TECHNOLOGICAL LABORATORY

INDIAN CENTRAL COTTON COMMITTEE

ANNUAL REPORT

OF THE

DIRECTOR

TECHNOLOGICAL LABORATORY

FOR THE

YEAR ENDING 31st MAY, 1965

PRICE Rs. 4.

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FORTY FIRST ANNUAL REPORT OF THE DIRECTOR, TECHNOLOGICAL LABORATORY—MATUNGA

FOR THE YEAR ENDING 31ST MAY, 1965.

INTRODUCTORY SUMMARY

This is the Forty First Annual Report of the Technological Laboratory and deals with the work done during the year 1964-65. It is gratifying to record that the Laboratory continued to render valuable service to the Cotton Breeders and other research workers besides making considerable progress in the expansion and modernisation programme of the Laboratory, as will be borne out by the details presented below.

It will be noted from the figures given in Table 1 (page 3) that the number of samples received for all tests during the year under review was 4,902 as against 5,761 during the previous year. It may be recalled that the Indian Central Cotton Committee at its meeting held in September, 1963, recommended that the number of samples submitted for spinning tests at the Laboratory by the Cotton Breeders should be reduced and it was suggested that the Director might circulate a technical note on the subject to the Cotton Breeders indicating at what stage and what type of samples should be subjected to actual spinning tests so that the breeder could use his discretion in keeping the number of samples for spinning tests to a minimum. Action was taken accordingly. The reduction in the number of samples received during the year under report and delay in their receipt may be partly due to this. Besides there is a fall of about a thousand samples in the number of samples received for moisture tests. However, the total number of samples received during this year is round about the normal number that can be expected to be handled annually. The total number of samples received from the State Departments of Agriculture for full spinning, micro-spinning, fibre and standard tests was 2,648. out of which the number received for micro-spinning tests alone was 1,746.

The work done on these samples is summarised in Table 2 (page 4) from which it will be seen that during the year under review, 3,772 samples were tested as against 5,261 last year. However, 2,640 samples were spun, tested and reported against 2,896 samples last year and 601 reports comprising the results of 3,772 samples were issued during the year as against 800 comprising the results of 5,261 last year. The cause for the reduction in the number of samples tested and reported is, as already mentioned, the fall in the number of samples received, particularly for moisture tests, besides late arrival of samples during this season. The Cotton Breeders were, as usual, provided with the technological data of more number of properties on their samples early in the season in accordance with the scheduled programme.

It will be noticed from the figures given in Table 7 (page 8) that 575 samples were received in the Testing House of the Laboratory from commercial and Government bodies as against 1,524 samples during last year, the reduction being in the number of samples received for moisture tests.

During this year, mill tests were arranged to be carried out on 33 samples of improved varieties from various States, including their controls, and reports were sent to the concerned Officers.

As mentioned in the last report, the research activities mainly on structural, development and agronomic aspects of the fibre were continued. Several investigations were completed and bulletins on them were published and some more are under publication.

The Laboratory continued to participate in the calibration programme of the United States Department of Agriculture for Micronaire and Pressley Strength tester. The proposal made by the Indian Central Cotton Committee for enrolling itself as a member of the International Calibration Cotton Standards Committee was pursued with the Government of India. After the Indian Central Cotton Committee is formally admitted as a member of the International Cotton Calibration Committee, the Technological Laboratory can be sponsored by it as a designated Laboratory. A similar calibration programme for the Technological Assistants posted at the breeding stations in India was continued during the year.

A project for the "Investigation of the microbial decomposition of cellulose with special reference to the effect of Indian bacterial organisms on cotton and cotton fabrics, to provide basic information for the improvement of cotton products" which was approved both by the U.S.D.A. and the Government of India under the P. L. 480 programme and which was put into operation from January, 1963 is functioning satisfactorily. A second project, viz., "Investigation of the preparation of radio-resistant and radio-sensitive celluloses to obtain basic information on the chemistry of cotton cellulose" has also been approved and the grant agreement signed on behalf of the Government of India. The actual work on this project, however, could not be started as the posts sanctioned under the scheme have yet to be filled. A third project on "The effects of high energy radiation on the induction and half-life of excited, free and/or ionised radicals in cotton cellulose," which was prepared by the United States Department of Agriculture and offered for investigation at this Laboratory under the same programme is under the consideration of the Government of India.

The construction of a new block in connection with the expansion and modernisation of the Laboratory was completed, and the ginning and the Fibre Testing Sections have been shifted to the new building. However, in the absence of provision of controlled atmosphere in the testing rooms it has not been possible to give effect to the programme of expansion and modernisation of the Laboratory. Further, while a large part of the spinning machinery has arrived, some machinery pertaining to the intermediate stages of processing are yet to be received. The Government of India is being repeatedly requested to expedite the sanction for the installation of the controlled atmosphere and for the grant of import license for the remaining machinery.

The work of the Laboratory during the period under review, is described in detail in the following pages.

II. TESTING WORK

1. GENERAL

Table 1 gives the number of samples received at the Laboratory for various tests under different heads during the year, together with the corresponding figures for the previous two years and averages for 3 five-year periods for purposes of comparison :—

TABLE 1—NUMBER OF SAMPLES RECEIVED

Type of sample	Average			1962-63	1963-64	1964-65
	1948-53	1953-58	1958-63			
1. Agri. Dept. Strains :						
(*a*) Full Spg. tests ..	807	728	896	880	735	638
(*b*) Micro Spg. tests ..	..	1,081	2,101	2,160	1,903	1,746
(*c*) Fibre tests alone	128	325	322	3	346	247
2. Standard cotton samples	17	20	21	26	21	17
3. Trade variety samples ..	37	41	74	79	88	89
4. Technological Research samples	63	135	277	74	907	1,434
5. Commercial samples (Tested on payment) :—						
(*a*) Spinning tests ..	68	89	61	38	49	37
(*b*) Fibre tests ..	110	161	166	130	157	138
(*c*) Yarn tests ..	188	233	240	178	95	123
(*d*) Cloth tests ..	115	390	218	189	129	111
(*e*) Moisture tests ..	5	168	1,013	1,175	1,077	150
6. Fibre tests for E.I.C.A. ..	@	@	116	130	174	132
7. Miscellaneous ..	151	157	50	41	80	40
Total	1,689	3,528	5,555	5,103	5,761	4,902

@ Included under item 7.

It will be seen from the figures given in the above Table that the total number of samples received during the period was 4,902, which is 15% less than that received last year.

Table 2 gives the number of samples tested at the Laboratory for various types of tests under different heads during the period under review together with the corresponding figures for the previous two years.

TABLE 2—NUMBER OF SAMPLES TESTED AND REPORTED

Type of test	1961-62	1962-63	1963-64	1964-65
Full Spinning	926	929	1,101	883
Micro Spinning	2,029	2,194	1,874	1,731
Fibre tests alone	471	299	597	440
Yarns tests	171	185	92	124
Cloth tests	170	195	130	107
Moisture tests	1,471	955	1,257	120
Technological Research	432	252	147	316
Miscellaneous	19	28	63	51
Total	5,689	5,037	5,261	3,772

It will be noted that 3,772 samples were tested during this year as against 5,261 last year, the reduction being mainly in the moisture tests, and due to the late receipt of samples this season.

Table 3 gives the number of test reports, classified under various categories, issued during the period together with the corresponding figures for the previous two years and for the five year periods, 1948-53, 1953-58, and 1958-63.

TABLE 3—NUMBER OF REPORTS ISSUED

Type of report	Average			1962-63	1963-64	1964-65
	1948-53	1953-58	1958-63			
Spinning test	220	328	432	489	531	416
Fibre test	73	104	116	81	94	52
Yarn test	109	92	105	77	50	55
Cloth test	56	189	102	83	68	59
Moisture test	3	11	31	25	44	8
Miscellaneous	2	9	7	7	13	11
Total	463	733	793	762	800	601

As will be seen from the above table, the total number of reports issued during the period is 25% less than the number issued last year. This is mainly due to the reduction in the number of samples received and late receipt of samples, as mentioned above.

2. SPINNING SECTION

Tables 4 and 5 give the distribution of samples and counts spun, tested and reported at the Laboratory during the year together with the corresponding figures for the previous two years and the recent three quinquennia.

TABLE 4—NUMBER OF SAMPLES SPUN, TESTED AND REPORTED

State	Average			1962-63	1963-64	1964-65
	1948-53	1953-58	1958-63			
Maharashtra	429	1,038	1,547	849	725	706
Gujarat				847	895	818
Mysore	—	80	383	337	300	319
Madras	94	120	57	59	104	117
Uttar Pradesh	29	84	194	256	256	166
Madhya Pradesh	113	232	147	118	218	123
Punjab	61	110	89	159	67	44
Rajasthan	2	35	30	27	28	35
Andhra Pradesh	@	70	125	107	103	103
Kerala	—	—	84	251	—	3
Bihar	—	—	10*	10	51	6
Others	18	53	15	10	5	21
Total	746	1,822	2,681	3,030	2,752	2,461
Standard cottons	18	21	22	29	19	20
Trade tests	233	213	225	119	119	81
Technological Research ..				45	6	78
Grand Total	997	2,056	2,928	3,223	2,896	2,640

* For 1962-63 only. @ Included in Madras State.

TABLE 5—NUMBER OF YARNS SPUN, TESTED AND REPORTED

State	Average			1962-63	1963-64	1964-65
	1948-53	1953-58	1958-63			
Maharashtra	728	1,508	2,478	1,380	1,078	1,084
Gujarat				1,317	1,487	1,374
Mysore	—	153	664	473	432	541
Madras	198	236	122	85	176	189
Uttar Pradesh	71	169	324	384	356	205
Punjab	112	221	155	248	129	257
Madhya Pradesh	154	338	286	186	317	122
Rajasthan	—	12	59	42	66	75
Andhra Pradesh	@	48	168	153	156	145
Kerala	—	—	98	251	—	3
Bihar	—	—	16*	16	60	12
Others	443	499	29	30	5	25
Total	1,706	3,184	4,399	4,565	4,262	4,032
Standard cottons	115	139	112	88	114	120
Trade tests	753	564	480	310	345	233
Technological Research ..				152	18	128
Grand Total	2,574	3,887	4,991	5,115	4,739	4,513

* For 1962-63 only. @ Included in Madras State.

These Tables show that the number of samples and yarns spun, tested and reported during the year were slightly less than those of last year.

3. FIBRE TESTING SECTION

The number of samples tested for fibre properties under different categories in the current year together with the corresponding figures for the previous two years and average for the period 1948-53, 1953-58 and 1958-63 for purposes of comparison are given in Table 6 which shows that during the period under review, fibre tests were made on 1,579 samples, against 1,610 samples tested last year.

TABLE 6—NUMBER OF SAMPLES TESTED FOR FIBRE PROPERTIES

Type of sample	Average			1962-63	1963-64	1964-65
	1948-53	1953-58	1958-63			
Agricultural (Large)	475	701	851	836	925	795
„ (Small) ..	190	447	835	287	239	269
Standard cottons	17	22	21	24	21	22
Trade Variety Cottons ..	197	315	340	72	64	59
Commercial (Paid tests) ..				154	173	156
East India Cotton Association				130	174	132
Technological Research ..	58	72	36	9	11	144
Ginning Investigations ..	64	51	28	28	—	—
Miscellaneous	27	24	20	11	3	2
Total	1,028	1,632	2,131	1,551	1,610	1,579

4. TESTING HOUSE

The Testing House of the Laboratory continued to receive a large number of samples of all types for various tests showing the usefulness of the Institution to the industry and the trade. Table 7 shows the number of samples received during the period under review. It will be seen from the figures that the total number of samples received during the year was 575 which is considerably less than 1,524 received during the previous year, the reduction mainly being in the moisture test samples, as already mentioned.

TABLE 7—NUMBER OF SAMPLES RECEIVED (TESTING HOUSE)

Type of sample	Average			1962-63	1963-64	1964-65
	1948-53	1953-58	1958-63			
Spinning tests	68	89	61	38	49	37
Fibre tests	110	161	166	130	157	138
Yarns tests	188	233	240	178	95	123
Cloth tests	115	390	218	189	129	111
Moisture tests	5	168	1,013	1,175	1,077	150
Miscellaneous tests	6	29	22	15	17	16
Total	492	1,070	1,720	1,725	1,524	575

It is gratifying to note that various Commercial and Government organisations are continuing to take advantage of the facilities offered by the Testing House for getting authoritative and technical reports on many items. Some of these are individual merchants, manufacturing concerns, foreign Government departments, Central and State Government departments, Bombay Municipal Corporation, etc.

The test fees received for carrying out the various tests on all the samples tested during the year amounted to Rs. 16,695/- as against Rs. 32,154/- during the last year.

5. GINNING SECTION

Most of the work done in the section during the year under report is described under the head "Research Investigations—summary of the work in progress" and an outline of the chief items are given below :

A leaflet on the Pre-cleaning and ginning tests on Digvijay cotton was written up for publication. The fabrication of an extractor was continued and good progress has been made in this work. About 16 trade varieties of 1963-64 season and about 30 varieties of 1964-65 season were ginned and their ginning percentages determined. Besides, about 330 small samples obtained from the agronomic and other experiments were ginned in the Laboratory gin and their ginning percentages determined. The work of erection and installation of pre-cleaning and ginning machinery in the new block is being executed.

Theoretical and practical training in cotton cleaning and ginning technique was imparted to six African trainees sponsored by the Uganda Government, under the special Commonwealth African Assistance Programme. A lecture on the Ginning and Processing and its relationship to Textile properties was delivered at the Laboratory by the Senior Research Assistant (Ginning) to the service personnel in the cotton Marketing.

He attended the meetings of the survey committee constituted for the study of facilities available for Ginning and Pressing of cotton in Madhya Pradesh and gave them the required help. He was also deputed for giving training in roller ginning to gin fitters and other technical staff at the Central Mechanised Farm Suratgarh, and adjusting their gins correctly. Besides, he gave guidance to a local firm in Bombay entrusted with the fabrication of Laboratory gins and 12 gins supplied by them during the period under report were tested and despatched to different cotton breeding and marketing centres.

6. SOME IMPORTANT TEST RESULTS.

Although the results contained in the test reports, mentioned earlier, were mainly intended for the Cotton Breeders and other research workers who had sent the samples, a few of them deserve particular mention, being of general interest. These are described below :

A. Agricultural Samples

(a) **Maharashtra**

(1) *Mill test on improved varieties:*

Mill and Laboratory tests were carried out on samples of A. K. 235, A. K. 277 and Virnar. Their results are given below :

Place	Variety	Mill test				Lab. test			
		Waste %	Count	Str. (lbs)	t.m.	Waste %	Count	Str. (lbs)	t.m.
Akola	A. K. 235	13·2	30s	86·7	4·1	12·8	20s	88·0	4·0
Buldana	A. K. 277	10·3	20s	88·4	4·0	13·8	20s	98·2	„
„	Virnar	10·9	20s	69·9	4·1	15·3	20s	89·1	„

A. K. 277 from Buldana gave better spinning performance than Virnar this year also. This sample had a mean fibre length of 0.88 inches and a P.S.I. of 9.1. According to Laboratory tests, it was adjudged suitable for spinning to 30s.

t. m. = twist multiplier.

(2) *Y.* 1, *C. J.* 73, *A. K.* 235 *and A. K.* 277 *at four places :*

Samples of Y. 1, A. K. 235 and A. K. 277 were received for tests from four places viz. Jalgaon, Nanded, Buldana and Badnapur and those of C. J. 73 from Jalgaon, Buldana and Badnapur. Their average test values are given below :—

	Mfl. (in)	Mic. Value	Millitex	M.C.	P.S.I. (lb/mgm.)	H.S.C.
Y. 1	·92	5·0	198	·82	9·5	32s
C. J. 73	·92	4·9	193	·81	9·0	33s
A.K. 235	·91	4·9	193	·80	8·7	32s
A.K. 277	·90	5·0	198	·80	9·2	31s

It is observed that all the four varieties have got more or less the same fibre properties and gave the same spinning performance.

(3) 331, *H.* 1, *H.* 2, *H.* 4, *A. K.* 235 *and A. K.* 277 *:*

Samples of these varieties had been received from several places in Maharashtra such as Yeotmal, Nagpur, Buldana, Akola, Shegaon, Asalgaon, Nandura, and Nimbala. Their average test results are given below :

	Mfl. (in)	Mic. Value	Millitex	M.C.	P.S.I. (lb/mgm.)	H.S.C.
331	·91	5·1	201	·81	8·9	32s
H. 1	·90	4·9	192	·80	8·3	30s
H. 2	·91	4·9	192	·79	8·7	33s
H. 4	·90	4·9	192	·81	8·8	32s
A.K. 235	·90	5·2	203	·81	8·8	31s
A.K. 277	·91	5·1	201	·81	8·3	28s

It is noted that all these varieties have nearly the same fibre characteristics and all of them except A. K. 235 have given almost the same spinning performance.

M f l. = Mean fibre length
Mic. value = Micronaine value
M. C. = Maturity coefficient
P. S. I. = Pressley Strength Index
H. S. C. = Highest Standard Count

(4) *New improved strains from Achalpur :*

Three improved strains viz. 56/23, 1007 and 107/221 with Buri 147 as control sample were tested for fibre properties and spinning performance. While all the samples were more than 1-1/16", both 56/23 and 1007 gave good spinning performance, spinning to above 50s. Their performance in later seasons will be watched.

(b) Gujarat

(5) *Mill test on improved varieties :*

(i) Mill tests were carried out this season on Kalyan and 797 from Kadi and on Kalyan, 797 and 597-B from Dhanduka. Their comparative test results at the mill and the Laboratory are given below :

		Mill test				Lab. test			
Variety	Place	Waste %	Count	Str. (lbs)	t.m.	Waste %	Count	Str. (lbs)	t.m.
Kalyan	Kadi	17·4	30s	51·3	4·4	20·6	30s	48·0	4·0
797	„	18·6	30s	52·2	4·1	19·8	30s	51·6	4·0
Kalyan	Dhanduka	17·5	30s	50·3	4·1	15·4	30s	46·8	4·0
597-B	„	20·2	30s	49·4	4·5	18·6	30s	52·6	4·0
797	„	20·9	30s	57·8	4·0	18·1	30s	53·3	4·0

The performance of 797 at the mill is better than that of Kalyan only for Dhanduka Samples.

(ii) Mill tests were also carried out on two samples of 199 from Bardoli. Their test results are as follows :

		Mill test				Lab. test			
Variety	Place	Waste %	Count	Str. (lbs)	t.m.	Waste %	Count	Str. (lbs)	t.m.
199	Bardoli	13·8	30s	54·5	4·0	15·8	30s	55·7	4·0
„	„	16·2	30s	60·7	4·0	11·3	30s	57·4	4·0

Both the samples of 199 have given satisfactory performance at the mill for the last two seasons.

(iii) Two samples of I. S. C. 67, one from Vanthali and another from Dhansura were tested at the mill and the Laboratory. Their mill test results are as follows :

Variety	Place	Mill test				
		Waste %	Count	Str. (lbs)	t.m.	Combing %
I.S.C. 67	Vanthali	9·0	50s	38·2	4·0	8·5
„	Dhansura	13·3	60s	32·3	3·9	16·7

The mill which tested these samples has observed that the Vanthali sample showed lower tensile values for 40s/50s than those found by the mill on yarns spun for American/Indian Cottons and that the tensile values of the Dhansura sample were also very low.

(iv) Two hybrid samples B.C. 68 x Moco and I.S. C. 67 x Moco were tested along with I.S.C. 67 (Maximisation) sample. These samples were combed by the mill. Their comparative test results at the mill and Laboratory are given below:

Variety	Place	Mill test				Lab. test			
		Waste %	Count	Str. (lbs)	t.m.	Waste %	Count	Str. (lbs)	t.m.
B. C. 68 x Moco	Surat	14·0	60s@	39·4	3·9	16·2	60s†	33·0	4·0
I.S.C. 67 x Moco	„	18·6	60s@	38·3	3·9	18·3	60s†	29·6	4·0
I.S.C. 67 (Max)		10·5	60s@	34·5	3·9	11·6	60s†	26·8	4.0

@ Combed † Carded

The hybrids gave better spinning performance than I. S. C. 67 at the Laboratory as well as the mill. Among the two hybrids, B. C. 68 x Moco gave better spinning performance than I. S. C. 67 x Moco at the Laboratory, while at the mill this superiority was not so pronounced.

(6) *Improved Varieties :*

Samples of 179, 199, 1474, 1567, 631, 2255, 2113, 2162, 92, 11-2, Digvijay and Vijalpa were received for tests from four places in Gujarat State viz. Surat, Achalia, Bardoli and Hansot. Although the improved strains possessed somewhat longer staple length, none of the strains were found to be superior to Digvijay in spinning performance in any of the places.

(7) *Hybrids :*

(a) Samples of B. C. 68 x Moco, I. S. C. 67 x Moco and I. S. C. 67 raised at five different places Surat, Deesa, Mehsana, Chanasma and Pilwai were tested

for their fibre properties and comparative spinning performance. The hybrid samples gave uniformly good performance at all the places.

(b) The hybrids B. C. 68 x S. I., B. C. 68 x Moco, B. C. 68 x Pima, B. C. 68 x Giza and I. S. C. 67 x S. I, I. S. C. 67 x Moco, I. S. C. 67 x Pima, I. S. C. 67 x Giza were tested against B. C. 68 and I. S. C. 67 as controls at Chanasma and Pilwai farms. It was observed that B.C. 68 x S.I., and I.S.C. 67 x S. I. were slightly poorer in spinning performance than the other crosses at both the places.

(c) Mysore

(8) *Mill tests on improved varieties :*

(i) Samples of 3870-IV 1, 4709 and Westerns-1 were tested at the mill and the Laboratory for their comprative performance. Their test results are given below:

		Mill test				Lab. test			
Variety	Place	Waste %	Count	Str. (lbs)	t.m.	Waste %	Count	Str. (lbs)	t.m.
3870-IV 1.	Hagari	20·1	24s	62·7	4·1	18·4	24s	60·2	4·0
4709	,,	19·6	24s	57·8	4·1	18·0	24s	57·0	4·0
Westerns-1	,,	21·6	24s	52·4	4·1	22·8	24s	60·6	4·0

All the three varieties have given more or less the same spinning performance at the Laboratory.

(9) 3870-*IV* 1, 5966-1, 4287-1-4-1 *and Suyodhar :*

These varieties had been raised at a number of places in the State and the samples received from Nargund, Jamkhand, Mudhol, Athani and Bagalkot were tested at the Laboratory. The average test values obtained are given below :

Variety	Mfl. (inch)	Mic. Value	Millitex	M.C.	P.S.I. (lb/mgm)	H.S.C.
3870-IV 1	·85	5·0	197	·81	8·8	31s
5966-1	·86	4·7	186	·79	8·8	34s
4287-1-4-1	·86	4·9	192	·79	8·7	31s
Suyodhar	·85	4·9	192	·80	8·7	34s

It will be seen that the four varieties are almost similar in all the characteristics.

(d) Andhra Pradesh

(10) *Mill test on improved varieties :*

One sample each of 5117 and Westerns-1 were received for tests at the mill and the Laboratory for their performance. Their test results were as follows :

		Mill test				Lab. test			
Variety	Place	Waste %	Count	Str. (lbs)	t.m.	Waste %	Count	Str. (lbs)	t.m.
5117	Raichur	13·9	24s	43·0	4·1	13·9	24s	63·0	4·0
Westerns-1	,,	17·1	24s	50·9	4·0	12·6	24s	60·9	4·0

It will be seen that both the samples have given almost the same spinning performance at the Laboratory.

(e) Madras

(11) *Mill test on improved varieties :*

Two samples, one each of 9978-B-5 and K. 6 from Kovilpatti were tested at the mill and the Laboratory for their performance. This is the second season when these samples are tested at the mill. The test results are given below :

		Mill test				Lab. test			
Variety	Place	Waste %	Count	Str. (lbs)	t.m.	Waste %	Count	Str. (lbs)	t.m.
9978-B-5	Kovilpatti	12·5	30s	60·7	4·3	11·9	30s	56·1	4·0
K. 6	,,	15·4	30s	53·4	4·3	14·8	30s	52·6	4·0

Both the samples gave nearly the same spinning performance in this season also, as observed last year.

(f) Madhya Pradesh

(12) *Mill test on improved varieties :*

Two samples, one each of B-59-1679 and Badnawar-1 from Badnawar were tested at the mill and the Laboratory for their performance. The test results are as follows :—

Variety	Place	Mill test				Lab. test			
		Waste %	Count	Str. (lbs)	t.m.	Waste %	Count	Str. (lbs)	t.m.
B-59-1679	Badnawar	11·2	44s	37·0	4·1	10·1	44s	39·3	4·0
Badnawar-1	,,	12·5	44s	39·9	4·0	11·7	44s	35·2	4·0

Both the samples have given practically the same spinning performance.

(13) *Improved strains from Badnawar and Khandwa ;*

A number of improved strains raised at Badnawar, and Khandwa were received and tested at the Laboratory. The test results of the promising strains which were adjudged suitable to spin above 40s are given below :

Variety	Place	Mfl. (in.)	Mic. value	Millitex	M.C.	P.S.I. (lb/mgm)	H.S.C.
B-59-1679	Badnawar	1·08	4·0	156	·74	8·4	48s
Badnawar-1	,,	1·08	3·5	137	·68	8·5	48s
B-61-1903	,,	1·00	3·2	126	·66	8·1	42s
B-59-1684	,,	1·01	3·0	118	·65	8·3	44s
B-57-969	,,	1·00	3·3	130	·67	7·9	42s
B-61-2005	,,	1·02	2·6	102	·57	8·2	42s
B-61-1896	,,	1·00	3·2	126	·64	7·9	42s
B-59-1557	,,	0·98	3·6	142	·72	7·6	44s
B-59-1546	,,	1·02	3·5	138	·69	7·8	41s
B-56-247	,,	0·96	3·9	154	·74	7·6	43s
B-61-2003	,,	1·02	2·8	110	·59	8·3	47s
Badnawar-I	,,	0·96	3·0	118	·63	8·0	42s
A. 56-347	Khandwa	0·96	4·3	169	·74	8·7	43s
Badnawar-I	,,	0·97	3·9	154	·72	9·2	46s
B. 57-661	,,	1·02	4·3	169	·76	9·0	41s
B. 56-181	,,	1·02	4·4	173	·77	9·2	41s

(g) Rajasthan

(14) *Improved strains from Sriganganagar :*

A number of samples of improved strains were received for tests from Sriganganagar. The test results of the promising strains which were adjudged suitable for spinning above 40s counts are given below :—

Variety	Place	Mfl. (in)	Mic. Value	Millitex	M.C.	P.S.I. (lb/mg)	H.S.C.
L.L. 80	Sriganganagar (V.T.)	1·03	3·4	135	·67	8·6	47s
A. S. 102	,,	1·03	3·2	125	·67	8·5	48s
L. L. 80	,, (D.T.)	0·94	3·5	139	·71	9·4	44s
A.S. 102	,,	0·96	3·6	144	·72	9·1	41s

(h) Punjab

(15) *Mill test on improved varieties :*

During this season, samples of J. 34 and 320F were tested at the mill and the Laboratory for their comparative performance. The test results obtained were as follows :

		Mill test				Lab. test			
Variety	Place	Waste %	Count	Str. (lbs)	t.m.	Waste %	Count	Str. (lbs)	t.m.
J. 34	Ludhiana	n.a.	30s	49·9	4·6	11·0	30s	58·2	4·0
320F	,,	n.a.	30s	50·9	4·6	17·9	30s	60·9	4·0

It will be seen that both the samples have given almost the same spinning performance at the mill.

(16) *Improved strains :*

A number of samples of improved strains evolved at Abohar and Hissar were received for tests at this Laboratory. Test results of samples which were adjusted suitable for spinning above 40s are given below :—

Variety	Place	M.fl. (in)	Mic. Value	Millitex	M.C.	P.S.I. (lb/mg)	H.S.C.
A. 165	Abohar	1·19	3·0	119	·66	8·4	>40s
A. 218	„	1·09	3·9	154	·74	9·5	>50s
A. 214	„	1·15	3·8	148	·74	9·0	41s
A. C. 134	Hissar	1·10	3·5	138	·71	8·8	42s

(i) Uttar Pradesh

(17) *Improved strains :*

A few samples of improved strains evolved at Raya were received for test at this Laboratory. The test results of samples which were adjudged suitable for spinning above 30s are given below :

Variety	Place	M.fl. (in.)	Mic. value	Millitex	M.C.	P.S.I. (lb/mg)	H.S.C.
R. H. 6	Raya	0·88	2·8	112	·61	7·7	34s
M. 4/58	„	0·83	3·2	124	·66	8·9	31s

(j) General

(18) *Samples of different generations :*

A number of samples of different generations of Deviraj, Kalyan, Vijalpa, Sanjay, A. K. 277, A. K. 235, Jayadhar, Suyodhar, Laxmi and M. C. U.1 were received for test at the Laboratory for their comparative performance. It was observed that there was very little difference in the spinning performance of the samples of the different generations of these varieties.

(19) *Results of extra long staple* (1-1/16" *and above*) *cottons :*

The test results of full scale spinning carried out on extra long staple material developed in various States during the 1963-64 season and tested at the Laboratory are given in Table below. This would be of help to the breeders to draw on the material for use in their breeding programme.

Table 8

Results of extra long staple (1-1/16" and above) cottons of 1963-64 season.

Variety	Place of growth	Mean fibre length (mm.)	Mean fibre length (inch)	Fibre weight (Millitex)	Matu-rity Coeffi-cent.	Press-ley str. index (lb/mg)	H.S.C.
I. Maharashtra							
170-Co2	Ambajogai	26·9	1·06	157	0·72	7·0	42s
97-41	Parbhani	31·5	1·24	130	0·65	7·7	>50s
97-63	„	30·5	1·20	146	0·69	7·3	>50s
56-23	Achalpur	26·9	1·06	177	0·75	9·0	>50s
1007	„	27·9	1·10	161	0·77	8·5	>50s
147	„	27·4	1·08	169	0·76	7·8	47s
282	„	26·9	1·06	154	0·74	7·4	43s
1371	„	27·4	1·08	161	0·74	7·9	46s
A. P. Buri	„	28·4	1·12	154	0·73	8·1	44s
Deviraj	„	26.9	1.06	15.7	0.73	7.6	43s
Andrews	Ahmednagar	31·0	1·22	138	0·68	8·1	>50s
II. Gujarat							
I.S.C. 67-582	Talod	28·2	1·11	106	0·61	7·7	36s
I.S.C.-67-583	„	28·4	1·12	106	0·64	8·0	38s
I.S.C-67-5B	„	30·2	1·19	102	0·62	7·4	38s
I.S.C.-67-4A	„	28·4	1·12	110	0·61	7·3	41s
Co-Ano-739	„	28·4	1·12	122	0·66	8·5	42s
Co-Ano-792	„	28·2	1·11	110	0·60	7·8	42s
Co-Ano-8-3-2 ..	„	27·9	1·10	110	0·59	7·7	43s
I.S.C.-67	„	27·7	1·09	102	0·59	7·6	37s
Devitej	„	29·0	1·14	110	0·60	7·9	37s
B.C-68 x Moco ..	Surat	26·9	1·06	106	0·58	8·9	>60s
I.S.C.-67 x Moco ..	„	26·9	1·06	102	0·59	8·8	>60s

Table 8 (*Contd.*)

Variety	Place of growth	Mean fibre length (mm.)	Mean fibre length (inch)	Fibre weight (Millitex)	Maturity Coefficent.	Pressley str. index (lb/mg)	H.S.C.
B.C-68 x Moco ..	Surat	28·4	1·12	122	0·64	9·1	>50s
I.S.C.-67 x Moco ..	„	28·2	1·11	98	0·56	8·7	>50s
I.S.C.-67	„	28·4	1·12	102	0·55	7·3	42s
B.C.-68 x S.I.	„	29·0	1·14	106	0·58	7·8	47s
B.C.-68 x S.I.	„	29·5	1·16	106	0·57	7·8	47s
B.C.-68 x Moco ..	Mehsana	29·0	1·14	94	0·51	8·9	>50s
I.S.C.-67 x Moco ..	„	27·7	1·09	98	0·53	8·7	>50s
I.S.C.-67	„	27·7	1·09	94	0·48	7·4	41s
I.S.C.-67 x Moco ..	„	27·9	1·10	102	0·56	8·9	>50s
I.S.C.-67	Kolwad	29·5	1·16	118	0·65	7·8	50s
I.S.C.-67-4A	„	29·5	1·16	118	0·64	7·7	48s
Co-Ano-8-3-2 ..	„	29·2	1·15	134	0·70	8·1	>50s
N.C.-14	„	28·2	1·11	118	0·64	7·5	49s
I.S.C.-67-4A	Dabhoi	28·2	1·11	118	0·64	8·0	48s
I.S.C.-67-4	Vijapur	27·9	1·10	102	0·55	7·4	41s
I.S.C.-67-4A	„	28·2	1·11	102	0·57	7·4	42s
Co-Ano-8-3-2 ..	„	31·5	1·24	122	0·64	6·7	48s
B.C. 68 x Pima ..	Chanasma	30·0	1·18	110	0·58	8·2	>80s
B.C. 68 x Giza ..	„	28·4	1·12	102	0·55	7·4	>60s
I.S.C.-67 x Moco ..	„	26·9	1·06	106	0·59	8·2	>60s
I.S.C-67 x Pima ..	„	30·0	1·18	98	0·52	8·6	>70s
I.S.C.-67 x Giza ..	„	28·7	1·13	94	0·53	7·6	60s

Table 8 (*Contd.*)

Variety	Place of growth	Mean fibre length (mm.)	Mean fibre length (inch)	Fibre weight (Millitex)	Maturity Coefficient.	Pressley str. index (lb/mg)	H.S.C.
I.S.C.-67	Pilwai	29·0	1·14	110	0·60	7·1	47s
I.S.C.-67 x Moco ..	,,	27·9	1·10	102	0·57	7·4	>80s
B.C.-68 x Moco ..	,,	27·9	1·10	106	0·59	8·7	>70s
I.S.C.-67 x Pima ..	,,	33·3	1·31	102	0·56	8·2	>70s
B.C.-68 x Pima ..	,,	30·0	1·18	110	0·57	8·3	70s
I.S.C.-67 x Giza ..	,,	30·5	1·20	110	0·59	8·1	80s
B.C.-68 x Giza ..	,,	28·7	1·13	102	0·55	8·2	>70s
I.S.C.-67 x S.I. ..	,,	30·5	1·20	106	0·57	8·1	>60s
B.C.-68 x S.I.	,,	30·0	1·18	102	0·55	8·1	>60s
III. Mysore							
S.I. Andrews	Arsikere	31·5	1·24	142	0·73	7·5	>70s
IV. Andhra Pradesh							
S.I. Andrews ..	Amaravathi	33·5	1·32	157	0·69	7·8	80s
V. Madhya Pradesh							
B.-59-1679	Badnawar	27·4	1·08	156	0·74	8·4	48s
Badnawar-1	,,	27·4	1·08	137	0·68	8·5	48s
VI. Rajasthan							
S.I. Andrews ..	Chittorgarh	30·0	1·18	134	0·66	8·5	>60s
VII. Punjab							
A.136	Abohar	29·0	1·14	146	0·73	8·9	40s
A.162	,,	29·0	1·14	139	0·71	9·3	38s
A.164	,,	27·9	1·10	157	0·74	9·3	39s
A.165	,,	30·2	1·19	119	0·66	8·4	>40s
A.168	,,	28·7	1·13	146	0·74	8·0	36s

Table 8 (*Contd.*)

Variety	Place of growth	Mean fibre length (mm.)	Mean fibre length (inch)	Fibre weight (Millitex)	Maturity Coefficient.	Pressley str. index (lb/mg)	H.S.C.
A.179	Abohar	26·9	1·06	167	0·80	8·6	37s
A.182	„	28·7	1·13	138	0·71	8·8	37s.
A.194	„	28·7	1·13	138	0·71	8·7	38s
A.213	„	29·5	1·16	170	0·80	9·7	38s
A.214	„	29·2	1·15	148	0·74	9·0	41s
A.218	„	27·7	1·09	154	0·74	9·5	>50s
A.221	„	28·4	1·12	128	0·67	8·4	40s
L.L.54	„	27·7	1·09	154	0·75	9·3	40s
A.C. 131	„	27·2	1·07	161	0·75	8·2	35s
A.C. 134	„	27·9	1·10	138	0·71	8·8	42s
VIII. Madras							
E.L. 123	Srivilliputhur	28·7	1·13	144	0·71	8·7	>50s
E.L. 156 E	„	27·7	1·09	142	0·73	8·8	>50s
E.L. 192	„	28·4	1·12	138	0·69	9·1	>50s
E.L. 467-H	„	29·5	1·16	140	0·69	8·6	>50s
E.L. 628	„	28·2	1·11	148	0·72	9·1	>50s
0892-B	„	31·0	1·22	152	0·74	8·6	>50s
9030-G	„	29·0	1·14	124	0·67	8·6	>50s
L. 0313 W	„	29·0	1·14	153	0·74	8·2	>50s

B. Standard Indian Cottons

As in the past, extensive fibre and spinning tests were carried out on the Standard Indian Cottons for the 1963-64 season and the results obtained for these cottons was published as a Technological Bulletin (Series A No. 117) entitled the 'Technological Report on Standard Indian Cottons—1964.' Out of the 20 varieties tested during the 1963-64 season, seven had recorded an improvement, and nine had maintained their performance while four had registered a decline in spinning value. The comparative performance of the vaious cottons in each State during 1963-64 season as compared to that in 1962-63 season is indicated below :

State	Definitely better	Approximately same	Definitely poorer
Maharashtra ..	Jarila ..	Gaorani-6, Gaorani-12. Gaorani-22, Virnar.	Parbhani America 1
Gujarat ..	Vijalpa, 1027 A.L.F	Kalyan, Digvijay	——
Mysore ..	——	Laxmi, Westerns-1	Jayadhar
Andhra Pradesh ..	—	N. 14	——
Madras ..	M.C.U.2 (Summer) K.6	——	M.C.U. 1 (Winter) M.C.U. 3
Punjab ..	L.S.S., 320F	——	——

Some samples of the Standard Indian Cottons of the 1964-65 season have also been received for tests. Tests on them are in progress.

C. Trade Varieties.

Samples of fair average quality of the principal trade varieties of Indian Cottons of 1963-64 season were obtained with the assistance of the East India Cotton Association wherever possible and in other cases, through the State Agricultural Departments. Representative kapas samples of the major trade varieties were also obtained through the co-operation of the State Agricultural Departments for the estimation of their ginning percentages. The fibre and spinning test results, ginning percentage, and other results obtained for each variety were, as in the past, published as Technological Circulars as early in the season as possible to be useful to the Cotton trade and the industry. The trade varieties on which such circulars were issued during the year are shown in page 58. Some more samples of the trade varieties of the 1964-65 season have also been received and tests on them are in progress.

The technological circulars relating to the 1963-64 season, excepting a few less important ones, were compiled and published as a Technological Bulletin (Series A, No. 116) entitled "Technological Report on Trade Varieties of Indian Cottons—1964."

III. RESEARCH INVESTIGATIONS

A. SUMMARY OF WORK IN PROGRESS

(a) Investigations on Ginning

1. Pre-cleaning and ginning tests on Indian Cotton. [G.1] (D.G. Shete)

It was mentioned in the previous report that the pre-cleaning and ginning tests as well as spinning and fibre tests on Digvijay cotton were completed and Grader's valuation for the samples were also obtained. During the period under review, a Technological Leaflet on this cotton was prepared for publication. The observations made and the conclusions drawn from the results obtained from the above tests are given below :—

Pre-cleaning :—The amount of trash removed by F.E.C. opener was slightly more than that removed by the other two openers which was of the order of 1.8%.

Effect of Pre-cleaning:—(*i*) The unopened seed cotton when ginned in saw-gin gave the highest output of lint per hour and lowest power consumption, while that opened in Platts opener gave the lowest out-put and highest power consumption. The ginning percentage of the unopened seed cotton was slightly lower than that of opened in any of the three pre-cleaning machines. (*ii*) When ginned in roller gins, the difference in output, power consumption and ginning percentage between the opened and unopened samples was not conspicuous.

Ginning :—(*i*) As usual, saw-gins gave one per cent lower ginning percentage than roller gins. (*ii*) Very little difference in the fibre properties, waste losses and yarn strength was indicated between the samples ginned in saw and roller gins. (*iii*) Saw ginned samples were more neppy than roller ginned samples (*iv*) There was no difference in the Grader's valuation on the sample ginned in saw and roller gins.

Effect of feed in saw-gin :—(*i*) The output of lint per hour was increased and power consumption was lowered with the increase of feed steps from No. 2 to 4 with the saw-shaft speed of 680 R.P.M. (*ii*) The samples obtained by ginning with different feed steps showed little difference in the ginning percentage, fibre properties, waste losses, yarn neppiness and yarn strength.

Effect of Overlap and speed in roller gins :—Samples ginned with different speeds and different overlaps did not show any marked effect on the fibre properties, blow room loss, ginning percentage, yarn neppiness, yarn strength and Grader's valuation.

Two cottons A-51-9 and Garo Hills obtained for conducting pre-cleaning and ginning tests on them could not be tested during the period under report because of the work of reinstallation of pre-cleaning and ginning machinery in the new block. After the reinstallation is completed, these tests will be undertaken.

2. Fabrication of an Extractor. [G. 3] (D. G. Shete)

It was mentioned in the previous report that the driving arrangement for rollers, taking into consideration the required speed and direction of rotation for each was completed. Steel wire screen and the arrangement for regulating the feed of raw-cotton to the machine was fabricated. During the period under report, the work of fixing of steel wire brush, its alignment and positioning etc. for satisfactory performance was carried out and the machine was made to run to study the performance of each of the above rollers. The working of the machine was demonstrated to the Fourth Visiting Committee, who have appreciated the design and its function. The work of finalising the positions of rollers and their speeds, the point and angle of contact of steel wire brush with respect to reclaimer cyclinder etc. to attain the maximum cleaning efficiency of the machine is in progress.

(b) INVESTIGATIONS ON FIBRE PROPERTIES

3. Study of variation between seeds of the same strain [F. 2] (V. G. Munshi)

The paper based on the results of the above investigation was published in the Indian Cotton Growing Review, November, 1964 issue. The results of this study showed that the bundle strength of the side region fibres was significantly higher than that of the chalazal region fibres and the value of difference in bundle strength between the two regions could be used by Cotton Breeder for evolving strains of more uniform strength. Some interesting correlations were obtained between the seed weight, the embryo-weight, the bundle strength and fibre maturity —the last two at the side and chalazal regions of a seed. Data on embryo and seed weight showed that the embryos and seeds of *G. hirsutum* cottons were heavier than that of the other two species. The overall ratio of the embryo weight to the seed weight was 0.57, showing that more than half of the seed weight was accounted for by the embryo weight.

4. Study of the Properties of Fibres collected from bolls of different ages. [F. 3] (S. M. Betrabet).

(*a*) *Structural Properties*

Further development studies on *herbaceum* strain 199 and I.S.C.67 (Season 1963-64) were undertaken. Degree of thickening was determined on fibres from the chalazal and side regions from seeds extracted from bolls of three different ages of each of two cottons, *viz.*, I.S.C. 67 and *herbaceum* strain 199. The full grown samples of the two cottons were also tested for length, strength, fineness and maturity. Further work is in progress on the 1964-65 season samples of these two cottons.

This work is being supervised by Shri S. N. Pandey.

(*b*) *Chemical Analysis of Fibres.* (S. N. Pandey)

Further studies on some of the chemical and physical properties of fibres from different stages of bolls of Laxmi Cotton for three seasons were carried out. The entire data obtained on various properties were analysed and a paper entitled "Changes in chemical and physical properties during development of cotton fibre" was presented at the Sixth Joint Technological Conference sponsored by ATIRA, BTRA and SITRA on the 19th January, 1965 at Bombay.

Following conclusions were drawn from the study :

(1) The degree of polymerisation (D.P.) of cotton was affected by the fibre development and it increased as the fibre developed. The fibre of 24 days old bolls (fibres with primary walls only) showed shorter chain-length compared to the fibres of 52 or 59 days old bolls (the fibres developed secondary walls). The D.P. of cotton fibre varied from variety to variety and for the same cotton from season to season.

(2) The percentage of waxy substances and mineral matters of fibres decreased with the development of fibres and reached a minimum in fully developed fibres. The wax content decreased rapidly from 24 days to 38 days and thereafter at a slower rate.

(3) Cellulose content of the fibre showed a steady increase during fibre development and reached a maximum in 52 days old fibres and then remained constant. Also the cellulose content of the same age fibre varied from season to season and it increased at a rapid rate during early period of development, *viz.*, upto 38 days age, after which it slightly increased and reached a constant value.

(4) Fibre crystallinity increased linearly from 24 days old fibre to 59 days old fibre during growth processes. Fibre crystallinity also varied from season to season for the same age fibre.

(5) Ash in the cotton fibre was found to be maximum in 24 days old boll and it decreased as the boll ripened and reached a minimum in fully developed boll. Like waxy substances of the fibres, the ash and mineral content of the fibre also decreased rapidly from 24 days to 38 days old fibre after which it decreased gradually and reached a minimum in 59 days old fibre.

(6) Percentage water soluble matter in the fibre of early ages samples was higher than in fully developed fibre. It decreased linearly during fibre development and reached a minimum after 52 days of growth.

(7) The ratio of cellulose content and water soluble matter may be used to recognize the fibre development during the ripeness of fibre. The ratio is

maximum for fully developed fibre and minimum for immature fibre of 24 days old.

(8) Moisture absorption capacity of the fibre decreased with the ripeness of the fibre.

(9) Fibre maturity and Micronaire value increased with the fibre development. Both the values for the same age Laxmi Cotton fibre differed from season to season.

(10) Fibre strength also increased with the ripeness of the fibre. This is in agreement with the findings of Berkley. Strength of same age fibre of Laxmi Cotton varied from season to season during its development.

5. Study of Properties of Fibres from different regions of a seed. [F. 4] (V. Sundaram, Jai Prakash, V. G. Munshi and S. N. Pandey).

A paper on the above investigation was being written up. The important characteristics studied were X-ray angle, Degree of polymerisation, Bundle strength at zero-gauge length, and fibre maturity of fibres extracted from the side and chalazal regions of seeds of 22 varieties belonging to three main botanical species. The statistical analysis of the results indicated that the fibres from the chalazal region of cotton seeds had higher X-ray angle and lower values of the Degree of Polymerisation, the bundle strength and the fibre maturity than the fibres from the side regions. Also the mean values of X-ray angle for fibres from side and chalazal regions of the seeds were lowest for cottons belonging to *G. arboreum* species and highest for those belonging to *G. hirsutum* species. Further, a highly significant negative correlation was obtained between the X-ray angle and the bundle strength both when the data relating to fibres from each region were separately considered and when the data for both regions were pooled together. A low positive correlation was observed between Degree of Polymerisation and the bundle strength when the data relating to fibres from both the regions were pooled together.

6. X-Ray Studies on the relationship between structural features and the physical properties of cotton. [F. 5]. (V. Sundaram).

(*i*) It had been mentioned in the last Annual Report that the results of tests for fibre rigidity (x_1), X-Ray angle (x_2) and the fibre weight per unit length (x_3) had been analysed. A simple correlation of—0.501* (significant at 5% level) had been observed between X-ray angle and fibre rigidity while a correlation of 0.966** (significant at 1% level) had been observed between fibre weight per unit length and rigidity. Further, the partial correlation co-efficient $r_{12 \cdot 3}$ was —0.243 and non-significant. From these results it has been concluded that the fibrillar orientation as measured by X-ray angle seems to have very little effect on the torsional rigidity of cotton fibres, the latter property being largely dependent on the degree of coarseness or the mean fibre weight per unit length of the samples. Based on the above results, a paper was written up and sent for publication in the Indian Cotton Journal.

(*ii*) A note based on the results of an earlier investigation on the relationships between 40% X-ray angle, degree of polymerisation of cellulose (D.P.) and bundle strength of cotton fibres was also sent for publication. It had been observed that there was a highly significant negative correlation (—0.849) between X-ray angle and bundle strength while there was a low positive correlation (+0.508) between D. P. and bundle strength. From the results obtained, it had been concluded that the influence of D.P. on bundle strength was of a much lower order than that of fibrillar orientation (40% X-ray angle).

7. Inheritance of X-Ray angle and strength. [F. 6] (V. Sundaram and Jai Prakash).

The object of the investigation is to study the manner of inheritance of fibre orientation and strength of cottons. On the basis of tests on a large number of samples received subsequently from Dr. Santhanam, Head of Regional Research Centre, Coimbatore, three varieties namely, Bobdel Cabal T-11, and Delfos 531C were chosen as suitable parents for crossing. About 150 single plant selections, from these three strains had been received in February, 1964 and on the basis of tests on these, three plants from each variety had been selected by Dr. Santhanam for further study. During the period under review, samples from 210 single plant strains raised from the seeds of the above selections already made were received and have been tested for bundle strength. Further work is in progress.

This work is being carried out in co-operation with Dr. Santhanam, Head of Regional Research Centre, Coimbatore.

8. Study of Structural properties of cotton by optical methods. [F. 7] (S. M. Betrabet).

(a) *Birefringence, frequency of reversals and tensile behaviour.*

A paper entitled "Birefringence, Density and Tensile Characteristics of Oxycelluloses" was presented at the Sixth Joint Technological Conference of ATIRA, BTRA and SITRA, on 20th January, 1965, at Bombay. This was subsequently published as a Technological Bulletin (B. 97).

This work was done in collaboration with Prof. E. H. Daruwalla of the University Department of Chemical Technology.

(b) *Structural properties of some cellulosic fibres.* (S. M. Betrabet and G. G. Phadnis).

The object of this investigation is to study the changes in structural properties of some of cellulosic fibres. Determination of birefringence on bast fibres, raw and mercerised under stretch, was completed. The data collected on the physical and structural properties of the cellulosic fibres are being analysed.

9. The comparison of stelometer value with (a) Pressley strength index (zero-gauge length) and (b) intrinsic strength on single fibres (1/8″ gauge length) [F. 8] (V. G. Munshi and V. Sundaram).

The paper on the above subject was being written up. The important findings obtained from the results of 21 cottons were as follows :

(1) Highly significant correlations were obtained between the bundle strength at 3 mm. gauge length, the bundle strength at zero-gauge length, the single fibre strength at 3 mm. gauge length and the single fibre strength at 10 mm. gauge length.

(2) Single fibre strength at 3 mm. gauge length was more than twice the bundle strength at 3 mm. gauge length or in other words, the percentage of single fibre strength realized in a bundle was approximately 57%.

(3) The percentage fall in the bundle strength differed in four botanical species. It showed lowest fall in strength in the case of cottons belonging to *G. Barbadense* species as compared with the other species.

10. Comparison of different methods of measuring fibre-maturity. [F. 9].

For this investigation, over 120 cottons were evaluated for their maturity by using (1) caustic soda (x_1) method, (2) polarised light (x_2), (3) Cotton Grader (x_3) (the performance of which depends upon the intensity of polarised light transmited), (4) Micronaire with spacer (x_4), and (5) a new method which also makes use of the Micronaire (x_5). Some fibre-weight determinations have also been made. The maturity coefficient (x_1) obtained by the first method was taken as the standard value with which the other results were correlated. Correlation coefficients and regression equation connecting x_1 with x_2, x_3, x_4 and x_5 had been calculated for the whole population as well as for the different, important species. Certain other relationships have also been investigated. Some of the important conclusions are given below :—

(1) Out of the methods mentioned the value obtained by the polarised light method (x_2) is correlated to the greatest extent with the maturity coefficient (x_1), r_{12} being as high as—0.96. This is followed by the Cotton Grader.

(2) Values obtained by polarised light methods (x_2 & x_3) are found to be correlated with x_1 to a higher extent than those obtained by the Micronaire methods (x_4, x_5)

(3) The correlation coefficients observed for *G. arboreum* are generally lower than the corresponding coefficients obtained for the other species.

(4) Whereas one equation is sufficient to estimate x_1 from x_2 or x_3 for all species, more than one are required if the estimate has to be made for x_4 or x_5 (air-flow methods). Separate equations have to be used for *G. arboreum* and *G. herbaceum*.

(5) Partial correlation coefficient studies have shown that all the measurements (x_2, x_3, x_4 and x_5) made by polarised and air-flow methods are affected to a certain extent by the gravimetric fineness ; the influence of this character on maturity measurement is greater for the air-flow methods than for the polarised methods.

(6) The polarised light methods by themselves are not correlated with each other to such a high degree as the air-flow methods *i.e.* r_{23} is less than r_{45}.

The results of this investigation are incorporated in a thesis submitted to the University of Bombay.

This work was done by Shri K. N. Seshan when he was working in the Laboratory for his M.Sc. degree under the guidance of Shri Hari Rao Navkal.

11. Effect of swelling agents on structural and mechanical properties of cotton fibres. [F. 14] (Jai Prakash and V. Sundaram).

It was mentioned in the last Annual Report that the circularity of cotton fibres when mercerised slack and under tension, increased progressively with increase in tension During the period under review, the changes in circularity of Pima and Kalyan cottons when treated with caustic soda solutions of various concentrations, *viz.*, 5, 10, 15, 18, 20, 25, 30, 40, 45, and 50% were investigated. Also, the effect of various tensions applied for stretching were investigated on Pima Cotton treated with caustic soda, of three different concentrations, *viz.*, (1) a weak concentration of 5% NaOH (2) 18% NaOH—a concentration where maximum changes are expected and (3) 25% of NaOH—a concentration generally employed in commercial mercerisation. A paper based on a part of the above results was presented at the Sixth Technological Conference organized by B.T.R.A. in January, 1965.

The following conclusions were drawn :

(1) The circularity of cotton fibres mercerized in slack condition increases with increase in concentration upto a certain limit and then remains almost constant.

(2) There is in general, an increase in circularity when the mercerising tension is applied to fibres. However, at high tensions—possibly near the rupture point—there is a decrease in circularity in the case of a few cottons.

3) The changes in circularity brought about by the application of tension are predominantly more when the cotton is mercerised in 18% solution than in 25% NaOH solution.

Further, the study of the swelling of cotton fibres in solution of Zinc-chloride ($ZnCl_2$) has been taken next. To ascertain the optimum time required for thorough penetration, samples of one cotton, namely, Ashmouni, were kept immersed in

70% $ZnCl_2$ solution for 15 min, 30 min, 1 hr and 4 hrs, respectively and then washed and dried. The dried samples after conditioning were tested on the Stelometer for tensile strength. However, no change in the tenacity with respect to the control was observed in the case of the sample which had undergone 4 hrs of treatment. The reasons are being investigated.

12. Nickerson Hunter Colorimeter Test colour charts for Indian Grade Standards. [F. 15] (V. Sundaram).

It had been mentioned in the last Annual Report that very little progress could be made on this investigation as very few samples had been received from the East India Cotton Association Ltd. During the current season, a large number of samples have been received from the E.I.C.A. during the months of March, April and May, 1965. The relevant data, namely, the name of the variety, the place of growth and the grade of each of these samples, are being collected from E.I.C.A. Ltd. Colour tests on these samples are in progress.

13. Distribution curves of some of the properties of single fibres of cotton. [F. 17] (G. S. Rajaraman).

This investigation was started with a view to find the distribution curves of the single fibre characteristics. Data on the single fibre weight and strength of M.C.U.-1, Parbhani American 1, Laxmi, Vijay and Jayadhar Cottons of the 1959-60 season tested at the Laboratory were collected for the purpose. As the data on each cotton variety were not sufficient, it was not possible to obtain a satisfactory generalised distribution curve for each property.

(c) INVESTIGATIONS ON FIBRE PROPERTIES AND YARN CHARACTERISTICS.

14. Effect of fibre properties on yarn evenness. [Y. 5] (N. Balasubramanian).

It had been reported earlier that rovings of nearly the same hank number had been prepared from six cottons belonging to coarse, medium and fine groups and that each of the rovings was then spun into yarns by employing five different drafts, ranging from 2 to 10, at the ring frame. The yarns had been tested for irregularity. The slope of variance-draft line was determined by calculating the regression coefficient for each of the samples. It was observed that cottons with high fibre length variation showed a tendency to have a higher regression coefficient while the regression coefficient did not show any tendency to increase with coarseness of the cotton that is, fibre fineness did not have much influence on the irregularity. A note based on the results was published in the form of a letter to the Editor in the Journal of the Textile Institute, July, 1964 issue.

15. Studies on lustre behaviour of cotton fibres and yarns. [Y. 6] (P. G. Oka and Jai Prakash)

As mentioned in the earlier report, the data relating to the lustre of raw and mercerised cotton fibres, as measured by the contrast ratio, were fully analysed.

(5) Partial correlation coefficient studies have shown that all the measurements (x_2, x_3, x_4 and x_5) made by polarised and air-flow methods are affected to a certain extent by the gravimetric fineness ; the influence of this character on maturity measurement is greater for the air-flow methods than for the polarised methods.

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15. Studies on lustre behaviour of cotton fibres and yarns. [Y. 6] (P. G. Oka and Jai Prakash)

As mentioned in the earlier report, the data relating to the lustre of raw and mercerised cotton fibres, as measured by the contrast ratio, were fully analysed.

Also, the changes in the structural properties and in the shape factor that were studied in the previous years were correlated with the changes in the contrast ratio.

The following conclusions were drawn :

(1) The instrument to read the lustre index as fabricated in the Laboratory was sensitive enough to differentiate the lustre of different cottons.

(2) Indian cottons showed a dull appeareance ; however a few cottons such as Gao-12, J-57, N-14 etc. exhibited appreciable lustre.

(3) Sea Island and Russian cottons grown in India possessed appreciable lustre.

(4) Of the many fibre properties, length and strength only showed significant correlation with lustre index.

(5) Colour grades of the specimen sample affect the lustre index.

(6) Lustrous cotton in raw state gained relatively more lustre on mercerisation.

(7) When the tension applied during mercerisation exceeded a certain limit, the lustre of cotton fibres was reduced.

(8) The circularity of the cotton fibres was increased on mercerisation. However, there was no direct correlation between increase in circularity and increase in lustre.

(9) The birefringence of the cotton fibres decreased when they were mercerised slack. Although the birefringence increased on stretching, it did not attain the original value present in the raw state.

(10) The molecular orientation did not seem to have any influence on the contrast ratio.

The results on the above investigation were submitted by Shri P. G. Oka in the form of a thesis to the University of Bombay for the M.Sc. degree.

16. Regression coefficients between fibre properties and spinning value on tract-wise basis. [Y. 8] (G. S. Rajaraman and V. Sundaram).

An attempt was made to obtain fresh regression equations to predict the spinning value of Indian Cottons from their chief fibre properties. For this purpose, the results of tests carried out on the various cotton samples tested at the Laboratory during the 1960-61 to 1962-63 seasons were compiled. These were classified according to the major cotton growing tracts of India and regression equations worked out to estimate the spinning value H.S.C. (C) in terms of the

fibre properties, mean fibre length (l) in inches, mean fibre weight (f) in $_{10}^{-6}$ Oz per inch, maturity coefficient (m) and Pressley strength index (p) O gauge in lbs. per milligram. Out of the fourteen tracts considered, suitable prediction formulae could not be obtained for five tracts *viz.*, Middle Gujarat, Vidharbha, Rajasthan, Punjab and Uttar Pradesh due to insufficient data. The formulae obtained for the nine tracts are as follows :—

(i) *Marathwada :*

$C = 43.83\ l - 58.42\ f + 12.90\ m + 3.01\ p - 32.84$

(S. E. = 3.16 counts ; $R^2 = 0.6171$).

(ii) *Khandesh tract :*

$C = 53.18\ l - 108\ .75\ f + 29.00\ m + 0.03\ p - 19.95$

(S.E. = 4.35 counts ; $R^2 = 0.5557$).

(iii) *South Gujarat*

$C = 72.08\ l - 1172.96\ f + 268.28\ m + 6.07\ p - 139.07$

(S.E. = 4.23 counts ; $R^2 = 0.0492$).

(iv) *North Gujarat :*

$C = 54.12\ l - 102.00\ f - 1.47\ m + 2.02\ p - 17.98$

(S. E. = 3.21 counts ; $R^2 = 0.6640$)

or $C = 54.26\ l - 94.20\ f - 4.55$

(S.E. = 3.33 counts ; $R^2 = 0.6328$).

(v) *Saurashtra tract :*

$C = 83.15\ l - 30.00\ f + 15.04\ m + 2.13\ p - 65.8$

(S.E. = 3.36 counts ; $R^2 = 0.4368$)

or $C = 94.22\ l - 50.00$

(S.E. = 3.33 counts ; $R^2 = 0.3829$).

(vi) *Nimar tract :*

$C = 117.93\ l - 14.07\ f + 14.62\ m - 0.61\ p - 78.5$

(S.E. = 4.75 counts ; $R^2 = 0.7767$)

(vii) *Andhra Pradesh*

$C = 76.01\ l - 47.68\ f - 18.29\ m + 3.11\ p - 40.96$

(S.E. = 3.92 counts ; $R^2 = 0.5889$)

(viii) *Madras :*

$$C = 40.97\ l - 128.37\ f + 23.19\ m + 0.46\ p - 5.65$$

(S.E. = 4.47 counts ; $R^2 = 0.4636$)

(ix) *Karnatak tract :*

$$C = 38.43\ l - 166.95\ f - 26.24\ m + 5.93\ p + 0.05$$

(S. E. = 1.00 count ; $R^2 = 0.9607$).

It is observed that the estimates obtained by the above formulae are generally of greater precision than those given by equations currently in use by the various Cotton Breeders.

A paper incorporating the findings of this investigation was presented and discussed at the 21st Conference of the Technological Assistants and senior members of the staff of the Technological Laboratory held on the 20th and 21st November 1964. It is proposed to collect further data for the remaining tracts.

17. Determination of the extent of the immaturity that could be tolerated in long staple cottons with reference to their final spinning performance and nep potentiality. [Y. 10]

No progress could be made on this investigation as suitable samples have not been received so far. Fresh reminders have been issued to Cotton Specialists and Cotton Breeders of various States requesting them to supply the required samples.

(d) INVESTIGATIONS ON SPINNING AND YARN CHARACTERISTICS.

18. Relationship between yarn mass irregularity and yarn strength irregularity. [S. 4] (V. Sundaram).

It had been reported earlier that the single strand strength on 10 yarn samples had been determined at 5 test lengths and the yarn strength gradient calculated for each sample. These samples had also been tested for yarn irregularity (U%) with the Uster Evenness Tester. Analysis of the results has shown that there is a significant negative correlation between yarn irregularity and yarn strength gradient. Further analysis is in progress.

19. Fabrication of a miniature Spinning Frame. [S. 8] (R. P. Neogi).

After making the frame sides, roller beams were put up, then roller stands and rollers were fixed and OM system of supper high drafting mechanism was set up on both sides of the frame. The draft gearing and twist gearings were also fitted and necessary adjustments made. Fixing different parts of the machines of bobbin-build and their gearings for the drive are to be done.

20. Preliminary study of the characteristic curve connecting count and C.S.P. [S. 10] (R. P. Neogi and G. S. Rajaraman)

Four Indian Cotton samples, one each of Digvijay (Broach), Laxmi (Gadag), Parbhani American-1 (Adilabad) and M. A. 5 (Arsikere) were spun into different counts (about 10 from each cotton). The yarn samples were under test. Some more counts are being spun and they will be tested. The results will be analysed.

21. Skein strength of the yarn in the metric system. [S. 12] (V. Sundaram)

It had been mentioned in the last Annual Report that a paper based on the results obtained earlier on tests carried out on yarns ranging in counts from 10^s to 80^s was published in the Indian Standards Institution Bulletin in February, 1964. Subsequently it was decided that tests should be carried out to determine whether the relationship between F. S. P. and C. S. P. reported in the earlier paper was valid for finer counts of yarn (80^s to 120^s) and for both warp and weft yarns. The Indian Standards Institution kindly arranged to supply samples of warp and weft yarns in the range of counts from 80^s to 120^s. The results of tests on these yarns have shown that the earlier findings were substantially valid for both warp and weft yarns of counts ranging from 80^s to 120^s also. It has, therefore, been concluded from this study that F.S.P. may be taken as equivalent to half C.S.P for all practical purposes and the regression equation connecting F.S.P. and C.S.P. used only where greater accuracy is required. Taking into consideration all the results obtained so far covering the entire range of counts from 10^s to 120 , the following regression equation was derived :

$$\text{F.S.P.} = 0.439 \text{ C. S. P.} + 46.35.$$

A paper based on the above results is being published in ISI Bulletin, May, 1965 issue.

22. Relationship between single thread strength measured at 500 mm. test length and at 12″ test length on a constant rate of traverse machine. [S. 13] (V. Sundaram).

Single thread strength is one of the important characters which determine yarn quality. Till recently the standard procedure was to carry out tests on a test length of 12″. With the introduction of the metric system, the Indian Standards Institution has specified a test length of 500 mm. for these tests. Hence a study was undertaken to compare the single thread strength values of different yarns of these two test lengths. For this purpose, tests at both the test lengths had been completed on 20 samples of each of the three counts 20^s, 30^s and 40^s. During the period under review, the results of the above tests were analysed and regression equations worked out for predicting the strength at 500 mm. test length from that at 12″ test length in the case of samples belonging to each of the above three counts separately and also for the pooled results of all the counts. It was further observed that the values calculated by using Peirce's equation agreed closely with the observed values. From the results, it may be generalised that, as a rough

estimate, 95% of the single thread strength at 12" test length was realised when the test length was changed to 500 mm.

23. Variation of yarn strength with relative humidity [S. 14] (V. Sundaram).

It had been mentioned in the last Annual Report, that tests for metric skein strength had been completed on all the 36 samples, conditioned at 35%, 45%, 55%, 65%, 75% and 85% relative humidities. During the period under review single strand strength tests on all 36 samples have been completed at 45% while tests at other levels of relative humidities are in progress.

(e) CHEMICAL INVESTIGATIONS

24. Evaluation of D. P. values of Indian Cottons by different methods. [C. 1] (S. N. Pandey).

As reported in the previous Annual Report, the results obtained by the two different methods were analysed and a paper entitled "Cellulose Viscosity in Cuprammonium and Cupriethylenediamine" was sent for publication in Indian Journal of Technology.

It was concluded from the above study that C. E. D. Method for determining the viscosity of cellulosic material is more convenient than cuprammonium for day to day work. Therefore, it has been decided to study the C. E. D. Method in more detail. For this purpose 30 cotton samples, covering a wide range of fibre properties (strength and maturity), belonging to different species have been selected. 18 cotton samples were dewaxed and kierboiled for the D. P. test in C. E. D. This work is in progress.

25. Estimation of pectin content and wax content and their relation to fibre strength and moisture absorption. [C. 2] (S. N. Pandey).

Investigation on this problem was continued during this period. It was reported earlier that the wax content on 14 cottons belonging to different species and moisture absorption on 14 dewaxed as well as 14 raw cottons was determined at the different levels of humidity. To investigate the relation of wax content and moisture absorption with fibre strength, tests were carried out on these samples for fibre strength at two different levels of humidity, viz., 65% and 85%. The entire data obtained, are being analysed and a paper will be written up.

26. Studies in the Chemical Modification of Cottons. [C. 3] (S. N. Pandey)

The object of this investigation, as has been reported in earlier reports, is to study the effect of chemical treatment on various fibre properties.

The purified lint samples of cotton Gaorani and 170-Co_2 were treated with lithiumchloride, sodium and potassium hydroxide, under varying conditions of time and temperature. Effect of different concentrations of these chemicals were also studied.

Treated samples along with control were studied for some of the chemical and physical properties. Further work on this problem is in progress.

27. Study of the ash and mineral contents of Indian Cottons. [C. 4] (S. N. Pandey).

A paper entitled "Study on Cotton Ash and some of the Ash Constituents" was published in the Indian Cotton Journal, January, 1965 issue.

28. Determination of the Oil content of different varieties. [C. 5] (S. N. Pandey)

193 seed samples were tested for the oil content during the year and the reports were sent to the respective breeding stations. The data obtained on the oil content of different varieties are being analysed.

Data on seed-weight and oil content of Sea Island Cotton from a number of agronomic trials were analysed and a paper entitled "A study on the Effects of Agronomic Treatments on the seed-weight and the Oil content of Cotton Seed" was prepared.

29. Study on gossypol content and chemical composition of cotton seed [C. 6] (S. N. Pandey).

The sample of pure gossypol and chemicals required for gossypol estimation, have been obtained. After standardization of the method, further study on this problem will be taken up. Work is in progress.

(f) MISCELLANEOUS INVESTIGATIONS.

30. Reduction of neps in neppy Indian Cottons. [M. 1] (S. M. Betrabet).

Single plant produce of I. S. C. 67 and 134-Co.2-M cottons were tested for neps and other important fibre properties. The results obtained will be analysed.

31. Study of the effects of different agronomic treatments on fibre properties. [M. 2] (V. G. Munshi).

(1) *Study of different frequencies of irrigation and manurial trials.*

As mentioned in the previous Annual Report, the interaction between season and quantity of irrigation was significant for the length-irregularity percentage, the micronaire fineness and the maturity coefficient. Hence, the results for these properties are being further analysed for individual season.

(2) *Effect of differential irrigation (different frequencies of irrigation and intensities of irrigation)*

A paper entitled "The effect of different quantity of irrigation and nitrogenous manure on physical properties and yield of 320F Cotton", based on the findings of the above investigation was presented at the 21st Conference of the Senior Research Assistants and the Research Assistants-incharge of Breeding Stations with the Senior Research Staff of the Laboratory held on the 20th and 21st November, 1964. It was observed that the irrigation treatments affected significantly the mean fibre length, the bundle strength and maturity coefficient and the nitrogen treatments affected the lint-weight, the mean fibre length, and percent length-irregularity in particular seasons. Data on the effect of nitrogen and irrigation treatment on yield per acre showed that the medium irrigations in combination with the higher rates of nitrogen could be profitably applied in respect of this property.

(3) *Effect of alpha-napthalene acetic acid*

As mentioned in the previous Annual Report, the statistical analysis for the physical properties viz. Seed weight, Lint weight., Ginning Percentage, Mean fibre length, Micronaire fineness, Bundle strength, Maturity coefficient and percent length-irregularity was done for all the four seasons. The results indicated that no property except the mean fibre length was significantly affected in any season. For 1956-57, the mean fibre length at three levels of hormone applications was found to have significantly increased over the control.

(4) *Agronomic Experiment at Sirsa.*

During this period, the Ginning percentage was determined on 30 samples belonging to NPK trial (1962-63 season). The samples from this experiment are being tested for physical properties.

(5) *Samples from I. A. R. I. investigations on phosphorous fertilization of cotton by Radio-Tracer Technique.*

In the previous report it was mentioned that the mean fibre length, the micronaire fineness and the bundle strength at zero-gauge length were determined for 72 samples, belonging to 1961-62 season. During the period under review, 60 samples of this experiment were tested for the mean fibre length by Fibrograph. In addition, the Fineness and the Maturity coefficient were determined for 30 samples using Micronaire.

(6) *Study of the effect of different concentrations of alpha-napthalene-acetic acid and different time of application.*

It was reported in the last Annual Report that the Ginning percentage was determined on all the 96 samples and the mean fibre length and the uniformity ratio were measured for 30 samples. During the period under review, the Mean fibre length, the Uniformity ratio, the Micronaire fineness and the Maturity coefficient were measured for 66 samples. In addition 20 samples were tested for the bundle strength at zero-gauge length.

32. Effect of attack of Pests and Diseases on quality of cotton. [M. 5] (V. Sundaram).

With a view to assess the extent of deterioration of the quality of cottons as a result of attack by pests and diseases and to assess the effect of the various insecticide treatments, samples of affected crop, crop treated with various insecticides and healthy crop have been collected from a few agricultural stations. Tests for colour, fibre length, fineness, maturity and strength on these samples are in progress. It is proposed to carry out tests on samples from the same stations over a period of 3 or 4 seasons before drawing any conclusions.

(g) P. L. 480 PROJECTS.

33. Investigation on the Microbial decomposition of cellulose with special reference to the effect of Indian bacterial organisms on cotton and cotton fabrics to provide basic information for the improvement of cotton products. [P. 1] (S. M. Betrabet, Kum. I. G. Bhatt and Kum. Dasani).

Samples of cotton and fabrics suspected of mildew attack were collected from various sources. 35 damaged cotton samples received were subjected to the determination of total count of bacteria, actinomycetes, yeasts and fungi, copper number and alkali solubility tests. Based on this data, 14 samples have been selected for the isolation of enrichment cultures.

5 samples were already screened earlier. The remaining 9 samples on screening gave 40 bacterial and 11 fungal cultures. All 40 bacterial cultures were tested qualitatively, for their ability to utilise cellulose and the 18 active cultures have been selected for further studies. The fungal cultures have been identified upto genus, and their quantitative capacity is being determined.

5 samples screened earlier, encountered 30 bacterial cultures out of which, 11 were tested quantitatively. The 3 most active ones have been taken up for nutritional studies.

During total viable count, 100 actinomycetes were encountered and all were tested for their ability to utilise cellulose as the sole source of carbon About

25 cultures showing good utilisation, were identified series-wise according to Waksman's system of classification and were screened quantitatively. Depending upon the qualitative and quantitative cellulolytic ability 8 cultures have been taken up for nutritional studies.

Out of 21 fabric samples received, 10 samples showing damage due to mildew were screened for the isolation of enrichment cultures by employing the same technique as that for cotton samples. In all, 18 fungal and 35 bacterial cultures were isolated. The fungal cultures have been identified upto genus and tested for their quantitative capacity to degrade cellulose. The bacterial cultures are being screened qualitatively for their ability to utilise cellulose as the sole source of carbon.

The micro-organisms isolated earlier from damaged cotton and fabric samples were screened for the quantitative evaluation of their cellulolytic activity by physico-chemical methods—viz., loss in weight of the substrate, copper number and alkali solubility—which have already been standardised.

The cellulolytic index of 32 isolates were determined. A set of 5 cultures kept in two different media viz., (1) Peptone water and (2) Synthetic medium for the quantitative studies, were screened for the cellulolytic activity.

On the basis of the data obtained, the samples inoculated with the selected cultures were tested for bundle strength by Stelometer. As it was not possible to carry out strength test where the damage was high, and the fibres too fragile, the damage count test by Extrusion method was carried out.

Two anti-mildew chemicals (1) 8-hydroxy quinoline and (2) Salicyl anilide were evaluated for their activity.

34. Investigation of the preparation of radio-resistant and radio-sensitive celluloses to obtain basic information on the chemistry of cotton celluloses. [P. 2] (V. Sundaram and Jai Prakash).

It had been mentioned in the last Annual Report that the P. L. 480 grant agreement covering this Project was signed on behalf of the Government of India on 25th April, 1964. The sanction of the Government for the creation of the posts of the research staff was received in August, 1964 and the posts were advertised in January, 1965. The actual recruitment of the required staff has not yet been made by the Government of India. The experimental work on the Project can be commenced only after the necessary appointments have been made. In the meanwhile, efforts are being made to obtain necessary equipments and other materials.

B. PUBLICATIONS.

A list of the publications issued by this Laboratory during the year is given in Appendix I. Eleven of these which were issued as Technological Bulletins are summarised below :—

1. Structural properties of cotton fibres:—Part III Interspecies relationship between convolution angle and strength. (Tech. Bulletin B. No. 90)

Convolution angle obtained by the microscopic technique and strength obtained with Pressley tester were determined on 67 cottons of Indian and foreign origin, belonging to four botanical species : *G. arboreum*, *G. herbaceum*, *G. hirsutum* and *G. barbadense*. The highest and highly significant correlation coefficient between convolution angle and strength was observed in *G. arboreum* race *bengalense* (—0.97) and Egyptian *G. barbadense* (—0.93) cottons, thereby indicating a close dependence of strength on fibrillar orientation in these two species. No correlation between the two entities was observed in *G. herbaceum* and Indian *G. hirsutum* cottons, which indicates that factors other than fibrillar orientation influence the strength of the cottons belonging to these two species. In spite of the interspecific differences it was observed that a common regression line could be fitted to the entire data and that the over-all correlation coefficient (—0.73) between convolution angle and strength for the 67 cottons was highly significant.

Interspecies differences in the behaviour of cottons with respect to fibrillar orientation versus strength were examined with particular reference to *herbaceum* and Indian *hirsutum* cottons, where special efforts are called for to establish the factors which influence strength.

2. Some observations on the differential technological behaviour of cottons belonging to different species—Part I, Old World desi cottons, Arboreums and Herbaceums. (Tech. Bulletin B. No. 91)

The old world cottons, *G. arboreum* and *G. herbaceum* are so closely related that they give vigorous, fully fertile F_1s and the species barrier only acts through genetic breakdown in later generations. In technological behaviour also, the old world cottons show a closer resemblance, being generally shorter in staple and coarser, as compared to new world cottons. It may, however, be mentioned that in spite of such close similarity in the general behaviour of cottons belonging to *G. herbaceum* and *G. arboreum* species, they do show some differences in certain respects. In this note an attempt has been made to present certain technological observations, where cottons belonging to *G. herbaceum* and *G. arboreum* species have shown some interesting or marked differential behaviour. These observations are give below :—

The defect of seed coat fragment removed during ginning operation is more predominant in some of the *G. arboreum* varieties than those of *G. herbaceum*, probably, because of greater strength of attachment of the fibres to the seed in the case of cotton belonging to the former specie and the stronger chalazal cap structure in *herbaceum* cottons. Although, there is a considerable variation

between the varieties and seasons, on the whole *G. herbaceum* cottons generally showed a tendency to give not only higher mean seed weight, lint weight and number of fibres per seed but also wider range of variation in these characters as compared to *G. arboreum* cottons. The mean oil content percentage calculated on the dry weight of the seed was found to be significantly higher for *G. arboreum* cottons as compared with *G. herbaceum* cottons. If, however, the percentage of oil content was calculated on the basis of kernel weight, the values obtained were not much different. The micronaire was found generally to underestimate the fibre weight per unit length for cottons of *G. herbaceum* species while it tended to overestimate slightly in case of *G. arboreum* race *indicum* cottons. For cottons of *G. bengalense* group, however, the estimate appeared to be quite fair on the limited number of cottons tested. Long staple cottons are generally finer ; however, the correlation between mean fibre length and fineness for cottons of *G. herbaceum* and *G. arboreum* race *bengalense* groups was found to be near the significance value, while for *G. arboreum* race *indicum* cottons it was negligible. The variation of fibre weight per unit length along the length of the fibre is much more in case of *G. herbaceum* cottons than for *G. arboreum* cottons. Cottons belonging to *G. herbaceum* species show a wider range of variation and a lower mean value of bundle strength at zero gauge length as compared with those belonging to *G. arboreum* race *indicum*, while for *G. arboreum* race *bengalense* they lie in between. So far as the percentage of strength realized at 1/8″ gauge length is concerned there does not appear to be much difference between *G. herbaceum* and *G. arboreum* race *indicum*, while for *G. arboreum* race *bengalense* it is lower. It may, however, be stated that, although certain differences have been indicated above, cottons belonging to *G. herbaceum* and *G. arboreum* species bear such a close resemblance to each other, that it may be extremely difficult to distinguish them from their technological behaviour.

3. The variation of fibre bundle strength at different regions of a cotton seed (Tech. Bulletin. B. No. 92)

Sixteen standard Indian varieties, representing the three important species, *G. hirsutum*, *G. herbaceum* and *G. arboreum* were selected for this investigation. The results of bundle strength of the fibres extracted from the side and chalazal regions, its variation between seeds and the relation of the former to maturity coefficient and embryo weight were studied and the main findings were :—

The bundle strength of the side region fibres was found to be significantly higher than that of the chalazal region fibres. It was also observed that the difference in bundle strength between the two regions (S_1-S_2) was different for the three species. (S_1-S_2) can be considered an index of uniformity within the seed and this can be used by the cotton breeder for evolving strains of more uniform strength. Mean bundle strength for the *G. arboreum* and *G. herbaceum* cottons did not differ from each other, although these were higher than that for the *G. hirsutum* cottons. The coefficient of variation, between seeds of bundle strength ranged from 10.98% to 24.41%. However, it did not show any considerable change between the chalazal and side regions or between *G. arboreum* and *G.*

hirsutum cottons, although its values were lower for the *G. herbaceum* cottons. The correlation coefficient between the bundle strength for the side region fibre and that for the chalazal region fibre was highly significant and positive. Similarly the correlation coefficient between the coefficient of variation between seeds of bundle strength of the side region fibres and that of the chalazal region fibres was also highly significant and positive. However, no association was observed between the differences in strength between the two regions (S_1-S_2) and overall maturity coefficient, but the association was improved when the latter was replaced by $\frac{(Ms-Mc)}{Mc} \times 100$. The results for embryo and seed weights showed that the embryos and seeds of *G. hirsutum* cottons were heavier than the two species. The overall ratio of $\frac{\text{embryo weight}}{\text{seed weight}}$ was 0.57, showing that more than half of the seed weight was accounted for by the embryo weight. There appeared to be a loose association ($r = -0.503^*$) between the embryo weight and the difference in bundle strength between the two regions (S_1-S_2), when all the cottons were pooled together. However, the correlation was much improved ($r = -0.746^*$) when the *G. hirsutum* cottons were omitted. This indicated an increase in the value of (S_1-S_2) with decrease of the embryo weight among the *G. herbaceum* and *G. arboreum* cottons. On the other hand, among the *G. hirsutum* cottons tested, there was very little association.

4. Study on cotton ash and some of the ash constituents (Tech. Bulletin. B. No.93)

A study was made on four different species of cottons to find the relation between ash content of lint as well as some of its mineral constituents. Following conclusions were drawn from the study:—

The mean ash per cent values of *G. herbaceum* and *G. hirsutum* cottons are significantly higher than those of *G. arboreum* cottons and the mean ash per cent of *G. hirsutum* cottons is significantly higher than that of *G. barbadense* cottons. Silica, Potassium, lime and Phosphorus contents of cotton ash were almost the same in all the species. Potash constitutes the largest part of lint-ash as compared to the other constituents.

Iron and alumina oxide content of the lint-ash in *G. hirsutum* cottons is significantly higher than that of *G. arboreum* and *G. barbadense* cottons, and that in *G. herbaceum* cottons higher than *G. barbadense* cottons.

5. Structural properties of cotton fibre : Part-IV. Secondary cell wall deposition in relation to convolution angle, birefringence, structural reversals and tensile strength. (Tech. Bulletin. B. No. 94)

Degree of thickening during secondary cell wall deposition in the fibres of Indo-American Deviraj and *desi* Vijalpa cottons was determined at an interval of 3 days from 24 days from the date of flowering to just prior to opening of the bolls.

Changes in convolution angle birefringence, structural reversals and bundle strength were also followed, at intervals, during this period. Tests on the fibres extracted from side and chalazal regions were carried out separately. While convolution angle and birefringence varied appreciably with the increase in cell wall deposition, the bundle strength varied but little. Structural reversals were in large numbers in Deviraj ; rate at which they appeared with improvement in degree of thickening, was followed. In Vijalpa they were very few which confirmed the earlier finding that number of reversals in a cotton is a genetic character. Period of secondary cellulose deposition is about 24 to 27 days for the two cottons studied, which appears to be inadequate and seems to be the cause of high immaturity.

6. Work done in pulling fibres from the cotton seed under impact conditions in relation to fibre properties and ginning behaviour. (Tech. Bulletin B. No. 95)

The strength of attachment of the fibre to the seed has been pointed out to be an important parameter that may considerably affect the ginning behaviour of a cotton variety. In order to stimulate ginning conditions more appropriately, this property was determined by pulling out fibres from different regions of the seed with an impact tester. Fifteen Indian cottons belonging to different species were tested by examining fifty seeds from each species ; the percentage of seeds throwing out seed coat fragments was also counted. The relationships found to exist between mean work of pulling per fibre, on the one hand, and the energy consumed in ginning these varieties in a double-roller gin, the percentage of seeds throwing out seed coat fragments, and other fibre characters, on the other hand, were studied. The important conclusions arrived at from this investigation are as follows :—

The work done to pull out a fibre from the side region of the seed was higher than that to pull out one from the chalazal region in all the varieties examined except two, Gaorani 12 and H. 420, where the values were almost identical. Sea Island (Andrews) cotton fibres required, on the average, the lowest work per fibre to pull from the seed, 45.2 ergs ; *G. hirsutum* fibres required a higher value, 75.8 ergs ; *G. herbaceum* fibres a still higher value, 80.4 ergs ; and *G. arboreum* fibres the highest value, 88.2 ergs. Omitting Sea Island (Andrews) cotton, among the other species the mean maturity coefficient and the average fibre weight per unit length followed an increasing trend from *G. hirsutum* through *G. herbaceum* to *G. arboreum*, similar to that for work of pulling per fibre. The energy consumed in ginning is of course very much more than the actual work required to be done for pulling out fibres from the seed. Much of the energy is used in the movement of the heavy machinery. The ratio of the energy required in removing lint from a known quantity of seed cotton in the ginning process to that calculated from the weighted mean work of pulling per fibre from the seed and the number of fibres in that quantity of seed cotton, was found to vary from 0.9 to 26.9. Several factors, such as the discrepancy between the conditions in the experimental set-up for determining the work of pulling and those existing in the ginning process, variation in the fuzziness of the seeds in different varieties, and the slippage factor, etc., are responsible for this large variation. Seed coat fragments invariably

originated from the chalazal end of the seed because of weak structure of the seed cells in that region. No seed coat fragment was removed in Sea Island (Andrews) cotton. In *G. hirsutum* varieties, fragments were removed from 2% to 30%, with a mean of 17.7%, in *G. herbaceum* the range was from 2% to 24% with a mean of 10%. However, in *G. arboreum* the greatest number of fragments was removed, ranging from 22% to 70%, with a mean of 43.6%. It was noted that the percentage of seed coat fragment thrown out depended upon (i) the weakness of the cell structure of the chalazal end ; and (ii) the strength of attachment of the fibre to the seed in relation to the weak structure of the cell.

A highly significant correlation of +0.773 was found between the work of pulling per fibre and the percentage of seeds throwing out seed coat fragments. The work required to pull out the fibres from the seed was in most cases lower than the work of rupture of fibres, which explains why fibres are generally pulled out from the seed and not broken. However, as the average ratio of the work of rupture to the work of pulling per fibre was only 4.06, there is a probability that some of the weak fibres whose strength is less than their strength of attachment to the seed might break during actual ginning process. Between different seeds within a cotton a highly significant correlation was found between mean work of pulling per fibre and their maturity coefficient. While considering the relationship between the work of pulling per fibre and other fibre characteristics among different cottons, the fibre weight per unit length and the estimated swollen hair perimeter showed the maximum degree of association, the correlation coefficient being + 0.732 and + 0.773, both highly significant. Work of pulling was found to be negatively correlated with mean length of the cotton. The correlation of —0.481 was, however, short of being significant at the 5 per cent probability level. Single fibre strength and maturity showed a rather poor relationship. When all the important fibre properties, *viz.*, the mean fibre length, the fibre strength, the fibre weight per unit length, the fibre maturity and the estimated swollen hair perimeter are combined together, they could explain as much as 75 per cent of the variation from cotton to cotton in the work of pulling from the seed, the multiple correlation coefficient being + 0.865.

7. Studies on chemical properties of cotton fibres. Part I. Wax content of cotton fibres from different regions of the seed. (Tech. Bulletin. B. No. 96).

An investigation was carried out for finding out the wax content of the side and the chalazal region fibres from cotton seeds. Twenty cottons belonging to three different species were included. The following conclusions were drawn from the investigation:—

It is observed that cotton fibres from the chalazal region of the seed contain higher wax than the fibres from the side region of the seed. Further statistical analysis shows that the wax content of the chalazal region fibres is significantly higher than that of the side region fibres of the same cotton. It is also observed that there is no significant difference in the wax content between the species of cottons. There is significant difference in the wax content from cotton to cotton. The same cotton grown at different places, does not always contain the same percentage of wax.

8. Birefringence, Density and Tensile Characteristics of Oxycelluloses. (Tech. Bulletin. B. No. 97).

Investigations were carried out on the changes in the characteristics such as refractive index, density, single fibre breaking strength and moisture regain of cotton fibres brought about as a result of oxidation with sodium metaperiodate and potassium dichromate-oxalic acid. The study was also extended to sodium chlorite treated and sodium borohydride reduced oxycelluloses obtained from these oxycellulose products. Results indicate that in the case of sodium metaperiodate oxidation, birefringence and density first increase, reach a maximum and then decrease sharply as oxidation is continued whilst breaking strength decreases in the initial stages, reaches a minimum and then increases in the later stages. With dichromate-oxalic acid oxidation, birefringence increases sharply during the initial stages of oxidation and after reaching a maximum, decreases as oxidation progresses whilst there is a rapid increase in the values of density during the initial stages followed by a slow rise as oxidation is continued. In the case of dichromate-oxalic acid oxycelluloses, breaking strength decreases continuously with the progress of oxidation. Results were interpreted in terms of changes in gross morphology and fine structure of cotton as a result of oxidation and subsequent chlorite and borohydride treatments.

9. Studies on Chemical properties and Physical properties during development of cotton fibre. (Tech. Bulletin B. No. 98).

Degree of polymerisation (D.P.) and wax content were determined at various stages of growth for three cottons. Fibres collected from 24 to 59 days old bolls of Laxmi cotton were also studied for cellulose content, fibre crystallinity, ash content and ash alkalinity, water soluble matter, moisture absorption and fibre maturity, fineness and fibre strength for three seasons. It is observed that D.P. varies during fibre development and it is a minimum for 24 days old fibre and increases with the fibre growth and reaches a maximum in the fully developed fibres. It also varies from cotton to cotton and for the same age cotton from season to season. Similarly, cellulose content, crystallinity and fibre maturity, fineness and strength increase with the boll development, but the rate of change differs from season to season. On the other hand non-cellulosic substances (wax, ash, water solubility etc.) decrease with the development of the fibre and reach a minimum in 52 or 59 days old fibres. The rate of change for waxy and fatty matters and ash content during fibre development is observed to occur in two phases and the rate of change differs for the same age sample from season to season. Moisture absorption capacity of early age fibres is higher and decreases as the fibre matures. The ratio of cellulose to water soluble matter may be useful in determining the fibre development.

10. Further studies on the skein breaking load of cotton yarns numbered in French counts—Finer counts. (Tech. Bulletin. B. No. 99).

In an earlier publication (Tech. Bulletin, B. 87), it had been shown that the values of F. S. P. (the product of the French count and Metric skein breaking load

in kg.) were nearly equal to half the value of the C.S.P. (product of English Count and lea strength) and a regression equation for calculating the values of F.S.P. from the corresponding values of C.S.P. had been given. The samples tested ranged from 10s to 80s count (Ne) and were mostly yarns spun at the Laboratory although a few samples of mill-spun yarns had been included. As the Indian Standards Institution desired to use the above regression equation for converting the Standard values of C.S.P. at various counts in the English system to corresponding values of F.S.P., the questions arose: (1) whether the above relation held good for both warp and weft yarns and (2) whether the relation was valid even for finer counts ranging from 80s to 120s. 18 samples of warp yarns and 14 samples of weft yarns in the count range 80s to 120s (Ne) were obtained from the Indian Standards Institution for the present study. These were tested for count, lea strength, French Count, tex number and metric skein strength. It was observed that the relationship between F.S.P. and C.S.P. was the same for both warp and weft yarns *i.e.* this relationship was independent of the degree of twist in the yarn. A combined regression equation based on the results of all the samples ranging in counts from 10s to 120s was worked out to estimate the F.S.P. from the C.S.P. as follows :—

$$\text{F.S.P.} = 0.4839\ \text{C.S.P.} + 46.35.$$

It was observed that the calculated value of F.S.P. calculated by using the above equation was higher than $\frac{1}{2}$ C.S.P. by about 6 per cent when the value of C.S.P. was about 1000, the difference decreasing continuously for higher values of C.S.P. being about 1.4 per cent at C.S.P. of 2000 and practically nil at C.S.P. values of 2500 to 3000. Hence it has been suggested that F.S.P. may be taken as equivalent to $\frac{1}{2}$ C.S.P. for all practical purposes and the regression equation used only where greater accuracy is needed.

11. Methods of measuring Staple Length of cotton. (Tech. Bulletin B. No. 100.)

This Bulletin explains the importance of the staple length in evaluating a cotton sample, the extent of variation observed and the concept of staple length as viewed by the Cotton Breeders, the Cotton Grader and the Technologist. It describes the difficulties that are inherent in assessing the staple length and gives a brief account of the procedures adopted in the different methods for measuring the staple length, along with the various instruments that have been designed for the purpose and are in use in the Technological Laboratory. The various measures employed for designating the staple length such as the mean length, the upper half mean, upper quartile, modal length, effective length, span length etc. are defined and their interrelationships explained. Based on this knowledge one could appreciate the differences in the estimates of length obtained by different instruments and methods.

The relationship between the Grader's estimate and the Laboratory Test values of the staple length, as observed in different countries such as U.S.A., U.K., U.A.R. and India has also been dealt with. In the case of Indian Cottons, it has been observed that the Grader's estimate is, in general, lower than similar estimates in other countries and the test values obtained by Laboratory Tests.

IV. MISCELLANEOUS

(i) Visitors

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

1. Shri Shah Nawaz Khan, Union Deputy Minister for Agriculture.

2.* Shri G. D. Parikh, Rector, University of Bombay.

3.* Shri G. M. Nabar, Director, Department of Chemical Technology, University of Bombay.

4.* Shri M. G. Kulkarni, Assistant Director, Bombay Textile Research Association, Bombay.

5.† Shri Narain V. Ullal, Manager, Khatau Makanji Spinning and Weaving Mills, Byculla, Bombay.

6.† Dr. C. Nanjundayya, Director, Bombay Textile Research Association, Bombay.

7.† Dr. Santhanam, Head of the PIRRCOM Centre, Coimbatore.

8. Dr. S. Krishnamurthy, Director of Agriculture, Madras.

9. Shri L. Venkataratnam, Deputy Director of Agriculture (Research), Andhra Pradesh.

10. Shri Vinayak N. Palekar, M/s. Palekar & Co., Bombay.

11. Dr. H. L. Manning, Cotton Expert of Colombo Plan, London.

12. Mr. T. L. W. Bailey, F.A.S. Cotton Division, U.S. Department of Agriculture, Washington D.C.

13. Mr. C. F. Rainwater, U.S.D.A. Agricultural Research Service, New Delhi.

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* Members of the University Commission.
† Members of the Visiting Committee.

14. Mr. George Richards, U.S. Department of Agriculture, Agricultural Research Service, New Delhi.

15. Dr. S. C. Gupta, U.S. Department of Agriculture, Agricultural Research Service, New Delhi.

As usual, a large number of students from various Technological Institutions also visited this Laboratory.

(ii) Membership of Committees etc.

Dr. R. L. N. Iyengar, Director, Technological Laboratory, is being deputed to attend the meetings of (*i*) the ISO/TC38/its Sub-Committees and working groups as the representative of India Member Body on the ISO Working Group ISO/TC38/SC6/WGI to be held in London from the 21st to the 25th June, 1965 and (*ii*) the International Calibration Committee on the 23rd June, 1965, as a representative of the Indian Central Cotton Committee.

Dr. R. L. N. Iyengar, Director, Technological Laboratory has been renominated as the Committee's representative on the Textile Division Council (TDC) of the Indian Standards Institution for a further period of three years from the 1st January, 1965.

The appointment of Dr. S. M. Betrabet, Senior Scientific Officer at the Technological Laboratory on the Sub-Committee for Biological Test Methods TDC 5 : 10 of the Indian Standards Institution has been continued.

Dr. V. Sundaram, Senior Scientific Officer was permitted to accept membership of the Research Advisory Committee of the Silk and Artsilk Mills' Research Association.

(iii) University Recognition and Awards

The recognition granted to the Technological Laboratory as a post-graduate institution for guiding students for the M.Sc. and Ph.D. degrees in Physics (Textiles) has been extended for a further period of three years with effect from the 2nd July, 1964.

Dr. R. L. N. Iyengar, Director, continued to be the recognised University Teacher for guiding students registered at this Laboratory for the M.Sc. and Ph.D. degrees in Textile Physics by research.

Dr. V. Sundaram, Senior Scientific Officer and Shri Harirao Navkal, Retired Senior Research Officer continued to be the recognised University teachers for guiding students registered at this Laboratory for the M.Sc. degree in Textile Physics by research.

(iv) Appointments

The following appointments were made during the year :—

Name	Designation	Date of Appointment
Kum. Urmil Malhotra	.. Technical Assistant (Hindi)	1-6-1964
Shri C. K. George	.. Stenographer, Grade II.	1-6-1964
„ S. Thambiraj	.. Lower Division Clerk	21-7-1964
Kum. R. Lakshmi	.. Research Assistant	1-8-1964
„ Santa Nayar	.. Research Assistant	1-8-1964
Shri P. P. Paul	.. Stenogapher, Grade II	6-10-1964
„ A. K. Gupta	.. Research Assistant	19-10-1964
„ H. L. Chandramowleswara	.. Research Assistant (Spinning)	12-11-1964
„ P. Padmanabha Sarma	.. Senior Research Assistant (Spinning)	3-12-1964
„ R. Seetharaman	.. Research Assistant (Workshop)	17-5-1965

Shri K. S. Bhyrappa, Research Assistant (Spinning) was promoted as Senior Research Assistant (Spinning) with effect from the 1st September, 1964.

Shri Zila Singh, Librarian in Secretariat of the Indian Central Cotton Committee was transferred as Librarian at the Technological Laboratory with effect from the 2nd November, 1964.

Shri Keshav Varja, Operative, was promoted as Temporary Fitter with effect from the 14th December, 1964.

Shri R. K. Landge, Workshop Operative, was promoted as Mechanic with effect from the 16th December, 1964.

Shri K. Venkateswaran, Research Assistant, was promoted as Senior Research Assistant (Statistics) with effect from the 21st January, 1965.

Shri N. S. Kuppuswamy, Superintendent (Establishment) in the Secretariat of the Indian Central Cotton Committee was transferred and appointed as Administrative Officer at the Technological Laboratory, with effect from the 1st April, 1965.

(v) Retirement and Resignations

Among the Junior Staff, resignations were received from the following members and were accepted from dates indicated against their names :—

Name	Designation of post held	Resignation accepted from
Shri C. M. Narayanan Nair	.. Lower Division Clerk	28-6-1964
Shri C. K. George	.. Stenographer Grade II	2-8-1964
„ C. N. Kartha	.. Librarian	15-8-1964
„ Y. A. Shetty	.. Senior Research Assistant (Spinning)	30-8-1964
„ R. G. Parekh	.. Research Assistant	9-9-1964
Kum. R. Lakshmi	.. Research Assistant	14-10-1964
Shri B. Ramamohanarao.	.. Research Assistant (Workshop)	25-11-1964
Kum. S. B. Karnik*	.. Technical Assistant	21-2-1965
Shri N. Venkataramu	.. Research Assistant	1-4-1965

* Staff under P. L. 480 scheme.

Shri K. G. Deo, Senior Research Assistant, having attained the age of 60 years retired from the services of the Committee with effect from the 21st January 1965.

Shri J. F. Quodras, Administrative Officer, on reversion to his parent Department was relieved from the services of the Committee on the afternoon of the 23rd January, 1965.

(vi) Leave

Name	Designation	Days	Period of Leave	
			From	To
Shri S. N. Pandey ..	Junior Scientific Officer ..	30	10-9-1964	9-10-1964
		6	22-2-1965	27-2-1965
		8	5-3-1965	12-3-1965
Shri Jai Prakash ..	Senior Scientific Officer (On deputation to U.K.)	180	29-3-1965	24-9-1965
Dr. V. Sundaram ..	Senior Scientific Officer	20	26-4-1965	15-5-1965
		6	24-5-1965	29-5-1965
Shri V. G. Munshi ..	Junior Scientific Officer ..	10	4-5-1965	13-5-1965

(vii) Training

(*a*) Dr. S. M. Betrabet, Senior Scientific Officer, who was selected for a Fellowship under the Colombo Plan for advanced training in U.K. Textile Microscopy and Textile Microbiology for a period of 12 months, left India on the 23rd September, 1964 (afternoon).

(*b*) Shri Jai Prakash, Senior Scientific Officer, who was on deputation for a period of eighteen months from the 28th September, 1963 (afternoon) to the 28th March, 1965, for a fellowship under the Colombo Plan for advanced training in U.K. in Textile Physics and Technology has been granted a further extension of six months beyond the 28th March, 1965, to enable him to complete his Ph.D. Degree.

(*c*) Shri S. K. Kohli, Research Assistant, Abohar, was given theoretical and practical training in fibre, yarn testing and application of statistical methods from the 3rd December, 1964 to the 7th January, 1965.

(*d*) Mr. Paul L. A. Ongee, Uganda Government nominee under the African Assistance Programme was given theoretical and practical training in single and double roller ginning technique at this Laboratory for a period of ten days from the 9th to the 18th June, 1964.

(*e*) Sarvashri O. P. Khullar, M. L. Pruthi and D. R. Kohli, Extra Assistant Directors (Probationers) of the Indian Standards Institution were given in-field-training at this Laboratory on the 1st and 2nd July, 1964.

(*f*) Shri W. T. Butany, Geneticist (Cotton), Indian Agricultural Research Institute, New Delhi was deputed to the Laboratory from the 28th May to the 5th June, 1964 and from the 5th April to the 24th April, 1965, for getting himself acquainted with the various techniques in Laboratory testing of cotton and for personally carrying out certain tests on a few samples of cotton brought by him.

(viii) Short Course in Cotton Techonology

The following were selected for the revised training courses in the elements of fibre testing and application of statistical methods.

(*a*) *Training Course for the persons employed in Cotton Trade, in Bombay City*—**One year (part-time) from the 1st June, 1964.**

1. Shri Niranjan C. Shah — M/s. Manu Shah & Co., Bombay.
2. „ S. K. Sankaranarayanan — M/s. Mehta Ramakrishna & Co. Ltd., Bombay.

3.	Shri Kanthi T. Kothari	The East India Cotton Association Ltd., Bombay.
4.	,, Gev. Kekshroo Nakra	The International Cotton Corporation, Bombay.
5.	,, J. H. Talati	M/s. H. M. Mehta & Co., Bombay.
6.	,, Kishore Jayantilal	M/s. Bhaidas Cursondas & Co., Bombay.

(*b*) *Training Course for the persons employed in Cotton Trade and Co-operative Marketing Societies at mofussil centres.*—**Two months (full time) from the 1st October, 1964.**

1.	Shri B. Manickya Reddy	M/s. Bellary Spinning and Weaving Mills Ltd., Adoni.
2.	,, Gautam Ratilal Shah	M/s. Vasantlal & Co., Bombay.
3.	,, Sharad Daulal Vyas	M/s. Srinivas Laddha & Co., Amravati.

(ix) Refresher Course and Conference

The Senior Research Assistants and Research Assistants (Technological) working at the various cotton breeding stations attended the refresher course at the Laboratory in November, 1964. The twenty-first Conference of the Research Staff of the Laboratory and the Technological Assistants was held on the 20th and 21st November, 1964. Several useful subjects brought forward by the members of the Conference were discussed. It is regretted that the Agronomist from Maharashtra was not able to attend.

(x) P. L. 480 Projects

The first project, "Investigation of the microbial decomposition of cellulose with special reference to the effect of Indian bacterial organisms on cotton and cotton fabrics, to provide basic information for the improvement of cotton products" which came into effect from the 3rd January, 1963, is progressing satisfactorily. The 4th Fiscal and Research Progress Reports for the half year ending the 31st October, 1964, and the 5th fiscal report and Annual Research Progress Report for the period ending 30th April, 1965, were submitted to the United States Department of Agriculture, Agricultural Research Service, in accordance with the terms of the agreement.

The Second project, "Investigation of the preparation of radio-resistant and radio-sensitive celluloses to obtain basic information on the chemistry of cotton cellulose" came into effect from the 25th April, 1964. The first instalment of grant amounting to Rs. 83,466 was received in June 1964. The 2nd fiscal and Research Progress Reports for the half year ending 31st May, 1965, were submitted

to the United States Department of Agriculture, in accordance with the terms of the agreement. The actual work of the scheme could not be started as the posts sanctioned under the scheme could not be filled.

The third project, "Investigation of the effects of high energy radiation on the induction and half-life of excited, free and/or ionised radicals in cotton cellulose, to obtain basic information needed for the development of potentially new useful cotton products" was approved by the Government of India provided no foreign exchange was involved. The P.L. 480 authorities visited this Laboratory on the 21st April, 1965, to discuss the financial aspects of the Project. However, the final approval of the Ministry of Finance is awaited.

(xi) Laboratory equipment

The following instruments were acquired for the use of the Laboratory :—

1. 'Gallenkamp' Universal Centrifuge with accessories.
2. 'Bausch & Lomb' Transister Regulated Spectronic 20 Colorimeter—Spectrophotometer with accessories.
3. Spinning Machinery Consisting of :—
   (*i*) One Drawing Frame.
   (*ii*) One Ring Spinning Frame (OM-S type with Super High Draft arrangement).
   (*iii*) Four Carding Engines.
4. Model 192 Fibro Sampler with accessories.
5. Model CS-45 Mechanical Cotton Blender.
6. 'USTER' Automatic Yarn Strength and Elongation Tester.
7. 'USTER' Imperfection Indicator.
8. 'USTER' Spectrograph.
9. 'USTER' Speed Recorder.

(xii) Instruments fabricated

The following instruments were fabricated and supplied to the parties concerned :—

1.	Laboratory Model Gins ...	9
2.	Ginning Percentage Balances ...	15
3.	Halo Length Discs ...	44

(xiii) Library

The number of books in the Library at the beginning of the year was 1859. During this year, 34 books were added bringing the total to 1893. The number of bound Volumes at the end of the year was 1709. This Laboratory was getting 112 Scientific Journals dealing with the textile and allied subjects. Of these, 63 were subscribed for and the other 49 were received on exchange or complimentary basis.

(xiv) Staff Research Council

Two meetings of the Staff Research Council were held during the period. The programme of work of the Laboratory, the progress made on the various investigations in hand and the Annual Report of the Director were discussed.

(xv) Establishment

One post of Fitter was created from the 23rd November, 1964. One post of Research Assistant (Spinning) was upgraded as Senior Research Assistant (Spinning) with effect from the 10th August, 1964.

The revised ratio of 1 : 2 between the Senior Research Assistants and Research Assistants under the Technological Laboratory (including the Technological Centres at the outstations) has been accepted by the Government of India with effect from February, 1965. Accordingly, proposals for the conversion of the posts in the Senior Cadre and the appointment of staff to the posts have been submitted.

(xvi) Expansion and modernization programme

Ginning Section and the Fibre Testing Section have been shifted to the new block of the Technological Laboratory. The Yarn Testing Section will be shifted to the new block as the air conditioning Plant is installed in the new building. The Government of India's sanction for the foreign exchange required in this connection is awaited. The whole of the blow-room machinery, carding engines and OM-S spinning machinery have been received but can be installed only after fixing the air conditioning plant. The old Ginning room has been modified suitably for installing the blow-room machinery and as soon as the Yarn Testing Section is shifted to the new building the whole of the blow-room machinery will be installed.

ACKNOWLEDGEMENT

I take this opportunity to express my gratitude and deep indebtedness to the office-bearers of the Indian Central Cotton Committee for their keen interest in the work of the Laboratory and for the valuable suggestions thereon. My grate-

ful thanks are due to the East India Cotton Association Ltd., Bombay, and their Sworn Surveyors for kindly grading a large number of experimental, trade, standard and technological samples of cotton and also for their kind co-operation in supplying the samples of different grades and their data. My thanks are also due to the authorities of the mills who conducted the mill tests.

I also wish to place on record my sincere thanks to the technical and administrative staff of the Laboratory for their willing and loyal co-operation, without which the work described in the present report could not have been accomplished.

R. L. N. IYENGAR.

APPENDIX I

LIST OF PUBLICATIONS

(A) Technological Bulletins:

(1) Series. A-116, "Technological Reports on Trade Varieties of Indian Cottons, 1964" by R. L. N. Iyengar.

(2) Series. A-117, "Technological Reports on Standard Indian Cottons, 1964" by R. L. N. Iyengar.

(3) Series. B-90, "Structural properties of cotton fibres Part-III. Inter-species relationship between convolution angle and strength" by S. M. Betrabet and R. L. N. Iyengar. (Reprinted from the Indian Cotton Growing Review, Vol. XVIII, No. 4, July, 1964).

(4) Series. B-91, "Some observations on the differential Technological behaviour of cottons belonging to different species—Part-I. Old world Desi cottons, Arboreums and Herbaceums." by Jai Prakash and R. L. N. Iyengar (Reprinted from the Indian Cotton Growing Review, Vol. XVIII, No. 5, September, 1964).

(5) Series. B-92, "The variations of fibre bundle strength at different regions of a cotton seed" by V. G. Munshi and R. L. N. Iyengar. (Reprinted from the I. C. G. R,* Vol XVIII, No. 6, November, 1964)

(6) Series. B-93, "Study on cotton ash and some of the ash constituents" by S. N. Pandey. (Reprinted from the Indian Cotton Journal, Vol. XIX, No. 1, January, 1965).

(7) Series. B-94, "Structural properties of cotton fibres—Part-IV. Convolution angle, birefringence, structural reversals and tensile strength" by S. M. Betrabet, G. G. Phadnis and R. L. N. Iyengar. (Reprinted from Indian Cotton Journal Vol. XIX, No. 1, January, 1965).

(8) Series. B-95, "Work done in pulling fibres from the cotton seed under impact conditions in relation to fibre properties and Ginning behaviour" by Jai Prakash and R. L. N. Iyengar. (Published in the Textile Research Journal May, 1964 and reprinted from Indian Cotton Journal, Vol. XIX, No. 2, March, 1965).

(9) Series. B-96, "Studies on Chemical Properties of Cotton Fibres. Part. I—Wax Content of Cotton Fibres from Different Regions of the Seed." (Reprinted from the Indian Cotton Journal, Vol. XIX, No. 3, May, 1965).

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* I.C.G.R. refers to 'Indian Cotton Growing Review' a bimonthly publication of the Indian Central Cotton Committee, renamed as 'Indian Cotton Journal' since January, 1965.

(10) Series. B-97, "Birefringence, Density and Tensile Characteristics of Oxycelluloses" by S. M. Betrabet, V. G. Munshi, E. H. Daruwalla and C. J. Jacob. (Reprinted from the Proceedings of the Sixth Technological Conference held in January, 1965).

(11) Series. B-98, "Changes in chemical and physical Properties during development of cotton fibre" by S. N. Pandey. (Reprinted from the Proceedings of the Sixth Technological Conference held in January 1965).

(12) Series. B-99, "Further studies on the Skein Breaking Load of cotton yarns numbered in French Counts" by R. L. N. Iyengar and V. Sundaram. (Reprinted from the I.S.I. Bulletin—May, 1965).

(13) Series. B-100, "Methods of measuring staple length of cotton" by R. L. N. Iyengar.

(B) Articles and Papers :

(a) Published:

1. A simple explanation of formation to reversals in a Cotton Fibre by R. L. N. Iyengar. (Textile Research Journal—May, 1964).

2. Evaluation of Length Parameters obtained with Digital Fibrograph with Special Non-uniformity by Jai Prakash. (Textile Research Journal—October, 1964).

(b) Sent for Publication :

1. 'A Note on the relationship between Fibrillar Orientation as measured by 40 per cent X-Ray angle and the torsional rigidity of Cotton Fibres' by V. Sundaram and R. L. N. Iyengar.

2. 'A Note on the relationship between Bundle Strength, 40 per cent X-Ray angle and Degree of Polymerisation of Cellulose of various Indian Cottons' by V. Sundaram.

3. A study of some aspects of boll opening and the effects of field exposure of Cotton on its quality by L. R. Jambunathan and R. L. N. Iyengar.

(c) Papers Contributed to Conferences:

1. * 'Study in changes in circularity of cotton fibres due to alkali concentration and tension' by P. G. Oka, Jai Prakash and R. L. N. Iyengar.

2. † 'The effect of different quantities of irrigation and nitrogenous manure in physical properties and yield of Cotton' by V. G. Munshi.

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* Contributed to the Sixth Technological Conference sponsored by ATIRA, BTRA, SITRA held at Bombay in January, 1965.

† Contributed to the 21st Conference of Senior Research Assistants and Research Assistants in charge of the Breeding Stations with the Senior Research Staff of the Technological Laboratory, held in November, 1964.

3. † 'Calculation of Effective length from Baer Sorter Diagram and Array Diagram—A comparison' by K. G. Deo.

4. † 'Regression equations to predict the Spinning Performances from the Chief Fibre Properties of Cottons grown in different tracts in the country' by G. S. Rajaraman and V. Sundaram.

(d) Technological Circulars:

No.	Variety	Month of issue
	1963-64 season	
1389	Vijalpa (Navsari)	June, 1964
1390	A. R. Busoga	,,
1391	L. L. 54	,,
1392	P. A. L. S. S.	,,
1393	Digvijay (Kapadvanj)	,,
1394	Daulat	,,
1395	Karunganni 5	,,
1396	Karunganni 6 (uncertified)	,,
1397	Co2 (Tirupur)	,,
1398	M. C. U. 1 (Coimbatore)	,,
1399	M. C. U. 3	July, 1964
1400	Kalyan (Viramgam)	August, 1964
1401	Parbhani-American-I	,,
1402	M. C. U. 2 (Summer)	,,
1403	Westerns (Bellary)	,,
1404	Digvijay (Cambay)	,,
1405	Vijalpa (Rajpipla)	,,
1406	Karunganni-6 (certified)	September, 1964
1407	M. A. 5	October, 1964
	1964-65 season	
1408	Jarila (Moglai/Barsinagar)	January, 1965
1409	A. K. 277	,,
1410	Virnar (East Khandesh)	,,
1411	Bengal Desi (Punjab)	,,
1412	Daulat	,,
1413	L. 147 (Achalpur)	,,
1414	Virnar (West Khandesh)	Feburary, 1965
1415	Virnar (Aurangabad)	,,
1416	Gaorani 22	March, 1965
1417	Mwanza	,,
1418	H-14	,,
1419	Badnawar	,,
1420	Jinja	,,

APPENDIX II

SCIENTIFIC AND TECHNICAL STAFF OF THE TECHNOLOGICAL LABORATORY

(*as on the 31st May*, 1965)

Director :	Dr. R. L. N. Iyengar, D.Sc., F. T. I.
Senior Scientific Officers :	Dr. V. Sundaram, M.Sc., Ph.D., A. R. I. C. Shri Jai Prakash, M.Sc. Dr. S. M. Betrabet, M.Sc., Ph.D., Shri R. P. Neogi, B. Sc., B.Sc. (Tech.) (Manch.), A. M. C. T. (Eng.).
Junior Scientific Officers :	Shri V. G. Munshi, M.Sc., ,, S. N. Pandey, M.Sc., ,, G. S. Rajaraman, M. A, (One post vacant)
Senior Research Assistants :	Shri P. S. Sambamurthy ,, P. V. Nachane, B.Sc. ,, S. Samson, B.Sc., LL.B. ,, S. B. Mogre, M.Sc. ,, P. D. Vakil ,, C. A. S. Aiyar, B.Sc.
Senior Research Assistant (Ginning) :	,, D. G. Shete, L. M. E.
-do- (Electrical) :	,, H. V. Tamhankar, L. M. E., L. E. E.
-do- (Spinning) :	,, K. S. Bhyrappa, L. T. T.
,,	,, P. Padmanabha Sarma, D. T. M.
-do- (Statistics) :	,, K. Venkateswaran, B. A.
Research Assistants :	,, S. Ramanathan ,, Y. N. Tendulkar ,, R. Braganza, B. Sc. ,, P. G. Oka, M. Sc., Smt. S. B. Pai, B. Sc. Shri G. G. Phadnis, B. Sc. Smt. K. L. Datar, B. Sc., Shri S. R. Ganatra B. Sc. ,, A. W. Shringarpure, B. Sc. ,, Sheshadri Srinivasan, B. Sc.

Research Assistants (*Contd.*)	Shri A. Rajagopalan B. Sc.
	,, A. V. Ukidve, B. Sc.
	,, K. S. Shama Rao, B. Sc.
	,, B. M. Petkar, B. Sc.
	,, K. R. Kamath, B. Sc.
	Smt. S. V. Pradhan, B. Sc.
	Shri A. K. Antony, B. Sc.
	Kum. S. Janaki, B. Sc.
	Shri P. K. Jairam, B. Sc.
	,, S. N. Nagwekar, B. Sc.
	,, V. Venugopalan, B. Sc.
	,, N. Thejappa, B.Sc.
	,, K. M. George, B. Sc.
	,, K. M. Vijayaraghavan, B.Sc.
	,, K. V. Babu, B.Sc.
	Kum. I. K. P. Iyer, B.Sc.
	Smt. S. D. Pai, B.Sc.
	Kum. T. T. Annamma, B.Sc.
	,, Santa Nayar, B.Sc.
	Shri A. K. Gupta, B.Sc.
	(Three posts vacant)
Research Assistants (Statistics):	Shri S. S. Malik, M. A. (Maths.) M. A. (Stat.).
	,, S. G. Nayar, B. Sc. LL.B.
	,, K. Chandran, B. A.
Research Assistant (Spinning):	,, H. L. Chandramowleshwara, B. Sc. (Textiles).
Research Assistant (Workshop):	,, R. Seetharaman, L. M. E., P. D. Au. E.
Draughtsman :	P. B. Gurjar.

P. L. 480 Project staff:

Bio-Chemist :	Kum. I. G. Bhatt, M. Sc.
Microbiologist :	,, U. P. Dasani, M.Sc.
Technical Assistant :	Vacant

Published by Dr. R.L.N. Iyengar, D.Sc., F.T.I., Director, Technological Laboratory, Indian Central Cotton Committee, Matunga, Bombay 19, and printed by Rev. Theodore A. Pereira at the Examiner Press, Fort, Bombay 1.