strength	Counts spun	Number of strains spinnable to the count selected	Number of strains better than control	Control strain
Arabhavi (I)	14	23·4—29·2	Low to average	Average	50s (full)	0	11	Vijaya
Coimbatore (I)	12	23·6—29·5	Average	Average	50s (full)	1	—	MCU.5
Amaravati (I)	12	23·4—27·9	Average	Average	50s (micro)	0	9	Hampi
Siruguppa (I)	13	23·4—28·2	Low to average	Average	50s (micro)	3	11	Hampi
Dharwar (R)	12	22·4—27·9	Low to average	Average	40s (micro)	0	3	Laxmi
Gadag (R)	12	22·4—27·7	Low	Average	50s (micro)	3	8	Laxmi
Kovilpatti (R)	12	22·9—27·2	Low to average	Average to good	50s (micro)	5	7	Bharati
Ranibennur (R)	12	22·6—27·9	Low	Average	50s (micro)	7	8	Laxmi

(I) = Irrigated. (R) = Rainfed.

In the case of Preliminary Varietal Trial, samples were received from Arabhavi, Coimbatore and Siruguppa. The tests results indicated that nine out of 10 strains from Arabhavi had a spinning potential of 50s count and above. The samples from Coimbatore and Siruguppa, however, did not show any impressive performance. Considering the performance of the strains individually the strains MCU.5, ELS.139, 6523 and AS.23 ranked within the first six at all the three locations.

As regards the Initial Evaluation Trial, the following strains were found suitable for the counts indicated :

Arabhavi (40s count)	:	SS.2, MCU.5, Vijaya, SS.4, JK.16, AHO.13-2, AS.38, JK.152, AHO.43, JK.122, JK.78 and JK.59.
Siruguppa (50s count)	:	MCU.5 and IC.516.
Ranibennur (40s count)	:	JK.78, JK.16, JK.97, Laxmi and JK.151.

G. barbadense Trials

Samples pertaining to *G. barbadense* trials were received from Coimbatore and Arsikere.

These samples had recorded satisfactory mean fibre length, average maturity and average to good bundle strength. The best performance at Coimbatore was shown by the strain SB.1085-6 (HSC 99s) followed by Sujata (HSC 98s), SB.101-A.61 (HSC 79s), and Andrews and Giza (both HSC 77s). The samples from Arsikere, however, did not give much impressive spinning performance as only one strain, viz. N.28, was found suitable for spinning even 60s count.

Hybridization and selection involving Sujata and Sea Island St. Vincent taken up earlier at the IARI Regional Station, Coimbatore, has since resulted in the evolution of new strains of "Suvin". This year many Suvin samples were received from the IARI, Coimbatore, for further screening. In the first set of 11 samples of Suvin representing the F.3 generation bulk, viz. Suvin 62, Suvin 1, Suvin C, Suvin 32, Suvin B and Suvin 44, recorded impressive spinning performance at 120s count when spun on S.K.F. high-drafting system.

Further, in order to obtain superior quality strain of Suvin which would have a span length of over 1.50″ combined with high pressley bundle strength index of about 10.0 lb/mg, 91 single plant progenies of Suvin 62 and Suvin 10 were tested for fibre properties. Some of the progenies [(Suvin 62) S.2/11, (Suvin 10) S.10-2, (Suvin 62) S.10-31 and (Suvin 10) S.10-8-36] were exceptionally long having span length over 1.50″. About 20 progenies which had recorded pressley index of 9.8 lb/mg and above have been recommended for further trials.

G. arboreum Trials

Twentytwo samples of *G. arboreum* cotton were raised at Kovilpatti. The strains 0320-1, 0321, 0555, 0731, 0528, 0360M and 0524 had given impressive performance at 30s count. The strain 0078F which recorded impressive per-

formance last year, continued to give equally good performance this year also. The local control variety, K.7, also fared well at 30s count. The strain 0078F with 16 per cent higher yield than that of K.7 has been approved for release as a rainfed crop in the southern districts of Tamil Nadu.

G. herbaceum Trials

The Co-ordinated Varietal Trial of *G. herbaceum* was conducted at Dharwar and Raichur. However, none of the *G. herbaceum* strains recorded promising performance at 30s count. The *G. hirsutum* cottons, viz. MCU.5, Reba-B.50, GS.23 and Hampi, raised simultaneously at Raichur, for comparative performance, were found to be spinnable to 40s count. It may be pointed out that the strains Reba-B.50, MCU.4, MCU.6 and GS.23 raised in the Feeler Trial at Raichur recorded far superior technological performance at 40s count than the local variety Raichur 51.

Hybrid Trials

Comparative performance of the two hybrids, viz. Varalaxmi and Hybrid 4, was studied using samples received from Arabhavi, Arsikere and Dharwar. The strain Varalaxmi was found to be superior in respect of mean fibre length, fineness, bundle strength and spinning potential, at Arabhavi and Dharwar. However, its performance at Arsikere was poorer and was on a par with that of Hybird 4.

The performance of Hybrid 4 in comparison with MCU.2 at Amaravati was somewhat discouraging as both the samples were found not spinnable to 40s count.

As a result of three-way cross programme, a few cultures were recently evolved at the IARI, Coimbatore. Of these, the culture CP.25/1 had been synthesized for the Northern Zone. This culture when raised at Coimbatore recorded mean fibre length of over 30 mm with good bundle strength to give a high CSP value at 60s count when spun on S.K.F. high-drafting system. Other promising cultures from the three-way cross programme were R.III/4-2, O.III/32-1 and CP.11/131.

As regards the Main Strain Trial at Coimbatore, the strains IS-MCU.5-2, ELS.191 and ELS.190 fared well at 50s count.

As the yield of cotton per unit area in USSR is very high as compared to that in our country, seed material of two Russian varieties, 108F and 152F were tried at Coimbatore with MCU.5 as a control variety. It was observed that the control variety MCU.5 had recorded far superior technological performance and yield than the Russian varieties.

In addition, a few strains from genetic stocks which had given consistently higher yields during the past three years, were raised at the IARI, Coimbatore. Of the five strains, which were reported to have given very high yields, the two strains (A.218 × MCU.5) RB.pl.15-1/2-1A and (MCU.5 × PRH.30/2) 9/11pl. 23-III/8-1, were found suitable for 50s count.

In the trial of "late sowing cotton varieties after pulse crop at Tenali", the strain A.218 had good mean fibre length, bundle strength and yarn strength for 50s count.

In the trial entitled "to study the quality of two strains under different stages of multiplication", the strains Bharati and K.7 at nucleus and foundation stages

were tested. The performance of each strain at both the stages was identical, the strain Bharati, having better mean fibre length than K.7, recorded HSC of 45s as against 31s by K.7. The performance of Bharati was also compared with that of the strain EL.909BK, both raised under rainfed conditions. The spinning potential of both the varieties was assesssed as 45s.

Varieties Released in 1971

At the All India Co-ordinated Cotton Improvement Project Workshop held in June, 1971, three varieties, viz. Hybrid 4, 3943 and Khandwa 2 were recommended for release.

Hybrid 4 : This strain has recorded very high yield of over 40 quintals of *kapas* per hectare. It is of a shorter duration and gives better spinning performance than Gujarat 67.

3943 : This is a strain suitable for replacing Digvijay especially under waterlogged conditions. It yields about 23 per cent more than Digvijay, gives a better ginning outturn and has a satisfactory fibre and spinning quality.

Khandwa 2 : This is a *G. hirsutum* strain suitable for replacing the *desi* Maljari in the Nimar tract of Madhya Pradesh. This is of a shorter duration, maturing in 150 days, yielding almost double that of Maljari and having better fibre and spinning properties.

The important technological properties of these cottons along with those of the local varieties are given in the Table below.

TECHNOLOGICAL PROPERTIES OF NEW VARIETIES RELEASED AND LOCAL CONTROLS

Variety	Kapas yield (q/ha)	G.P.	Mean length		Micronaire value	Bundle strength		HSC
			mm	in.		g/t	lb/mg	
Hybrid 4	30-40	36	27·4	1·08	4·6	42·3	7·9	50s
Gujarat 67	6·8	34	30·0	1·78	3·9	41·8	7·8	46s
3943	7·4	40	23·3	0·91	4·0	47·2	8·8	32s
Digvijay	6·0	39	22·5	0·89	3·9	49·8	9·3	34s
Khandwa 2	9·2	36	24·1	0·95	4·1	47·1	8·8	34s
Maljari	4·2	36	21·8	0·86	5·2	42·4	7·9	26s

N.B. Other names for certain new improved varieties are :

Bharati = MCU.6 = EL.156E

MCU.7 = L.1143EM

Mahalaxmi = 1301DD

Hybrid 4 = ISC.67 × American Nectariless
= Sankar 4

Khandwa 2 = KW.66-2096

K.8 = 0078F

Suvin = Sujata × St. Vincent

IMPROVED VARIETIES EVOLVED UNDER OTHER STATE SCHEMES

Although the major work of evolution of improved strains is being carried out in various States under the All India Co-ordinated Research Project on Cotton, some of the States and Agricultural Universities conduct experimental work on their own. Some of the interesting results observed while testing such samples are given below :

GUJARAT

A number of improved strains had been tested in several centres in Gujarat State. Among the samples received and tested during 1971, the test results of the promising ones having an HSC of 42s and above are given below :

Variety	Mean fibre length		Fineness		Maturity coefficient	Tenacity		B.1. (%)	C.1. (%)	HSC
	mm	in.	Millitex	Micronaire value		g/t	lb/mg			
Khedbrahma										
IAN.579/188	26·7	1·13	134	3·4	0·67	45·0	6·4	5·9	7·0	77s
3943/1879	23·4	0·92	157	4·0	0·74	46·8	9·1	3·1	5·1	44s
1474/31655	22·9	0·90	204	5·1	0·75	52·0	9·7	4·7	5·3	43s
2681	21·6	0·85	177	4·5	0·74	50·9	9·5	5·0	5·6	44s
16×S.3W	23·4	0·92	165	4·2	0·74	52·0	9·7	6·9	5·9	43s
Digvijay	21·1	0·83	181	4·6	0·74	53·1	9·9	5·8	6·1	43s
DHY.286	24·9	0·98	122	3·1	0·62	45·0	8·4	6·9	6·4	44s
DHY.82	26·2	1·03	122	3·1	0·61	45·0	8·4	7·2	6·3	47s
IAN.579/5856/246	29·5	1·16	157	4·0	0·70	38·1	7·1	6·2	6·4	44s
Acchalia										
SRT.1	25·7	1·01	169	4·3	0·72	44·5	8·3	5·6	6·0	49s

Strain SRT.1 is a high yielding strain and is very promising in quality also.

MYSORE

Varieties DCH.1 and Hybrid 4 were tested along with Laxmi at Dharwar and both DCH.1 and Hybrid 4 gave very good performance in comparison with Laxmi. Their test results are as follows :

Variety	Mean fibre length		Fineness		Maturity coefficient	Tenacity		B.1. (%)	C.1. (%)	HSC
	mm	in.	Millitex	Micronaire value		g/t	lb/mg			
DCH.1	30·7	1·21	142	3·6	0·70	44·5	8·3	4·1	5·1	80s
Hybrid 4	29·0	1·14	157	4·0	0·74	38·6	7·2	3·9	5·7	60s
Laxmi	23·0	0·91	138	3·6	0·71	40·7	7·6	4·7	5·6	36s

TABLE 7 : COMPARATIVE MILL AND LABORATORY TESTS — SPINNING TEST RESULTS

Place	Variety	Laboratory Test Results				Mill Test Results				
		Waste (%)	Count	Strength (lb)	t.m.	Waste (%)	Yarn recovery (%)	Count	Strength (lb)	t.m.
Madhya Pradesh										
Indore	66BH.5/91	10·3	40s	45·6	4·0	13·4	—	40s	47·0	4·0
Badnawar	Badnawar 1	11·0	40s	47·2	4·0	11·1	—	40s	49·7	4·0
Khandwa	Khandwa 2	14·1	32s	54·3	4·0	7·9	86	32s	60·3	4·54
Punjab										
Faridkot	A.218	15·5	30s	59·1	4·0	—	—	30s	46·3	4·0
„	320F	12·3	30s	45·0	4·0	—	—	30s	32·4	4·0
Abohar	A.218	22·8	30s	50·8	4·0	—		30s	59·3	4·0
„	LSS	14·0	30s	32·9	4·0	—	—	30s	41·9	4·0
Mysore										
Gadag	GS.23	10·5	20s	87·9	4·0	7·3	—	18s	80·3	5·04
„	Laxmi	10·5	30s	71·2	4·0	5·0	—	32s	55·5	4·56
Arabhavi	Vijaya	10·5	30s	63·8	4·0	10·7	—	30s	70·0	4·0
„	Deviraj	10·5	30s	55·1	4·0	9·8	—	30s	60·7	4·0
Siruguppa	Varalaxmi	7·4	40s	55·8	4·0	5·2	88	32s	87·9	4·0
„	Hybrid 4	7·3	32s	56·1	4·0	5·0	88	32s	64·7	4·64
„	Hampi	7·5	32s	53·9	4·0	6·7	88	32s	60·2	4·64
Gadag	GS.23	10·4	32s	51·0	4·0	5·9	85	32s	60·2	4·55
„	Laxmi	11·1	32s	59·3	4·0	7·5	84	32s	60·1	4·55

Note : The spinning system and machinery employed by the mills are in many cases different from those adopted at this Laboratory, and hence the strength values obtained are not strictly comparable.

TAMIL NADU

A number of improved cotton strains evolved from different centres in Tamil Nadu were received and tested during 1971. Average test results of the promising ones are given below :

Variety	Mean fibre length		Fineness		Maturity coefficient	Tenacity		B.1. (%)	C.1. (%)	HSC
	mm	in.	Millitex	Micronaire value		g/t	lb/mg			
K.7	23·9	0·94	200	5·1	0·79	50·0	9·3	7·1	5·4	29s
PRS.72	24·5	0·96	177	4·5	0·78	39·4	7·9	4·9	5·9	42s
L.1143EM	25·6	1·00	165	4·2	0·79	44·0	8·2	4·2	5·0	46s
K.3400	25·1	0·99	167	4·2	0·75	43·7	8·1	5·9	5·5	40s
MCU.4	26·1	1·03	159	4·0	0·73	47·6	9·1	5·4	6·0	57s

MILL TESTS

Selected improved varieties of cottons, which possess promising characteristics and are considered superior to the current ones on the basis of the Laboratory tests, are subjected to actual mill tests for their performance at the mills. Only after the superiority of the new varieties is confirmed by mill tests, at least for two seasons, the varieties are recommended for large scale propagation. Necessary arrangements for carrying out mill tests are made by this Laboratory. A few mills have been co-operative enough to undertake such tests on the samples sent to them.

During the year, mill tests were carried out on 16 samples. The comparative test results at the mill and the Laboratory are given in Table 7.

It will be seen that in Madhya Pradesh the new variety 66BH.5/91 was not up to the expectations as its spinning performance was similar to that of Badnawar 1. Another improved variety Khandwa 2 was tested at the mills and its performance was good. The Punjab variety A.218 gave better spinning performance than the local varieties at the mills, although its performance was not as good as expected. In Mysore, the improved variety Vijaya gave better spinning performance than the local Deviraj for the third year in succession. Varalaxmi was also better than Hybrid 4 and Hampi at the mill tests as well as at the Laboratory. As regards GS.23 and Laxmi, the performance of GS.23 was not up to the expectations. Its performance has to be confirmed by further tests.

EXTRA LONG STAPLE (27 MM AND ABOVE) COTTONS

The results of full scale spinning tests carried out on extra-long staple cotton samples received and tested at the Laboratory during 1971 are shown in Table 8. This supplements the prominent strains described under the All India Co-ordinated Research Project on Cotton.

TABLE 7 : RESULTS OF EXTRA-LONG STAPLE (27 MM AND ABOVE) COTTONS TESTED IN 1971

Variety	Place	Mean fibre length		Fineness		Maturity coeffi-cient	Percentage (M-H-I)	Bundle strength	
		mm	in.	millitex	micronaire value			Tenacity 0″ gauge (g/t)	P.S.I. 0″ gauge (lb/mg)
Andhra Pradesh									
S.I. Andrews	Yemmiganur	32·8	1·29	154	3·9	0·72	—	42·3	7·9
Delhi									
PS.9	IARI, New Delhi	27·4	1·08	173	4·4	—	63-5-32	44·0	8·2
PS.15	,,	28·0	1·10	169	4·3	—	67-5-28	44·5	8·3
Gujarat									
Gujarat 67	Anjar	30·2	1·19	126	3·2	0·67	—	41·3	7·7
IAN.579(1456)	Broach	27·7	1·09	134	3·4	0·67	—	47·7	8·9
IAN.579	Hansot	28·2	1·11	146	3·7	0·68	—	42·9	8·0
IAN.937	,,	28·0	1·10	138	3·5	0·67	—	40·7	7·6
IAN.941	,,	29·4	1·16	122	3·1	0·64	—	41·3	7·7
Gujarat 67	Idar	27·5	1·08	130	3·3	0·66	—	40·7	7·6
Hybrid 4	Jagudan (Viramgam)	27·9	1·10	169	4·3	0·71	—	47·7	8·9
IAN.579(188)	,,	29·2	1·15	118	3·0	0·61	—	48·8	9·1
MCU.5	,,	28·2	1·11	94	2·4	0·50	—	48·8	9·1
IAN.564	Junagadh	29·2	1·15	122	3·1	—	42-5-53	42·9	8·0
IAN.579(188)	,,	27·9	1·10	134	3·4	0·66	—	43·4	8·1

TABLE 7 (*Contd.*): RESULTS OF EXTRA-LONG STAPLE (27 MM AND ABOVE) COTTONS TESTED IN 1971

Variety	Place	Mean fibre length		Fineness		Maturity coeffi-cient	Percentage (M-H-I)	Bundle strength	
		mm	in.	millitex	micronaire value			Tenacity 0″ gauge (g/t)	P.S.I. 0″ gauge (lb/mg)
IAN.579(1456)	Junagadh	29·0	1·14	142	3·6	—	56-4-40	45·0	8·4
MCU.5	,,	27·7	1·09	118	3·0	0·61	—	47·2	8·8
CCV.2	Khedbrahma	27·9	1·10	118	3·0	0·60	—	41·3	7·7
Gujarat 67	,,	29·5	1·16	126	3·2	0·64	—	38·6	7·2
IAN.579(188)	,,	28·7	1·13	134	3·4	0·67	—	45·0	8·4
IAN.579(1456)	,,	29·5	1·16	138	3·5	0·68	—	45·0	8·4
IAN.579/5845	,,	28·2	1·11	114	2·9	0·60	—	39·7	7·4
IAN.579/5856/246	,,	29·5	1·16	157	4·0	0·70	—	38·1	7·1
IAN.937	,,	27·9	1·10	118	3·0	0·61	—	37·0	6·9
IAN.941	,,	29·5	1·16	122	3·1	0·65	—	42·3	7·9
SC.8(126)	,,	29·7	1·17	126	3·2	0·66	—	39·1	7·3
66BH.5/91	Ratanpur	27·7	1·09	161	4·1	0·71	—	45·6	8·5
Hybrid 4	,,	28·2	1·11	157	4·0	0·71	—	42·9	8·0
IAN.579(1456)	,,	29·7	1·17	142	3·6	0·68	—	46·1	8·6
MCU.5	,,	30·2	1·19	154	3·9	0·68	—	47·2	8·8
4420	Surat	27·4	1·08	169	4·3	—	63-6-31	39·7	7·4
66BH.5/91	,,	27·9	1·10	157	4·0	—	79-4-17	45·0	8·4

TABLE 7 (*Contd.*) : RESULTS OF EXTRA-LONG STAPLE (27 MM AND ABOVE) COTTONS TESTED IN 1971

Variety	Place	Mean fibre length		Fineness		Maturity coeffi-cient	Percentage (M-H-I)	Bundle strength	
		mm	in.	millitex	micronaire value			Tenacity 0″ gauge (g/t)	P.S.I. 0″ gauge (lb/mg)
B.59-1684	Surat	27·7	1·09	169	4·3	—	61-5-34	44·5	8·3
Hybrid 4	,,	27·4	1·08	150	3·8	—	51-4-45	38·1	7·1
IAN.560	,,	27·9	1·10	146	3·7	0·71	—	42·9	8·0
IAN.564	,,	29·2	1·15	146	3·7	—	59-6-35	41·8	7·8
IAN.579(188)	,,	27·7	1·09	142	3·6	—	54-6-40	43·9	8·1
IAN.579(1456)	,,	30·0	1·18	150	3·8	—	56-5-39	44·0	8·2
EL.192	,,	29·0	1·14	138	3·5	—	58-7-35	43·4	8·1
MCU.5	,,	28·7	1·13	126	3·2	—	42-4-54	43·4	8·1
Giza 7	,,	29·5	1·16	157	4·0	0·73	—	46·1	8·6
IBSI	,,	30·2	1·19	157	4·0	—	72-4-24	49·8	9·3
N.28	,,	31·8	1·25	142	3·6	—	66-4-30	49·3	9·2
Sujata	,,	30·0	1·18	142	3·6	—	71-4-25	49·3	9·2
G.67 × N.28	,,	34·5	1·36	110	2·8	0·59	—	45·6	8·5
G.67 × SB.289E	,,	32·0	1·26	106	2·7	—	55-3-42	41·3	7·7
G.67 × USSR.76	,,	32·8	1·29	142	3·6	0·57	—	46·6	8·7
Co-ano.8-3-2 × Sea Island	,,	33·5	1·32	122	3·1	0·64	—	42·3	7·9
815-3-2 × USSR.76	,,	31·5	1·24	106	2·7	0·57	—	48·2	9·0
Co-ano.8-3-2 × USSR.76	,,	10·7	1·21	114	2·9	0·62	—	42·9	8·0

TABLE 7 (*Contd.*) : RESULTS OF EXTRA-LONG STAPLE (27 MM AND ABOVE) COTTONS TESTED IN 1971

Variety	Place	Mean fibre length		Fineness		Maturity coeffii-cient	Percentage (M-H-I)	Bundle strength	
		mm	in.	millitex	micronaire value			Tenacity 0″ gauge (g/t)	P.S.I. 0″ gauge (lb/mg)
4420	Talod	27·9	1·10	165	4·2	—	67-6-27	47·2	8·8
66BH.5/55	,,	27·7	1·09	165	4·2	—	78-4-18	50·9	9·5
66BH.5/91	,,	28·2	1·11	157	4·0	—	74-4-22	52·0	9·7
B.59-1684	,,	27·4	1·08	173	4·4	—	68-4-28	49·3	9·2
DHY.286	,,	27·4	1·08	154	3·9	—	72-3-25	50·4	9·4
EL.192	,,	29·2	1·15	126	3·2	—	62-5-33	49·3	9·2
Gujarat 67	,,	29·2	1·15	134	3·4	—	40-5-55	40·7	7·6
Hybrid 4	,,	28·2	1·11	169	4·3	—	59-4-37	43·4	8·1
IAN.564	,,	29·5	1·16	126	3·2	—	53-6-41	46·6	8·7
IAN.579(188)	,,	27·7	1·09	138	3·5	—	69-4-27	46·6	8·7
IAN.579(1456)	,,	28·2	1·11	142	3·6	—	59-6-35	47·7	8·9
MCU.5	,,	29·7	1·17	118	3·0	—	64-3-33	49·8	9·3
66BH.5/91	Tegra (Broach)	29·0	1·14	150	3·8	0·67	—	49·3	9·2
IAN.579/1456	,,	30·2	1·19	142	3·6	0·67	—	41·8	7·8
MCU.5	,,	30·0	1·18	110	2·8	0·59	—	49·3	9·2
IAN.579(188)	Vankura (Broach)	27·9	1·10	134	3·4	0·65	—	41·8	7·8
IAN.579(188)	Viramgam	28·7	1·13	142	3·6	0·69	—	47·7	8·9

TABLE 7 (*Contd.*) : RESULTS OF EXTRA-LONG STAPLE (27 MM AND ABOVE) COTTONS TESTED IN 1971

Variety	Place	Mean fibre length		Fineness		Maturity coeffii-cient	Percentage (M-H-I)	Bundle strength	
		mm	in.	millitex	micronaire value			Tenacity 0″ gauge (g/t)	P.S.I. 0″ gauge (lb/mg)
Madhya Pradesh									
4420	Badnawar	28·4	1·12	138	3·5	—	44-5-51	40·7	7·6
66BH.5/91	„	27·2	1·07	138	3·5	—	62-3-35	43·4	8·1
B.59-1684	„	28·2	1·11	134	3·4	—	56-4-40	44·0	8·2
Badnawar 2	„	27·9	1·10	142	3·6	—	65-4-31	40·7	7·6
EL.192	„	27·9	1·10	110	2·8	—	44-5-51	47·7	8·9
IAN.579(188)	„	27·2	1·07	118	3·0	—	43-4-53	45·0	8·4
MCU.5	„	27·9	1·10	98	2·5	—	42-4-54	45·6	8·5
4420	Khandwa	27·2	1·07	126	3·2	—	53-3-44	40·2	7·5
B.59-1684	„	27·2	1·07	165	4·2	0·74	—	48·2	9·0
DHY.82	„	27·2	1·07	138	3·5	—	48-6-46	42·3	7·9
EL.192	„	27·9	1·10	110	2·8	—	45-4-51	45·0	8·4
IAN.564	„	29·0	1·14	114	2·9	—	29-5-66	44·5	8·3
IAN.579(188)	„	27·4	1·08	150	3·8	—	62-4-34	40·7	7·6
IAN.579(1456)	„	28·2	1·11	134	3·4	—	49-5-46	42·9	8·0
MCU.5	„	29·7	1·17	126	3·2	0·63	—	46·3	8·7

TABLE 7 (*Contd.*) : RESULTS OF EXTRA-LONG STAPLE (27 MM AND ABOVE) COTTONS TESTED IN 1971

Variety	Place	Mean fibre length		Fineness		Maturity coeffi-cient	Percentage (M-H-I)	Bundle strength	
		mm	in.	millitex	micronaire value			Tenacity 0″ gauge (g/t)	P.S.I. 0″ gauge (lb/mg)
Maharashtra									
MCU.5	Achalpur	30·0	1·18	130	3·3	0·67	—	44·0	8·2
Nimkar 1	,,	27·4	1·08	157	4·0	0·74	—	36·4	6·8
Hybrid 4	Badnapur	28·1	1·11	150	3·8	0·73	—	38·6	7·2
Nimkar 1	,,	27·9	1·10	161	4·1	0·76	—	40·7	7·6
Hybrid 4	Parbhani	27·6	1·09	157	4·0	0·73	—	37·0	6·9
MCU.5	,,	30·7	1·21	134	3·4	0·67	—	43·4	8·1
Mysore									
EL.031	Arabhari	28·2	1·11	124	3·2	—	57-5-38	39·1	7·3
ELS.117	,,	27·4	1·08	134	3·4	—	49-2-49	38·1	7·1
EL.0162	,,	28·7	1·13	118	3·0	—	45-4-51	42·3	7·9
ELS.201	,,	27·2	1·07	126	3·2	—	48-4-48	39·7	7·4
MCU.4	,,	29·2	1·15	114	2·9	—	32-3-65	40·2	7·5
MCU.5	,,	28·7	1·13	118	3·0	—	46-5-49	43·4	8·1
DCH.1	Dharwar	30·7	1·21	142	3·6	0·70	—	44·5	8·3
Hybrid 4	,,	29·0	1·14	157	4·0	0·74	—	38·6	7·2
S.I. Andrews	Shimoga	32·2	1·27	138	3·5	0·69	—	42·9	8·0
Varalaxmi	Siruguppa	28·2	1·11	126	3·2	0·66	—	42·3	7·9

TABLE 7 (*Concld.*) : RESULTS OF EXTRA-LONG STAPLE (27 MM AND ABOVE) COTTONS TESTED IN 1971

Variety	Place	Mean fibre length		Fineness		Maturity coeffi-cient	Percentage (M-H-I)	Bundle strength	
		mm	in.	millitex	micronaire value			Tenacity 0″ gauge (g/t)	P.S.I. 0″ gauge (lb/mg)
Tamil Nadu									
ELS.117	Coimbatore	27·4	1·08	130	3·3	—	59-5-36	41·3	7·7
EL.0162	,,	28·2	1·11	130	3·3	—	65-3-32	41·3	7·7
ELS.201	,,	27·4	1·08	138	3·5	—	54-4-42	43·4	8·1
MCU.4	,,	27·9	1·10	142	3·6	—	65-4-31	40·7	7·6
MCU.5	,,	28·9	1·14	126	3·2	0·65	—	43·4	8·1
IAN.579	,,	27·2	1·07	130	3·3	—	51-4-45	40·2	7·5
SB.101-A.61	,,	29·2	1·15	154	3·9	—	71-4-25	46·6	8·7
SB.1085-6	,,	29·0	1·14	146	3·7	—	64-5-31	47·7	8·9
S.I. Andrews	,,	29·5	1·16	154	3·9	—	64-3-33	46·6	8·7
Sujata	,,	29·2	1·15	150	3·8	—	65-4-31	48·2	9·0
EL.909BK	Kovilpatti	27·9	1·10	122	3·1	0·63	—	44·0	8·2
MCU.4	Sankarankoil	27·2	1·07	150	3·8	0·74	—	47·7	8·9
MCU.4	Srivilliputtur	28·2	1·11	150	3·8	0·73	—	46·6	8·7

2. Evaluation of the Quality of the Major Trade Varieties of Cotton Grown in Different Parts of the Country

Lint samples of fair average quality of the major Trade Varieties of Indian Cottons are being obtained through the East India Cotton Association, Ltd., Bombay, each season. Representative *kapas* samples of the varieties are procured from the State Departments of Agriculture for determination of ginning percentage. The fibre and spinning test results, ginning percentage and other test results on each variety of cotton were published as a Technological Circular as early in the season as possible, for the information of the cotton trade and industry. Such circulars were issued during 1971 on 43 Trade Varieties. The test results on all the Trade Varieties of the 1969-70 season were compiled and published as Technological Report No. 9, entitled "Technological Report on Trade Varieties of Indian Cottons, 1969-70 season". Most of the samples of the 1970-71 season have also been received and tested.

3. Evaluation of the Quality of the Standard Indian Cotton Varieties Maintained at Chief Cotton Research Stations

In order to assess the seasonal fluctuations in the characters of Indian cottons and with a view to judging the comparative superiority or otherwise of the newly evolved strains, a number of selected varieties of Indian cottons called Standard Indian Cottons are tested at the Laboratory every year. These are grown under identical conditions from year to year in the Government Farms under departmental supervision. Extensive fibre and spinning tests are regularly carried out on such samples. The results obtained on the samples received are published as Technological Circulars for the information of the Cotton Breeders and other research workers as early in the season as possible. During 1971, such Technological Circulars were issued on 17 samples. The results of all the samples pertaining to the 1969-70 season were consolidated and published at the end of the season as Technological Report No. 10, entitled "Technological Report on Standard Indian Cottons, 1969-70 season". Most of the samples of the Standard Indian Cottons of the 1970-71 season have been received and tested.

4. Studies on Blends of Indian Cottons with Polyester Fibre

This project has been taken up with a view to evaluate optimum processing conditions for blending suitable Indian cottons with indigenous polyester fibre (Terene) to increase the utilization of Indian cottons by increasing its proportion in blends, as well as to reduce the dependence on imported cottons.

The superior quality Indian cottons selected for the study are Sujata, MCU.4, MCU.5, Hybrid 4, IAN.579 and Gujarat 67 ; in addition two imported cottons, viz. Giza 45 and Moroccan Pima, have also been selected for comparative study. Fibre properties and micro-spinning values of all these samples were determined. The procedure for processing the cotton : polyester blends in the proportion 33 : 67, 50 : 50 and 75 : 25 was standardized and the study on Sujata-Polyester blends has been almost completed.

Among the properties determined at different stages of spinning were neps/g, Baer Sorter patterns and percentage composition of the components. The yarns spun were tested for strength, using both the Lea Tester and the Uster Single Thread Tester, and for evenness using Uster Evenness Tester. Instron Tensile Tester was used to determine stress-strain curves of single fibres as well as the blended yarns. The results are being analysed.

5. Evaluation of Linter, Oil and Gossypol Content of Various Genetic Stocks for Evolving Varieties with Higher Oil Content and Low Gossypol Content

During the period under report, cotton seed samples of 26 varieties belonging to different botanical species were tested for seed weight and oil content. The values of oil content of these samples ranged from 15.10 per cent (S.I. Andrews) to 21.60 per cent [MCU.5-gl(3)]. The following varieties showed high (20 per cent and above) oil content—3943, Laxmi (Adoni), SC.8-126, IAN.560, Hybrid 4, 74-gl, MCU.5-gl(3), MCU.5-gl(5) and MCU.5-gl(6). Linter content of 16 cotton seed samples was determined. Linter content of these samples varied from 3.91 per cent (AK.235) to 14.57 per cent (II/16-5-5gl). The following varieties had high linter content (above 9 per cent)—Krishna, Nimkar, Laxmi (Adoni), D.46-2-1, G.54-1, G.135-49, 72-gl, 74-gl, II/16-5-5-gl, MCU.5-gl(3), MCU.5-gl(5) and MCU.5-gl(6). The percentages of hull and kernel were estimated for 29 cotton seed samples. Kernel content of these samples varied from 50.03 per cent (Wagad) to 63.36 per cent (Sujata). The following varieties showed high kernel content (above 55 per cent)—Krishna, Nimkar, PA.1, L.147, MCU.2, Digvijay, S.I. Andrews, Sujata, 72-gl, 74-gl, MCU.5-gl(3), MCU.5-gl(5) and MCU.5-gl(6).

The amounts of protein and free gossypol present in the kernels of 26 cotton seed samples were also estimated. Protein content in these samples ranged from 28.48 per cent (Mungari) to 43.48 per cent (72-gl). High protein content (above 40 per cent) was observed in the kernels of the following varieties—S.I. Andrews, Deviraj, D.46-2-1, G.54-1, G.135-49, 72-gl, 74-gl, II/16-5-5-gl, MCU.5-gl(3), MCU.5-gl(5) and MCU.5-gl(6). Free gossypol content of 20 of the above seed samples varied from 0.65 per cent (G.27) to 1.87 per cent (Laxmi). The following six varieties were practically gossypol free—72-gl, 74-gl, II/16-5-5-gl, MCU.5-gl(3), MCU.5-gl(5) and MCU.5-gl(6). The oil extracted from the above six samples was very light coloured.

6. Physico-chemical Characteristics of Cotton Treated with Decrystallyzing and Swelling Reagents

Cotton fibres of MCU.5 were treated with different concentrations of orthophosphoric acid (70 per cent to 89 per cent) at various temperatures (10°C, 29°C and 40°C). Samples treated with orthophosphoric acid of concentrations above 81 per cent became powdery. Moisture regain, iodine absorption and viscosity of the samples were studied. Moisture regain and iodine absorption increased with acid concentration while viscosity decreased.

Cotton Fibres of MCU.3 were treated with different concentrations of sulphuric acid at various temperatures (10°C, 29°C and 40°C). Samples treated

with higher concentrations of acid showed higher moisture regain.

7. Study of Free Radicals Formed by Gamma-ray Irradiation in Chemically Modified Cottons

Cotton yarn was phosphorylated using the method adopted by Reid and Mazzeno. The yarn sample was soaked in solution of urea, phosphoric acid and water, for 30 minutes. After adjusting the pickup to about 400 per cent, the sample was dried for 30 minutes at 105°C and then cured for 30 minutes at 150°C. It was then washed with water and dried in vacuum at 60°C. The phosphorous content was determined : (*i*) gravimetrically using ammonium molybdate reagent and (*ii*) spectrophotometrically using vanado-molybdate reagent.

The phosphorylated sample prepared by the above method had a phosphorous content of 5.67 per cent and nitrogen content of 2.60 per cent.

In order to reduce the nitrogen content of the phosphorylated sample, it was treated with dilute hydrochloric acid. The acid treatment reduced the nitrogen content from 2.6 per cent to 0.45 per cent ; but it also brought about additional degradation of the sample.

The phosphorylated sample with 5.67 per cent phosphorous content and 2.60 per cent nitrogen content was irradiated to three dosages of gamma-rays, viz. 1×10^5, 1×10^6, and 1×10^7 roentgens.

It was observed that the tenacity retained of the phosphorylated sample increased slightly (about 8 per cent) at initial dosage of 1×10^5 roentgens but decreased with further dosage. The copper number and water solubility increased with dosage.

The acetylated cotton samples of varying degrees of substitution (DS) were studied for the nature and behaviour of free radicals formed during irradiation by e.s.r. spectroscopy. The study revealed that :

(*i*) The yield of acetyl radicals increased with increase in degree of substitution of acetyl group when irradiated at 77°K, while the overall radical yield was adversely affected by an increase in the DS when irradiated at 300°K.

(*ii*) Dehydrogenation and deacetylation appeared to be responsible for the formation of free radicals at 77°K.

(*iii*) The presence of peroxy-radicals was indicated.

8. Fabrication of an Extractor for Improving the Ginning of Kapas

It was mentioned in the previous Annual Report that by making suitable changes in the speeds of doffer and reclaimer cylinders, the choking of *kapas* in the machine could be reduced. Accordingly a suitable set of vee-belt pulleys has been made and fitted to respective positions. Further, during the trials made on the above machine with various types of cottons, it was observed that by making changes in the speed ratio of reclaimer and big band saw cylinders, the separation of hulls from *kapas* could be impoved. Accordingly, the changes in their respective speeds have been made by using cog wheels. This has improved the separa-

tion of hulls, but did not show much improvement in the cleanliness of *kapas*.

The work of conducting trials with various speed ratios and positions of rollers, etc., is in progress.

9. Structural Peculiarities of Indian G. hirsutum and G. herbaceum Cottons

American *G. hirsutum* cottons are being compared with Indian *G. hirsutum* and *G. herbaceum* cottons with respect to the structural peculiarities of each group of cotton. For this purpose, 10 samples in each of the three groups were selected on the basis of comparable maturity coefficient, which ranged from 0.57 to 0.97. These thirty cottons were examined for various characteristics. Orientation was determined from convolution angle and birefringence. Swelling behaviour was determined using propanol-2-retention and Alkali Centrifuge Value (ACV) techniques. The density, moisture regain and dye absorption values were determined to get an idea of the microfibrillar packing or compactness of cell-wall structure as well as the crystalline-amorphous contents.

The data are being statistically analysed. The results indicate that the cell-wall structure of Indian *G. hirsutum* cottons is not significantly different from that of American *G. hirsutum* cottons. Even though the American *G. hirsutum* cottons have void or intermicellar space of the same order as that of *G. herbaceum* cottons, they are more crystalline and have larger pore size as compared with the *G. herbaceum* cottons. On the other hand, *G. herbaceum* cottons, with larger perimeter and less number of convolutions, have more amorphous region, but with smaller size of micropores as compared with the American *G. hirsutum* cottons.

Some experimental work of exploratory nature was carried out to see the effect of drying temperature on the gross and fine structure of cotton fibres extracted in uncollapsed state from cotton bolls. Two varieties of cotton, viz. Gujarat 67 and Digvijay, were selected for study. The cotton bolls were carefully opened under water and the seeds were boiled to remove muscillagenous matter. The fibres from the side region of the seeds were carefully cut under water. The fibre samples were solvent exchanged with methanol followed by ether and dried at three different temperatures, viz. room temperature, 60°C and 105°C. The convolution angle was determined for each set of 100 fibres. The trend of results indicated that the number of convolutions appreciably increased when dried at 60°C and 105°C as compared to the room temperature. This needs to be confirmed. It has been proposed to take up further work on physiologically mature cotton bolls just before their bursting open.

10. Investigations of the Microbial Decomposition of Cellulose in Indian Environments with Special Reference to Cellulolytic Enzymes Produced by Streptomyces and Fungi Isolated from Cotton and Cotton Products

Deterioration During Storage

Cellulolytic micro-organisms were isolated from samples of cottons deteriorated during storage in mills from different parts of India. In all 14 bacteria, 4 streptomyces and 12 fungi were isolated. The gacteria were feeble in elaborating cellulase. The fungi and streptomyces being active were screened for cellulase

production on seven different media. *Penicillium funiculosum* among fungi and *Streptomyces viridis* among streptomyces were highly cellulolytic and were subjected to enzyme kinetic studies. *Penicillium funiculosum* being rich in C_1 component of cellulase enzyme brought about high solubilization of cotton fibres which was comparable to the activity of well known culture *Trichoderma viride*.

The following table illustrates high activity of *P. funiculosum* in comparison with *Myrothecium verrucaria* and *T. viride*, the two standard cellulase producing cultures.

Organism	Reducing sugar μg/ml
Penicillium funiculosum	600
Myrothecium verrucaria	280
Trichoderma viride	675

Further work to exploit *P. funiculosum* for the production of cellulase is underway.

Deterioration in Sea Water

(*a*) Micro-organisms from sea water belonging to all three classes—bacteria, actinomycetes and fungi—showing cellulolytic activity were isolated. The 29 bacteria were very feebly active while 9 streptomyces and 19 fungi were fairly active.

The streptomyces belonging to *S. cinereus* group were predominent, and those belonging to *S. scabies* and *S. ruber* groups normally encountered in terrestrial sources were conspicuosuly absent.

One streptomycete, *S. flavus*, and one fungus, *Penicillium* sp., showed fair cellulolytic activity on cotton fibre. Enzyme production by these organisms was favoured by *Chaetomium*-cellulose medium incorporating NH_4Cl instead of $NaNO_3$. The optimum period for enzyme elaboration was 10 days for *S. flavus* and six days for *Penicillium* sp. The enzymes elaborated by these organisms were comparable to those elaborated by similar organisms from terrestrial habitats. However, sea water seemed to favour the enzyme production by *S. flavus* while it had no effect on *Penicillium* sp.

(*b*) Three marine cellulolytic fungi, two *Aspergillus* sp. and one *Paecilomyces* sp., were isolated from canvas cloth exposed to sea water in Bombay. The cultures were screened for cellulase production in eight different media. Enzyme kinetic studies were carried out on the most active isolate, *Aspergillus niger*, using carboxymethyl cellulose and pure cellulose as substrates. The action of this culture and its filtrate on purified cotton was studied.

Publications

The following papers were sent for publication under this project :

1. Cellulolytic Activity of Marine Fungi, by A. J. Desai and S. M. Betrabet. *Current Science*, **40**, 423-426 (1971).
2. Marine Cellulolytic Microflora of Bombay, by S. M. Betrabet and K. Kasturi. *Labdev. J. Sci. & Tech.* (under publication).
3. Cellulase Activity of Micro-organisms Isolated from Cotton Deteriorated During Storage in Indian Mills, by A. J. Desai and S. M. Betrabet. *Ind. J. Bioch & Biophy.* (under publication).

11. Effect of Swelling and Decrystallizing Treatments on the Strength-Length Gradiant of Cottons in Relation to Changes in Structural Parameters

Ten of the selected samples which had been separately swollen with 98 per cent and 70 per cent ethylenediamine (EDA), were tested for bundle strength and elongation at 0, 1, 2, 3.2, 4 and 6 mm gauge lengths, using the Instron Tensile Tester.

The X-ray diffraction photographs were taken using parallelised bundles of the control as well as treated cottons. The 40 per cent X-ray angle was calculated by analysing the intensity along the 002 arc of the diffraction patterns.

Average number of structural reversals was determined for ten of the cottons selected for different treatments. The following observations were made from the statistical analyses of the data :

(*i*) There was a significant correlation between 40 per cent angle and bundle strength at zero gauge length of control samples. The value of correlation coefficient decreased with increasing gauge length, the same becoming non-significant at 6 mm gauge length.

(*ii*) There was no significant correlation between 40 per cent angle and bundle strength at any gauge length of samples swollen with 25 per cent NaOH.

(*iii*) Correlation between 40 per cent angle and bundle strength at different gauge lengths was significant in the case of samples treated with 98 per cent EDA.

(*iv*) Bundle strength at any gauge length was not significantly correlated with 40 per cent angle in the case of samples swollen with 70 per cent EDA.

(*v*) Structural reversals were not found to be significantly correlated with percentage fall in bundle strength (from 0 to 3.2 mm g.l.).

(*vi*) Degree of imperfection was not significantly correlated with 40 per cent angle.

12. Physico-chemical and Structural Properties of Gamma-ray Irradiated Cellulose in Relation to Some Other Oxycelluloses

Cellulose samples were irradiated with gamma-rays to four more intermediate dosages, viz. 1.87×10^7, 2.67×10^7, 3.49×10^7 and 4.09×10^7 bringing the total number of samples to 10 to cover the range from 1×10^5 to 1×10^8 roentgens.

The copper number of these oxycelluloses ranged from 0.6548 to 33.58. The copper number values were slightly reduced (0.5850 to 31.26) when the samples were refluxed with distilled water for one hour. When the samples were oxidized with chlorous acid, the copper number values were reduced further, the range being 0.3873 to 16.34. On treatment with sodium borohydride, there was a considerable decrease in the copper number values and the range was 0.1178 to 4.46. The values of tenacity and elongation of these oxycelluloses decreased with increasing dosages of gamma-rays, while those of copper number and alkali solubility increased with the dosage. The moisture regain did not show any definite trend.

Conditions have been standardized for the preparation of oxycelluloses by the action of specific oxidizing agents, viz. (*i*) sodium metaperiodate, (*ii*) potassium dichromate in sulphuric acid, and (*iii*) potassium dichromate and oxalic acid, to produce oxycelluloses oxidized to the same extent as those produced by the irradiation of cotton cellulose with gamma-rays (the extent of oxidation determined by the value of copper number).

13. Investigations on the Untwisting/Twisting Behaviour of Cotton Fibres in Water

A large number of fibres from Giza cotton were initially allowed to untwist in water and dried subsequently in air. During their withdrawal from water and drying in air, the free ends of fibres were constrained from executing any rotations. It has already been reported that fibres collected in above manner possess an appreciably low number of convolutions. The breaking load and elongation at break of these fibres, using 1 cm gauge length, were measured on the Instron Tensile Tester. It was observed that the results were the same as those obtained for normal fibres from Giza cotton. It may, therefore, be inferred that internal stresses in a fibre, caused by convolutions, do not at all disappear when the latter are removed or reduced in number without altering the fine structure. The effect of drying conditions on the twisting behaviour of a fibre when it is taken out of water was also studied. For this purpose tests were performed under two conditions of drying, viz. (*i*) 27°C, 65 per cent R.H. and (*ii*) 27°C, 98 per cent R.H. The water soaked fibre did not twist back and exhibit rotations when exposed to the latter atmospheric conditions, whereas it did so rapidly under the former conditions. This indicates that the fraction of water escaping from the fibre (and causing the latter to twist back) may be very small and can leave the fibre at a very fast rate even at 27°C and 65 per cent R.H.

14. Investigations on the Transformation of Cellulose I to Cellulose II Brought About by Swelling Cotton Fibres in Aqueous Solution of Caustic Soda

The new Philips X-ray generator with diffractometer attachment was received and installed during the period. Work was taken up on the choice of parameters, such as the mass of specimen, its density of packing and instrumental constants, etc., with a view to standardise conditions for recording x-ray intensity using the diffractometer. Standards of crystalline and amorphous cellulose were prepared for use in determing the crystallinity of cotton fibres. The amorphous cellulose was prepared by ball-milling cotton fibres in a specially fabricated stainless steel

chamber. The work on establishing a method for measuring the crystallinity of raw as well as mercerised cottons is in progress. Samples already prepared under the project will be analysed shortly for their cellulose I and II contents.

15. Studies on the Changes in the Shape of Cotton Fibres due to Different Chemical Treatments

During the period under report, investigations were carried out on the effect of temperature of alkali solution on the cross-sectional shape of cotton fibre under slack as well as stretch conditions. Cotton fibres were treated with 30 per cent NaOH at different temperatures, viz. 0° (approx.), 20°, 40°, 60°, 80° and 100°C, separately, both under slack and stretch conditions. It was observed that the changes in the cross-sectional shape of cotton fibre treated under slack and stretch conditions, were of the same order. Moreover, the circularity of the cross-sectional shape of cotton fibre decreased progressively with the increase in temperature of alkali solution, irrespective of whether the treatment was carried out under slack or under stretch condition.

The cross-sectional shape of cotton fibre of 20 cottons (five cottons from each of four botanical species) having maturity level of 75 per cent were determined and classified into round, elliptical and flat shapes. The results obtained are given in Table 9:

TABLE 9 : PERCENTAGE OF FIBRES WITH DIFFERENT CROSS-SECTIONAL SHAPES

Species	Round	Elliptical	Flat
G. arboreum	40·5	48·0	11·5
G. herbaceum	34·8	51·5	13·7
G. barbadense	18·2	65·3	16·5
G. hirsutum	15·3	67·6	17·1

It was observed that old world cottons, i.e. *G. arboreum* and *G. herbaceum*, had higher percentage of round fibres than the new world cottons, i.e. *G. barbadense* and *G. hirsutum*.

15. Study of Evenness of Material at Different Stages of Processing with Different Systems of Processing

The purpose of this study is to assess the evenness of yarn spun on four different spinning systems, viz. (*i*) 3-roller, (*ii*) A-500 casa, (*iii*) SKF and (*iv*) GX-2. For this purpose the following cottons were selected and spun to the counts mentioned against them on each of the four systems : Kalyan and V.797—20s count ; Sanjay and L.147—30s count ; and Laxmi (Gadag)—40s count. Tests were carried out using the Uster Evenness Tester for determination of the irregularity of the material at different stages as well as of yarns spun on the above four systems. Simultaneously, single thread strength and lea strength were also deter-

mined for these yarns. The work will be continued on other yarns of finer count ranges and the results analysed after testing sufficient number of samples.

In addition, as a modification of the work on influence of length parameters on yarn irregularity, a study on the relationship between the long term variations and different fibre length parameters was undertaken. Thirty yarns of 30s count were tested on Uster Evenness Tester at inert position. The coefficient of lea weight variation was also determined. The work is in progress.

17. Standardization of Imperfection Tests

In order to standardise the Uster Imperfection Indicator, 10 cottons were spun to 20s and 30s count and the number of thin places, thick places and neps were determined for each sample exhausting the entire yarn in each bobbin. It was observed that the number of thin places was more than both the number of thick places as well as neps. All the imperfections were more for 30s count than for 20s count. A detailed analysis of the data is being carried out.

Further, a study was undertaken to find out the relationship between the visual assessment of yarn (yarn gradation index) and Uster values (U%), number of thin and thick places, neps, etc. Thirty cottons were selected and spun to 20s and 30s counts for the above study. The visual examination for 15 samples was completed. Data on other yarn properties (single thread and lea strength) were also collected.

18. Study of the Spinning of Mixings of Different Cottons

A number of mixings of different cottons have been prepared and spun. The yarns have also been tested. The data are under analysis.

19. Effect of Different Systems of Processing on the Spinning Performance of Superior Quality Cottons

Three Indian cottons, viz. Sujata, MCU.4 and MCU.5, and six foreign cottons for the purpose of comparison, have been procured. Preliminary tests on Sujata have been completed. Further work is in progress.

20. Study of Yarn Strength for Different Counts in Relation to Chief Fibre Properties

For this study, the test results of all the samples tested during 1970 were collected. The data comprised of the test results on 246 samples spun to 20s count, 44 samples spun to 30s count and 282 samples spun to 40s count. Since it is proposed to study which of the fibre properties contribute most to the yarn strength at each of the counts, the data were grouped into different CSP ranges, with a class interval of 50. The average values of the mean fibre length, micronaire fineness and tenacity at zero gauge length of all the samples falling in each CSP range were calculated. These were plotted on a graph to have an idea of their relationship with CSP. It was observed that generally in the case of samples spun to 30s and 40s, an increase in mean fibre length showed a corresponding increase in CSP. The effect of micronaire fineness was noticeable only in the case

of 30s and an increase in CSP corresponding to an increase in fibre bundle strength was noticed in the case of 20s count only. Further analysis is being continued.

21. Adaptation of Micronaire Instrument for the Determination of Fibre Weight per Unit Length of Very Coarse Desi Cottons

During the period under report, statistical analysis was carried out to assess the relationship of micronaire values obtained by using a plug of 60 grains and the normal pressure of 6 lb./sq. in. (psi) and by using a plug of 50 grains under a reduced pressure of 4 psi with the value of fibre weight obtained by the gravimetric method on 60 coarse *desi* cottons.

It was observed that the degree of association between the micronaire values obtained under the first condition (60 grains sample weight and pressure of 6 psi) and the corresponding gravimetric fineness values was extremely poor. However, by employing the alternate method (50 grains sample weight and pressure of 4 psi) it was found that there was highly significant correlation ($r = +0.844$) between the micronaire values of the coarse cottons and fibre weight obtained by gravimetric method. The following regression equation was worked out connecting the two measures of fineness, viz. $\mathbf{y} = 1.35\,\mathbf{x} + 1.6048$, where, **y** is the fibre weight obtained by gravimetric method and **x** is the micronaire value.

The final report of this research investigation is under preparation.

22. Determination of Balls Sorter Equivalent Values of Mean Fibre Length of Cotton for Different Values of 2.5% Span Length and Uniformity Ratio of the Digital Fibrograph

During the year under report, statistical analysis was carried out on the test data on 4,025 samples for which fibre length values on Balls Sorter and Digital Fibrograph had already been determined. The cottons studied under this investigation covered a wide range in mean fibre length from 0.60 in. to 1.40 in.

For purposes of analysis, the cottons were divided into three length groups on the basis of mean fibre length obtained on the Balls Sorter, to study the effect, if any, of the length relationships in different length ranges. The results of the simple correlations obtained between Balls Sorter mean length and 2.5% span length and the respective regression equations for prediction purposes are given in Table 10.

TABLE 10 : SIMPLE CORRELATION COEFFICIENTS AND REGRESSION EQUATIONS BETWEEN BALLS SORTER MEAN LENGTH (1) AND 2·5% SPAN LENGTH BY DIGITAL FIBROGRAPH (L)

	Number of cottons tested	Simple correlation coefficient	S.E. of estimate	Regression equation
For cottons with mean length below 0·85 in.	341	0·925	0·024	1=0·811 L + 0·0924
For cottons with mean length 0·85 in. to 1·14 in.	3,184	0·952	0·024	1=0·756 L + 0·1769
For cotton with mean length exceeding 1·14 in.	500	0·949	0·027	1=0·787 L + 0·1338
For all cottons	4,025	0·980	0·026	1=0·821 L + 0·0950

The degree of accuracy of the prediction equations evolved from the present study was checked by using the above equations in respect of four calibration cottons supplied by the USDA. The various values obtained are given in Table 11.

TABLE 11 : PREDICTED VALUES OF MEAN LENGTH FROM 2·5% SPAN LENGTH VALUES EMPLOYING THE GENERAL EQUATION

USDA calibration sample	USDA calibrated values		Predicted values of Balls Sorter mean length from 2·5% span length (in.)
	2·5% span length (in.)	Corresponding mean length (in.)	
Short staple	0·88	0·80	0·82
Medium staple	1·05	0·97	0·96
Long staple	1·18	1·08	1·06
Extra-long staple	1·30	1·15	1·16

The mean length values obtained using the equation agree closely with the calibrated values.

An article based on the results of this research investigation has been published in the Indian Textile Journal, December, 1971, issue.

23. Studies on the Influence of Fibre Length and Strength Parameters on Spinning Performance

During the year under report, experimental evaluation of span length measurements on the Digital Fibrograph and fibre bundle strength measurements at both zero and 1/8 in. gauge lengths, with percentage elongation at break on the Stelometer, were carried out on 52 more samples of cotton, widely varying in fibre and yarn characteristics, in addition to 68 samples already tested.

For purpose of this analysis, the test samples were grouped according to fineness values, with a class interval of 0.5 μg/in., so that the effect of variability in fineness on spinning performance is restricted. The association of the various fibre characteristics of these cottons to skein CSP values at 30s and 40s count of the respective yarns was studied by correlation analysis. Simple correlation coefficients of some of the fibre properties, which are significantly related to yarn CSP values at the two count levels, are given in Table 12.

It will be observed that all length measurements obtained either by the Sorter technique or on Fibrograph are significantly correlated to CSP of the yarn at 30s and 40s counts. However, span length at 50 per cent appeared to be marginally superior in this respect to other length parameters. Among the length distribution measurements, those obtained on the Balls Sorter, viz. irregularity percentage or coefficient of length variation, were non-significant in relation to yarn CSP values, whereas similar parameters obtained with the Digital Fibrograph were showing significant association with the latter. The new fibre quality

factor, termed 'Effective Uniformity Index', was consistently superior to Uniformity Ratio in this aspect. Bundle strength values at the conventional zero gauge test length had only poor correlation with the yarn property in most cases, whereas strength measurements at the finite gauge length of 1/8 in. were correlated to a highly significant measure. The values of strength uniformity, an index of the rate of retention of bundle strength at 1/8 in. gauge as compared to the strength at zero gauge, were also found to be significantly correlated to spinning performance.

TABLE 12 : SIMPLE CORRELATION COEFFICIENTS BETWEEN SKEIN CSP VALUES AT 30s COUNT (†40s COUNTS)

Fibre properties	Fineness range			
	(3·0-3·4μg/in.)	(3·5-3·9μg/in.)	(4·0-4·4μg/in.)	(4·5-4·9μg/in.)
Number of samples	30	44	27	19
Mean length	0·4836** (0·4221)*	0·5774** (0·5437)**	0·6901** (0·7222)**	0·5463** (0·6158)**
2·5% span length	0·5007** (0·4697)**	0·5545** (0·5104)**	0·5783** (0·6128)**	0·5326** (0·6191)**
50% span length	0·5717** (0·4786)**	0·6235** (0·5895)**	0·7069** (0·7456)**	0·6659** (0·7270)**
Uniformity ratio	0·3732* (0·2517)	0·3507* (0·3468)**	0·5783** (0·6048)**	0·5236** (0·4972)*
Effective uniformity index	0·4475* (0·3288)*	0·4248** (0·4161)**	0·6406** (0·6690)**	0·6198** (0·6079)**
Bundle strength (1/8" gauge)	0·6564** (0·6225)	0·6605** (0·6285)**	0·6038** (0·6291)**	0·6436** (0·7267)**
Strength uniformity	0·3844* (0·3730)*	0·4740** (0·3715)*	0·4059** (0·4264)**	0·6475** (0·6601)**

* Significant at 5%.
** Significant at 1%.
† Figures in brackets indicate corresponding values of correlation coefficients for 40s counts.

The results indicate that span length measurements on the Digital Fibrograph, with a suitable length distribution parameter, combined with strength measured at 1/8 in. gauge, will explain, to a good measure, the contributory factors of fibre quality influencing the spinning behaviour of cotton.

24. Fabrication of a New Fibre Stapler

A gadget has been made for the measurement of fibre length parameters by a new technique. This technique involves the measurement of the thickness of an aligned tuft of cotton fibres held between tweezers, by an optical interference device.

Twentyfour samples of cotton covering a range of mean length from 0.65 in. to 1.01 in. were tested by the new technique and the results compared with those obtained by the Baer Sorter method. The parameters compared were mean length and short fibre (S.F.) content, i.e. fibres shorter than half the effective length.

The correlation coefficients between the two methods were 0.98 and 0.80 for the mean length and the S.F. per cent, respectively. The regression equations were :

$$L_I = 0.96\ L_B \quad .. \quad .. \quad .. \quad (1)$$

$$S_I = 0.78\ S_B + 0.16 \quad .. \quad .. \quad .. \quad (2)$$

where L and S are the mean length and the S.F. content, and the suffixes $_I$ and $_B$ denote the Interferometric and the Baer Sorter methods, respectively.

Further work for improving the device is in progress.

25. Study on the Quality of Cotton Samples from Different Entomological Trials

The object of this study is to evaluate the difference in quality of cotton lint from plants treated with different insecticides in relation to the quality of cotton lint from untreated plants.

Seventeen samples of 1968-69 season and 32 samples of 1969-70 season of Sujata variety received from the IARI Regional Research Station, Coimbatore, and nine samples of MCU.5 variety of 1970-71 season received from the Agricultural College, Coimbatore, were tested for various fibre properties.

The results of samples from 1968-69 season did not show any significant change in the properties due to treatments except that the bundle strength was considerably high in the case of the treatment with carbaryl + sulphur. Further, the differences in properties of samples from two frequencies of spraying were not significanct.

The results of 1969-70 season samples also did not show any marked difference in any of the fiber properties, either due to different treatments or due to different frequencies of the treatments.

However, all the treated samples gave a better trend of fibre properties than the untreated ones.

The results of nine samples of 1970-71 season of Sujata variety are being analysed.

25. Investigation of the Breaking Behaviour of Cotton Fibres Conditioned at Standard Humidity (65 per cent R.H.) and Tested and Various Ambient Humidity Levels

Five cotton varieties (USDA check cottons) covering a strength range of 6 to 9 lb./mg were chosen for the study. The slivers prepared were pre-dried over anhydrous calcium chloride and conditioned at 65 per cent R.H. over saturated solution of sodium nitrite. The strength tests were made on each cotton using the Pressley Tester at an ambient humidity of about 36 per cent R.H. The tests were started as soon as sliver was exposed to this atmosphere. A test consisted

of five breaks and the combined weight of the five broken tufts was immediately determined on a torsion balance. The 2nd, 3rd and 4th tests were carried out in close succession using the fibres from the same sliver. The bundle strength values obtained from successive tests showed a progressive decrease on account of continual dehydration of the fibres. The values were compared with the control value obtained in a test atmosphere of 65 per cent R.H. for each cotton. The five cottons chosen for the study have so far been tested only at one ambient humidity (36-38 per cent R.H.) besides at the control, 65 per cent R.H.

A tentative conclusion from the data is that if strength tests are made within 20 minutes of exposure of conditioned (65 per cent R.H.) fibres to an atmosphere of humidity as low as 36 per cent R.H., the Pressley Strength Index is not significantly different from the control value (at 65 per cent R.H. test atmosphere). More detailed work will be carried out at a number of ambient humidity levels above and below 65 per cent R.H., after the Aerosol apparatus (for maintaining constant humidity) is set up in working order.

27. Studies in the Physical Characteristics of Cotton Blends

Samples of two cottons, Badnawar 1 and C. Indore 2, widely differing in micronaire value but having practically similar values for the other fibre properties were blended in five proportions 100 : 0, 75 : 25, 50 : 50, 25 : 75 and 0 : 100. The blends were passed through scutcher, carding, drawing and canfed roving and spun on the S.K.F. ring frame into three counts. Fibre properties of the card sliver of each blend were determined and the yarns were also tested.

Tests on further samples will be carried out.

III. Publications

During the period, two Technological Reports, five Research Publications, two Articles and two Annual Reports were published, and 63 Technological Circulars were issued. Further, six Articles were sent for publication and two Articles contributed for being presented at conferences. The details are given below :

A. Technological Reports

No. 9. Technological Report on Trade Varieties of Indian Cottons, 1969-70 Season.

No. 10. Technological Report on Standard Indian Cottons, 1969-70 Season.

B. Research Publications (C.T.R.L. Publication — New Series)

No. 23. Cellulolytic Activity of Marine Fungi, by A. J. Desai and S. M. Betrabet (Reprinted from *Current Science*, August 20, 1971, issue).

No. 24. Influence of Some Fibre Length Parameters on Yarn Irregularity, by A. V. Ukidve, V. Sundaram and P. G. Oka (Reprinted from *Textile Digest*, September, 1971, issue).

No. 25. Formation and Reactions of Radiation Induced Free Radicals in Chemically Modified Cotton, by P. K. Chidambareswaran, V. Sundaram and Jai Prakash (Reprinted from *Journal of Polymer Science*, September, 1971, issue).

No. 26. Recent Development on Microbial Degradation of Cellulosic Textiles and Its Prevention, by A. J. Desai and S. N. Pandey (Reprinted from *Journal of Scientific and Industrial Research*, November 1971, issue).

No. 27. Accurate Estimation of Mean Fibre Length of Cotton, by C. A. S. Aiyar, Smt. S. B. Pai and S. G. Nayar (Reprinted from *The Indian Textile Journal*, December, 1971, issue).

C. Articles and Papers

(*a*) *Published*

1. Cottonseed — A Valuable Agricultural Product, by S. N. Pandey (Published in June, 1971, issue of *Indian Farming*).

2. Flammability and Flame-resistant Finishing of Cotton Textiles, by S. N. Pandey (Published in July-August, 1971, issue of *Textile Machinery Accessories and Stores*, Bombay).

(*b*) *Sent for Publication*

1. Study on Cottonseeds from Different Stages of Growth, by S. N. Pandey.

2. Studies on Cellulolytic Micro-organisms. Part III : Marine cellylolytic microflora of Bombay, by S. M. Betrabet and K. Kasturi.

3. Optimum Size of Skein for Determination of Strength and Linear Density of Cotton Yarn in Metric System, by V. Sundaram, S. Ramanathan and R. L. N. Iyengar.

4. A Critical Assessment of Various Methods of Fibre Length Measurement, by V. Venugopalan, R. L. N. Iyengar and V. G. Munshi.

5. Studies on Cellulolytic Micro-organisms. Part IV : Cellulose activity of micro-organisms isolated from cotton deteriorated during storage in Indian mills, by A. J. Desai and S. M. Betrabet.

6. Cotton Ginning in India : Problems Encountered and Some Recommendations, by V. Sundaram and D. G. Shete.

(*c*) *Contributed at Conferences*

1. Effect of Mercerisation on Yarn Irregularity, by A. V. Ukidve, V. Sundaram and P. G. Oka (Contributed to 13th Joint Technological Conference Sponsored by BTRA, SITRA and ATIRA — since postponed due to national emergency).

2. Quality Improvement of Cotton in India, by V. Sundaram and P. G. Oka (Contributed to All India Seminar on Cotton organised by Andhra Pradesh Agricultural University — since postponed due to national emergency).

D. Annual Reports

1. Annual Report of the Cotton Technological Research Laboratory for the Calendar year 1969.

2. Annual Report of the Cotton Technological Research Laboratory for the Calendar Year 1970.

E. Technological Circulars

1. Nos. 68 to 84 on Standard Indian Cottons.

2. Nos. 1654 to 1699 on Trade Varieties of Indian Cottons.

Standard Indian Cottons

S.C. No.	*Variety*	*S.C. No.*	*Variety*
	1969-70 Season		
68	Laxmi (Maharashtra)	69	K.6
	1970-71 Season		
70	H.14	78	Digvijay
71	Buri 147	79	V.797
72	AK.277	80	Gujarat 67
73	MCU.2	81	Gaorani 22 (Maharashtra)
74	Sanjay	82	Jayadhar
75	320F	83	Deviraj (Mysore)
76	LSS	84	AK.235
77	Deviraj (Gujarat)		

Trade Varieties of Indian Cottons

T.C. No.	*Variety*	*T.C. No.*	*Variety*
	1969-70 Season		
1654	Westerns	1656	Gaorani 22 (Mysore)
1655	Suyodhar		
	1970-71 Season		
1657	MCU.2 (Summer)	1679	Gujarat 67 (Idar)
1658	C. Indore 1	1680	Gujarat 67 (Anjar)
1659	Bengal Desi (Punjab)	1681	Badnawar 1
1660	Bengal Desi (Ganganagar)	1682	Deviraj (Nagar)
1661	H.14 (Haryana)	1683	LSS
1662	Buri 147 (Vidarbha)	1684	Digvijay (Palej)
1663	Laxmi (Baramati)	1685	320F
1664	V.797	1686	L.147 (Adilabad)
1665	Laxmi (Raichur)	1687	Sanjay (Botad)
1666	Digvijay (Dabhoi)	1688	AK.235
1667	Wagad (Saurashtra)	1689	Deviraj (Mysore)
1668	Jayadhar (Hubli)	1690	Digvijay (Kapadvanj)
1669	Laxmi (Gadag)	1691	Westerns 1 (Mysore)
1670	Y.1 (Jalgaon)	1692	Buri 1007 (Vidharba)
1671	Virnar (Khandesh)	1693	Sea Island Andrews (Mysore)
1672	Gaorani 6 (Bhainsa)	1694	Narmada
1673	AK.277	1695	Sanjay (Maharashtra)
1674	Deviraj (Manavadar)	1696	Khandwa 1
1675	U.P. Desi	1697	216F (Tamil Nadu)
1676	Kalyan	1698	Laxmi (Tamil Nadu)
1677	MCU.5	1699	K.6
1678	Sea Island Andrews (A.P.)		

IV. Extension

This Laboratory has no farm attached to it and no field work is carried out directly under its own charge. All the field work is carried out at various agricultural research stations in the States and the samples of the improved cotton strains evolved under various research projects are tested for quality characteristics at the headquarters of the Laboratory as well as at the regional stations maintained under its charge. This Laboratory does not directly deal with the farmers but indirectly helps them through the State Departments of Agriculture. Further, the Technological Circulars issued on Trade Varieties of Cotton are useful to the growers, the trade and the industry inasmuch as these Circulars indicate the quality of the commercially grown crop.

The Laboratory also renders considerable assistance to those engaged in cotton trade, to other Government and Civic Organisations, etc., by undertaking tests on samples received from these organisations, by imparting training in cotton technology and by supplying some useful testing instruments.

Testing Work

Apart from the research samples received from various agricultural stations, this Laboratory continued to receive a number of samples of cotton, yarn and cloth for special tests, from commercial firms and Government and semi-Government organisations. Such samples were tested on payment of the prescribed fees. The number of such samples received for various tests during the year 1971, together with the corresponding figures for 1970 and for the quinquennia 1960-65 and 1966-70 are given in Table 13.

TABLE 13 : NUMBER OF SAMPLES RECEIVED FOR PAID TESTS

Type of test	Average for the quinquennium		1970	1971
	1960-65	1966-70		
Spinning	52	14	18	6
Fibre (E.I.C.A.)*	148	68	63	84
Fibre (Others)	155	81	46	56
Yarn	168	109	74	55
Cloth	158	81	44	58
Moisture	933	75	78	164
Miscellaneous tests	16	21	24	13
Total	1,630	449	347	436

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

The total test fees realised during 1971 for carrying out tests on these samples amounted to Rs. 7,376 against Rs. 9,864 during 1970.

Apart from the usual tests of routine nature, some of the special investigations carried out during the year under report are listed below :

1. One sample of rubberised canvas was tested for strength, both warp-way and weft-way.
2. Two samples of Goat Hair patties were received for moisture test.
3. Four samples of sewing thread of high tenacity were received for single thread strength test.
4. Two samples of cotton fish net twine were received to determine actual counts, single thread strength and C.V. of strength, twist of the cord and plied yarn.
5. A few samples of absorbent cotton wool were received and tested for determination of fibre length and convolutions.

Training Facilities

The Laboratory is conducting two training courses each of two months' duration, for persons employed in Cotton Trade and Co-operative Marketing Societies, one for those in Bombay city and the other for those coming from mofussil centres. During the year, the following eight students were selected and given training in fibre tests and elements of statistics :

1.	Shri P. V. Patel ..	Rajprakash Spinning Mills Ltd., *Bombay.*
2.	Shri Sumermal Nahata ..	Bharatiya Udyog Sangh, *Bombay.*
3.	Shri K. J. Thakker ..	M/s. Khimji Damji & Co., *Bombay.*
4.	Shri V. P. Chitrakar ..	The Vidarbha Co-operative Marketing Society Ltd., *Achalpur.*
5.	Shri Y. S. Dantwala ..	M/s. Bhaidas Cursondas & Co., *Bombay.*
6.	Shri Basavaraj Andanur ..	Andanur Channaveerappa Kotrabassappa, *Davangere.*
7.	Shri A. V. Kalyanaraman ..	District Agricultural Officer (Marketing), *Tiruppur.*
8.	Shri K. N. Ghungrudkar ..	Directorate of Marketing & Inspection (Head Office), *Faridabad.*

Supply of Equipments

The following instruments were fabricated and supplied :

1.	Laboratory Model Gins (Electrically operated)	25	
2.	Laboratory Model Gins (Hand operated)	1	
3.	G.P. Balances	20	
4.	A.N. Stapling Apparatus	1	
5.	Quartz Micro-Balances	5	
6.	Halo Length Discs (Small size)	24	
7.	Halo Length Discs (Large size)	32	
8.	Halo Length Cards	299	
9.	Steel Combs	159	
10.	Lint wire pans (for G.P. Balances)	7	

V. Conferences and Symposia

The Director and/or other Scientific Officers of the Laboratory participated in the following scientific and technical conferences and meetings connected with the work of this Laboratory during 1971 :

Conference/Meeting	*Place*	*Date & Month*
Field Day Celebrations of IARI Regional Research Station	Coimbatore	8th January
40th Meeting of TDC:1 for Physical Methods of Test (ISI)	Bombay	21st January
Meeting at IARI to Discuss Strategy on Application of Results of Research for Increasing Cotton Production	New Delhi	9th February
12th Joint Technological Conference (BTRA)	Bombay	16th and 17th February
SASMIRA 6th Technological Conference	Bombay	22nd to 24th February
Joint Meeting held at the Directorate of Cotton Development on Intensive Area Development Programme on MCU.5 and Sujata	Bombay	1st March
North Zone Workshop Meeting of AICCIP	New Delhi	1st and 2nd April
VIIth Meeting of the Indian Cotton Development Council	Bombay	15th May
5th All India Workshop of Cotton Research Workers (AICCIP)	Dharwar	2nd to 4th June
ICAR Society Annual Meeting and Special Meeting	New Delhi	19th June
ICAR Advisory Board Meeting	New Delhi	21st June
Joint Meeting of the Directors of CSWRI, Avikanagar, JTRL, Calcutta and CTRL, Bombay	Bombay	26th and 27th June
Meeting of the Scientists of ICAR Projects on Technology of Oil Seeds, Oil and Scientific Panel for Agricultural Sciences Technology	New Delhi	1st and 2nd July

Conference/Meeting	*Place*	*Date & Month*
41st Meeting of TDC: 1 (ISI)	Bombay	14th September
Meeting of the Small Group for Drawing up a Draft Strategy to Evolve Cotton Varieties which Give the Best Response to Chemical Treatment for the Improvement of Easy-care Characteristics, Held at CTRL	Bombay	12th October
Discussion between Textile Commissioner and Directors of Cotton Textile Research Institutions Regarding Projects to be Submitted for Being Financed by International Institute for Cotton	Bombay	22nd October
Meeting called for by Secretary (Agriculture) at ICAR to discuss ICAR Bill	New Delhi	25th October
20th Meeting of TDC (ISI)	New Delhi	24th November
Directors' Meeting (ICAR)	New Delhi	30th and 31st December

VI. Summary of the Report

This is the forty-eighth Annual Report of the Laboratory and pertains to the year 1971.

The research activities and the testing work progressed satisfactorily as in the past. During 1971, the Laboratory continued to serve the needs of the State Departments of Agriculture in the authoritative evaluation of the qualities of the improved cotton strains evolved at various cotton research centres and was a co-ordinating centre on Cotton Technology under the All India Co-ordinated Cotton Improvement Project. The scheme for modernisation and expansion of the Laboratory made some headway and a part of the new machinery for the spinning work has been installed. Further procurement of other equipments is under way.

During the financial year 1970-71 a sum of Rs. 15.24 lakhs was actually spent against a sanctioned grant of Rs. 15.39 lakhs leaving only Rs. 0.15 lakh unutilised. Further, out of a sanctioned grant of Rs. 1.95 lakhs for modernization and strengthening of the Cotton Technological Research Laboratory for intensive research on cotton, an amount of Rs. 0.44 lakh was spent, showing a saving of Rs. 1.51 lakhs which amount could not be utilised due to non-materialisation of purchases of equipment. Apart from this, an expenditure of Rs. 1.24 lakhs was incurred on Technological Schemes (including projects financed from P.L.480 funds) against the sanctioned grant of Rs. 1.26 lakhs, leaving an amount of Rs. 0.02 lakh unutilised.

Various research investigations on the cotton quality evaluation, basic research, better utilisation of cotton and by-products were undertaken. The progress made in the important research investigations during 1971 is indicated briefly below :

1. During 1971, about 3,700 samples of cottons were received for tests, more than half of which were from trials under the All India Co-ordinated Research Project on Cotton. The test results were sent to the officers concerned as quickly as possible. The results of tests on the Co-ordinated Project samples were made available for consideration at the respective zonal workshop meetings. The nine regional units of the Laboratory continued to assist the Cotton Breeders and Specialists of the States concerned by carrying out fibre tests on the samples of improved strains in their initial stages. The results of tests on 46 Trade Varieties and 17 Standard Cotton samples were issued in the form of Technological Circulars immediately after the tests were completed. Mill tests were arranged on 16 samples of improved varieties and their respective controls to confirm their comparative performance at the Laboratory.

Under the All India Co-ordinated Research Project on Cotton, a number of improved strains were found promising in respect of several aspects including fibre quality. During the year, Hybrid 4, Khandwa 2 and 3943 were recommended for release. Some of the other promising strains were :

North Zone (Haryana, Punjab and Rajasthan) :
A.218, H.275, H.297, RS.83, RS.89, PS.9, PS.10, PS.16, SS.167 and SS.265.
Central Zone (Gujarat, Madhya Pradesh and Maharashtra) :
IAN.579(188), IAN.579(1456), B.59-1684, 66BH.5/55, 66BH.5/91, 66BH.25/60, DHY.286, MCU.5, Sujata, IBSI, N.28, 3200 and 3943/1879.
South Zone (Andhra Pradesh, Mysore and Tamil Nadu) :
A.56, EL.0162, EL.031, ELS.117, ELS.139, L.1143EM and 0078F.

2. With a view to increasing the consumption of cotton in cotton-polyester blends, so as to reduce the dependence on imported cottons, studies have been initiated for blending superior quality Indian cottons, viz. Sujata, MCU.4, MCU.5, Hybrid 4, IAN.579 and Gujarat 67, with Terene in the proportions of 33 : 67, 50 : 50 and 75 : 25. The yarns spun from blends of Sujata and Terene polyster fibre were under test.

3. During the period, 26 seed samples of different varieties were tested for seed weight, oil content, protein content and gossypol. Twentynine seed samples were tested for kernel content. The highest and the lowest values for different properties are indicated below along with the varieties :

Property	Highest (%)	Lowest (%)
Oil content	MCU.5-gl (3)—21·60	S.I. Andrews—15.10
Linter content	II/16-5-5-gl—14.57	AK.235—3·91
Kernel content	Sujata—63·36	Wagad—50·03
Protein content	72-gl—43·48	Mungari—28·48
Gossypol content	Laxmi—1·87	Glandless Types—Negligible

4. MCU.3 cotton fibres were treated with 28 per cent ammonia solution at 7°C under tension as well as slack conditions and with different concentrations of orthophosphoric acid and sulphuric acid at various temperatures. There was no appreciable difference in tensile strength due to ammonia treatments. In the case of samples treated with orthophosphoric acid, moisture regain and iodine absorption increased with concentration while viscosity decreased. Samples treated with higher concentrations of sulphuric acid showed higher moisture regain.

5. From a study of the gamma-ray irradiation of phosphorylated samples, it was observed that the tenacity retained increased slightly in the initial stage but decreased with further dosage, while the copper number and water solubility increased with dosage. The acetylated cotton samples of varying degrees of sub-

stitution were studied for the nature and behaviour of free radicals formed during irradiation by e.s.r. spectroscopy. It was observed that :

(*i*) the yield of acetyl radicals increased with increase in degree of substitution of acetyl group when irradiated at 77°K but was adversely affected when irradiated at 300°K

(*ii*) dehydrogenation and deacetylation appeared to be responsible for free radicals formation at 77°K.

(*iii*) the presence of peroxy-radicals was indicated.

These radicals are of great interest as they may be utilised for imparting various chemical finishing treatments to cotton.

6. Studies on the cell-wall structure of American *G. hirsutum*, Indian *G. hirsutum* and *G. herbaceum* species indicated that even though the American *G. hirsutum* cottons have total void or intermicellar space of the same order as that of *G. herbaceum* cottons, they are more crystalline and have larger pore size as compared to *G. herbaceum* cottons. On the other hand, *G. herbaceum* cottons, with larger perimeters and less number of convolutions, have more amorphous region, but with smaller size of micropores as compared to the American *G. hirsutum* cottons. Experimental work was carried out to see the effect of drying temperature on the gross and fine structure of cotton fibres.

7. Cellulolytic micro-organisms were isolated from samples of cotton deteriorated during storage in mills from different parts of India. In all, 14 bacteria, 4 streptomyces and 12 fungi were isolated. *Penicillium funiculosum* among fungi and *Streptomyces virides* among streptomyces were highly cellulolytic and were subjected to enzyme kinetic studies. From micro-organisms in sea water, 29 bacteria, 9 streptomyces and 19 fungi were isolated. Study on the microbial degradation of cotton under storage and under marine conditions was completed and several highly cellylolytic cultures have been isolated. Work on production of cellulase enzyme is in progress.

8. For studying the effect of swelling and decrystallising treatments on the strength-length gradient of cotton in relation to changes in structural parameters, 10 samples of cotton, swollen separately in 98 per cent and 70 per cent EDA, were tested for bundle strength and elongations at different gauge lengths. The 40 per cent x-ray angle was significantly correlated with bundle strength at different gauge lengths when the samples were treated with 98 per cent EDA, but not when treated with 70 per cent EDA or 25 per cent NaOH.

9. Cellulose samples irradiated with gamma-rays to dosages of 1.866×10^7, 2.667×10^7, 3.489×10^7 and 4.089×10^7 were analysed. Their copper number ranged from 0.6548 to 33.58. The values of tenacity and elongation of these oxycelluloses decreased with increasing dosages of gamma-rays, while the copper number and alkali solubility values increased with the dosage. Conditions have been standardised for the preparation of oxycelluloses by the action of specific oxidizing agents to produce oxycelluloses oxidized to the same extent as those produced by the irradiation of cotton cellulose with gamma-rays.

10. Further investigations on the untwisting/twisting behaviour of cotton fibres in water showed that internal stresses in a fibre caused by convolutions do not at all disappear when the convolutions are removed or reduced in number

without altering the fine structure. Tests on drying conditions showed that the water escaping from the fibre while drying, although small, can leave at very fast rate even at 27°C and 65 per cent R.H.

11. For undertaking investigations on the transformation of Cellulose I to Cellulose II brought about by swelling cotton fibres in acqueous solutions, standards of crystalline and amorphous cellulose were prepared for use in determining the crystallinity of cotton fibres. Work on establishing a method for measuring the crystallinity of raw as well as mercerised cottons is in progress.

12. The cross-sectional shape of the cotton fibres treated with alkali at different temperatures was studied and it was observed that the changes in the cross-sectional shape of the cotton fibre treated under slack and stretch conditions were of the same order and the circularity decreased progressively with the increase in temperature of alkali. Among different species of cotton, it was observed that *G. arboreum* and *G. herbaceum* cottons had higher percentage of round fibres than *G. barbadense* and *G. hirsutum* cottons.

13. In order to study the evenness of material at different stages of processing with different systems of processing, five cottons were spun on four different systems, viz. 3 roller, A 500 Casa, S.K.F. and GX-2; of these, two cottons were spun into 20s count, two cottons into 30s count and one cotton into 40s count. The yarn samples are being tested for Uster U per cent, number of thick and thin places and neps. The samples are also being examined visually.

14. In order to compare the properties of yarns produced by spinning mixings of different types of cottons, a number of mixings of different cottons had been prepared and spun into different counts. The yarns have been tested. The test results are being analysed.

15. To study the relationship between the fibre properties and the yarn strength at different counts, the test results of the samples tested during 1970 were being analysed. A preliminary analysis indicated that generally in the case of samples spun to 30s and 40s, an increase in mean fibre length showed a corresponding increases in CSP; the effect of micronaire fineness was noticeable only in the case of 30s and that of fibre bundle strength in the case of 20s count only.

16. In order to adopt the micronaire instrument for determining the fibre weight per unit length of very coarse *desi* cottons, two different methods one using a 60 grains of cotton witht he normal pressure of 6 lb./sq. in. and another using 50 grains of cotton under reduced pressure of 4 lb./sq. in. were used to obtain micronaire values of 60 coarse cottons. It was observed that the latter method gave values close to the gravimetric values.

17. On the basis of test results on 4,025 cotton samples, an equation for the estimation of the Balls Sorter equivalent values of fibre length from the 2.5 per cent span length values obtained on the Digital Fibrograph was arrived at as follows : $l = 0.821\ L + 0.095$; where l stands for Balls Sorter mean length and L stands for the 2.5 per cent span length.

18. For studying the influence of the fibre length and strength parameters on spinning performance, the test results on 120 samples of cotton belonging to four different groups of fineness, spun in 30s and 40s count were analysed. It was observed that the fibre length values were correlated highly with the CSP value for 30s and 40s counts ; among the fibre length parameters, the 50 per cent span length value was marginally superior. The effective uniformity index

was showing better association with the CSP than the uniformity ratio. Similarly, bundle strength values at 1/8 in. gauge was better associated with the CSP than those at zero gauge.

19. A new gadget to measure the fibre length using an optical interference has been fabricated and it has been found to give satisfactory values. Further modifications to facilitate easier operation, etc., are being made.

20. To examine the effect of insecticidal treatments on the quality of cotton, a few samples of Sujata and MCU.5 from Coimbatore were tested for fibre properties. It was observed that the frequency of treatments did not show any significant difference in the quality and there was no significant change in the fibre properties between the treated and untreated cottons except in the case of the treatment with carbaryl + sulphur which increased bundle strength.

21. Experiments were conducted to investigate the breaking behaviour of cotton fibres conditioned at standard humidity and tested at various ambient humidity levels. Preliminary tests so far carried out indicate that if strength tests were carried out within 20 minutes of exposure of conditioned fibres to an atmosphere of a humidity as low as 36 per cent R.H., the value obtained is not significantly different from that determined under standard conditioned atmosphere.

22. In order to study the physical characteristics of cotton blends, samples of Badnawar 1 and C. Indore 2, which differ in micronaire value but have other fibre properties practically the same, have been blended in the proportions 100 : 0, 75 : 25, 50 : 50, 25 : 75 and 0 : 100 and spun into yarns of different counts. Further tests are in progress.

Publications

During the year, two Technological Reports, five Research Publications, two Articles and two Annual Reports were published and 63 Technological Circulars issued. Further, six Articles were sent for publication and two Articles contributed for being presented at conferences.

Training

During the year, training courses for persons employed in the Cotton Trade and Co-operative Marketing Societies, etc., were conducted and eight persons completed the course successfully.

Fabrication and Supply of Instruments

There was continued demand for the instruments fabricated at the Laboratory. During the year, 25 Laboratory Gins (Electric model), one Laboratory Gin (Hand operated), 20 Ginning Percentage Balances, one A.N. Stapling Apparatus, five Quartz Micro-Balances, 56 Halo Length Discs, 299 Halo Length Cards, 159 Steel Combs and seven Lint Wire Pans (for G.P. Balances) were supplied to interested parties.

VIII. Personnel

Under the Fourth Five Year Plan Scheme for Modernisation and Strengthening of the Cotton Technological Research Laboratory for Intensive Research on Cotton, Dr. S. M. Betrabet, Senior Scientific Officer (Microscopy), was appointed on *ad hoc* basis to the post of Senior Scientist (Microscopy), in the pay scale of Rs. 1100-1400 with effect from the 13th January, 1971, for a period of six months. Thereafter, his appointment on merit prometion in a supernumerary post of Senior Scientist in the scale of pay of Rs. 1100-1400, created with effect from the 1st January, 1969, was continued. Dr. N. B. Patil, Senior Scientific Officer, was appointed to the higher post of Senior Physicist in the scale of pay of Rs. 1100-1400, with effect from the 5th October, 1971, Dr. K. R. Krishna Iyer, Junior Scientific Officer, to the post of Junior Physicist in the scale of pay of Rs. 400-950, with effect from the 4th August, 1971, and Shri H. V. Tamhankar, Senior Research Assistant (Electrical), to the post of Junior Engineer in the scale of Rs. 400-950, with effect from the 5th August, 1971.

The following Research Assistants were promoted to the posts of Senior Research Assistant :

Shri E. S. Abraham with effect from the 1st April, 1971.

Shri K. R. Kamath with effect from the 10th August, 1971.

Shri P. K. Jairam with effect from the 11th November, 1971.

Dr. A. J. Desai, Senior Research Assistant (Microbiology), holding the post of Junior Microbiologist on *ad hoc* basis resigned his post at the Laboratory for better prospects and was relieved on the afternoon of the 12th October, 1971.

Smt. S. P. Bhatawdekar, Research Assistant, was appointed to the post of Senior Research Assistant (Biochemist) on *ad hoc* basis with effect from the 1st May, 1971.

Shri V. G. Khandeparkar was appointed to the post of Senior Research Assistant (Microbiology), on *ad hoc* basis, for the period 15th November to the 31st December, 1971.

Seven Research Assistants were recruited during the year, of whom three were on *ad hoc* basis, as per particulars given below :

S. No.	*Name*	*Date of appointment*	*Nature of appointment*
1.	Shri P. K. Bhatnagar	1-9-1971	Regular
2.	Shri Tula Ram (at Sriganganagar)	-do-	-do-
3.	Kum. H. B. Dwivedi	-do-	-do-
4.	Shri S. K. Saha	8-10-1971	-do-
5.	Kum. Pratibha S. Kulkarni	11-10-1971	*Ad hoc*
6.	Shri P. P. Govindan	-do-	-do-
7.	Shri N. Venkataramani	16-11-1971	-do-

Among the seven Research Assistants mentioned above, Kum. Dwivedi was relieved on the 16th November, 1971, to enable her to take up appointment under the Textiles Committee, Bombay. The *ad hoc* appointments of Kum. Kulkarni and Sarvashri Govindan and Venkataramani, were terminated on the 27th December, 1971.

Shri C. A. S. Aiyer, Senior Research Assistant, retired from the services of the Laboratory from the 19th July, 1971, after a long and successful career of over 31 years. Shri R. C. Sankalia, Research Assistant, Surat, retired from the service of the Laboratory from the 18th May, 1971, after a service of over 25 years.

Shri P. N. Elayathu, Senior Research Assistant, was relieved on resignation of the post, on the 11th October, 1971, afternoon.

Kum. T. T. Annamma, Research Assistant, was relieved on transfer to a similar post in the Central Institute of Fisheries Technology, Cochin, with effect from the 1st April, 1971.

Shri M. S. Sitaram, Senior Research Assistant, Dharwar, was transferred to a similar post at the main Laboratory at Bombay and Shri E. S. Abraham, Senior Research Assistant at the Laboratory, was transferred to Dharwar in his place, with effect from the 2nd August 1971.

VIII. Appendices

APPENDIX I

FINANCIAL STATEMENT

Expenditure and Receipts of the Laboratory during 1970-71

A. Expenditure

	Sanctioned grant (Rs.)	Actual expenditure (Rs.)	Savings (—) Deficit (+) (Rs.)
I. *Technological Research*			
Technological Research Laboratory including outstations (Non-Plan)			
(*a*) Capital expenditure including expansion of Laboratory	2,86,700	2,80,265	(—) 6,435
(*b*) Working expenses	12,52,700	12,43,479	(—) 9,221
Total	15,39,400	15,23,744	(—) 15,656
II. *Scheme for Modernisation and Strengthening of CTRL for Intensive Research on Cotton (Plan)*	1,95,000	44,060	(—) 1,50,940
III. *Technological Schemes including P.L.480 Projects*	1,25,972	1,24,179	(—) 1,793

B. Receipts

	Rs.
Sale Proceeds of Goods, Products Fabricated/Manufactured by the Institute	64,936
Sale Proceeds of Fruits, Vegetables, Plants, Seedlings, etc.	160
Analytic and Testing Fees	8,534
Rent	18,763
Fees for Training, Application Fees, etc.	2,800
Sale of Publications	1,498
Miscellaneous Receipts (including sale of waste cotton)	35,866
Foreign Service Contribution	4,760
Total	1,37,317

APPENDIX II

Scientific and Technical Staff Working at the Cotton Technological Research Laboratory as on the 31st December, 1971

Director	Dr. V. Sundaram, M.Sc., Ph.D., A.R.I.C., F.T.I.
Senior Microscopist	Dr. S. M. Betrabet, M.Sc., Ph.D.*
Senior Physicist	Dr. N. B. Patil, M.Sc., Ph.D.*
Senior Spinning Technologist	(Vacant)*
Senior Scientific officer (*Spinning*)	Shri R. P. Neogi, B.Sc., B.Sc. (Tech.) (Manch.), A.M.C.T. (Eng.)
Senior Scientific Officers	Dr. V. G. Munshi, M.Sc., Ph.D. On deputation for training at the University of Leeds under Colombo Plan, for 9 months from the 21st September, 1971)
	(Two posts vacant)
Junior Spinning Technologist	Shri B. Srinathan, B.Sc. (Text.)
Junior Physicists	Shri P. G. Oka, M.Sc.**
	Dr. K. R. Krishna Iyer, M.Sc., Ph.D.*
Junior Engineer	Shri H. V. Tamhankar, L.M.E., L.E.E.*
Junior Ginning Technologist	(Vacant)*
Junior Microbiologist	(Vacant)*
Junior Biochemist	(Vacant)*
Junior Quality Evaluation Officer	(Vacant at Surat)*
	(Vacant at Coimbatore)*
Junior Scientific Officer (*Chemistry*)	Dr. S. N. Pandey, M.Sc., Ph.D. (On deputation for training at the University of Leeds under Colombo Plan for 9 months from the 21st September, 1971)
-do- (*Statistics*)	Shri G. S. Rajaraman, M.A.
-do- (*Chemistry*)	Kum. I. G. Bhatt, M.Sc.
-do- (*Physics*)	Shri P. K. Chidambareswaran, M.Sc.
-do- (*Testing*)	(Vacant)
Senior Research Assistant (*Ginning*)	Shri D. G. Shete, L.M.E.
-do- (*Statistics*)	Shri K. Venkateswaran, B.A.
-do- (*Electrical*)	(Vacant)
-do- (*Spinning*)	Shri K. S. Bhyrappa, L.T.T.
	Shri S. Raghupathi, D.T.T.
	(One post vacant)*

Senior Research Assistant	(*Microbiologist*)	Shri V. G. Khandeparkar, M.Sc.
-do-	(*Physics*)	(Two posts vacant)*
-do-	(*Biochemist*)	Smt. S. P. Bhatawdekar, M.Sc. (on *ad hoc* basis)
-do-	(*Chemistry*)	(Vacant)*
Instrumentation Foreman		(Vacant)*

Senior Research Assistants (*Testing*)

Shri S. Ramanathan	Shri S. G. Nayar, B.Sc., L.L.B.
Smt. Vatsala Iyer, M.Sc.*	Shri A. Rajgopalan, B.Sc.
Shri M. S. Sitaram, B.Sc.	Shri A. V. Ukidve, M.Sc.
Smt. S. B. Pai, B.Sc. (Hons.)	Shri B. M. Petkar, B.Sc.
Smt. K. L. Datar, B.Sc.	Shri Radha Ballabha, M.Sc.**
Shri S. R. Ganatra, B.Sc.	Shri K. R. Kamath, B.Sc.
Shri A. W. Shringarpure, B.Sc.*	Shri P. K. Jairam, B.Sc.

Research Assistant	(*Statistics*)	Shri K. Chandran, B.A.
		(Two posts vacant)
-do-	(*Spinning*)	Shri N. K. Haridas, D.T.T.
-do-	(*Workshop*)	Shri H. R. Laxmi Venkatesh, D.T.T.
-do-	(*Workshop*)	Shri M. L. Sounkariya, D.M.E.

Research Assistants (*Testing*)

Shri N. Thejappa, B.Sc.
Kum. I. K. P. Iyer, B.Sc.
Smt. S. D. Pai, B.Sc.
Shri A. K. Gupta, B.Sc. (Hons.)
Shri G. S. Patel, B.Sc.
Smt. J. K. S. Warrier, B.Sc.
Shri T. K. M. Das, B.Sc.
Shri V. Jose Joseph, B.Sc.
Shri K. Vijayan, M.Sc.
Shri P. Bhaskar, M.Sc.
Shri G. Varadraj Rao, M.Sc.
Smt. P. Nair, M.Sc.
Shri C. R. Sthanu Subramoni Iyer, B.Sc.
Shri K. V. Anantha Krishnan, B.Sc.
Kum. R. R. Nayak, B.Sc.
Kum. S. R. Jage, B.Sc.
Shri G. Viswanathan, B.Sc.
Shri V. B. Suryanarayanan, B.Sc.
Shri G. F. Sulaiman Hussain, M.Sc.
Kum. C. R. Raje, M.Sc.
Shri B. S. Ganvir, B.Sc.
Shri P. K. Bhatnagar, M.Sc.
(Six posts vacant)

Regional Stations

Station	*Senior Research Assistant*	*Research Assistant*
Coimbatore	Shri S. K. Iyer, B.A.	Smt. S. V. Nayar, B.Sc.
		Shri C. P. Venugopalan, B.Sc.**
Dharwar	Shri E. S. Abraham, B.Sc.	Shri I. H. Hunsikatti, B.Sc.
Hissar	Shri S. N. Nagwekar, B.Sc.**	—
Indore	Shri N. C. Chiplonkar, M.Sc.	Shri S. K. Saha, B.Sc.
Ludhiana	—	Shri Ram Parkash, B.Sc.
Nanded	Shri W. R. Sharma, B.Sc.	Shri S. P. Ingole, M.Sc.
		Shri E. Kesavan Kutty, B.Sc.**
Nandyal	Shri R. Dwarkanath, B.Sc.	Shri Y. Subrahmanyam, M.Sc.**
Sriganganagar	Shri A. K. Antony, B.Sc.**	Shri Tula Ram, B.Sc. (Hons.)
Surat	Shri L. R. Jambunathan, B.Sc., A.M.I.E.T.	Shri S. S. Iyer, B.Sc.**
		Shri M. C. Bhalod, B.Sc.**
		(One post vacant)

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** Under the All-India Co-ordinated Cotton Improvement Project.